

## Groundwater and Hydrology

### Technical Discussion

1. This Technical Discussion statement relates to expert discussion on the topic of Groundwater and Hydrology.
2. This statement relates to the Fast-track consent application lodged by Genesis Energy Limited under the Fast-track Approvals Act 2024 for a water permit to divert, take and use water and a discharge permit to discharge water and associated contaminants, all associated with the operation of the Tekapo Power Scheme (referred to in this document as the “**Tekapo PS**”)
3. The technical discussion was held by Teams conference call on 26 June 2025 with Bas Veendrick, Hilary Lough, Ben Wilkins and Hamish Graham meeting in person.
4. Attendees at the conference were:

Person	Organisation	Role
Bas Veendrick (“ <b>BV</b> ”)	Pattle Delamore Partners (“ <b>PDP</b> ”)	Advice to Genesis regarding hydrology
Hilary Lough (“ <b>HL</b> ”)	PDP	Advice to Genesis regarding groundwater
Ben Wilkins (“ <b>BW</b> ”)	Canterbury Regional Council (“ <b>CRC</b> ”)	Advice to CRC regarding groundwater
Hamish Graham (“ <b>HG</b> ”)	CRC	Advice to CRC regarding hydrology
Susannah Black (“ <b>SB</b> ”)	CRC	Advice to CRC regarding planning matters
Gareth Gray (“ <b>GG</b> ”)	Genesis Energy Limited (“ <b>Genesis</b> ”)	Genesis operations advice (monitoring, hydrology)
Richard Matthews (“ <b>RM</b> ”)	Mitchell Daysh Limited (“ <b>MDL</b> ”)	Advice to Genesis regarding planning matters

5. The scope of the issues discussed included:
  - a. Discussions regarding matters raised by CRC.
  - b. Confirmation of areas of agreement/disagreement.

- c. Discussions regarding draft consent conditions.
- d. Any other matters we considered relevant.

7. The matters discussed and the positions reached are summarised in the following table:


Issue	Discussion / Comments
Need for groundwater monitoring data.	<p><b>BW</b> – there is uncertainty regarding future climate change effects on catchment hydrology and therefore of effects on groundwater hydrology. It would be useful to have monitoring data relevant to lake levels, Takapō River and Canals. The concern relates to the limited long-term groundwater monitoring over the previous 35 year consent and uncertainty in groundwater resource changes over the 35 year duration of the consents sought.</p> <p><b>HL</b> – a very comprehensive monitoring programme was undertaken to inform effects on groundwater for the application, and the application referred to earlier comprehensive monitoring work done in respect of canal relining. The monitoring work undertaken has provided a very good understanding of the interaction between groundwater and surface water around the lake, the river and the canal, to inform the effects assessments. No change in the effects of the exercise of the consents sought for the Tekapo PS would be anticipated over the duration of the consents sought because no changes are proposed (including the same operating lake levels) meaning that future monitoring of groundwater is not considered necessary as part of the consents sought.</p> <p>The general pattern of lake levels is unlikely to change under climate change [discussed further below]. The operating levels are not changing, and the influence of the current lake level operation has been well studied in the comprehensive monitoring programme.</p> <p><b>BW</b> – there is value in monitoring data to understand climate change effects; the information would also assist with understanding future effects on groundwater of the Tekapo PS in combination with other activities in the catchment.</p> <p><b>Action: BW</b> to consider the form of a condition should this be proposed for the consents sought.</p>
Availability, locations and frequency of data collection.	<p><b>BW</b> – CRC would have a preference for monitoring in the vicinity of the river and unlined sections of the canal; monthly groundwater levels would probably suffice.</p>

Issue	Discussion / Comments
<p>Potential for any ongoing monitoring data being routinely undertaken by Genesis for other reasons to be provided to CRC.</p>	<p><b>GG</b> – Genesis collects some data as part of routine scheme operation.</p> <p><b>SB / RM</b> – could data currently being collected be shared with CRC via an arrangement external to the consents sought?</p> <p><b>Action: GG</b> to identify by 4 July what groundwater data is collected by Genesis and whether that can be readily shared with CRC.</p>
<p>Changes to the existing climate in the catchment and effect of Genesis operational changes to respond to this.</p>	<p><b>BV</b> noted that changes to the existing climate since Genesis commenced exercising consents for the Tekapo PS in 2011 have been very small. It would be hard to detect climatic changes over such a short period beyond the natural variations.</p> <p><b>GG</b> outlined the Genesis operating approach, which is broadly that generation is managed on (typically) a weekly basis taking into account inflows and lake levels and consideration of the risks of reaching the lake levels specified in consent conditions, and that this approach had not changed since Genesis commenced exercising consents for the Tekapo PS in 2011.</p> <p><b>HG</b> to consider.</p>
<p>How will projected changes to Lake Takapō / Tekapo inflows due to climate change affect the Genesis operations within the present operating range (noting that there is reference to a 10% decrease in summer inflows and 26 % increase in winter inflows in a report reviewed for the PDP hydrological assessment).</p>	<p><b>GG</b> considered that the operating approach would not change and that the time scale used means that climate change effects would fall within the range of responses to short term variations in inflows anyway.</p> <p><b>BV</b> noted that the magnitude of the projected changes to Lake Tekapo inflows due to climate change depend on the emission scenario. The changes in flow characteristics are generally greater with increased radiative forcing. In other words, the available studies indicate that the greatest changes in flow characteristics can be expected under the highest radiative forcing scenario (RCP8.5) with generally little/much less change in inflow for the lowest radiative forcing scenario (RCP2.6).</p> <p><b>GG / RM</b> noted that the presence of the Tekapo PS may mean that lake levels are unlikely to fall as low as they otherwise might in the absence of the scheme because of the risk based approach Genesis operates in order to comply with the lake levels required by consent conditions.</p> <p><b>Action: GG</b> to identify information that could be provided to HG to assist with understanding the risk-based approach used by Genesis, noting that there is commercially sensitive data associated with this.</p>

Issue	Discussion / Comments
	<b>HG</b> to consider once additional information around risk-based approach has been provided by Genesis.
How will projected electricity demand change the effect of scheme operations within the present operating range.	<b>RM</b> – projected electricity demand will not affect Tekapo PS operations as projected increases in electricity demand will need to be met by additional generation options elsewhere. Any reduction in flow through the Tekapo PS stations will mean that additional generation options (solar, wind, geothermal, thermal etc.) will be required to meet projected demand.  CRC to consider.
Effects of changes in lake levels (e.g., more frequent changes, longer duration changes, approach maximum or minimum levels) compared to current operations.	<b>BV</b> noted that although Lake Tekapo inflows are likely to increase in winter under climate change the general pattern of relatively low inflow in winter and relatively high inflow in summer would be retained. Changes in lake levels due to climate change would be difficult to predict because of uncertainties in what the climate change effect would be and the timing of that effect (e.g. higher inflows may be accommodated within the lake storage volume). Drawdown would still occur largely as at present.  <b>GG</b> indicated that higher winter inflows can be accommodated within the existing generation capacity of up to 130 m <sup>3</sup> /s. In other words, the increased lake inflows would likely result in increased generation in winter while still managing to the consented lake levels taking into account the risks of reaching the lake levels specified in the consent conditions. In that regard, the general pattern of the existing lake levels is unlikely to change.  <b>HG</b> to consider once additional information around risk-based approach has been provided by Genesis.
Effect of Lake George Scott weir spill changes (frequency/flow, rates/duration) based on climate change projections used in the application, if the currently consented operation of the scheme were to continue.	<b>BV</b> noted that this is discussed in the Tekapo Power Scheme – Hydrological and Hydrogeological Analyses report submitted with the Fast-track application (section 4.1.3.3 Spill Flows) and discussed why he considered that spill flows are unlikely to change.  <b>GG</b> indicated that the projected changes as a result of climate change are unlikely to change spill flows.  <b>HG</b> to consider.

Issue	Discussion / Comments
Proposed conditions: Metering/monitoring of rates of take, lake levels and rates of discharge.	<p><b>SB</b> requested that Genesis consider aspects of draft conditions based on Meridian conditions she has provided that wouldn't work for the Tekapo PS. She noted that further discussion may be required regarding specific conditions.</p> <p><b>GG/RM</b> noted that the Genesis proposed conditions are based on achievable accuracy for open channel (10%) and pipe systems (5%) and that a range of monitoring devices or systems are necessary in order to confirm the accuracy of the measurements undertaken. Also referred to the Flow Monitoring section (section 6.11, pages 209 – 210 in the Tekapo Power Scheme Fast-track Application for Resource Consents and Assessment of Environmental Effects (April 2025) to clarify the approach used for flow measurement.</p>

**Confirmed by email:**

Bas Veendrick	Email dated 4 July 2025, 7:30 pm.	Gareth Gray	Preparing information requested in notes.
Hilary Lough	Email dated 7 July 2025, 2:43 pm.	Susannah Black	Draft confirmed, email 1/7/25 10:36 pm.
Ben Wilkins	Email dated 7 July 2025, 10:59 am.	Richard Matthews	
Hamish Graham	Awaiting further Genesis data (as per notes)		<p><i>[Note: further discussion on draft flow / level conditions to take place week commencing 14 July]</i></p>

## **Draft Conditions Provided by SB for Further Discussion**

### **Take**

- a. *The consent holder must measure and record the take for the purpose of compliance via [gate] rating, measured at or about map reference NZTM xxxxxx xxxxxx [description], at a frequency not greater than every 60 minutes to within an accuracy of  $\pm 10\%$  of the actual take.*
- b. *Take compliance shall be determined as a 24-hour fixed interval average.*
- c. *The recording device shall be connected to a telemetry system which collects and stores all of the data continuously. The consent holder must provide the flow records at 5 minute intervals, electronically, to the Canterbury Regional Council, Attention: Regional Leader Compliance Monitoring, that cover:*
  - i. *each day, no later than the end of the next day; and*
  - ii. *each water year (1 July - 30 June), no later than one month after the end of that water year.*
- d. *No data in the recording device(s) shall be deliberately changed or deleted.*
- e. *The consent holder must supply the flow records to Canterbury Regional Council, attention: RMA Compliance and Enforcement Manager at least annually and at any time on request by the Council.*

### **Lake level**

- a. *The consent holder must measure and record for the purpose of compliance the lake water levels of [Lake name], measured at or about map reference NZTM XXXXXX, XXXXXX (description), at a frequency not greater than every 60 minutes to within an instrument resolution of  $\pm 3$  mm of the actual lake level.*
- b. *Lake level compliance shall be determined as a 60-minute fixed interval average in relation to mean sea level (Lyttelton datum) (amsl).*
- c. *The recording device shall be connected to a telemetry system which collects and stores all of the data continuously. The consent holder must provide the records at 5 minute intervals, electronically, to the Canterbury Regional Council, Attention: Regional Leader Compliance Monitoring, that cover:*
  - i. *each day, no later than the end of the next day; and*
  - ii. *each water year (1 July - 30 June), no later than one month after the end of that water year.*
- d. *No data in the recording device(s) shall be deliberately changed or deleted.*
- e. *The consent holder must supply the lake level measurement records to Canterbury Regional Council, attention: RMA Compliance and Enforcement Manager at least annually and at any time on request by the Council.*
- f. *Notwithstanding a above, any existing lake measurement device that does not meet the instrument resolution must be upgraded to achieve a. above within 24 months of the*

commencement of consent. Until any upgrading is completed measurement for the purpose of compliance is to occur based on the best instrument resolution available.

### **Discharge**

- a. *The consent holder must measure and record the flow for the purpose of compliance via [a spillway] rating system, measured at or about map reference NZTM XXXXX, XXXXX [description], at a frequency not greater than every 60 minutes to within an accuracy of  $\pm 10\%$  of the actual volume of the flow.*
- b. *Flow compliance shall be determined as a 60-minute fixed interval average.*
- c. *The recording device shall be connected to a telemetry system which collects and stores all of the data continuously. The consent holder must provide the flow records at 5 minute intervals, electronically, to the Canterbury Regional Council, Attention: Regional Leader Compliance Monitoring, that cover:*
  - i. *each day, no later than the end of the next day; and*
  - ii. *each water year (1 July - 30 June), no later than one month after the end of that water year. 5 May 2025*
- d. *No data in the recording device(s) shall be deliberately changed or deleted.*
- e. *The consent holder must supply the flow measurement records to Canterbury Regional Council, attention: RMA Compliance and Enforcement Manager at least annually and at any time on request by the Council.*

Locations: Gate 16, Gate 17 and Lake George Scott weir