BEFORE Independent Commissioner appointed by Tasman District Council

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by CJ Industries Ltd for to discharge contaminants to land (backfill material) RM220578

THIRD SUPPLEMENTARY EVIDENCE OF RYAN CHARLES SMITH NICOL ON BEHALF OF CJ INDUSTRIES LIMITED (GROUNDWATER AND CLEANFILL)

19 December 2022

1. INTRODUCTION

1.1 My full name is Ryan Charles Smith Nicol. I am a Hydrogeologist with Pattle Delamore Partners (PDP) and have been employed in that role since 2012.

1.2 The applicant has applied for resource consents authorising the extraction of gravel, stockpiling of topsoil, and reinstatement of quarried land, with associated amenity planting, signage and access formation at 134 Peach Island Road, Motueka:

(a) RM200488 land use consent for gravel extraction and associated site rehabilitation and amenity planting and

(b) RM200489 land use consent to establish and use vehicle access on an unformed legal road and erect associated signage

1.3 The applicant has also applied for a discharge permit authorising the discharge of contaminants to land, in circumstances where the contaminants may enter water (RM220578).

1.4 I have produced evidence addressing clean fill parameters, a groundwater assessment for the purposes of the land use consent application and supplementary evidence addressing issues relevant to the discharge permit rather than the land use activities.

1.5 This evidence does not repeat the evidence already filed, and so this statement should be read together with my statements dated 15 July 2022, 4 November 2022 and 18 November 2022.

Qualifications and Experience

1.6 My qualifications and experience are set out in my statement dated 15 July 2022.

Purpose and Scope of Evidence

1.7 The purpose of my evidence dated 15 July 2022, 4 November 2022 and 18 November 2022 were to assess the effects of the proposal on groundwater, provide recommendations to avoid, remedy or mitigate potential adverse effects on groundwater resources at Peach Island and provide updates to groundwater monitoring data.

1.8 The purpose of this evidence is to provide additional response and clarification to queries that the commissioner raised during the hearing on 22 November 2022.

Code of Conduct

1.9 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014 and I agree to comply with it. My evidence is within my area of expertise, however where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.

2. EXECUTIVE SUMMARY

2.1 **WasteMINZ update:** Subsequent to the hearing, I became aware that the WasteMINZ "Technical Guidelines for Disposal to Land" 2018 were updated by a revised document dated October 2022. While my evidence dated 15 July 2022, 4 November 2022 and 18 November 2022 referred to the previous version of the guidelines, all further reference to the WasteMINZ "Technical Guidelines for Disposal to Land" in my evidence and updated versions of the GCMP will refer to the WasteMINZ 2022 version.

2.2 No changes to the Class 5 Clean Fill criteria in the 2022 version of the WasteMINZ "Technical Guidelines for Disposal to Land" alter my groundwater assessment or the waste acceptance criteria for the proposed Peach Island quarry. I have recommended some amendments to conditions to clarify that although small volumes of products such as concrete would meet the WasteMINZ clean fill definition, these products will not be used at Peach Island.

2.3 In WasteMINZ 2022, groundwater is not considered to be an exposure pathway of concern for Class 5 Fill (clean fill) due to only virgin excavated natural material (VENM)[1] being accepted at a Class 5 Fill facility.

2.4 **Additional water quality monitoring bore:** To ensure there is an effective monitoring framework that avoids effects on downgradient water supply bores, I recommend installation of an additional monitoring bore at the downgradient (northern) extent of the proposed quarry boundary, upgradient of the closest privately owned downgradient bore used for drinking water supply purposes (bore 24135 at 131 Peach Island Road). This bore will be located within the proposed quarry boundary but as close as practically possible and directly upgradient of bore 24135. The proposed monitoring bore will enable any unanticipated changes in groundwater chemistry to be picked up before there is any change in water chemistry in a downgradient drinking water supply bore. Furthermore, any unanticipated changes in water chemistry will be larger in the proposed bore and be reduced before they are observed in bores located at larger distances downgradient of the quarry. I consider this to be very much a robust approach to avoiding any effects on neighbouring bore owners, particularly given that this testing is a backstop method (with the key controls to reduce any water chemistry changes being the quality and testing of the clean fill material).

2.5 The location of the additional water quality monitoring bore will allow for variations in groundwater flow directions and the bore will be 8 metres deep and screened between 1 metre bgl and the base of the bore to capture the full range of groundwater level fluctuations. Groundwater samples will be collected from this additional monitoring bore at one monthly intervals following commencement of clean fill activities.

[1] Other than minor, incidental volumes of manufactured materials and organic materials as discussed at 3.4 below.

2.6 I recommend that groundwater monitoring in the existing downgradient monitoring bores (24543 and 24545) and at least one upgradient monitoring bore (24544, and 24546) occur at three monthly intervals following commencement of clean fill activities.

2.7 **Hydraulic conductivity**: Hydraulic conductivity is defined, in simple terms, as a measure of how easily water can flow through a porous medium such as a gravel aquifer. A hydraulic conductivity of 100 m/day has been estimated for the strata underlying the proposed Peach Island quarry. It is important to clarify that hydraulic conductivity is not a measure of the groundwater velocity as the groundwater velocities are also dependant on the hydraulic gradient and porosity of the strata. Based on a hydraulic conductivity estimate of 100 m/day, a hydraulic gradient of 0.004 (measured from groundwater contours measured on 1 July 2022) and porosity estimates of 25% to 40% for sandy gravel, average groundwater pore velocities of 1 to 1.6 m/day were estimated for the aquifer underlying the proposed Peach Island quarry. I note that this is an average, and that within an alluvial aquifer there can be a wide range of different velocities over distances of a few metres, which makes it difficult to accurately predict travel times from one location to another. Regardless of the range of velocities, the additional water quality monitoring bore will allow for any changes in water chemistry to be observed at the quarry boundary before they would occur at the closest bore downgradient of the quarry. Furthermore, any unanticipated water chemistry changes would be larger in magnitude in the additional water quality monitoring bore than what would be expected in a bore located at a larger downgradient distance, due to the attenuation of concentrations that occurs at increasing distance from a point of origin.

2.8 **Background water quality/trigger levels:** The applicant is now proposing to complete at least one full year of groundwater chemistry samples and analyses at the existing monitoring bores at the proposed quarry site (24543, 24544, 24545 and 24546) prior to commencement of clean filling activities. As a result of this, the criteria for determining if a water chemistry exceedance has occurred have been updated to take into account effects of upgradient land use and natural variations in groundwater chemistry. The proposed exceedance criteria and trigger levels are considered to be consistent with the National Policy Statement for Freshwater Management (NPS-FM) (NZG, 2020).

2.9 **Use of test pitting results (groundwater level)**: Groundwater level contours will inform the anticipated groundwater level beneath a particular location at the proposed quarry and the groundwater elevation will be confirmed by a temporary test pit by the

quarry operator. Test pit results do not need to feed back into the groundwater level contours, but the results will be presented as part of the annual reporting of the monitoring proposed to be undertaken at the site.

2.10 **Effects of rainwater infiltration**: Rainfall infiltration is not expected to result in any additional mobilisation of contaminants beyond that which has already been considered to occur from fluctuating groundwater levels causing inundation of clean fill material. The primary control to avoid mobilisation of contaminants from the clean fill into groundwater is the strict controls and clean fill acceptance criteria to avoid contaminated material being placed within excavations. Provided that the proposed controls in the GCMP are implemented, effects on groundwater will be less than minor.

2.11 **Redox**: Changes in oxidation / reduction potential (Redox potential) as a result of the proposed clean filling activities are not anticipated, as the strata beneath the site and available water chemistry indicate the groundwater environment is naturally oxidising. Organic rich sediments can be a source of elevated metal concentrations and high Redox potential, but the available borelogs indicate that no organic rich deposits are present within the strata beneath the site and strict controls on clean fill material placed in excavations will limit any organic material to a level that will not result in a change in Redox conditions in the aquifer or be a source of elevated contaminants (i.e. metals).

2.12 **Water level data from Bore 24543**: Bore 24543 is located at 134 Peach Island Road and owned by Mr Tim Corrie-Johnston was confirmed to have a depth of 4.8 m bgl.

2.13 Water level data for bore 24543 for the period between 18 October 2019 and 4 December 2019 was updated based on a correction to the measuring point elevation provided by another consultant. Bore 24543 is located outside of the proposed quarry footprint and the updated water level data for this bore has not changed my conclusions regarding the range of groundwater level fluctuations at the location of the proposed quarry.

2.14 **Updated groundwater levels**: Manual groundwater levels measured during groundwater chemistry sampling in September and November 2022 are included in an updated timeseries plot of groundwater levels for accessible bores at the proposed quarry (Figure 4 of attachment). The measured groundwater levels were within the range of water levels measured to date.

2.15 **"Missing" bores**: A number of submitters referred to bores that were not shown on Figure 7 of the Hydrogeology Report. I have relied on Council records. As noted by Council, it is quite possible that there are bores that are not known to Council. The controls on clean fill material and the monitoring of bores at the boundaries of the quarry means that the downgradient groundwater resource will be protected from adverse effects.

3. EVIDENCE

WasteMINZ 2022 revision

3.1 My previous evidence (dated 15 July 2022, 4 November 2022 and 18 November 2022) and the Groundwater and Cleanfill Management Plan (dated 2 September 2022 and referred to as the "GCMP") refer to the document "Technical Guidelines for Disposal to Land" dated August 2018 and were prepared by the Waste Management Institute New Zealand (WasteMINZ). The Technical Guidelines for Disposal to Land (WasteMINZ, 2018) were replaced by an updated version in October 2022, titled Technical Guidelines for Disposal to Land, Revision 3 (WasteMINZ, 2022). As a result of this update and for clarity, all reference to the "Technical Guidelines for Disposal to Land" or "WasteMINZ guidelines" will be referring to the version of the guidelines dated October 2022.

3.2 A summary of the changes to the guidelines between the 2018 and 2022 versions has been prepared by WasteMINZ and a copy of this summary of changes is attached to my evidence.

3.3 The summary of the changes to the guidelines between the 2018 and 2022 versions applicable to the proposed Peach Island quarry are related to exposure pathways to be assessed as part of a Class 5 Fill. An "exposure pathway" is a contaminant at a source being mobilised along a pathway to a receptor. The updated WasteMINZ guidelines (2022) indicate in Table C1 (pages 176 to 179) that for Class 5 Fill, the only exposure pathway is from material being mobilised by erosion or runoff. It is noted that groundwater is not considered to be an exposure pathway for Class 5 Fill due to only virgin excavated natural material (VENM) being accepted at a Class 5 Fill facility (other than minor, incidental manufactured and biodegradable materials).

3.4 The waste acceptance criteria (WAC) for Class 5 Clean Fill is defined on page 78 of the WasteMINZ Guidelines (2022) as:

(a) "*VENM; and*

(b) *maximum incidental inert manufactured materials (e.g., concrete, brick, tiles) to be no more than 5% by volume per load; and*

(c) *maximum incidental or attached biodegradable materials (e.g., vegetation) to be no more than 2% by volume per load; and*

(d) *maximum chemical contaminant limits accepted by the regulatory authority to be the background concentration for VEMN within the intended catchment of the site."*

3.5 The above definition (paragraph 3.4) has informed the materials that will be accepted at the proposed Peach Island quarry. Table 1 of the GCMP details acceptable materials for clean filling purposes at the proposed Peach Island quarry. While the WasteMINZ Guidelines (2022) waste acceptance criteria for Class 5 Fill includes manmade materials for up to 5% by volume per load, a conservative approach has been taken for the proposed Peach Island quarry and no manufactured materials (i.e. concrete, bricks etc) will be included in clean fill. Further to this, topsoil will not be accepted as clean fill. This is a pragmatic approach to reduce the potential for incidental organic material such as grass and roots being included in the clean fill material.

3.6 As part of the Class 5 Clean Fill waste acceptance criteria (WAC), the maximum incidental or attached organic material (i.e. biodegradable vegetation) shall be no more than 2% by volume per load (WasteMINZ, 2022). This criterion is included in Table 1 of the GCMP.

3.7 I would like to clarify that in referring to "clean fill", my evidence (and the conditions and GCMP) is referring to the material placed at depths greater than 1 metre below existing ground level. Material placed between the existing ground level and 1 metre below existing ground level will be materials for land rehabilitation purposes (i.e. sub soil and top soil). Material placed between existing ground level and 1 metre below ground level for rehabilitation purposes is not considered under the GCMP. The requirements for material for rehabilitation purposes are included in the Soil Management Plan as part

of the evidence of Mr Reece Hill and I understand a condition will be added to ensure imported soil (if used) is free from contamination.

3.8 Material for clean filling purposes at the proposed Peach Island quarry will only be accepted, if it meets the requirements of Table 1 of the GCMP. The proposed clean fill management system is detailed in Section 4.0 of the GCMP but includes the following controls:

(a) Details of the source of the clean fill material.

(b) Prior to delivery to the proposed Peach Island quarry site, chemical testing of the clean fill undertaken by a suitably qualified and experienced person (SQEP) to ensure total soil concentrations of the fill material do not exceed regional background concentration limits.

(c) Offsite and onsite (prior to placement in excavations) visual inspections of the material to ensure clean fill material is not wet, visibly stained or have any olfactory evidence of contamination.

(d) Random chemical testing of incoming clean fill material to the proposed Peach Island quarry from 1 in every 500 m^3, as recommended in the WasteMINZ Guidelines (2022) (Table 6-4, page 86)[2]. In addition, random annual sampling of material placed in excavations shall also be undertaken as recommended by the WasteMINZ Guidelines (2022) (page 85, first paragraph).

Groundwater Monitoring

3.9 While the applicant has volunteered to collect groundwater samples from drinking water supply bores located downgradient of the proposed Peach Island quarry, no access to the closest downgradient bore used for drinking water supply purposes (bore 24135, located at 131 Peach Island Road) has been provided to date.

[2] The Commissioner had asked for clarification as to what part of WasteMINZ was being referenced in the s 92 response. This is the part of WasteMINZ that is being referenced in relation to "random chemical testing" in the s 92 response.

3.10 In order to ensure a robust monitoring framework that detects any unanticipated groundwater effects upgradient of the nearest drinking water bore, the applicant has proposed to install an additional monitoring bore. The approximate location of this additional monitoring bore is shown in Figure 1 attached with my evidence and is proposed to be located near the downgradient (northern) boundary of the proposed quarry extent. This location has been selected as it is upgradient of bore 24135. As the monitoring bore is proposed to be located within the proposed quarry boundary but as close as practically possible to bore 24135 (i.e. in the order 88 to 120 m), if any changes in water chemistry occur, the changes will be observed in the proposed monitoring bore before changes would be observed in bore 24135.

3.11 The proposed additional monitoring bore would be expected to be drilled up to a depth of 8 metres and be screened from approximately 1 metre below ground level (m bgl) to the base of the bore. The purpose of the long screen in this bore would be to capture the full range of groundwater level fluctuations and ensure that water samples can be collected close to the water table, because chemical concentrations are typically highest at the water table.

3.12 To establish background groundwater chemistry prior to commencement of clean filling activities, at least one full year of groundwater chemistry data shall be collected at three monthly intervals from both the existing downgradient monitoring bores (24543 and 24545) and both upgradient monitoring bores (bore 24544 and 24546). The locations of these bores are shown in Figure 1 attached with my evidence.

3.13 Following the commencement of clean filling activities at the proposed Peach Island quarry:

(a) Groundwater samples will be collected from the two existing downgradient bores (bores 24543 and 24545) and at least one upgradient bore (bore 24544 or 24546) at three monthly intervals.

(b) The proposed additional monitoring bore described in paragraph 3.10 above will be sampled at monthly intervals. The purpose of this to provide additional certainty to the users/owners of bore 24135 at 131 Peach Island Road and other downgradient groundwater users and to capture any changes in water chemistry if any changes occurred, prior to

chemistry changes occurring in bore 24135. Further to this, given its much closer proximity to the quarry, any unanticipated water chemistry changes occurring in the additional proposed monitoring bore would be of a larger magnitude than what would be expected to occur in a bore located further downgradient.

3.14 In my Hydrogeology report (dated 15 July 2022), an estimate of hydraulic conductivity in the range of 0 to 500 m/day was noted based on information from Weir and Thomas (2018). In my response (dated 2 September 2022) to a s92 request for further information from Tasman District Council, an estimate of hydraulic conductivity was refined using borelog descriptions of the strata underlying the proposed Peach Island quarry which indicate that the dominant strata are sandy gravels. Based on literature values, sandy gravel has a hydraulic conductivity in the order of 100 m/day (Kruseman and de Ridder, 1991).

3.15 Hydraulic conductivity (K) is defined in simple terms, as a measure of how easily water can flow through a porous medium such as a gravel aquifer (Kruseman and de Ridder, 1991). The actual velocity at which the groundwater moves also depends on the hydraulic gradient (i) between two points and the porosity of the aquifer material, as expressed in the following equation:

$$va = \frac{(-\mathrm{K} \times \mathrm{i})}{n}$$

va = average pore velocity (m/day).
K = hydraulic conductivity (m/day).
i = hydraulic gradient (unitless).
n = porosity (expressed as a percentage).

3.16 An estimate of the pore velocity of a water particle in the Peach Island Aquifer can be determined using a hydraulic gradient of 0.004 as outlined in the Hydrogeology report. Literature values for the porosity of gravel is in the order of 25 to 40% (Kruseman and de Ridder, 1991). Using these values, the hydraulic conductivity of 100 m/day and the equation in paragraph 3.15, indicative average groundwater pore velocities within the aquifer (i.e. the velocity of a water particle within the aquifer) underlying the proposed Peach Island quarry are estimated to be between 1 and 1.6 m/day. However, over short travel distances (tens of metres) there can be quite a wide range of velocities within alluvial strata both above and below these average values. It is possible for much higher

pore velocities within alluvial strata to occur, although these higher velocities occur within discrete zones of the aquifer material. A field study at Burnham on the Canterbury plains estimated that these most permeable zones only make up around 1.2% of that aquifer (Dann et. al, 2008). These zones extend laterally rather than vertically and given the relatively low occurrence within an alluvial aquifer, there is a low chance of a water supply bore intercepting the same permeable flow zone adjacent to clean fill that occurs above the lowest groundwater level.

3.17 However, to allow for variations in pore velocities, the additional water quality monitoring bore proposed at the downgradient extent of the proposed quarry will allow for any changes in water chemistry to be observed at the quarry boundary before they would occur at the closest bore downgradient of the quarry. Furthermore, any unanticipated water chemistry changes would be larger in magnitude in the additional water quality monitoring bore than what would be expected in a bore located at a larger downgradient distance.

3.18 As expressed in my previous evidence (dated 15 July 2022, 4 November 2022 and 18 November 2022), the removal of the naturally deposited strata and backfilling with cleanfill material will result in some change to the physical and chemical characteristics of the aquifer at the proposed Peach Island quarry (but as noted in WasteMINZ 2022, this is not considered a contaminant exposure pathway). To ensure that the magnitude of any groundwater chemistry changes are at a level that won't result in adverse effects to groundwater users and the downgradient environment, trigger level criteria are proposed for assessing if any noteworthy change in groundwater quality has occurred.

3.19 As the applicant is now proposing to complete a full year of groundwater chemistry monitoring prior to commencement of clean filling activities, the methodology for assessing whether the clean filling activities are impacting downgradient groundwater chemistry has been updated.

3.20 The results of all groundwater chemistry sampling will be compared against the proposed trigger levels provided in Table 3 of the GCMP (and the conditions, if these trigger levels are moved up into conditions). A moving, year-to-year median concentration for each chemical parameter will be calculated for the water chemistry data from an upgradient monitoring bore. A groundwater chemistry exceedance will be deemed to have occurred if one of the following occurs:

(a) 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

(b) 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.

A diagram illustrating each of these exceedance scenarios is provided in Figure 2, attached with my evidence.

3.21 The purpose of this proposed methodology is to distinguish between upgradient landuse activities and clean filling activities as well as allowing for natural variations in groundwater chemistry. This proposed methodology has been adapted from approved conditions as part of consent conditions for resource consent CRC204349 granted to Fulton Hogan for a similar activity at Miners Road, Canterbury. There are two differences between the conditions for CRC204349 and my recommended methodology. The differences relate to Exceedance Criterion B. First, I have recommended a 20% threshold not a 10% threshold, because 20% is the trigger percentage proposed in the s42A Officers report and because even 20% is a very small change given the concentrations that have been measured to date. Second, in my recommended methodology the 20% threshold relates to the percentage difference between the year-to-year median concentration in the upgradient bore and the year to year median concentration in the downgradient bores. CRC204349 conditions used a percentage of the relevant trigger level.

3.22 If an exceedance occurs as defined in paragraph 3.20, additional actions will be undertaken by the applicant, as outlined in the GCMP. For ease of interpretation, a summary flow chart has been updated with the updated exceedance criteria in Figure 3, attached with my evidence. The proposed response to an exceedance is consistent with the approved conditions as part of consent conditions for resource consent CRC204349.

3.23 While the Tasman Resource Management Plan (TRMP) does not have any groundwater chemistry limits, Environment Canterbury provides an example of groundwater chemistry limits in Schedule 8 of the Canterbury Land and Water Regional Plan (LWRP). Canterbury has similar alluvial gravel aquifers that are widely used for groundwater abstraction and the purpose of these limits within Environment Canterbury's LWRP is to provide limits for changes in groundwater chemistry as result of a discharge that may enter groundwater, such as industrial and trade waste discharges (Rule 5.91 of the LWRP), stormwater discharges (Rule 5.93 of the LWRP) and passive discharges from contaminated sites (Rule 5.187 of the LWRP). The limits provided in Schedule 8 of Environment Canterbury's LWRP are:

(a) a limit of <1 MPN/100 ml for *E. coli*;

(b) a maximum limit of 11.3 g/m^3 and an annual average concentration of 5.65 g/m^3 for nitrate-N, and

(c) half maximum acceptable values (MAV) of the Water Services (Drinking Water Standards for New Zealand) Regulations 2022 (Taumata Arawai, 2022) for other relevant chemical parameters. It should be noted that the annual average concentration of 5.65 g/m^3 for nitrate-N equates to half MAV.

The proposed trigger concentrations provided in Table 3 of the GCMP are consistent with the groundwater chemistry limits from Schedule 8 of the LWRP.

Groundwater Level Monitoring

3.24 Groundwater level monitoring as outlined in the GCMP involves continuous water level monitoring in four bores located at the proposed quarry site (24543, 24544, 24545 and 24546). This water level data will be used to create on-demand groundwater level contour maps for the proposed quarry area which will provide the quarry operator an indicative groundwater level elevation at the location of that particular excavation. As there will be a level of uncertainty from interpolating groundwater levels between the monitoring bores, a test pit excavation to temporarily expose groundwater can be undertaken by the quarry operator. This will confirm the groundwater level elevation beneath that particular excavation. This information will inform the excavator operator of the depth that the quarry excavations can extend down to for that particular day.

3.25 The groundwater level elevation confirmed during the temporary test pit will be documented by the quarry operator and will be included in the proposed annual reporting for the proposed quarry operations. This data will not inform the groundwater level contour maps as the purpose of the contour maps are to provide an indicative groundwater level depth for the wider quarry area which is refined using the temporary testing to confirm groundwater levels for a specific part of the site for a particular excavation on that day.

Effects of rainfall infiltration

3.26 The groundwater level contours measured at Peach Island on 7 July 2022 and provided in the Hydrogeology Report (dated 15 July 2022) and in Figure 1 attached with my evidence, indicate that a major source of groundwater recharge to the aquifer beneath Peach Island occurs via losses from the Motueka River around the vicinity of Hurley Road. Rainfall infiltration is also likely to contribute to groundwater recharge but will be much smaller and more intermittent compared to the much larger contribution provided from flow losses in the Motueka River. Furthermore, the available groundwater level data show that groundwater level fluctuations closely align with variations in Motueka River flow.

3.27 Groundwater inundation of fill material will occur at higher groundwater levels when clean filling at that part of the quarry has been completed. Because the clean fill material has a different structure and composition to the natural gravel deposits it could cause some changes to the groundwater characteristics in the immediate vicinity, although this would not constitute an adverse effect due to the clean fill acceptance criteria outlined in the GCMP and noted in paragraph 3.8 of my evidence.

3.28 Rainfall infiltration percolating vertically downwards through the clean fill material also has potential to cause a change in groundwater chemistry when it infiltrates through the clean fill material. However, the effect of rainfall infiltration mobilising water chemistry changes within the deposited clean fill material will be proportionally smaller and intermittent compared to the effect of inundation of the fill material from fluctuating groundwater levels. The primary control to avoid mobilisation of contaminants from inundated fill material is the clean fill acceptance criteria. Provided the recommended clean fill acceptance criteria controls are implemented, the effects from the infiltration of rainfall through fill material are considered to be less than minor.

Redox Potential

3.29 Oxidation / Reduction potential (referred to as "redox") is the transfer of electrons between gas, dissolved and solid matter, such as water or sediments with the loss of electrons defined as oxidising conditions and the gain of electrons defined as reducing conditions (Freeze and Cherry, 1979). A change in Redox conditions within a groundwater environment (i.e. from oxidising conditions to reducing conditions) can result in a change in chemical species, such as whether nitrogen is present as nitrate species or ammonia species. A change in redox conditions can also result in the mobilisation of some metals (such as manganese, iron and arsenic) that are normally bound within alluvial strata to be released into groundwater.

3.30 Available borelogs for the Peach Island area indicate that the strata consist predominantly of sandy gravel and do not indicate any presence of lower permeability confining strata or naturally occurring organic rich strata (i.e. peat). Based on this, and the available groundwater quality data for the bores at the proposed Peach Island quarry site presented in my evidence dated 4 November 2022 and 18 November 2022, it is expected that the groundwater environment at Peach Island has predominantly naturally oxidising conditions. The removal of the natural strata and backfilling with clean fill material is not expected to change the Redox conditions of the aquifer and therefore will not result in adverse changes in groundwater chemistry.

Bore 24543 and Groundwater Levels

3.31 Bore 24543 is located at 134 Peach Island Road and is located downgradient of the proposed quarry footprint. Bore 24543 is owned by Mr Tim Corrie-Johnston and the depth of bore 24543 is listed on Tasman District Council's records as being 4.8 metres below ground level (m bgl). Independent measurements undertaken by Pattle Delamore Partners Limited (PDP) and Mr Tim Corrie-Johnston confirmed that the bore has a depth of 4.8 m bgl.

3.32 Water level data for bore 24543 is available from a combination of manual water level measurements and data collected using an automated water level logger. Water level data collected from this bore between 18 October 2019 and 4 December 2019 was collected by Envirolink Limited and was provided to PDP as an elevation, not as a depth below ground level. To convert the water level data from an elevation to a depth below ground

level, a measuring point elevation was required. The correct measuring point elevation has now been provided and the water level data for bore 24543 between 18 October 2019 and 4 December 2019 has been corrected. A timeseries plot showing all available groundwater level data including the corrected data for 24543 is shown in Figure 4, attached to this evidence. As bore 24543 is located outside of the proposed quarry footprint, my conclusions regarding the range of groundwater levels beneath the proposed quarry have not changed as a result of this updated water level data for bore 24543.

3.33 The timeseries plot of available groundwater levels for the proposed Peach Island quarry displayed in Figure 1 show manual water levels measured for both of the September and November groundwater quality monitoring rounds undertaken at Peach Island. The measured water levels are within the range of groundwater levels provided in my evidence dated 18 November 2022.

"Missing Bores"

3.34 The locations of bores at Peach Island that are shown in figures attached with my statements of evidence 15 July 2022, 4 November 2022 and 18 November 2022 used information provided by Tasman District Council. Some submitter's indicated during the hearing that their bore(s) were not shown or were shown in an incorrect location. I would like to confirm the location of any incorrect or missing bore locations if the bore owner/landowner provides access. However, the GCMP is designed to avoid adverse effects on any bores in the area, irrespective of their location.

4. CONCLUSION

4.1 The updated version of the WasteMINZ "Technical Guidelines for Disposal to Land" (dated October 2022) has not changed my groundwater assessment or waste acceptance criteria for the proposed Peach Island quarry.

4.2 An additional monitoring bore will be installed at the downgradient extent of the proposed quarry boundary and upgradient of the closest privately owned downgradient bore used for drinking water supply purposes. This bore will be drilled to a depth of 8 m deep and screened between 1 m bgl and the base of the bore to capture the expected full range of groundwater level fluctuations. Groundwater samples will be collected from this additional monitoring bore at one monthly intervals following commencement of

clean filling. The purpose of the additional monitoring bore is to account for variations in groundwater pore velocities and will be used to detect any changes in water chemistry prior to the changes occurring in the closest downgradient water supply bore (24135) as any unanticipated changes in chemistry will be larger in the proposed bore compared to bore located at further distance downgradient.

4.3 Groundwater monitoring in the existing monitoring bores (24543, 24544, 24545 and 24546) will occur at three monthly intervals.

4.4 The applicant is now proposing to complete at least one full year of groundwater chemistry monitoring of bores at the proposed quarry site prior to commencement of clean filling activities. This has allowed for the criteria for determining if a water chemistry exceedance has occurred to be updated and takes into account effects of upgradient landuse and natural variations in groundwater chemistry.

4.5 The proposed clean filling activities are not expected to affect Redox conditions within the aquifer beneath the proposed quarry and rainfall infiltration through deposited clean fill material is not expected to result in any additional change in groundwater quality than will occur from fluctuating groundwater levels causing inundation of clean fill material. The primary control to avoid contamination as a result of the clean filling activities are the strict controls and clean fill acceptance criteria to avoid contaminated material being placed within excavations. Provided the proposed controls in the GCMP are implemented, effects on groundwater are considered to be less than minor.

4.6 Updates to groundwater level data for accessible bores at the proposed Peach Island quarry have not changed any of my conclusions regarding the range of groundwater level fluctuations at proposed quarry.

Ryan Charles Smith Nicol

19 December 2022

REFERENCES

Dann, R. L., Close, M. E., Pang, L., Flintoff, M. J., Hector, R. P. 2008. Complementary use of tracer and pumping tests to characterise a heterogeneous channelized aquifer system in New Zealand. Hydrogeology Journal 16(6) pp 1177 – 1191.

Freeze, R. A., Cherry, J. A. 1979. Groundwater. Prentice Hall Inc. New Jersey. 07632

Kruseman, G. P., de Ridder, N. A. 1991 Analysis and Evaluation of Pumping Test Data. Second Edition. International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands. 1994.

New Zealand Government (NZG). 2020. National Policy Statement for Freshwater Management 2020. August 2020.

Taumata Arawai. 2022. Water Services (Drinking Water Standards for New Zealand) Regulations 2022. June 2022.

Waste Management Institute New Zealand (WasteMINZ). 2022. Technical Guidelines for Disposal to Land. Revision 3. Waste Management Institute New Zealand Incorporated. October 2022.

Weir, J., Thomas, J. 2018. Motueka – Riwaka Plains Water Resources: Model Upgrade. Groundwater Report. Prepared for Tasman District Council. Aqualinc. C17050. 26 April 2018.

Technical Guidelines for Disposal to Land Revision 3

Summary of changes

What are the Technical Guidelines for Disposal to land?

The Technical Guidelines for Disposal to Land provide technical guidance relating to the siting, design, operation and monitoring of landfills in New Zealand, based on local and international experience. They are relevant for operators, consultants and regulators.
They were first published in 2016, revised in 2018 and again in 2022.

What has changed?

- Waste acceptance criteria (WAC) for Class 3 Fills have been added. The WAC are based on maximum chemical contaminant limits. *See Appendix F.*
    - Descriptions of exposure assessments utilised in determining the WAC for Class 3 Fills are included in *Appendix C.3*.
    - Table C-1 has been updated to reflect the exposure pathways assessed for Class 3 WAC. *See Appendix C.3*.
    - The basis utilised for determining the WAC for Class 3 Controlled Fills has been added to *Appendix C.4.*
    - The methodology utilised to derive the Class 3 WAC has been added to *Appendix C.7*.

- WAC for Class 4 Fills have been updated. *See Appendix G*.
    - Table C-1 has been updated to reflect the exposure pathways assessed for Class 4 Managed Fills. *See Appendix C.3*.
    - The methodology used to revise the Class 4 WAC is detailed in *Appendix C.7*.

- Discussion of the exposure assessment pathways for Class 5 Fills has been updated, given the only materials acceptable at these facilities are virgin excavated natural materials.
    - Table C-1 has been updated to reflect the exposure pathways assessed for Class 5 WAC. *See Appendix C.3*.

- Discussion of the relevant sections of the Health and Safety at Work Act (Asbestos) Regulations 2016. *See Appendix A.4*.

- Updated information around the Waste Minimisation Act (2008), which includes the expanded data reporting and levy payment requirements under the Waste Minimisation (Calculation and Payment of Waste Disposal Levy) Regulations 2009 and the Waste Minimisation (Information Requirements) Regulations 2021. *See Appendix A.8*.

Read the full document on the WasteMINZ website.

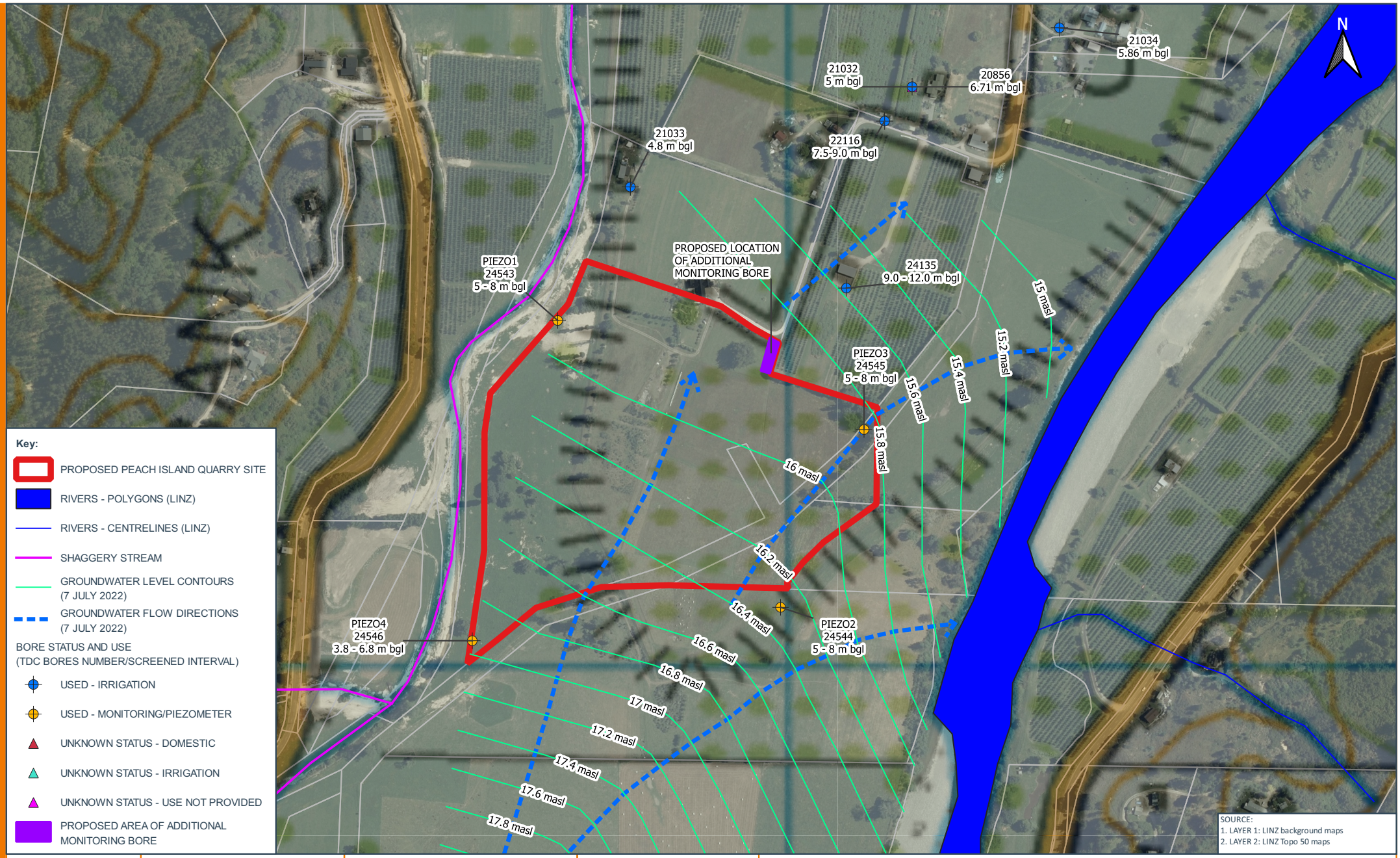

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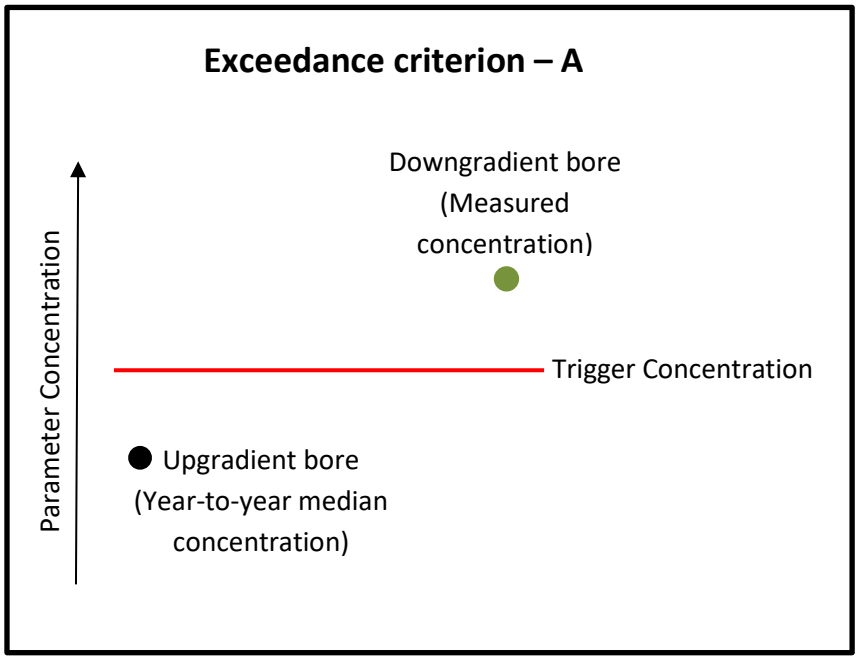
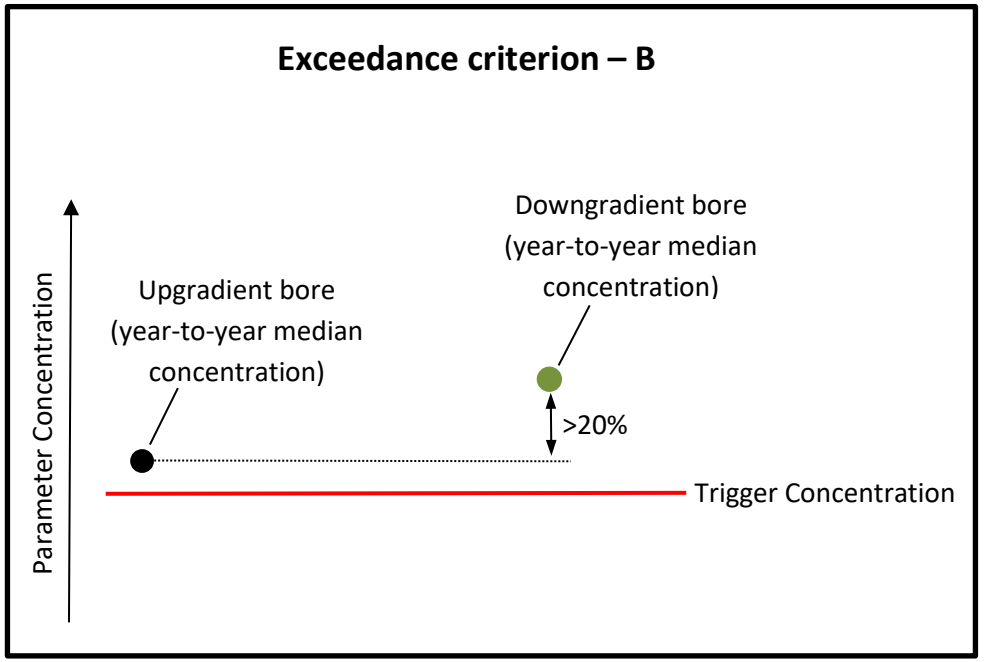
FIGURE

FIGURE 1: LOCATION OF EXISTING BORES AND PROPOSED LOCATION OF ADDITIONAL MONITORING BORE AT PEACH ISLAND

PROJECT

PEACH ISLAND PROPOSED QUARRY - HYDROGEOLOGY





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.

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%, where the year-to-year median concentration in the upgradient monitoring bore exceeds the trigger concentrations in Table 3 of the GCMP.

FIGURE 2: DIAGRAM ILLUSTRATING CRITERIA FOR DETERMINING WHEN A GROUNDWATER CHEMISTRY EXCEEDANCE HAS OCCURRED

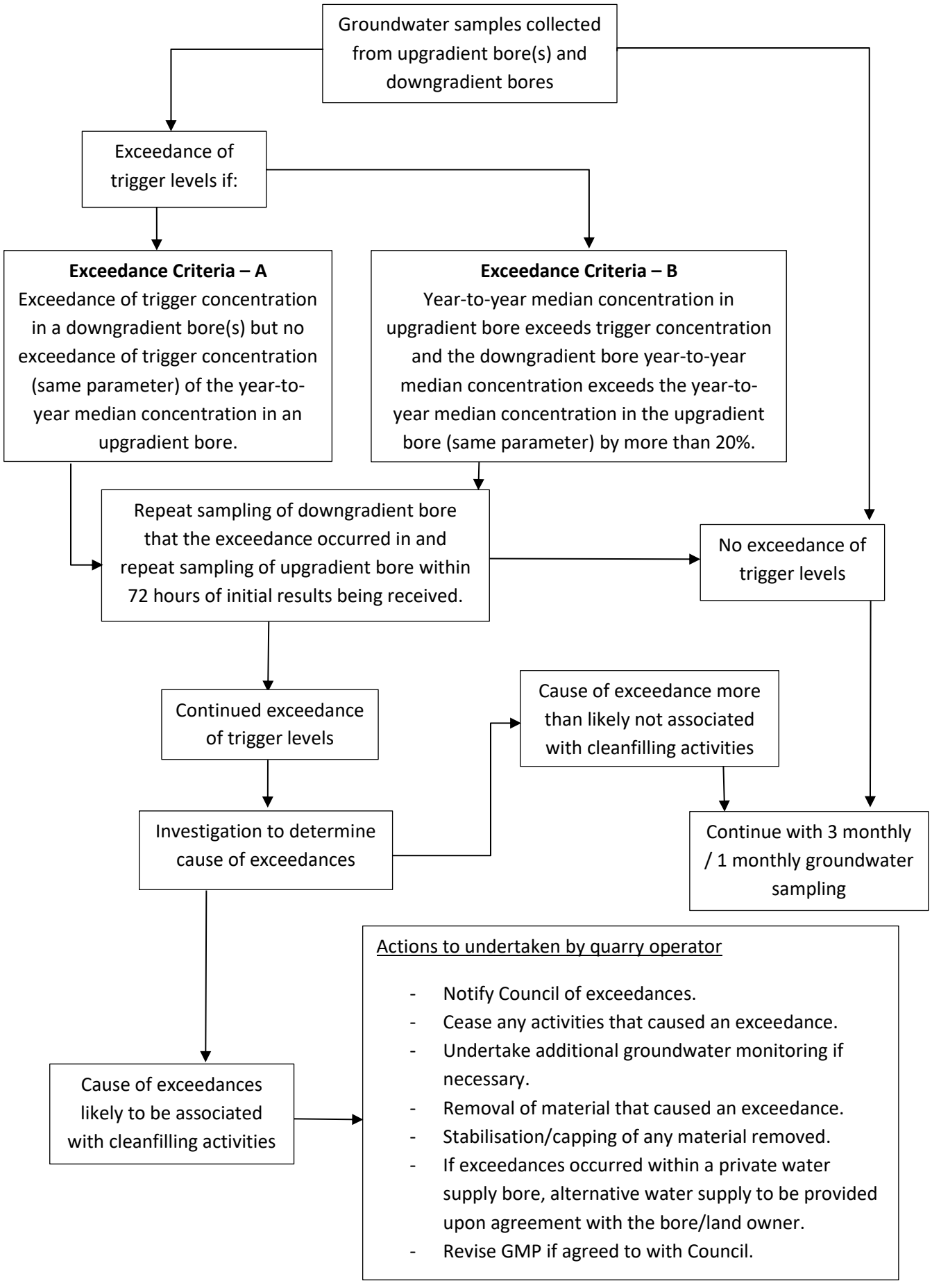


FIGURE 3: SUMMARY FLOW CHART OF RESPONSE TO EXCEEDANCE OF A TRIGGER LEVEL

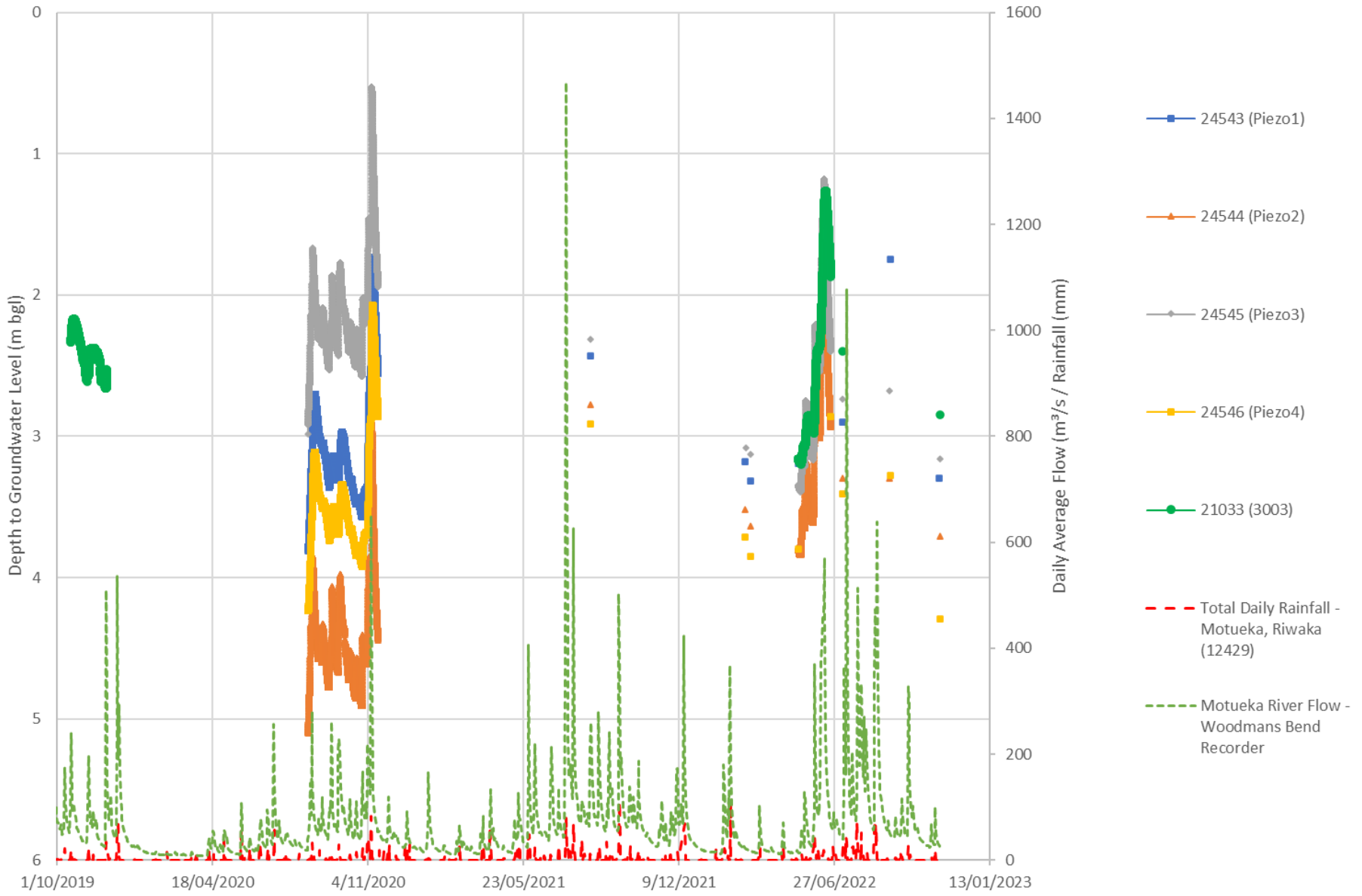


FIGURE 4: MEASURED GROUNDWATER LEVELS AT PEACH ISLAND (2019 – 2022)