BEFORE THE HAWKE'S BAY REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of an application by various applicants ('the applicant group') for taking and use of Tranche 2 Groundwater from the Ruataniwha Basin

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JOINT WITNESS STATEMENT

WELL INTERFERENCE ASSESSMENT

20 October 2022

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1. This joint witness statement (JWS) has been prepared as part of expert conferencing on the topic of well interference, in relation to the application for resource consents made by the Applicant Group to Hawke's Bay Regional Council (**HBRC**). The applications relate to proposed abstraction of Tranche 2 groundwater from the Ruataniwha Basin for use to irrigate land and for augmentation of rivers and streams.

2. The expert conference was held on 20 October 2022 at the offices of Pattle Delamore Partners Ltd (PDP), Christchurch, and via video communication. The focus of this conferencing was well interference assessments and the subsequent effects on existing bores.

3. The groundwater modelling experts who attended the conference were:

   (a) Neil Thomas, Pattle Delamore Partners Ltd (PDP), engaged by HBRC (in person);

   (b) Hilary Lough, PDP, engaged by HBRC (in person)

   (c) Susan Rabbitte, Consultant, engaged by the Applicant Group (via video); and

   (d) Julian Weir, Aqualinc Research Ltd (Aqualinc), engaged by the Applicant Group (in person);

   (e) Alexandra Johansen, Bay Geological Services Limited (BGSL), engaged by the Applicant Group (via video);

   This JWS is prepared in accordance with Section 4.7 of the Environment Court Practice Note 2014.

4. It is confirmed that all attendees have read the Environment Court Practice Note 2014, and agree to abide by the Code of Conduct.

5. This JWS sets out:

   (a) Those matters which are agreed between the experts;

   (b) Those matters which need to be addressed prior to the hearing that require further information; and

   (c) Those matters which are not agreed and for the reasons stated.

6. Items set out below include those presented in the Summary Well Interference Methodology (Rabbitte, 2022), dated October 2022, generally falling into the topics of groundwater levels, the incorporation of seasonal water level change and cumulative effects of existing groundwater abstraction.

Questions and Responses

Preliminary Comments

The objective of the Ruataniwha Basin well interference assessment is to quantify the potential drawdown effects from pumping the proposed Tranche 2 bores on neighbouring bores. This drawdown interference effect is then used to determine whether that pumping effect will restrict the use of those neighbouring bores.

The Panel, in their first Minute, also requested that the experts conference on the:

> Effects on other existing water users potentially affected by the proposal, in particular the magnitude of interference drawdown and cumulative effects on existing wells, including shallow wells.

The well interference methodology (Rabbitte, 2022)[1] has been updated after the lodgement of Mr Thomas' evidence in chief (EIC) (dated 8 August 2022). Some matters of concern that Mr Thomas raised in his EIC have now been addressed in this latest well interference methodology report.

The review of the well interference assessment is based solely on the latest interference report (Rabbitte, 2022). This report consists of a summary of the methodology applied to determine the drawdown interference effects. The final calculations of drawdown interference have not been provided for review by the experts. Therefore, the Panel's request may not be fully addressed at this time.

[1] Rabbitte (2022): *Summary WI Methodology*. Report prepared for Various Collaborative Participants. October 2022. Circulated on 15th October 2022.

__Estimation of static water level (SWL)__

Q1: Is the methodology for estimating static water levels based on interpolation between SOE monitoring points reasonable?

SR – Agree. Sufficient coverage and best available data. The monitoring wells are located in the areas of the basin where most of the existing groundwater abstraction supply wells are. They do represent the variety of depths, and they adequately represent existing use.

JW- Agree with SR. Note that the use of controls along rivers for shallow GWL would provide a more precise interpolation.

AJ- Agree with current methodology based on historical data. A coarse comparison with the Tranche 1 pumping effects would be beneficial.

NT- Disagree based on current information. The methodology as it stands cannot fully account for Tranche 1 pumping effects between monitoring bores. Also note that further controls are required along the rivers for interpolation and recommend that stage could be used where the HBRC maps indicate gaining reaches. Recommend that LiDAR or other DEM is used rather than interpolation for estimating ground levels at bores without data.

HL – Disagree based on current information. Recommend that there is a comparison provided of any measured water levels in the wells assessed with the interpolated water levels to show that the interpolated water levels are conservative, or if they aren't then an explanation is provided. Recommend further validation with comparison of groundwater model results of the drawdown predictions from Tranche 1 pumping compared to no pumping. Although this is not a like-for-like comparison, it would help illustrate the pattern of Tranche 1 pumping impacts and potentially improve confidence in the interpolation of low static water levels.

Q2: Does the methodology adopted adequately allow for impacts of seasonal variation? Does it account for natural variation, pumping related declines and predictions of future declines?

SR- The methodology used for determining the static water level allows for potential future declines in water level associated with increasing use and/or climate change. Temporal decline in low groundwater levels was observed in some (20) wells. This may be reflective of increasing use of T1 allocations or other climatic factors. A value was calculated at each well where a trend was observed, a five-year prediction was then made and subtracted from the wells SWL. These reduced levels were used for contouring and interpolation.

JW- Agree that the method adequately allows for seasonal variations, pumping related declines, and allowance for future declines. As HBRC have granted no new take consents since approximately 2009/2010, existing development is therefore likely to be maximised, and variations experienced are likely due to seasonal irrigation demand.

AJ – Agree with methodology. Considering historic data available which includes significant droughts the Tranche 1 allocation has not been fully used to date. The larger scale abstractors often struggle to realise full use of Tranche 1 water due to various considerations (including hydrogeology).

HL & NT- Concerned about the full effect of the Tranche 1 water takes and that the use recorded as shown in Figure 1 of NT evidence in chief is significantly less than the Tranche 1 consented allocation limit. We have been involved in a number of transfers between properties, and further transfers would provide for greater use of the Tranche 1 water within the currently consented allocation. It would be helpful to see some commentary on the climatic variation in the last 10 years and how this compares to the records of actual use particularly in relation to 2020, the year of greatest recorded use of Tranche 1 water (Figure 1 of NT evidence in chief). Concerned that climate change will result in increased irrigation demand and increased use of Tranche 1 water on existing properties, even in absence of transfers, resulting in potentially lower groundwater levels without the Tranche 2 takes.

Q3: Is the use of the average value of the lowest 10% water level records appropriate?

To calculate SWLs, the updated methodology uses average values of the lowest 10% of records in each monitoring bore. The assessment uses an existing network comprising 74 monitoring wells (or State of the Environment (SOE) wells) operated by HBRC (these are the same wells used for groundwater model calibration). Some of these have a long history of data, extending back to 1992, and others have only relatively recent monitoring data. Of the 74 wells, 46 have recorded their lowest SWL since 2019, with 30 of these occurring in the first half of 2020.

SR – Agree. The SOE coverage is the most comprehensive groundwater dataset available, both temporally and spatially. This allows for incorporation of datasets of varying lengths. Multiple monitoring wells with shorter lengths of record include some extreme low values from the dry 2019/2020 season, and therefore because the record is short, the resulting low value (used in the assessment) is heavily weighted to the 2019/2020 season.

JW - Agree. The use of an average from the lowest 10% reduces the influence of local scale extreme lows due to short-term pumping (or other causes).

AJ- Agree. The use of the average value from the lowest 10% does not specifically reflect the lowest levels of 2020 or any dry period recorded in wells with long records, but it provides a weighted average over dry periods for the assessment.

NT – Generally agree. But note that the lowest values recorded will not be reflected in SWLs and that the record from some bores does not cover the 2020 low water levels.

HL – Generally agree in this instance with the use of an alternate to the lowest water levels, based on the comparisons shown in Figure 1 of Rabbitte (2022). It generally shows the levels are very similar. However, I do acknowledge that in times of low water levels the adverse effects will be greater. For the shallow wells the difference is small but in some of the intermediate and deep wells there are quite significant differences of over 20 m in the levels.

Q4: Is well-depth variability in water level considered and allowed for?

Monitoring wells across the basin have different depths. Wells were separated into depth categories to accommodate different static water levels at different depths.

SR – Agree. Three depth categories were identified, based on our understanding of the basin's physical geology (shallow gravels [<20m top screen] Young Gravels [20-50m top screen] and Salisbury Gravels [>50m top screen]). These three categories have 26, 25 and 23 wells each, respectively, allowing an adequate and relatively even spread over the basin. Data is more limited in the west and north of the basin, but there are also fewer wells to assess in these areas.

JW – Agree. A pragmatic balance between depth categories and available data was achieved

AJ – Agree that the well depth variability is allowed for.

HL & NT - Agree recognising limitations with spatial coverage of the monitoring wells.

Well data

Q5: Is the recorded top screen height plus pump length the most suitable reference level?

All experts agree.

Q6: Is the method used to fill top screen data gaps appropriate?

All experts agree.

Q7: Are the pump length and ground level (GL) to top of casing (TOC) adjustments used appropriate?

A surface pump may draw from an intake at the base of a well, lifting a height of about 7m (max). A submersible pump used for irrigation may be 2m long, although in a small diameter well used for domestic or stockwater (or small irrigation rates) the submersible pump length is likely to be shorter (such as 1 m). Pump lengths of 2m were therefore used, or 0m if the top of the screen is less than 6m deep.

The height above GL of a TOC reference point varies from well to well. Though they are usually in the range 0.3m to 0.5m above ground level (0.4m was used as an average).

All experts agree.

Well Interference Assessment

Q8: Was the best method used to apply data from the numerical groundwater model for Tranche 2 (T2) drawdown interference?

The T2 drawdown for each well assessed has been derived from the appropriate model cell within which the bore is located, allowing for depth and location. There may therefore be differences in drawdowns shown in the shallow drawdown plots in the groundwater modelling report compared to values used in Rabbitte (2022) (which are generated from the same groundwater model).

The T2 drawdown used in the well interference assessment has been derived from the groundwater model results as of March 2011. This date presents an extreme dry year for low river flows and groundwater levels, and presents an extreme (or nearly extreme) response of the T2 takes for the simulation period modelled (1972 – 2012)

All experts agree, however HL & NT would like to see the uncertainty ranges from the groundwater model applied to the well interference assessment.

Q9: Is the method to calculate the Available Head (AH) appropriate?

The AH was calculated by subtracting the top of the well screen from the low static water level with a further adjustment for pump height.

All experts agree.

Q10: Is an arbitrary value of 20% a reasonable cut-off, when calculating the proportion of available head represented by the proposed T2 activities?

An arbitrary value of 20% was used to highlight wells requiring further, more specific consideration. Specific effects on drinking water supply bores will be noted in relevant evidence.

HL & NT- Agree provided that T1 takes are adequately accommodated either in the SWL assessment or in a separate drawdown interference assessment (the concerns on this are discussed above).

SR, JW, AJ- Agree and consider that the T1 takes are adequately accommodated in the SWLs. We consider that the 80% AH is sufficient for drawdown within the well from pumping that well (self-induced drawdown).

Q11: Are wells with negative calculated available head potentially "inefficient"?

Policy 77 (c) defines efficient taking of groundwater. A number of bores in the assessment are calculated to have no available drawdown (even without the additional T2 effects) which could indicate that they would not meet the definition of an efficient take in terms of the policy.

In Policy 77 (c), the term 'well efficiency' refers to the well depth relative to the aquifer resource and whether or not it is adequate to access groundwater over a range of climatic conditions. In this case, the term 'well efficiency' does not refer to the hydraulic performance of the bore (which is the 'normal' focus for the term 'well efficiency').

All experts agree that with the additional T2 drawdown, bores with negative AH may be drier for longer, may have to rely on other sources at times and/or reduce their pumping rates more frequently.

SR: The calculation of AH currently identifies many wells with negative AH. No wells at the deepest category have negative AH, and only a few at the intermediate level. This issue therefore overwhelmingly impacts shallow wells.

Q12: How has the uncertainty in effects associated with the proposed bores been accommodated?

As some bores proposed as part of the T2 applications are not yet drilled, the drawdown interference effects related to the use of these bores are not precisely known.

The experts agree that this uncertainty can be accommodated to some extent now by using the uncertainty assessments from the model and further accommodated through appropriate conditions, or variations to consents. Specifically, this should include aquifer testing and subsequent effects assessments with mitigation (if required).

Dated 20 October 2022

Neil Thomas

Susan Rabbitte

Julian Weir

Alexandra Johansen

Hilary Lough