Your Comment on the Oparure Quarry South-Western Pit

Please include all the contact details listed below with your comments and indicate whether you can receive further communications from us by email to substantive@fasttrack.govt.nz.

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Please ensure that you have authority to comment on the application on behalf of those named on this form.			
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We will email you draft conditions of consent for your comment			
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Introduction

New Zealand Speleological Society Cave Conservation and Access Trust (NZSS CCAT) has been set up exclusively for charitable purposes under the Charities Act 2005 for conserving and managing access to caves and karst environments for recreational and other purposes.

NZSS CCAT would like to bring to the attention of the Expert Panel that we consider the New Zealand Speleological Society (NZSS) should be invited to comment on this Fast Track proposal. For nearly 80 years the NZSS has been the national body for speleology (the scientific study of caves and karst environments) in New Zealand. The NZSS has been studying, documenting and mapping caves and karst throughout New Zealand, with the karst region adjacent to the quarry documented within their periodicals since 1952.

The Expert Panel should also give consideration to inviting the Australasian Cave and Karst Management Association Inc. (ACKMA) to make comments on this Fast Track application. ACKMA is the professional association for those responsible for planning and management of limestone and caves in the Australasian region.

1) Below are our comments on matters relating to our field of expertise, arranged according to subject. References for comments can be found at the end of the document.

Subsurface Ecology

2) The removal of terrestrial sedimentary input into cave entrances changes the speleogenisis of the caves and alters the proportion of organic matter entering the system, this fundamentally changes the development of the cave and induces changes in cave fauna populations. When sedimentation inputs cease the cave transitions from aggradation to incision, marking a shift from sediment-dominated to dissolution-dominated passage evolution. The incision and removal of existing sediments can lead to layers of sediment containing chemical contamination from agricultural use being mobilised downstream through the system. It can also reduce the availability of organic matter which drives the food chain for cave fauna.

3) The claim by that *'Furthermore, sediment deposition to the cave floor (or instream) [sic] does not impact wall and roof dwelling troglobite fauna' (*BlueGreen Ecology (2026). Oparure Quarry South-Western Pit. Terrestrial and Subsurface Ecological Assessment*)* is not backed by research, evidence of which is provided below. Increased sediment deposition without organic carbon input smothers existing habitat. There is scientific literature supporting the argument that sediment deposition and sedimentation can negatively affect troglobitic invertebrates and cave ecosystems.

3.1) Direct smothering and burial: sediment covers animals, e.g. snails, eggs, feeding surfaces and refuges.

3.2) Habitat alteration: fine sediment fills cracks, crevices and interstitial spaces that provide essential habitat for subterranean invertebrates.

3.3) Changes to aquatic cave habitats: increased turbidity and sediment deposition affect food availability, filter-feeding organisms, respiration and the structure of benthic communities.

3.4) Excessive sediment input represents a significant potential threat to subterranean invertebrate communities. Fine sediments can accumulate within cave streams and terrestrial substrates, filling interstitial spaces, covering existing habitat structures, and altering the physical characteristics of the substrate. These spaces provide important refuges, feeding areas and movement pathways for subterranean invertebrates. Research in Tasmanian cave systems has demonstrated that sedimentation can smother benthic habitats, restrict the distribution of cave-dwelling aquatic invertebrates and reduce their abundance (Eberhard, 1995).

3.5) Experimental studies have further demonstrated that fine sediment deposition can obstruct the movement of subterranean-associated crustaceans through interstitial habitats (Vader et al.,

2018). Such changes may be particularly consequential for specialised subterranean species with restricted distributions and limited opportunities for recolonisation.
3.6) Also, cave ecosystems are strongly influenced by the quality of the surrounding catchment and the resources transported into subterranean habitats. Cave-stream communities depend largely on surface-derived organic matter, with microbial communities and aquatic invertebrates forming important components of subterranean food webs.
3.7) Research in New Zealand cave streams has demonstrated that these aquatic communities are resource-limited and that aquatic invertebrates also provide an important food source for terrestrial cave predators, including glow-worms, spiders and harvestmen (Watson, 2009; Reid et al., 2012).
3.8.) Excessive sediment input can alter stream substrate structure, clog interstitial spaces and negatively affect the abundance and composition of freshwater invertebrate communities (Larsen et al., 2011; McKenzie et al., 2024). Such changes have therefore consequences beyond the aquatic environment, potentially affecting the availability and transfer of energy to terrestrial subterranean communities (Venarsky et al. 2014).

4) It cannot be argued that quarry dust is a sediment type found naturally, it is not considered a standard clastic input for karst aquifers. Removal of terrestrial sediment inputs to compensate for dust contamination produced by quarrying does not lead to betterment of the karst ecosystem. It fundamentally changes the sedimentation process and the throughput of organic carbon on which the in-cave food chain relies. Fundamental changes to cave sedimentation have impacts on the karst ecosystem and associated hydrology that reach beyond the boundaries of the Project.

5) Mention is made of removing rubbish from Tomo's as part of Ecological Betterment Plan, caution is necessary to prevent mobilisation of contaminated sediments from underneath the accumulated rubbish into the aquifer below. Testing for contaminants should be undertaken as part of any rubbish removal process.

6) Filling of Dolines can contribute significant sediment loads to the underlying aquifer, especially if the fill material contains mud stone or any organic debris. Any fill material that acidifies rain and groundwater on contact will accelerate the solutional process that underpins doline development, leading to future ground stability issues.

7) The plan to enhance 21 entrances with a combined floor area of a minimum of 224㎡ needs to include a proportionate area of organic debris relative to the seven caves that will be removed by the quarrying process. *'The development of the proposed South-Western Pit will result in around 1 ha of native vegetated Karst features and the loss of the seven caves, with a loss of 111 m2 of cave floor.'* (BlueGreen Ecology (2026). Oparure Quarry South-Western Pit. Terrestrial and Subsurface Ecological Assessment) and *'This sums to 111 m2 of floor area and 12.75 m2 organic debris (leaves, wood, roots etc.). Of course, not all the floor, wall and roof surface area is habitat. Habitat for spider fauna is different from that of the snails and that of the millipedes, isopods and amphipods. The area of floor and area of organic debris is used as a reasonable proxy of the area of habitat potential in each of the caves surveyed and so by way of summation a total area of in-cave habitat that will be lost.' (*BlueGreen Ecology (2026). Oparure Quarry South-Western Pit. Terrestrial and
Subsurface Ecological Assessment*)* The 21 entrances referenced in the Ecological Betterment Plan need to include a minimum of 25㎡ of existing organic debris within the caves in total.

Hydrology

8) The catchment of Guildford's Cave has not been defined via dye tracing, bringing into question the modelling derived location of the subsurface flow divide. The modelling in Appendix I Water, Fig 5: Dye Injection and Doline Locations, shows that the area where the drainage divide is inferred to be will lay inside the pit proposed by the Project, increasing risk to Guildford's Cave and the Mangawhitikau. The caves shown on the inset of the Digme Cave Map called Half Acre Tomo, 15M Tomo, and Short Overland

Flow should be located and included within the dye tracing and sedimentation monitoring programmes to provide a more accurate hydrological picture of the caves taking drainage from the quarry area (Worthy, T. 1985). A buffer zone similar to Camellot should be enforced near the inferred subsurface flow divide. Further tracing should be carried out on the areas surrounding the proposed pit.

8.1) Further dye tracing should be undertaken to define the boundaries of the catchment areas South, West, and North of the proposed pit that to better understand where the subsurface drainage divides exist in relation to the proposed pit. The flow direction on the North side of the inferred subsurface drainage divide has not been identified by dye tracing undertaken to date.

9) The upper testing point for water emerging at Pōtea Spring should be the surface section of the Camellot Stream, not the Upstream Mangawhitikau Stream. Dye tracing undertaken to date has not shown a confirmed link between water submerging in the Upper Mangawhitikau and Pōtea Spring. This testing regimen can not show the actual impact of the existing quarry operation on Pōtea Spring, either in terms of SSC or pH. The proposed testing regimen for the Project will not show actual impacts on the underlying karst aquifer and Pōtea Spring.

10) It is interesting to note that classifications proposed by biologists tend to stress the role of springs as source of surface water habitats, whereas definitions put forward by hydrogeologists tend to focus on springs as the endpoint of groundwater flow paths (Scarsbrook, M, et al, 2007). Springs are 'ecotones'. This reflects the unique position of springs at the interface between groundwater, surface water and terrestrial ecosystems. Ecotones possess specific physical and chemical attributes, biotic properties, and energy and material flow processes, but each is unique in its interactions with adjacent ecosystems (Naiman & Decamps 1997). Contemporary stream ecology recognises an important role for ecotones in the structural (e.g. community structure, biodiversity) and functional attributes (e.g. carbon and nutrient dynamics) of freshwater ecosystems (Naiman & Decamps 1997; Ward & Tockner 2001). As cited by Scarsbrook, M, et al, 2007, New Zealand coldwater springs and their biodiversity. Science for Conservation 278

Existing caves

11) There appears from the appendixes that apart from some physical work by contracted cavers, no effort has been made to geophysically locate any currently unknown cave passages are underneath the proposed quarry pit. Have all methods of underground void detection been exhausted?

Air quality

12) Regarding air quality, overseas research has shown that gases from blasting operations can enter surrounding caves. 'The migrations pathways may be in multiple directions from a blast. Gases can travel through rock pores and fractures. The porosity and permeability of the transmitting medium affect the travel rates. Generally, pressure gradients cause gases to migrate to areas of lower pressure. Sometimes, gases will follow man made features such as buried pipelines and other utilities. Fractures provide a significant migration pathway. They include natural breaks produced by jointing and stress relief. The fractures are avenues for gases to move from one area or level to another through differing rock units. Faulting may also produce a conduit for gases to travel from its source. Conversely, faults can form a barrier against movement when permeable units on one side of the fault are in contact with less permeable units on the other side.' (Eltschlager, et al. 2004)

12.1) Consideration must be given to the air quality effects of the blasting operation in relation to caves. Analysis of the air in Camellot Cave prior to development of the SW Pit as well as ongoing monitoring will allow for concentrations of NO, CO2, and CO to be recorded. Any change from baseline (pre-development) gas concentrations shall be notified to the consenting party and the source investigated.

The ‘low oxygen levels’ stated as being present in Camellot Cave are unlikely to be of natural origin and a search of the New Zealand Speleological Society records shows no prior mention by cavers involved in the intimal discovery, exploration, and surveying of Camellot of bad air within the cave (McKay, K. 1989). Monitoring should also include caves considered under the Ecological Betterment Plan.

Conclusion

13) Our conclusion is that the Project can not be supported at this time. The hydrology modelling is incomplete, and the proposed quarry pit will extend across the inferred subsurface drainage divide, exposing the catchment of Guildford’s Cave and the downstream Mangawhitikau to potential contamination. The proposed EBP plan will not lead to net benefit for the surrounding Karst environment, and would lead to further reductions in the quality of the cave habitat’s not destroyed by the quarrying process. Unlike most land uses, where a development sits on top of conservation values and can in principle be removed, quarrying consumes the resource itself. Quarrying a limestone or marble outcrop does not disturb a cave; it destroys it outright and permanently. There is no mitigation, no remediation, and no recovery. A cave that took tens of thousands of years to form, together with its speleothems, sediments, subfossil deposits, and any specialised fauna, simply ceases to exist. A karst ecosystem is also not confined to the cave passages themselves. It is a single connected system that extends from the land surface above, through the soil and epikarst, down into the underground. Water, nutrients, organic matter, and organisms move continuously between the surface and the cave below. Surface vegetation, sinkholes, and the soil profile feed and regulate the cave environment, and the cave fauna depend on inputs from above. Quarrying removes the surface, the rock, and the subsurface together, severing these connections across the whole system. Even where a quarry does not intersect a known cave passage directly, stripping the overlying land and rock destroys the hydrology, the sediment supply, the temperature and humidity regime, and the biological inputs that the surviving cave depends on. The damage extends well beyond the footprint of the excavation, and once the karst is gone it will never reform.

References

Appendix I – Water Assessment, PDP Ltd
https://www.fasttrack.govt.nz/__data/assets/pdf_file/0024/31497/Appendix-I-Water.pdf

Appendix K – Terrestrial and Subsurface Ecology Assessment, Blue Green Ecology Ltd.
https://www.fasttrack.govt.nz/__data/assets/pdf_file/0026/31499/Appendix-K-Terrestrial-and-Subsurface-Ecology.pdf

Appendix U1 – Oparure Quarry South-Western Pit: Ecological Betterment Plan, PDP Ltd

https://www.fasttrack.govt.nz/__data/assets/pdf_file/0010/31510/Appendix-U1-Ecological-Betterment-Plan.pdf

Appendix U7 – Oparure Quarry South-Western Pit: Karst and Riparian Management Plan, PDP Ltd
https://www.fasttrack.govt.nz/__data/assets/pdf_file/0016/31516/Appendix-U7-Karst-and-Riparian-Management-Plan.pdf

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