



Stock drinking water requirements

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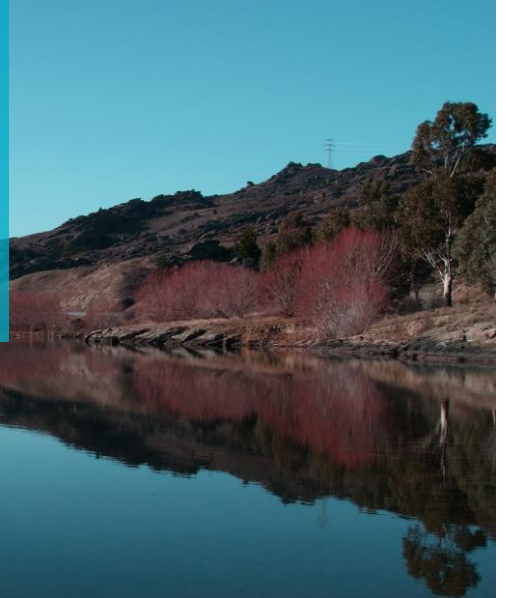
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STOCK DRINKING WATER REQUIREMENTS



PREPARED FOR
Horizons Regional Council

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EXECUTIVE SUMMARY

Aqualinc Research Limited (Aqualinc) have been contracted by Horizons Regional Council (HRC) to complete a review of nationwide stock drinking water requirements.

The objective of this study was to:

- Review the recent scientific literature to re-establish standard estimates of drinking water requirements for a range of farm animals
- Analyse regional council plans and policies to determine regional regulations regarding water take for stock drinking water
- Gather additional information of water requirements and use as needed from related industry associations
- Recommend reasonable levels of water use that HRC can apply as a standard for resource consent applications

This work builds on a 2007 report prepared for HRC by Aquas Consultants Limited and Aqualinc. It examines stock drinking water requirements on eight farm animals/fowl: dairy cattle, beef cattle, sheep, deer, horses, goats, pigs, and poultry. This report examines drinking water requirements for dairy cattle, beef cattle, sheep, deer, pigs and chickens only, as there was no recent research found or information provided by regional councils regarding horses or goats.

To summarise the information, the report provides tables noting estimated average daily demand and peak daily demand for each stock category along with relevant details from the research literature and resource materials reviewed. Tables are also provided noting regional plans that outline rules regarding water take for stock drinking water. A brief discussion concludes the section on each stock type and includes a suggested allocation for drinking water requirements which HRC could use as a basis for redetermining water requirements.

1 BACKGROUND

1.1 Purpose of the Work

Horizons Regional Council (HRC) have identified the need to reassess stock drinking water requirements. HRC needs to determine if the volume of water they are consenting is consistent with what is reasonably required by the specific type of farming enterprise.

The objective of this study was to:

- Review the scientific literature to establish standard estimates of drinking water requirements for a range of farm animals
- Analyse regional council plans and policies to determine regional regulations regarding water take for stock drinking water
- Gather additional information on water requirements and use as needed from related industry associations
- Recommend reasonable levels of water use that HRC can apply as an allocation for resource consent applications

The purpose of this report was to assess whether there has been any research regarding stock drinking water requirements since 2007. There has been quite a bit of work completed on dairy cattle drinking water requirements, two of them by Higham et al (2017a). The other stock types did not have any recent research, with some only having values provided by regional councils.

1.2 Research Steps

A report prepared for HRC by Aquas Consulting Limited and Aqualinc has served as a starting point for the current work aiming to capture any additional relevant information. The report, submitted in 2007 is entitled *Reasonable Stock Water Requirements – Guidelines for Resource Consent Applications*. Section 3 of that report includes a detailed table on “Range for Devising a Standard for Stock Drinking-Water Requirements”.

The current review has been carried out to:

- Locate any relevant research/information produced after 2007
- Look for greater detail in the other farm stock areas (similar to the extensive information on dairying), and
- Identify any other resources and information that might be helpful.

Several steps were taken to obtain relevant information.

- Searches of peer-reviewed literature (key words: stock water requirements, farm animal water requirements, etc) generated several relevant articles.
- Key contacts at industry organisations such as Beef and Lamb NZ, Ag Research and NZ Pork were informed of the work and have provided helpful information. Dairy NZ was not contacted as their information is available online.
- Lincoln and Massey Universities were contacted with a request for relevant information, from which Lincoln University provided relevant research papers.
- All of the regional councils in New Zealand were contacted with a request for relevant information. Almost all the councils responded with useful information, or where to find it.

2 DATA, DETAILS AND DISCUSSION

Values for stock drinking water estimates are reported in the below tables.

It should be noted that all of the values include leakage: that is losses from the pipe network distributing the drinking water. According to Higham et al (2017b), a notable portion (>21%) of stock drinking water is lost to leakage, but average leakage ranged from 2 – 61% of stock drinking water on individual farms. Dairy NZ (2021) found that leakage accounts for 29-47% of the water use recorded at the pump on non-irrigated farms, and 13% of the water pumped on irrigated farms.

In the following sections:

- Relevant data is included in the tables, estimating drinking water in litres per head per day (l/h/d), except in the case of poultry where it is in litres per 100 birds per day.
- Estimates are noted as average daily demand (ADD) and/or peak daily demand (PDD) as provided by the sources. ADD is the average use over the year (derived from the total annual consumption divided by 365), while PDD is the highest single day consumption during the year.
- Details are provided following the tables, either explanatory/support information from the sources cited in the table or information from other sources that doesn't fit the table format but is worth noting.

A brief discussion concludes each section. It covers details relevant to proposing a range for stock drinking water requirements, with the range encompassing an estimate of average daily demand to peak daily demand.

2.1 Response from councils

Table 1 provides a summary of the response from the regional councils that were not given in l/head/day or ADD/PDD.

Although a lot of the regional councils have rules and regulations regarding water take for stock drinking water, almost all the councils referred to the fact that the taking of water for reasonable stock water needs is a permitted activity under section 14 (3) (b) (ii) of the Resource Management Act 1991 (RMA) unless there are adverse effects on the environment from that take. All regional plans and policies must adhere to the rules and regulations in the RMA.

Hawke's Bay Regional Council have further regulations; if a landowner is supplying stock water to multiple properties, then it would be assessed against the 20m³/day limit outside of Tutaekuri, Ahuriri, Ngaruroro and Karamu catchments (TANK) and 5m³/day inside TANK catchments.

Taranaki Regional Council have regulations regarding permitted water takes. The taking and use of surface water is a permitted activity if it is within the following limits; (a) the rate of abstraction for any one property shall not exceed 1.5 l/s, or 5 l/s for not more than 30 minutes per day for temporary taking and use of surface water; (b) the volume of abstraction for any one property shall not exceed 50m³ in any one day; (c) no more than 25% of instantaneous flow measured at the point of abstraction shall be taken.

West Coast Regional Council does not have any specific rules or regulations for taking water for stock drinking water in its plans. Taking and using surface water is a permitted activity if all of the following conditions are met; (a) the total take per landholding does not exceed 2 l/s, up to a maximum value of 25,000 l/day; (b) no other lawful take of water is adversely affected as a result of the take; (c) the intake is protected by a fish screen; (d) the Council is informed in writing of the location, expected rate and frequency of the take prior to the take occurring and contact details of the person taking are provided.

Marlborough District Council have standards regarding the take and use of water for the reasonable needs of a person's animals. These are; (a) where the take is from a river, except an ephemerally flowing river, the instantaneous take rate must not exceed 5% of river flow at the point of take; (b) the take must not be from a Water Resource Unit with a Natural State water quality classification, or a significant wetland; (c) the take must not be otherwise provided for by a resource consent.

The values given by Canterbury Regional Council (ECan) are from the average daily stock water requirements provided in the Lincoln University Farm Technical Manual (2003). The average daily stock water requirements have been multiplied by a factor of 1.1 for the values reported by ECan to allow for some potential loss from

the delivery system (leakage). The peak daily demand values reported by ECan have been multiplied by a factor of 1.5 to allow for both peak daily demand and for some potential loss from the delivery system (leakage).

Table 1: Response from Regional Councils regarding stock drinking water estimates

Council	Response
Otago Regional Council	25,000 l/day for domestic use, which <u>includes</u> stock drinking water
Hawke's Bay Regional Council	Stock water is <u>excluded</u> from the permitted 20m ³ /day.
Tasman District Council	Taking water for the reasonable needs of an individual's animals for drinking water is a <u>permitted</u> activity. There is no limit on the amount of water that can be taken.
Northland Regional Council	Stock drinking water is <u>included</u> in the permitted 10m ³ /day for domestic use/stock drinking water
West Coast Regional Council	No specific rules or requirements for stock water in its plans. The taking and use of surface water is a permitted activity, providing conditions are met.
Waikato Regional Council	Anyone taking more than 15m ³ of water/day for farm use needs a resource consent. Stock drinking water is <u>excluded</u> from this.
Greater Wellington Regional Council	If a landowner has a resource consent to take and use water and uses it to supply stock drinking water, then the applicant will have to provide calculations as to how much water is used for stock, to ensure it is reasonable
Taranaki Regional Council	Water take for stock drinking water is a permitted activity, providing the take is in the limits outlined in the Regional Fresh Water Plan.
Marlborough Regional Council	Take and use of water for the reasonable drinking water needs of a person's animal's is a <u>permitted activity</u> , as long as specific standards are met.

3 DAIRY CATTLE

3.1 Data

HRC's current allowance for dairy cattle stock drinking water requirements is outlined in Table 2.

Drinking water requirements for dairy cows drawn from literature, regional council plans and industry organisation are outlined in Table 3.

Table 2: HRC's current allowance for dairy cattle drinking water requirements

Farming Enterprise	Type of Animal	ADD (l/h/d)	PDD (l/h/d)
Dairy	Milking cows	45	70
	Dry stock	30	45

Table 3: Drinking water estimates for dairy cattle

Source	Animal Description	ADD (l/h/d)	PDD (l/h/d)
Canterbury Regional Council (2011)	Lactating cows	77	105
	Dry cows	50	68
Lincoln University Farm Technical Manual (2011)	Lactating cows	70	
	Dry cows	45	
Statistics NZ (2011)	Lactating cows	70	
Farrell et al (2016)	Dry cows (on fodder beet)	46	
	Dry cows (on kale)	64	
Higham et al (a) (2017)	Lactating cows (irrigated pasture)	39	
	Lactating cows (non-irrigated pasture)	90	
Higham et al (b) (2017)	Lactating cows (non - irrigated pasture)	60	105
Bryant et al (2018)	Lactating cows (on ryegrass)		115
	Lactating cows (on forb)		110
Southland Regional Council (2018)	Lactating cows (including dairy shed use)	70	90
	Dry cows	30	45
Dairy NZ (2021)	Lactating cows (irrigated pasture)	28	68

Source	Animal Description	ADD (l/h/d)	PDD (l/h/d)
	Lactating cows (non-irrigated pasture)	60	105
	Lactating cows – average milking period (Sep – Feb) (irrigated pasture)	39	
	Lactating cows – average milking period (Sep – Feb) (non-irrigated pasture)	70	
	Dry cows (non -irrigated pasture)	45	
	Dry cows (irrigated pasture)	45	
	Calves (at trough)	25	25

3.2 Details

Bryant et al (2018): Study investigating the effect of including a mixture of forbs in a standard ryegrass – white clover pasture to compare urinary nitrogen excretion and milk yield of dairy cows. The study was run between February and March, so the stock drinking water values have been deemed PDD as opposed to ADD.

Farrell et al (2016): Comparative study to evaluate nitrate leaching risks on different diets, fodder beat and ryegrass or kale and oat silage.

Higham et al (a) (2017): Study comparing water use on irrigated and non-irrigated pasture based dairy farms. The irrigated farms were in Canterbury, and the non-irrigated in Manawatu. The reported values have leakage taken into consideration and are during the average milking day, from September to February.

Higham et al (b) (2017): Study quantifying the seasonal pattern of water use on non-irrigated pasture based dairy farms. The reported values include leakage.

Southland Regional Council (2018): Values for lactating cows include dairy shed usage. The ADD of 120l/h/d comprises of 70l/h/d for stock drinking water and 50l/h/d for dairy shed use. Peak daily demand and annual allocation for surface water and groundwater takes for stock and dairy use are calculated based on the number of each stock type multiplied by the figures outlined in the above table.

Dairy NZ (2021): The values reported are those for at the pump, as opposed to at the trough. Values at the pump are including leakage.

3.3 Discussion

There is large variation in the suggested stock drinking water requirements when leakage is taken into consideration. Leakage rates are higher on non-irrigated farms compared to irrigated farms. This is most likely to be due to factors such as age of infrastructure, system design, and how well the system is maintained. Leakage explains much of the difference between stock drinking water requirements on irrigated compared to non-irrigated pasture.

The other reason for the difference in stock drinking water requirements between irrigated and non-irrigated pasture is because of the moisture contained in the irrigated pasture that the stock are able to utilise.

It is recommended that the ADD and PDD for milking cows and dry stock increase. This is based on recent literature suggesting that higher values are required.

Suggested range as a basis for determining a water requirement for milking cows

- ADD – 70 l/h/d
- PDD – 105 l/h/d

Dry stock. This includes cows at various stages of growth, en route to becoming part of the milking herd. Less drinking water is required for these stock as they are not lactating.

Suggested range as a basis for determining a water requirement for dry stock

- ADD – 45 l/h/d
- PDD – 70 l/h/d

4 BEEF CATTLE

4.1 Data

HRC's current allowance for beef cattle drinking water requirements are outlined in Table 4.

Drinking water requirements drawn from literature and regional councils are outlined in Table 5.

Table 4: HRC's current allowances for beef cattle drinking water requirements

Farming Enterprise	Type of animal	ADD (l/h/d)	PDD (l/h/d)
Beef	Mature cattle, herd replacement, stock and bulls	30	55

Table 5: Drinking water estimates for beef cattle

Source	Animal Description	ADD (l/h/d)	PDD (l/h/d)
Canterbury Regional Council (2011)	Beef cattle	50	68
Lincoln University Farm Technical Manual (2011)	Beef cattle	45	
Statistics NZ (2011)	Adult beef cattle	35	
Southland Regional Council (2018)	Beef cattle	45	

4.2 Discussion

It is recommended that the ADD and the PDD for mature beef cattle increase. Although most of the recent research was concentrated around dairy cattle, it is believed that dry dairy cattle would require the same amount of water as mature beef cattle, meaning that the beef cattle water requirements should increase.

Suggested range as a basis for determining a water requirement for mature beef cattle

- ADD – 45 l/h/d
- PDD – 70 l/h/d

5 SHEEP

5.1 Data

HRC's current allowance for sheep drinking water requirements are outlined in Table 6.

Drinking water requirements for sheep drawn from literature and regional council are outlined in Table 7.

Table 6: HRC's current allowance for sheep drinking water requirements

Farming enterprise	Type of animal	ADD (l/h/d)	PDD (l/h/d)
Sheep	Ewes, hoggets and rams	3	4.5

Table 7: Drinking water estimates for sheep

Source	Animal Description	ADD (l/h/d)	PDD (l/h/d)
Canterbury Regional Council (2011)	Breeding ewes	3	5
Lincoln University Farm Technical Manual (2011)	Breeding ewes	3	

5.2 Discussion

The drinking water requirements for sheep appear to be the same as previously reported in 2007, as the ADD value has not changed, based on the available information. Therefore, we have recommended no change to the suggested water requirement for sheep.

Suggested range as a basis for determining a water requirement for ewes

- ADD – 3.0 l/h/d
- PDD – 4.5 l/h/d

6 DEER

6.1 Data

HRC's current allowance for deer drinking water requirements are outlined in Table 8.

Drinking water requirements for deer drawn from regional councils are outlined in Table 9

Table 8: HRC's current allowance for deer drinking water requirements

Farming enterprise	Type of animal	ADD (l/h/d)	PDD (l/h/d)
Deer	Hinds and Stags (all ages)	6	12

Table 9: Drinking water estimates for deer

Source	Animal Description	ADD (l/h/d)	PDD (l/h/d)
Canterbury Regional Council (2011)	Hinds	30	45
	Stags	20	30
Southland Regional Council (2018)	Hinds	30	45
	Stags	20	30

6.2 Discussion

There is a large difference between HRC's current allowance for deer drinking water requirements and the values used by both Canterbury Regional Council and Southland Regional Council. We do not recommend a specific value for the water requirement for deer, but instead recommend that HRC consider the values used by Canterbury Regional Council and Southland Regional Council when determining a drinking water standard.

7 PIGS

7.1 Data

HRC's current allowance for pig drinking water requirements are outlined in Table 10.

Drinking water requirements for pigs drawn from literature, regional councils and industry bodies are outlined in Table 11.

Table 10: HRC's current allowance for pig drinking water requirements

Farming enterprise	Animal Description	ADD (l/h/d)	PDD (l/h/d)
Pigs	Mature pigs	11	18
	Brood sows	22	35
	Pigs up to 120kg	7	11

Table 11: Drinking water estimates for pigs

Source	Animal Description	ADD (l/h/d)	PDD (l/h/d)
Canterbury Regional Council (2011)	Sows	28	38
	Pigs	12	17
Lincoln University Farm Technical Manual (2011)	Sows	25	
	Pigs	11	
NZ Pork (2012)	10kg	1.2 – 1.5	
	11-25kg	2.3 – 2.5	
	26-50kg	3.0 – 5.0	
	51-120kg	6.0 – 8.0	
	Boars	5.0 – 10.0	
	Replacement gilts	5.0 – 8.0	
	Pregnant sow or gilt	5.0 – 10.0	
	Lactating sow	15.0 – 50.0	

7.2 Details

NZ Pork (2012): Information from NZ Pork. The reported values are from their best practice free range guidelines. It outlines water requirements for different classes of pigs at 'normal' ambient temperatures.

7.3 Discussion

There is no change to the suggested range for water requirement for mature pigs or brood sows, as there has not been any recent research to suggest a need for change, and the current values are reasonable.

Suggested range as a basis for determining a water requirement for mature pigs

- ADD – 11 l/h/d

- PDD – 18 l/h/d

Suggested range as a basis for determining a water requirement for brood sows

- ADD – 22 l/h/d
- PDD – 35 l/h/d

8 CHICKENS

8.1 Data

HRC's current allowance for chickens drinking water requirements are outlined in Table 12.

Drinking water requirements for chickens drawn from literature and regional council are outlined in Table 13.

Table 12: HRC's current allowance for chicken drinking water requirements

Farming Enterprise	Animal Description	ADD (l/100h/d)	PDD (l/100h/d)
Chicken	Laying and breeder hens	30	45
	Non-laying chickens and hens	18	29

Table 13: Drinking water estimates for chickens

Source	Animal description	ADD (l/100h/d)	PDD (l/100h/d)
Canterbury Regional Council (2011)	Poultry	33	45
Lincoln University Farm Technical Manual (2011)	Poultry	30	

8.2 Discussion

As with pigs, there is no change to the suggested range for water requirements for chickens, as there has not been any recent research to suggest the need for change, and the current values are reasonable.

Suggested range as a basis for determining a water requirement for laying and breeder hens

- ADD – 30 l/100h/d
- PDD – 45 l/100h/d

Suggested range as a basis for determining a water requirement for non-laying chickens and hens

- ADD – 18 l/100h/d
- PDD – 29 l/100h/d

9 RECOMMENDATIONS

The range for drinking water requirements for the stock types studied are summarised in Table 14.

Table 14: Suggested stock drinking water requirements

Farming enterprise	Type of animal	ADD (l/h/d)	PDD (l/h/d)
Dairy	Milking cows	70	105
	Dry stock	45	70
Beef	Mature beef cattle	45	70
Sheep	Ewes	3	4.5
Deer	Hinds/stags	No recommended value, consider using Canterbury and Southland Regional Council's values	No recommended value, consider using Canterbury and Southland Regional Council's values
Pigs	Mature pigs	11	18
	Brood sows	22	35
Chickens	Laying and breeder hens	30	45 (l/100h/d)
	Non-laying hens and chickens	18	29 (l/100h/day)

Average daily demand can serve as a good guide in the case of groundwater use. Alternatively, peak daily demand is a helpful guide for surface water sources, given that the greatest demand tends to occur at times of natural low flow.

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