

In reply to the commissioners queries:

1. How did ECan determine the degree of confinement (and associated Ss value being a default 0.0001) applicable to the pumped well and associated spring environment given variability in subject well depth?

Spring depletion via a Theis (1935) drawdown analysis was adopted as an additional test for potential effects on streams. The primary reason for the inclusion of this second test was that opposition to the Theis (Jenkins) stream depletion model was anticipated.

Some areas around Lake Ellesmere are significantly confined, which violates Theis' original stream depletion assumptions, so where the streambed could be in a confined part of the aquifer system, the effects on the nearest spring were also estimated.

In the case of depression springs, i.e. diffuse gains to streams along their length, a stream depletion assessment should be appropriate. However, in the case of true Artesian springs, the source of water is discrete and a stream depletion model will over estimate depletion rates.

As no field validation was carried out, any permanent spring marked as unknown or artesian (5 only) have been treated as fully confined artesian, and as such drawdown effects have been modeled using a fully confined S value of 0.0001 independent of well depth.

- Step 1 Undertake a stream depletion analysis based on available information (aquifer tests, streambed conductance), and identify potential stream depleting takes.
- Step 2 Identify possible confined reaches of stream bed.
- Step 3 If streambed potentially confined, identify nearest springs listed as permanently flowing. If spring type recorded as depression, use initial stream depletion estimate.
- Step 3 If spring recorded as artesian or unknown, undertake Theis drawdown assessment using aquifer test parameters or where no test is available estimated T and S=0.0001. Where drawdown exceeds 0.1m at spring, recommend minimum flow conditions

2. How did ECan determine actual (seasonal) spring flow variability due to changes in potentiometric head?

Natural variability was not determined. The Theis drawdown modelling was undertaken to identify potential spring depletion, simply as a second test.

3. How did ECan provide estimated spring depletion rates based on Theis depressurisation calculations in relation to the 7-day or 150-day abstraction rates in consideration of (point 2) above?

Spring depletion was not estimated. The depletion rates have been estimated using the stream depletion models and the second test applied where the streambed is potentially confined.

Without flow information from an artesian spring depletion rates cannot be calculated.

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