EXPERT WITNESS CAUCUSING CONFERENCE AND JOINT WITNESS STATEMENT: Pit erosion

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	14 February 2023, 9.00 am -10.30 am
Venue / Remote Technology Platform	https://us02web.zoom.us/j/88931508680

Witnesses	**For**
Mr Aiken (SA)	Applicant
Dr Harvey (MH)	Valley RAGE
Mr Griffith (GG)	Council

JOINT WITNESS STATEMENT – PIT EROSION

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 is the records the discussions and positions during caucusing. The parties have reviewed the record. "[…]" indicates notes added during the collaborative statement finalisation process, and footnotes are references provided as part of the document finalisation process.

While the caucusing was done on a without prejudice basis, the witnesses have chosen to generally maintain a version with relatively transparent 'free and frank' version of their professional discourse to assist the Commissioner.

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

1.	**The volume of material that could be eroded from backfilled areas should inundation of Stage One works area occur prior to vegetation becoming established was estimated by Mr Aiken (supplementary evidence dated 19 December 2022). Is this a reasonable estimate of potential volume (including** • **assumed AEP used is appropriate, and** • **will water velocities make a material difference in sediment mobilised and consequently significance of effects** • **(& if so to what extent insoafar as relates to volume, and likely deposition locations))?**
SA By reference to supplementary evidence 19 Dec 2022 – 10% AEP used generally suitable. Hundreds of different storm types possible, but the 48-hour storm event was	

selected from multiple scenarios available. It was not considered practicable to model others and was considered to have reasonable likelihood of occurring. A more frequent annual event was not chosen as limited evidence re back-channel floods on an annual event. Other factors (upstream bed level, channel roughness etc) also important to back channel flooding. Local records from Coralie Le Frantz show years where no floods observed. Longer term records (Woodmans Gauge) show years where 900 cumecs (the flow rate generally accepted to cause flooding in the back channel) was not reached.

MH – TDC Hydrology Section identified bankfull flow at the Woodmans Gauge (located on the Motueka River in the vicinity of the site) (data set to attach to this useful)[1] was about 900 cumecs and flows in excess of this value will flow into the Peach Island backchannel; 900 cumecs is less than annual flood (c. 1205 cumecs for annual), which indicates that an annual flow in the area of concern is highly probable. However, no problems with adoption of 10% AEP flood since it had been modelled and hydraulic output data were available for computation of pit backfill erosion. My conclusion is that the use of the 10% AEP event for the period of operation (with a 10%-15% probability of occurrence during the proposed period of mining) is not conservative since more frequent, annual events of lower magnitude than the 10% AEP event, are likely to occur. Additionally, events of higher magnitude and lower frequency could also occur.
Local resident (Coralie Le Frantz) has documented annual flows in the back channel (but acknowledged volume not documented). But, in my view this seems to align with TDC Hydrologic records.

SA notes records, has peak flows from Woodman gauges, less than 900 cumecs, but believes there are subtleties in what flow is re to flood back channel, vs flow coming down Motueka.ie SA notes the years the back channel doesn't flood.

SA 10yr event peaking at 141 m3/s in backchannel cf 1400m3/s for river itself; vs Woodman gauge (MH) at 1798. On balance see them as 'close enough'.

GG re 10-15 percent probability of Stage 1 flooding while pitting is underway – does believe the probability is higher than that ie not conservative, but in other respects the erosion calculation estimate is conservative, except that more than one pit may not be stabilised at time of flood. Bit of a moot point (as MH commented either you pick more frequent smaller floods or larger less frequent one, they will all cause some measure of erosion of unstabilised pit surface). Overall considers appropriate re 10 year event.

SA asked GG, from his ten years' experience at TDC, re the channel floods annually, as to whether there was seasonal element? (ie is there relevance if during winter no extraction occurred due to higher groundwater levels). GG in response not aware of any such correlation from his experience – and can be any time of year (and notes for datasets Woodstock gauge has longer history of records). But based on ten years' experience, any time of year, no apparent correlation. MH states familiar with Woodstock gauge record (located upstream of Peach Island), that a reasonable size flood event can happen at any time of the year, but suggests larger events are likely to be cyclonic driven events in the summer.

[1] Following provided by Dr Harvey:

Bankfull flow - 900 cms	Annual Flood - 1205 cms	10-yr flood - 1798 cms	100 -yr flood - 2630 cms

Source: https://www.tasman.govt.nz/my-region/environment/environmental-data/river-flow/motueka-at-woodmans/

MH – regarding conservatism – modelling is what it is done for 10 and 100 year events, held by TDC and done some time back. Would need to rerun hydraulics, but at this point 10% event and probability re 10-15% chance while extraction then real issue, and SA has identified the erosional component.

SA notes event may happen more frequently, but the view is that the actual erosion would be less due to lower velocity and duration; MH happy with 10% event used. GG agrees.

SA acknowledges Hjulstrom curve not most up to date but with variables – it provided an expedient tool to understand with current model outputs; MH states 'close enough' fits with other literature. GG agrees.

SA Comparison re overall catchment load appropriate as literature re considers delivery/deposition of suspended sediment to Tasman Bay.; Acknowledges single pit cf entire stripping of entire floodplain. GG re deposition – depends on event used – if it had been done on smaller more frequent deposition on island smaller, cf larger wash into river due to depth / velocity. Overall agrees estimate re erosion conservative ie wouldn't get erosion down to bottom of pit (based on erosion / flood damage). Note that computed pit erosion numbers do include a bedload component (as opposed to suspended sediment) MH computed pit erosion numbers reasonable; annual suspended yield reasonable, but with roughly 400,000 tonnes per year of suspended sediment delivered to Tasman Bay, SA increase from 1.9 to 2.3 percent is significant– that's the issue – increase in existing load coming out of the system; can't ignore the additional load since it doesn't happen in vacuum; if it was just about erosion of the backfilled pit that would be an operational issue, but the issue of concern is material moving offsite to the Motueka River and Tasman Bay. MH there is a long history of documented accelerated suspended load delivery to the Bay, and estimation of bedload not the key issue. Notes suspended sediment plume into Bay during every flood on the Motueka River. Notes re Cawthron Institute studies[2] – floor of the Bay impacted by fine sediment. Key point is that an increase in suspended sediment load is of concern to the Bay, which is the receiving environment.

2. year	**The estimate of potentially eroded material was contextualised by comparison to suspended sediment yields from the Motueka Catchment. Is the estimate of potentially eroded material as a percentage of catchment yield a reasonable estimate?**

SA see above, plus response to Mike re more frequent event, percentage would be smaller, magnitude lesser, and material eroded deposited on downstream flood plain rather than Tasman Bay single event and perhaps consolidated into floodplain (vegetation). Notes re all material from pit – won't be as large so therefore reflected in percentages re contribution.

MH states not binary – ie not either / or . matter of magnitude and frequency. SA agree.

[MH notes backchannel drains to the Shaggery River so suspended sediment is likely to be discharged to the Motueka River during smaller more frequent events].

[2] Example - Newcombe, E 2016. *State of the Bays: Tasman Bay and Golden Bay Marine Environments*. Prepared for Nelson City Council and Tasman District Council. Cawthron Report No. 2891 15 p

3.	Are other stabilisation measures for pit material possible/necessary (including deflection and / or bunding)

SA clarifies that assumptions that material not consolidated, and no stabilisation.

SA deflection or bunding –apprehensive without more analysis – clear that no veg or bunding sitting perpendicular to flows due to impact on erosion, deflection into flood barriers a risk. View them as off the cards. Other stabilisation methods (acknowledging these would require input from other experts) but – compaction, hydro seeding, biodegradable mat below ground level (200mm to 500mm) possible. A scalable approach/best practical option approach is required – in this case a concerted effort to ensure grass strike occurs quickly.

GG – this is the most important question – read section re stabilisation of surfaces; lacking more efforts re practicable options before fully stabilised. Issue re veg that needs irrigation system, germination during winter (ie underlying assumptions). Re bunding, another example Waimea where bunding used, other Council staff involved – bunding around pits, unknown re fully bunded or not, but unknown re flood risk (the land there is less likely to flood). Re potential for concentrating flows to stopbank, is acknowledged as a concern, but doesn't rule out as an option – ie through conditions. Suggests more than vegetation stabilisation without details. Suggest range of methods need to be considered eg geotextile if winter and no germination, and / or no extractions.

MH agrees with SA re avoiding bunds around pits, especially re deflection of flow to stopbanks; notes issue of lack of design criteria for the bunds and design events. More capacity lost from back channel, and push water surface elevations up, so something wouldn't contemplate, and in fact original application stressed no stockpiles etc in floodplains, so introduction of anything that impacts flow conveyance not good. Re stabilisation of fill issue: when revegetation is required, can't overcompact topsoils not good for plants, so pretty erodible when bare, could put down geotextile liner, but that is a cost; but other option could be to use a gravel mulch to roughen surface when vulnerable, but notes cost, as well as potential impacts to soil productivity. Proposal is to mine gravel, not use it as a surface mulch on backfilled pits.

SA Operational plan light on details, but expects extraction won't occur during winter due to elevated groundwater levels, during summer, contractor will be irrigating surfaces for dust suppression and management, so if laying topsoil and seeding that, would expect grass strike within 3 to 4 weeks and heading into autumn. Issue also re phasing of work programme.

GG asked re in light of comments – noting in practicality real problems, effects unsure, acknowledging creating options for applicant to ground truth for site characteristics.

SA to MH – if vegetated with generic plant / grass, would that address concerns ie how to identify 'stabilised' surface – noting focus on more frequent events as more appropriate cf larger events with erosion scour more unavoidable. MH re definition of stabilised surface agrees re reasonable grass cover to increase amount of energy needed to mobilise sediment. Notes issue re watering in the summer with water trucks is likely to cause compaction of the topsoil and affect plant growth medium (acknowledging outside area of expertise). Other irrigations schemes/options are feasible

GG views grass as acceptable, if can be achieved on the site. Mentions 80% coverage in a month as prospective condition.

4.	If so what measures should be used (and by reference to differences in significance of effects under under Q1)?

SA steal best practicable option term / concept from RMA, seeding the site and establishing grass the most practicable. Noting compaction issue re other disciplines; coconut geotextile tiles, would prevent erosion below that depth, but not sure how deep erosion would occur so uncertain re efficacy plus cost extra and securing in ground. Supports more intensive grass striking approaches, taking into account staging of work across the stage 1 area, seasonality, seeding to maximise grass strike; and think about how much of stage one surface is mined at any time – risk based approach – only break area into (for example thirds, fifths, halves by practicalities), and one third over a summer period and revegetate that, so if experience large event then still have two thirds of flood plain it is unconsolidated. Consideration of risk and incorporation into an operational plan is is appropriate.

[MH notes that all risk is born by the receiving environment.]

If stabilisation of the backfilled surface cannot be achieved then TDC as regulator may then have escalation to require less practicable options.

GG mentions another method (noted outside area of expertise) – understands seed drilling has worked well.

SA notes erosion of pit headwall is another risk. Can excavation occur downstream to upstream direction and stabilising as they go, so downstream pits above them already been stabilised, to further manage erosion upstream.

MH step back a little bit – fundamental assumption is the pits are backfilled – no open pit addressed– if open pit, flood as likely to occur as for a backfilled pit, since flood event can occur at any time, SA had looked at potential impacts – showed flow acceleration into head of pit that will cause erosion of pit — need to recognise it is a risk to areas previously mined and reclaimed and areas that have yet to be mined; notes analogy with Douglas Rd July 2021 floods, clear evidence of upstream movement of head of pit, will get headcut erosion.

[SA notes that these are on the ain branch of the Motueka R, so are a different hydraulic environment].

MH says different process re starting upstream and working downstream. Real question (don't know answer) is relative erodibility of backfill vs native ground; we do know once removed topsoil, larger material (gravel and cobbles) are present in the unmined alluvium so potentially argue that is less erodible then backfill (finer and not compacted). Backfill more susceptible to headcut erosion potentially.

SA – what about if batter back head and side of pit to more 'acceptable' angle to control erosion –

MH believes unlikely to be very successful since steep slope remains even with batter. Open pit in floodplain is always a risk (SA agrees always a risk).

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

Witness	Signature	Date
Mr Aiken		6 March 2022
Dr Harvey		6 March 2022
Mr Griffith		6 March 2022