EXPERT WITNESS CAUCUSING CONFERENCE AND JOINT WITNESS STATEMENT: Groundwater quality

BEFORE THE TASMAN DISTRICT COUNCIL IN THE MATTER	Of application RM200488, RM200489 (Land use consents) and RM220578 (Discharge Permit to Land) at 134 Peach Island Road, Motueka
APPLICANT	CJ Industries Ltd

Date / Time	1pm to 4pm, 15 February 2023
Venue	https://us02web.zoom.us/j/85643672447?pwd=QU1lRndxNEhqTmhKaXFubDdUOEt0dz09

Witnesses	**For**
Mr Nicols (RN)	Applicant
Dr Rutter (HR)	Council

JOINT WITNESS STATEMENT – GROUNDWATER QUALITY

Record of issues discussed, areas of agreement or disagreement, reasons. Witnesses should:

- **identify their position and reasons by their initials**
- **identify if any matter is not within their expertise**

The following records the positions during caucusing. The parties reviewed the record of the caucusing, and collaboratively prepared the table.

While the caucusing was done on a without prejudice basis, the witnesses have chosen to attach as an Appendix the records of the 'free and frank' version of their professional discourse to assist the Commissioner.

The witnesses confirm that they have read and followed the Code of conduct for expert witnesses (Environment Court 2023 practice note – Section 9.0, including 9.5 relating to Joint witness statements - link https://www.environmentcourt.govt.nz/about/practice-note/).

Groundwater levels			
1.	**Is there adequate information about groundwater levels at the site to inform excavation depths and processes for back filling, specifically:**		
a.	**Are there enough groundwater level monitoring bores?**		
HR and RN agree There are enough monitoring bores given the outlined approach to inform excavation depths.		**HR Disagree**	**RN Disagree**
b.	**Is there enough current groundwater level data?**		
HR and RN Agree		**HR Disagree**	**RN Disagree**

No	Concern about the short-duration of existing groundwater level record and whether it captures occasional and significant events, that cause groundwater levels to rise rapidly close to ground level.	There is enough groundwater level data to allow clean filling. Fluctuations in groundwater levels are managed by active groundwater level monitoring in the monitoring bores, confirmation of water levels from temporary test pits and having sufficient fill material to back fill excavations if groundwater levels show signs of rising.
c.	**Will there be enough groundwater level data (including proposed test pitting) to inform excavation depths for clean filling?**	
HR and RN Agree	**HR Disagree** Same response as comment 1b.	**RN Disagree** Same response as comment 1b.
d.	**Do the effects of climate change on fluctuating water levels and predictability add any further considerations not already covered?**	
HR and RN Agree Depth of excavations dictated by real-time groundwater level.	**HR Disagree** Increase in rainfall as a result of climate change may result in higher groundwater levels. More extreme events could result in more rapid groundwater level changes.	**RN Disagree** Variations in groundwater level including fluctuations as a result of climate change managed by: - Ongoing groundwater level monitoring in monitoring bores. - Generation of on-demand groundwater level contour maps. - Confirmation of groundwater levels from temporary test pits. - Only undertaking excavations to 0.3 and 1 m above groundwater if excavation control criteria allow – which captures effects of large weather events etc. - Having sufficient backfill available and capability to rapidly fill excavations.
2.	**Will the proposal to backfill if groundwater levels are rising be effective in preventing surface exposure of groundwater?**	
HR and RN Agree Partly an operational matter for rate of backfilling to be as fast/faster than groundwater level increase.	**HR Disagree** Concerns that groundwater levels will rise faster than excavations will be able to be backfilled, particularly from large/prolonged flood/rain events when it's not just a 24 hour period that needs to be assessed, but ongoing groundwater level rise over	**RN Disagree** Strong hydraulic connection between Peach Island groundwater levels and Motueka River. No long-term Peach Island specific rainfall data available but effect of rainfall on groundwater level fluctuations expected to be managed operationally via the measures noted in 1d above. Mr Corrie-Johnston confirmed there will

		two or more days. Rainfall events/groundwater level responses specific to Peach Island area don't appear to have been assessed in application such that the operator can understand which rainfall events/weather warnings are likely to trigger a response to stop quarrying/start filling.	be access to sufficient clean fill and machinery to backfill excavations in advance of rising groundwater levels.
Groundwater quality			
3.	**Groundwater is not considered to be an exposure pathway of concern for Class 5 Fill in WasteMINZ 2022 – are there reasons to differ from that guidance in this case?**		
HR and RN Agree No adverse effects on groundwater – provided that all clean fill material used as backfill at Peach Island meets the Class 5 requirements in WasteMINZ 2022		**HR Disagree** Even with best processes, accidents can happen. This proposal is unusual in that material will be paced into the zone of groundwater level fluctuation. If contaminated material was to be placed, then there is much higher potential for contaminants to migrate rapidly than if there was unsaturated material between the fill and groundwater.	**RN Disagree** No need to differ from the WasteMINZ guidance. If undetected contaminated material was to occur in the material for backfilling purposes, the waste acceptance criteria is expected to limit the quantity of contaminated material to small, localised zones of material (as opposed to gross contamination). If mobilised, elevated contaminant concentrations would be expected to be attenuated/diluted due to small volume.
4.	**The key controls proposed to reduce any water chemistry changes are the quality and testing of the clean fill material:**		
a.	**Are the clean fill parameters in Table 1 of the draft Groundwater and Clean Fill Management Plan ("GCMP") appropriate?**		
HR and RN Agree Clean fill parameters in Table 1 of draft GCMP are appropriate.		**HR Disagree**	**RN Disagree**
b.	**If the clean fill meets the requirements of Table 1 of the GCMP, are adverse effects on groundwater quality likely to arise?**		
HR and RN Agree If the requirements of the GCMP are always met, adverse effects are unlikely to arise.		**HR Disagree**	**RN Disagree**
c.	**If accidents occur despite following best practice, are adverse effects likely to occur?**		
HR and RN Agree		**HR Disagree**	**RN Disagree**

Low probability for an accident to occur and a significant volume of contaminated material would be required to cause adverse effects.	Complex conditions can be difficult for consent holders to follow. Cites an example where an accident has occurred.	The requirements of the proposed waste acceptance criteria make the probability of an "accidental" use of a large volume of contaminated fill material low.
d.	**Are there potential adverse effects from groundwater interaction with topsoil and subsoil (material placed less than 1 m from surface)? Are controls on topsoil and subsoil suitable to avoid/minimise such effects?**	
HR and RN Agree Topsoil and subsoil imported from off site that will be placed less than 1 m below ground level (and subject to appropriate levels of control), then the proposed controls will avoid adverse effects from interactions with groundwater.	**HR Disagree** Original concern had been that soil was not going to be subject to the same rigorous controls as fill, and that soils would be inundated at times in parts of the site. Unaware of the SMP and thus on specifics and appropriateness of the proposed controls on quality of subsoil and topsoil.	**RN Disagree** Provisions in Soil Management Plan (SMP) to manage sub soil and topsoil properties, although the SMP will be updated to ensure consistency with the GCMP (defer to Mr Hill / evidence on soil productivity). Only difference expected to be organic content and type of organic material in the soil to be used as topsoil which is expected to be the case for the existing onsite topsoil.
e.	**Are the proposed processes for offsite screening and testing requirements for clean fill in Section 4.0 of the draft Groundwater and Clean Fill Management Plan appropriate?**	
HR and RN Agree Covered above in 4b.	**HR Disagree**	**RN Disagree**
5.	**Is *any change* in groundwater chemistry an adverse effect on water quality, or does there need to be a change beyond a certain level for this to be an adverse effect on water quality?**	
HR and RN Agree People using bores to abstract groundwater is the focus. Changes in downgradient water chemistry within the drinking water standards will not cause an adverse effect on water quality groundwater users.	**HR Disagree** Groundwater quality changes within the drinking-water standards is a negative change as it could impact other "users" (e.g. aquatic ecology) but it appears likely that contaminants would be diluted so unlikely to be an adverse effect. Linked to point 6 below.	**RN Disagree**
6.	**Is *any change* in groundwater chemistry consistent with upholding Te Mana o te Wai?**	
HR and RN Agree Complex question in relation to groundwater as there are no specific groundwater quality	**HR Disagree** Te Mana o te Wai about not causing a deterioration in water quality. Does not think drinking-water standards can	**RN Disagree** Unlike surface water, NPS-FM does not recommend groundwater specific bottom lines or water quality guidelines to assess if a change in water chemistry is having an effect.

guidelines documented in the NPS-FM/Te Mana o te Wai.	be applied as measure of deterioration.	Because the groundwater in the area is used for drinking-water, the drinking-water standards provide a relevant indicator for consistency with Te Mana o te Wai.
7.	**More generally, what trigger levels are consistent with maintaining water quality in terms of both drinking water quality and the quality of the environment / te mana o te wai?**	
HR and RN Agree In addition to trigger limits, assessing water chemistry trends and investigating causes of trends in groundwater chemistry data before concentrations get to trigger limits would be useful and practical for capturing water chemistry changes early.	**HR Disagree** Point of clarification – if say, copper, approached half MAV, then this would be a significant deterioration from current state and it would be unlikely that it would remain at half MAV. By assessing trends, it would be possible to identify a deterioration before half MAV is breached and address the cause.	**RN Disagree**
8.	**The applicant proposes to compare groundwater chemistry samples taken once the clean fill activity is underway with: (a) the proposed trigger levels in Table 3 of the GCMP; and (b) background water chemistry, being a moving year-to-year median concentration for each chemical parameter calculated from an upgradient monitoring bore. A groundwater chemistry exceedance will be deemed to have occurred if one of the following occurs:** • **Exceedance Criterion – A: The concentration in the downgradient bore exceeds the relevant trigger concentration in Table 3 of the GCMP and the year-to-year median concentration of the same parameter in the upgradient monitoring bore is below the respective trigger concentration; or** • **Exceedance Criterion – B: The year-to-year median concentration in the downgradient bore exceeds the year-to-year median concentration in the upgradient bore for the same parameter by more than 20%, and the year-to-year median concentration in the upgradient monitoring bore exceeds the trigger concentrations in Table 3 of the GCMP.** **In relation to that methodology:**	
a.	**Will the proposed one year of groundwater chemistry samples prior to commencement of clean filling activities provide suitable background data for determining the initial year-to-year median? How regularly should the background samples be taken?**	

HR and RN Agree A year of groundwater chemistry monitoring prior to commencement of clean fill activities suitable for determining initial year to year median.	**HR Disagree** Concerns if groundwater conditions are unusual during initial year of monitoring e.g. low recharge years will result in different groundwater quality to high recharge years. Point sampling is just a point in time, so monthly monitoring would be better for capturing range of groundwater conditions.	**RN Disagree** As the first year of monitoring is to establish the initial year to year median concentrations, quarterly monitoring targeted at seasonal changes is an appropriate balance between gathering sufficient data to calculate median concentrations without being prohibitive for the operator to collect the data. The year to year median data will continually be updated year to year and will allow for variations in different groundwater recharge.
b.	**Are the proposed trigger levels to be used as part of determining whether an exceedance has occurred appropriate?**	
HR and RN Agree Proposed trigger levels are adequate if trend analysis of data is included to capture changes in water chemistry so the change can be investigated before an exceedance occurs. Relies on all aspects of the waste acceptance criteria being met.	**HR Disagree** If all aspects of the waste acceptance criteria met, exceedances of trigger limits unlikely so trigger levels could be lower. Should consider whether trigger levels are based on current groundwater quality.	**RN Disagree** A change in groundwater chemistry is expected as part of clean filling, although the level of change in chemistry is expected to be within the proposed trigger limits such that it doesn't cause any adverse effects. The TRMP provides qualitative standards for discharges that enter groundwater and change groundwater chemistry in the nearby Motueka/Riwaka Plains area (Schedule 36A, Class G of the TRMP). The proposed water chemistry trigger limits are considered to be consistent with the qualitative standards in Schedule 36A, Class G.
c.	**Are the proposed trigger levels consistent with the groundwater chemistry limits from Schedule 8 of the Canterbury LWRP? Is it appropriate/ relevant to apply the Canterbury LWRP GW chemistry limits to this site, given that the measured background levels are much lower?**	
HR and RN Agree The proposed trigger limits are consistent with groundwater chemistry limits from the Schedule 8 of the Canterbury LWRP.	**HR Disagree** Groundwater chemistry from downgradient of Miners Road already shows chemical changes although concrete clean fill at Miners Road is a major contributor. Noted that groundwater quality at Peach Island appears to currently be very good, and possibly much better than some of the locations in Canterbury where these limits have been used.	**RN Disagree** Schedule 8 of the Canterbury LWRP apply to discharges to groundwater for the wider Canterbury region. Groundwater chemistry in areas of the Canterbury Plains where the Schedule 8 limits are applicable, have concentrations of a similar order of magnitude as those that currently occur measured at Peach Island. Therefore, Schedule 8 of the Canterbury LWRP is a relevant

		Also noted that the Miners Road consents are to quarry and fill to no less than one metre above highest groundwater level – at Peach Island it is into the zone of water table fluctuation. It is noted that no concrete or manmade materials proposed for Peach Island clean fill.	comparison for the trigger levels in the Peach Island groundwater setting.
d.	**Are the Exceedance Criteria appropriate to detect any potential adverse effect on groundwater users and groundwater quality?**		
HR and RN Agree If trigger limits not exceeded, then no adverse effects on downgradient groundwater users in terms of drinking water quality. The proposed water chemistry trend analysis to assist with identifying changes in water chemistry will allow potential adverse effects to be addressed before exceedances occur.		**HR Disagree** There could still be considered to be an adverse effect on groundwater quality, even if half MAV isn't exceeded.	**RN Disagree**
e.	**Will the methodology enable a distinction to be drawn between effects of unrelated land uses/natural variability and effects of clean fill?**		
HR and RN Agree The methodology will be useful in assessing natural variability compared to effect of clean fill.		**HR Disagree** It is difficult to separate out effects of filling from other potential drivers completely. Need to build evidence to show where contamination is coming from – this includes having "background" data that you can be confident covers all likely variability.	**RN Disagree** Assessing trends, the timing of trends, and comparing upgradient and downgradient groundwater chemistry will allow any significantly different effects to be distinguished between clean fill activities and unrelated land use activities.
f.	**To the extent that there are differences between this approach and the Miners Road, Canterbury conditions (described in paragraph 3.21 of Mr Nicol's third supplementary evidence of 19 December), are those differences appropriate?**		
HR and RN Agree The main change is the use of a 20% difference rather than 10%. A 20% difference is a small change in groundwater		**HR Disagree** Use of year-to-year median concentrations removes outliers. However, use of a 10% difference would be more conservative.	**RN Disagree** The exceedance criteria trigger additional actions, including additional monitoring and investigations into the source of the contamination and providing an alternative water supply to down-gradient groundwater users.

chemistry compared to the range of natural fluctuations in groundwater quality. Exceedance Criteria B is not the only exceedance criteria and only be used when there is a significant contaminant source upgradient of the clean fill area.	Unresolved comment outstanding as at 4.30 pm 6 March. Therefore will issue updated page once confirmed between the witnesses.	

9.	**The applicant proposes to install an additional monitoring bore at the downgradient (northern) end of the proposed quarry boundary, upgradient of bore 24135 at 131 Peach Island Road. In relation to that bore:**
a.	**Are the bore specifications (8 m deep, screened between 1 m bgl and the base of the bore) appropriate to capture the full range of groundwater level fluctuations?**

HR and RN Agree The proposed bore specifications are appropriate.	**HR Disagree**	**RN Disagree**

b.	**Will the monthly monitoring at the proposed bore enable unanticipated changes in groundwater chemistry to be picked up before there is any change in water chemistry in bore 24135 or any other downgradient bore?**

HR and RN Agree There is a good probability that the proposed monitoring bore will detect changes in water chemistry before changes detected in bore 24135.	**HR Disagree** Can never be 100% certain that the proposed bore will capture everything. Even monthly monitoring means a discharge could get through without detection if it was a pulse.	**RN Disagree** From the available information, the proposed bore is located upgradient and as close as possible to the closest private downgradient bore used for drinking-water supply. It is the best practicable option for achieving this monitoring objective.

10.	**In addition to monthly testing of the additional monitoring bore, the applicant proposes three monthly testing of the existing downgradient monitoring bores (24542 and 24545) and at least one upgradient monitoring bore (24544 and 24546). Is this appropriate?**

HR and RN Agree Quarterly monitoring sufficient as unlike the proposed monitoring bore, the other existing monitoring bores are not located immediately upgradient of a drinking water supply bore. Cost prohibitive	**HR Disagree** Additional data is always better as noted previously.	**RN Disagree** Purpose of the existing monitoring bores is to capture seasonal fluctuations, trends in water chemistry from land use activities and calculate year to year median concentrations. Quarterly monitoring is sufficient to collect enough data for these assessments.

to operator to sample existing monitoring bores monthly.		
11.	**Are the actions outlined in the GCMP for responding to an exceedance appropriate?**	
HR and RN Agree In principle the actions of repeat sampling, sampling downgradient drinking-water supply bores, undertaking an investigation of the source/cause of the exceedance and ultimately providing an alternative drinking-water supply is appropriate – though refer HR comments.	**HR Disagree** The overall response to an exceedance should occur faster and be more pro-active than what has been proposed particularly given the fact that exceedance of the proposed triggers would be a significant change in water quality. Repeat sampling should occur faster than the proposed 72 hours. Notification of council and downgradient bore owners should occur immediately if an exceedance of trigger values occurs. Provision of an alternative water supply should be prepared for as soon as possible if half MAV exceedances occur in downgradient drinking-water supply bores, rather than waiting until after an investigation, knowing that investigations could take months or longer, potentially leaving bore owners with unsafe drinking water.	**RN Disagree** The water chemistry trigger limits have been proposed at a level that won't cause adverse effects on downgradient groundwater users (i.e. GV and half MAV). The proposed trigger limits apply to the dedicated monitoring bores at the downgradient boundary of the clean fill site as well as the more distant, down gradient drinking-water supply bores. Unanticipated changes in groundwater chemistry would be expected to occur in the dedicated monitoring bores prior to changes occurring in downgradient drinking water supply bores. Furthermore, unanticipated changes in water chemistry within the dedicated monitoring bores would be expected to be larger in magnitude than the more distant downgradient drinking-water supply bores. Therefore, the proposed response times are a reasonable and appropriate response to an exceedance in the dedicated monitoring bores.

More detailed notes of the caucusing are attached as an Appendix to this summary joint statement

Signed: (digitally via email confirmation to facilitator, final for release).

Witness	Signature	Date
Mr Nicol		3 March 2023
Dr Rutter		3 March 2023

Date / Time	1pm to 4pm, 15 February 2023
Venue	https://us02web.zoom.us/j/85643672447?pwd=QU1lRndxNEhqTmhKaXFubDdUOEt0dz09

Independent facilitator and note-taker – Alastair Jewell

Witnesses	**For**
Mr Nicol (RN)	Applicant
Dr Rutter (HR)	Council

JOINT WITNESS STATEMENT – GROUNDWATER QUALITY

Record of issues discussed, areas of agreement or disagreement, reasons. Witnesses should:

- **identify their position and reasons by their initials**
- **identify if any matter is not within their expertise**

The following are records of the professional discussion between the parties during caucusing, and as such are a free and frank exchange to understand the other's facts, assumptions, and opinions between the experts. Though done on a without prejudice basis, the experts have chosen to release these notes for context behind their primary summary.

Groundwater levels	
1.	**Is there adequate information about groundwater levels at the site to inform excavation depths and processes for back filling, specifically:**
a.	**Are there enough groundwater level monitoring bores?**
RN – Yes. The existing 4 bores, , are located at the approximate corners of the site, and capture of spatial variation in groundwater levels etc. Data from the 4 bores plus the temporary test pits to check groundwater levels results in sufficient data to inform excavation depths. HR – Yes. Noting approach driven by practicality. The 4 perimeter bores are practical and agreed as adequate. One thing unclear is how data is to be interpolated across site and used. Questions if data is gathered on daily basis, plus site (works) specific via digging test pit and the visual inspection. In practice how would that be made workable to inform decision making? RN – Addresses practicalities on daily basis. The 4 existing bores will be telemetered, with frequent (hourly/daily) water level data collection, with the information available on demand. For example, at the start of the day, the groundwater level data for that day can be used to create a water level contour map interpolated from the most recent data. Confirms to HR regarding daily operations check of groundwater levels using data from bores to create a groundwater level contour map which provides the depth to groundwater level at the location of the excavation for that day. The water level from the map is then checked by the operator digging a temporary test pit.	
b.	**Is there enough current groundwater level data?**

RN. – Ys. Acknowledges more data always valuable however the methodology described in 1a. will allow fluctuations in groundwater level to be captured and provide more certainty on actual groundwater levels to inform excavation depths.

HR. Concern is expressed about the short-term record (ie absence of long term historical data), and whether that the shorter term background data captures information on the more occasional and significant 'what-if' events, such as large events resulting in GW level rapidly coming up to the surface (but acknowledges that this is probably an operational level - ie may not be able to extract gravel on the day etc).

RN – Confirms in his view that any such suggested risk is addressed by operational management of the extraction. Acknowledges that while the records to date do show that groundwater does come up close to ground level, it will also drop to a sufficient depth to allow gravel extraction. Excavations unlikely to happen if groundwater levels are high. Excavations will ideally occur when groundwater levels are lowest. Re-emphasises reliance on the methodology (described under (1a) for confirming groundwater levels beneath a particular excavation.

c.	**Will there be enough groundwater level data (including proposed test pitting) to inform excavation depths for clean filling?**

RN – Yes. Repeat– reliance on methodology above. The methodology will provide sufficient up to date groundwater level data to inform excavation depths for that particular location.

HR – repeat concern re Q1b– re absence of historic data records. Notes re rapid up and down GW level and seeks confirmation that such a methodology of notes no re-excavation of backfill. Potential hotch-potch of levels of excavation and filling with the proposed approach.

RN – Acknowledges that while high groundwater levels could occur, low groundwater levels as a result of o droughts could also occur. Acknowledges that once an excavation has been back filled, it will not be re-excavated.

d.	**Do the effects of climate change on fluctuating water levels and predictability add any further considerations not already covered?**

RN – The effects of climate change have been considered. The proposed methodology (described in 1a) will capture changes in groundwater level fluctuations. The criteria for when excavations to between 0.3 m to 1 m of groundwater level can occur would capture large weather/flood events to avoid accidental exposure of groundwater in excavations.

HR – It is notable that there is an increase in extreme events with atmospheric warming (with 1 degree increase = 8% increase rainfall extreme). Concern re excavation close to GW, more extreme events could cause more rapid/more prolonged groundwater level responses. But acknowledges operational matter and practicality and may limit what can be done at site.

2.	**Will the proposal to backfill if groundwater levels are rising be effective in preventing surface exposure of groundwater?**

RN – Yes – The excavation control criteria for when excavations can occur combined with the requirement of maintaining 1 m of material between groundwater level and

base of excavation every day will be effective in preventing accidental exposure of groundwater. Part of the criteria for when excavations can occur close to groundwater level includes the requirement for groundwater levels at the site to be stable or declining., If groundwater levels are increasing, excavations close to groundwater level won't occur. Further to this, if any major flood/weather event was forecast for the region, there would be time in advance for the operator to prepare/backfill the excavation. The combination of maintaining 1 m of material between groundwater level and the base of the excavation at the end of each day, and the time between when a weather/flood event is forecast enables the operator to back fill excavations without accidentally exposing groundwater.

HR
Concern 1 – it's not just about a one metre rise in GWL – some of groundwater changes could be 2.0m in very short time if there is a major event. So the operator needs to be able to plan for and deal with needing to fill 2m or more within a short space of time.

Concern 2 – what sort of event would be enough to inform trigger to cease and start backfilling to 1.0m? Hasn't seen anything in application re what that sized event would be to trigger a response in terms of filling. The application is vague, relying on forecast of storms/weather warning. All storms are different, and feels that we need to better understand responses in order to understand when filling would be required.

RN - Referred to groundwater level data from Peach Island monitoring bores that indicates groundwater level increase rates of around 1.0 m per day. The operator has capability to back fill at a rate of 1.0 m vertical per day, so will be able to stay ahead of increasing groundwater levels. At a high level, the groundwater level data from the Peach Island monitoring bores generally indicates that the faster groundwater level increase rates occur during larger changes in Motueka River flow (i.e. flood event). Regarding large weather/flood events, there will to be some form of flood warning or weather warning (i.e. Metservice warning etc) in advance.

HR - this is a large and complicated catchment so not simple to understand responses to different rainfall events.

RN - There will be some refinement of the methodology within the proposed excavation control criteria as operations occur.
The proposed groundwater level monitoring and temporary test pitting wis expected to capture any changes in groundwater level appropriately. No Peach Island specific rainfall data available although the available groundwater data indicates a strong hydraulic connection to the Motueka River. The over time the operator would refine procedures over time as they would know the site and have an understanding of how groundwater interacts with rainfall.

HR concern re 'learn as you go along approach' On one hand this is an operational issue, (eg rapid backfill') but if the operator is learning as they go along, there is the likelihood that GW will be exposed.

Considers there is a gap in rainfall event / GW relationship.

RN – The key here is the rate of groundwater level rise. Available groundwater level data for Peach Island indicates groundwater level increase rates in order of 1.0m per

day. Groundwater level data from TDC monitoring bore at Wratts Road (20937 – located near CJ Industries Douglas Road site) has a longer groundwater level data record (1976 – present). Flood event in 1990's caused groundwater level increase rate of around 1.3 m/day in the TDC bore at Wratt's Road so the operators capability to back fill at a rate of 1.0 m vertical per day anticipated as sufficient to ensure groundwater not exposed if these events do occur.

HR questions to RN re duration of responses – i.e. how many days could this response rate occur over.

RN - Estimate of the duration of these events of around 2 days, some at extreme 2 1/ 2 days (data indicates 2 days). Any weather event that resulting in a flood that would cause groundwater levels to increase at rates of 1 m/day would be forecast in advance, so operator would be able to start backfill earlier.
RN relies on information from Mr Carrie-Johnson to RN that enough backfill will be available onsite to back fill excavations.

Discussion re data presented (held) with rainfall data (not held) at this moment. Noted issue that Peach island has own rainfall.

RN – Looking at occurrence of rapid increases in groundwater, the rate of increase and coincidence with larger flow events. Considered to be sufficient.

RN Wratt's Road groundwater data includes records from early 1990s etc data available.

Groundwater quality

3.	**Groundwater is not considered to be an exposure pathway of concern for Class 5 Fill in WasteMINZ 2022 – are there reasons to differ from that guidance in this case?**

RN - No reasons to differ, but conservative approach adopted to minimise downgradient effects. This approach includes adopting the waste acceptance criteria as outlined in WasteMINZ 2022 plus additional, stricter requirements.

HR – effectively filling into GW zone of water fluctuation; even with best processes accidents do happen; so if not cleanfill, immediately into groundwater, and so any potential contamination will migrate. If was all Class 5, no concerns, however accidents/mistakes do happen and will happen.

RN – The extra waste acceptance criteria requirements proposed include chemical testing of all clean fill material before it is delivered to the Peach Island site and should capture most material with elevated concentrations before it is used as back fill. Providing the proposed waste acceptance criteria are implemented, it is not clear how contaminated material at level that could cause adverse effects could be placed in an excavation. If contaminated material was placed in an excavation, it would most likely be a smaller localised zone of fill with elevated chemical concentrations and if mobilised within groundwater, any elevated chemical concentrations would be attenuated. .

HR contaminants are generally not attenuated just diluted.

4.	**The key controls proposed to reduce any water chemistry changes are the quality and testing of the clean fill material:**
a.	**Are the clean fill parameters in Table 1 of the draft Groundwater and Clean Fill Management Plan ("GCMP") appropriate?**

RN – Yes. They capture requirements of the WasteMINZ 2022 criteria plus additional stricter measures. .
HR – yes okay for parameters to be measured.

b.	**If the clean fill meets the requirements of Table 1 of the GCMP, are adverse effects on groundwater quality likely to arise?**

RN – If the requirements are met, adverse effects are unlikely to arise.
HR – agreed.

c.	**If accidents occur despite following best practice, are adverse effects likely to occur?**

HR To me what proposed is fine, but from experience have happened and proposed procedures aren't followed and do end up with problems. Even with all the procedures written down, if they are not followed then that is when mistakes do happen. Compliance with complicated conditions can be difficult sometimes to follow. So an additional concern is about this. Notes example where conditions are long and complicated to the extent that they are very difficult to ensure compliance with.

RN – Is the example relevant to Peach Island given the proposed management approach that includes inspection of and chemical testing/comparison against guidelines of clean fill at another site before delivery at Peach Island? Very low probability of it occurring.

HR also noted that sampling is sampling of small part of load, so small sample from large load.

RN - (noting sampling methodology outside expertise), Composite sampling of clean fill material would detect capture any significant contamination. Would require a significant contaminant source.

HR agreed that probability of contaminated material low, but flip side of consequences since placed directly into GW and drinking water is located downstream.

RN - Agrees with Helen's statement, but considers fairly large load of contaminant needed to result in adverse effect downstream, which unlikely to occur.

Agree re low probability – consequences high – agrees reasonably significant contamination event, but HR notes from experience has happened.

d.	**Are there potential adverse effects from groundwater interaction with topsoil and subsoil (material placed less than 1 m from surface)? Are controls on topsoil and subsoil suitable to avoid/minimise such effects?**

RN – Yes the controls on subsoil and topsoil are suitable to avoid which implemented should not result in adverse effects. Informed by Mr Corrie-Johnston and Mr Hill soil that soil for rehabilitation purposes (material placed less than 1 m from the surface) will be predominantly sourced from the Peach Island site. Soil Management Plan to be amended (defer to Mr Hill). Any imported subsoil proposed to be consistent with

GCMP requirements. Topsoil characteristics need to be amended as organic content and type of organic material will differ from GCMP.

HR 1m soil depth will be saturated at times from GW. Soil quality is not considered under GCMP, haven't seen controls in plan. But from what was discussed in caucusing re sampling and quality of imported soil, should be okay. Initially appeared that no controls.

e.	**Are the proposed processes for offsite screening and testing requirements for clean fill in Section 4.0 of the draft Groundwater and Clean Fill Management Plan appropriate?**

Covered above

5.	**Is *any change* in groundwater chemistry an adverse effect on water quality, or does there need to be a change beyond a certain level for this to be an adverse effect on water quality?**

RN - Some level of change expected as a result of the removal of natural strata and backfill with clean fill. Provided the clean fill acceptance criteria is adhered to, adverse effects on downgradient users not expected. Changes in water chemistry expected to be within, trigger levels, which keeps changes at a level that won't cause adverse effects on groundwater users.

HR – the effect on the users is the focus here; If users include those downstream if kept within drinking water standards arguably not affected persons, but there could be a change that would concern downgradient users. There may be impact on other values, e.g. ecological values as example, though it could be that contamination is sufficiently diluted that it would not adversely affect water body.

6.	**Is *any change* in groundwater chemistry consistent with upholding Te Mana o te Wai?**

RN – This is a complex question. Firstly, an understanding of the aspects of Te Mana o Te Wai that I am able to comment on is required. Te Mana o Te Wai incorporates all freshwater environments including groundwater. There are 3 policy areas which are obligations, principles and leadership. In terms of principles, there are 6 principles of which3 I can comment on which are: governance, stewardship, and care and respect.
Governance deals with those of authority (central and local government) to prioritise health of freshwater which includes planning/policy infrastructure, water quality standards etc);
Stewardship is the responsibility ofall New Zealanders to manage freshwater in such a way that provides for health of nation and ensures that all groundwater resources are sustained for future and present generations.
In terms of governance in relation to groundwater, there are no national bottom lines for chemistry. There are also no specific Tasman region groundwater chemistry limits. However, the Water Services (Drinking Water Standards for New Zealand) Regulations 2022 and Aesthetic Values for Drinking Water Notice 2022 provide groundwater chemistry limits for the protection of human health and aesthetic effects. Guideline values (GV) and half maximum acceptable values (MAV) from the above drinking-water standards have been proposed as trigger levels which are consistent

with regionwide drinking water chemistry limits in other regions (e.g. Schedule 8 groundwater chemistry limits for Canterbury in Environment Canterbury's Land and water Regional Plan) and are considered to be conservative. Water changes are expected to be below the proposed trigger levels (which includes half MAV values) and therefore consistent with Te Mana o te Wai and the hierarchy of obligations.

HR – complex – TMoTW is about not causing deterioration in WQ. On that basic level any negative change in water quality is not consistent. From my understanding TMoTW is not concerned with DW standards but rather bottom lines in NES FW management. IMO in terms of upholding TMoTW, it would not be consistent to cause any deterioration to GW, but application of this strict line is not practical. However, the proposed water trigger levels – if applied as criteria (met or exceeded) - would indicate significant deterioration. For example, copper – the proposed trigger levels are orders of magnitude greater than naturally occurring which would be a significant deterioration not consistent with TMoTW.

RN - Queried drinking water standards stds not being applicable and noted that bottom lines water chemistry limits in NPS-FM are listed as being relevant to rivers / lakes but not groundwater., Questions whether surface water chemistry bottom lines in NPS-FM can be applied to groundwater.

HR agrees re application of NES F to surface water, but appears to be gap (RN agrees). RN trying to find out source re DW stds not applying – will fwd to RN

7.	**More generally, what trigger levels are consistent with maintaining water quality in terms of both drinking water quality and the quality of the environment / te mana o te wai?**

RN – As noted in response to 6, the proposed trigger levels are considered consistent with avoiding adverse effects downgradient users, and therefore consistent with Te Mana o te Wai.

HR – considered that trends are really important. Using copper as an example, if it reached half MAV, the trend wouldn't stop at half MAV and would expect it to climb. Trigger may be acceptable in terms of maintaining DW quality, but if contaminants get to that level then indicative of a problem that has been identified but not dealt with.

RN - Trigger levels selected at a level that won't result in an adverse effect and 'triggers' response at that time.

RN - Acknowledges that assessing trends in water chemistry is relevant. Using the data collected and identifying trends before they exceed the trigger would be useful. For example if downgradient water chemistry data displayed any trends of concern, (e.g. copper), then an investigation into the cause of the trend could be implemented (i.e. actiivty at clean fill site, or other land use/source). If the cause of the trend identified to be from clean filling, then it would ideally addressed before concentrations get to the trigger concentrations. If concentrations get to trigger, additional actions are implemented, including increased groundwater monitoring in monitoring bore, and also in downgradient drinking water supply bore (if it is available/accessible). Example for action, if identified as sourced to clean fill, actions such as additional monitoring, such as amend management plan to address.

HR and RN – Assessing water chemistry trends with reporting function, and investigation with background and activity analysis is a practical way of capturing water chemistry changes early. HR and RN agreed that self monitoring of trends and reporting on them would be appropriate. If anything looked like it was worsening, then carry out an investigation with background and activity analysis.

8.	**The applicant proposes to compare groundwater chemistry samples taken once the clean fill activity is underway with: (a) the proposed trigger levels in Table 3 of the GCMP; and (b) background water chemistry, being a moving year-to-year median concentration for each chemical parameter calculated from an upgradient monitoring bore. A groundwater chemistry exceedance will be deemed to have occurred if one of the following occurs:** • **Exceedance Criterion – A: The concentration in the downgradient bore exceeds the relevant trigger concentration in Table 3 of the GCMP and the year-to-year median concentration of the same parameter in the upgradient monitoring bore is below the respective trigger concentration; or** • **Exceedance Criterion – B: The year-to-year median concentration in the downgradient bore exceeds the year-to-year median concentration in the upgradient bore for the same parameter by more than 20%, and the year-to-year median concentration in the upgradient monitoring bore exceeds the trigger concentrations in Table 3 of the GCMP.** **In relation to that methodology:**
a.	**Will the proposed one year of groundwater chemistry samples prior to commencement of clean filling activities provide suitable background data for determining the initial year-to-year median? How regularly should the background samples be taken?**

RN – Yes. The initial year of monitoring prior to commencement of clean filling activities will be used to establish the initial year to year median concentrations in the up and downgradient bores which is used in the exceedance criteria outlined in 8 above. Samples will be collected quarterly which is considered to be sufficient for capturing seasonal variations in water chemistry and calculating median concentrations.

HR year monitoring okay, but caveat if unusual conditions. For example, dry years can result in lower levels of nitrates in groundwater as it is not leached from the surface. Wet years can be the opposite.

Regarding regularity – these are point samples, monthly would give better picture of variability. Monthly data better chance of capturing all the conditions eg pulse recharge in winter, and would provide a more robust dataset to understand the background. Once activity is started there will be more data to add to that background.

RN – The level of monitoring required comes back to the purpose of the monitoring. In this case it is to establish the initial year to year median concentrations for the exceedance criteria. Quarterly monitoring provides a balance between gathering sufficient data to calculate the year to year median concentrations without being prohibitive for operator to gather the data.

b.	**Are the proposed trigger levels to be used as part of determining whether an exceedance has occurred appropriate?**

RN – Yes the proposed trigger levels to determine if an exceedance has occurred are appropriate. The proposed trigger levels combined with above trend analysis (suggested in the response to 7) would appropriate to avoid exceedances and associated adverse effects on downgradient groundwater users.

HR – If a significant contamination event occurred then determinant concentrations could stay under exceedance trigger level. The question is partly whether exceedance in itself would be an adverse effect (in sense that below is not, and above is by virtue of exceedance becomes adverse). Happier in professional opinion if the proposal does include trend analysis for capture of potential event before an exceedance occurred and investigation of the reason for that. Concentrations discussed; noting concerns on facts –

- the proposed concentrations may be appropriate to areas already impacted – versus this area which isn't impacted,
- noting that material is going directly into GW, rather than above as is the case with the Yaldhurst quarry consents
- noting need adequate certainty that the cleanfill is in fact cleanfill per caveats above

These factors beg the question re whether exceedance levels should be adjusted to be stricter. Further too, if cleanfill is in fact cleanfill (doesn't accommodate accidental non-compliance) then there would not be any exceedances / adverse effects, ie could have levels far lower to reflect existing levels and nature of material as proposed.

RN – Proposed trigger levels generally consistent with the Schedule 8 regional water chemistry limits in Environment Canterbury's Land and Water Regional Plan. The Schedule 8 chemistry limits apply to all groundwater in Canterbury and allow discharges to cause water chemistry changes up to those levels. In the absence of equivalent levels in the TRMP, there are qualitative groundwater standards in the Tasman Regional Management Plan (TRMP) that apply to discharges in the neighbouring Motueka/Riwaka Plains management area (Schedule 36A – class G). While no specific chemistry limits are provided in Schedule 36A Class G standards of the TRMP, the standards require that groundwater must not be tainted or contaminated for irrigation, stock water or be unpalatable for consumption by humans. This suggests that the TRMP contemplates that discharges can cause changes in groundwater chemistry.

HR - one option (if applicant prepared to adopt) would be to use background concentrations to help set the trigger levels

RN – A change in groundwater chemistry is anticipated but the level of change is not expected to be at a level that will adversely affect downgradient groundwater users. The Schedule 36A Class G standards of the TRMP indicates that some level change in groundwater chemistry is appropriate. , The Environment Canterbury LWRP Schedule 8 regionwide groundwater limits are consistent with the TRMP Schedule 36A qualitative Class G standards and shows that the trigger levels proposed are acceptable as part of the framework in managing potential for adverse groundwater effects.

c.	**Are the proposed trigger levels consistent with the groundwater chemistry limits from Schedule 8 of the Canterbury LWRP? Is it appropriate/ relevant to apply the Canterbury LWRP GW chemistry limits to this site, given that the measured background levels are much lower?**

RN – Discussed in my response to 8b (above). View that they are consistent and appropriate and to be applied at Peach Island even though groundwater chemistry concentrations are lower than LWRP Schedule 8 limits. Groundwater chemistry throughout the wider Canterbury Plains have groundwater chemistry concentrations similar to that measured at Peach Island.

HR asks re those – RN "places on the Canterbury plains"; Miners Rd cleanfill for example some chemical changes, noting concrete material, major contributor, cf no concrete or manmade proposed for Peach Island.

HR reflects on ones involved in Canterbury haven't had such high water quality.

d.	**Are the Exceedance Criteria appropriate to detect any potential adverse effect on groundwater users and groundwater quality?**

RN Yes – see above. If the triggers limits at half MAV are breached, users aren't going to be adversely affected.

HR If didn't exceed half MV agree no effects, back round to issue re increase in trends from current concentrations to half MAV would be a significant effect and wouldn't be expected to stop there – assessing trends would create more confidence re future adverse effects on DW quality.

e.	**Will the methodology enable a distinction to be drawn between effects of unrelated land uses/natural variability and effects of clean fill?**

RN – Groundwater chemistry trend analysis to be used as part of methodology to identify potential changes in groundwater chemistry earlier. The exceedance criteria also assists with identifying groundwater chemistry changes between upgradient and downgradient concentrations. The use of assessing median concentrations helps to smooth out natural variability to see level of change that may be attributable to cleanfill activity or from another activity.

HR – nothing is black and white – and there can be considerable debate regarding understanding effects and separating out likely causes of s decline in groundwater quality. It's often not possible to separate out effects of filling from other potential drivers completely – need to build evidence to show where contamination is coming from. A good understanding of natural variability is likely to help in separating out natural or other drivers vs cleanfill source.

f.	**To the extent that there are differences between this approach and the Miners Road, Canterbury conditions (described in paragraph 3.21 of Mr Nicol's third supplementary evidence of 19 December), are those differences appropriate?**

RN – The differences relate to Criterion B exceedance and are the use 20% rather than 10%, and 20% difference between the year to year median up and downgradient bore concentrations. These difference have been adopted as the data collected to

Outstanding unresolved comment still pending as at 6 March

HR preference for more conservative 10% in view of the fact that there would have to be considerable change in groundwater quality anyway before this would be needed based on the proposed conditions.

RN – The situation is unlikely to occur and would require an external third party/upgradient contaminant source. Therefore a difference of 20% is appropriate.

9.	**The applicant proposes to install an additional monitoring bore at the downgradient (northern) end of the proposed quarry boundary, upgradient of bore 24135 at 131 Peach Island Road. In relation to that bore:**
a.	**Are the bore specifications (8 m deep, screened between 1 m bgl and the base of the bore) appropriate to capture the full range of groundwater level fluctuations?**

Yes - both in agreement

b.	**Will the monthly monitoring at the proposed bore enable unanticipated changes in groundwater chemistry to be picked up before there is any change in water chemistry in bore 24135 or any other downgradient bore?**

RN – Yes it will assist with identifying unanticipated groundwater chemistry changes in the area upgradient of bore 24135. The proposed bore is proposed to be located approximately 88 - 120m upgradient of 24135 and as such, groundwater chemistry changes would be expected to occur in the proposed monitoring bore before would occur in 24135. The proposed monitoring bore is closer to the clean filling area so water chemistry changes would be expected to be greatest in the proposed monitoring bore and reduce with distance downgradient.

HR – yes with caveats – for example, we don't know exact hydraulic gradients, so could miss something. Also point sampling so could miss an event. Hopefully not, but

sampling can be hit and miss and we can't be 100% certain. Considered there is a good probability sampling will detect changes before contaminants migrate as long as the gradients are correct. Monthly monitoring means a discharge could get through without detection is it was a pulse.

10.	**In addition to monthly testing of the additional monitoring bore, the applicant proposes three monthly testing of the existing downgradient monitoring bores (24542 and 24545) and at least one upgradient monitoring bore (24544 and 24546). Is this appropriate?**

RN - Yes the focus of the monthly sampling in the proposed bore is because of its location and proximity upgradient of closest water supply bore (24135). The purpose of the other dedicated monitoring bores is to capture seasonal fluctuations, any trends in the data from land use activities as well as calculating median concentrations as part of the exceedance criteria, so quarterly monitoring in these bores is considered sufficient.

HR – based not directly upgrade of water source, reasoning for quarterly, more data better, but acknowledge expense.

11.	**Are the actions outlined in the GCMP for responding to an exceedance appropriate?**

(caucusing by email exchange after Zoom, by agreement of parties)
RN – Yes the actions outlined in the GCMP are appropriate to respond to an exceedance. These actions include:

- Repeat sampling of the downgradient bore(s) that the exceedance occurred in within 72 hours of receiving the initial results.
- Repeat sampling of the upgradient monitoring bore within 72 hours of receiving the initial results.
- If repeat sampling confirms the exceedance, an investigation into the cause of the exceedance will be undertaken by the quarry operator.
- Undertake additional actions that include (but not limited to) additional monitoring, ceasing activities that caused the exceedance, removal of contaminant sources, revision of management plan as well as provision of an alternative water supply if exceedances occur within a downgradient private water supply bore (upon agreement with bore/land owner).

HR: Concerns with some of the proposed conditions:
(32) We have discussed concentrations already, but I would say that the conditions as they are written would allow for significant contamination before triggering an action.
(33) If there was to be an exceedance of MAV, you would need a much quicker and pro-active response. As this is considered unlikely to occur, there shouldn't be any issue with having more robust conditions if it were to occur. I would prefer that here is a condition about if the concentrations exceed MAV, then there is immediate sampling of any D/G drinking water bores and notification of the council and bore owners. As I said, unlikely to happen, but I would have said it is sensible to cover it off in case it did.
(35) Another (immediate) action should be to sample the drinking water bores downgradient
(39) If any monitoring shows that water supply bores exceed MAV, then the owners should be provided with an alternative supply – it can't wait for anyone to prove that it was the quarry/filling activities. It is often not clear-cut where contamination may have been come from, and hence to expect a bore owner to wait until an investigation has been carried out could take months or years. Who is going to do the investigation

anyway? The way it is written, it sounds like it will be the bore owners who have the responsibility to prove it. I have similar concerns with (40) – if there is an issue with taste/odour for example, the bore owners could be left with no alternative supply until the consent holder has determined the cause of the problem, remediated it, and the groundwater system has been left sufficiently long for the problem to have gone away. (34) Complicated – can the wording be simplified or is it needed like this?