BEFORE THE COMMISSION
APPOINTED BY THE OTAGO REGIONAL COUNCIL

UNDER	the Resource Management Act 1991 (RMA)
IN THE MATTER	Of an application by Dunedin City Council for resource consent being processed with reference RM20.280
BY	**BIG STONE FORESTS LIMITED, ŌTOKIA CREEK AND MARSH HABITAT TRUST, SOUTH COAST NEIGHBOURHOOD SOC INC, BRIGHTON SURF LIFESAVING CLUB INC, DAVID GRANT** **('The Submitter Group')**

NOTES OF COMMENTS TO PANEL FROM DAVID IFE FOR SUBMITTER GROUP

DATED 24 MAY 2022

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NOTES OF COMMENTS TO PANEL FROM DAVID IFE

May it please the Commissioners:

Design Standard for Side Liner

1. I would challenge Richard Coombe on the issue of the design standard for side liners because of the potential for perching of leachate and lateral migration through the side before the leachate reports on the base liner. I consider that a higher standard of liner is required to mitigate the potential impact of leachate migration through the side liner. I have made further comments on this aspect at the end of my statement.

Groundwater interception rate

2. Groundwater interception by the subdrainage system is 87 m^3/day, as stated in the evidence of Mr Kirk, not 87 m^3/year as Mr Coombe stated.

Speed of Leachate Migration

3. I would like to address the issue of how quickly leachate migration will take to show up in the groundwater. Because there is an underdrain system, this will act like a leak detection system since it will provide a pathway for any leachate leakage through the liner to escape to the external environment. So I agree that the travel time will be slow vertically through the profile to the water table, but where the water table is high, such as at the bottom of the slope where it will be intersected by the underdrain, it will be much more rapid – within a year.

PFOS leakage

4. Mr Kirk commented that my calculation of PFOS leakage on groundwater quality did not take account of mixing. In fact my calculation is based on total mixing of the load of PFOS in the leachate leakage adding to the total load of PFOS in the groundwater flow. This is the issue with PFAS compounds – they are persistent and small quantities can make a significant impact. So in my

calculation, I assumed a PFOS concentration of 1 ug/L in leachate and zero in groundwater. When the leakage rate of 1.4 m3/year is added to the groundwater flow rate of 2,200 m3/year, the predicted PFOS concentration will rise from zero to 0.000636 ug/L exceeding the 99% ecosystem species protection value of 0,00023 ug/L. I also take issue with the statement that implies that dilution (i.e. by mixing) is the answer to pollution. In fact the persistent organic compounds, including PFAS compounds, can bioaccumulate in ecological receptors, reversing any perceived dilution benefits.

5. The 99% ecosystem protection standard comes from the Table 5 in the PFAS National Environmental Management Plan, Version 2.0, January 2020.

Hydraulic Gradient

6. I wish to address the issue raised by Mr Kirk that the hydraulic gradient is always downwards. In fact, Figure 2 in Mr Kirk's statement indicates that in Bores BH211 and BH04, shallow groundwater levels are close to surface and further down the catchment they are at surface level. This is the reason they are proposing a groundwater underdrain system for that part of the landfill, because they need to intercept shallow groundwater pressures.

Potability

7. Potability is based on quality, not yield. Although the groundwater may not be used for drinking water supply, it is a high quality resource that interacts with groundwater dependent ecosystems downgradient and so quality needs to be protected.

Monitoring and trigger levels

8. The issue of monitoring was the subject of some discussion and I would like to provide more explanation on the subject of trigger levels and trend analysis.
9. Monitoring should identify the groundwater quality characteristics and whether there is seasonal variability. As Mr Rumsby has pointed out,

there needs to be a sufficient record of monitoring to inform the background groundwater conditions prior to construction of the landfill and trend analysis can be used to discern transient variability. Trigger levels, however, are a different thing and should be based on water quality beneficial use criteria such as ANZECC or NEPM for specific contaminants.

Suitability of Loess

10. I would like to address some of the issues raised by Samantha Webb in relation to the suitability of loess as a construction material for the liner system. In my view this issue could be quite significant for this application.
11. It is clear from her work that the loess will need to be treated with either lime or bentonite or both to provide an acceptable level of dispersivity. Her testing has shown that there is clearly quite a range of dispersivity and hydraulic conductivity within the material on site, and the treatment with lime/bentonite appears to provide an acceptable outcome for these parameters.
12. There is, however, a separate question as to whether an acceptable level of plasticity can be achieved with treatment, and her results don't seem to be definitive on this. Plasticity is important for any compacted clay liner but in this case it is particularly relevant because of the issue of seismicity and the potential for movement or displacement of the liner.
13. Ms Webb also indicated that a pug mill provides better QC for the liner material, but QA/QC procedures are lacking in the Management Plan. The draft LMP, prepared on 29th April 2022, contains no detailed procedures on construction quality assurance or quality control for the very important liner construction stage, instead referencing "applicable New Zealand Standards relating to landfill construction (including geotechnical, lining system and drainage standards)". The draft LMP notes that content will be included following issue of consent, but this provides no basis for review beforehand.

Liner System

14. I have prepared this additional material in response to a request from the Chair on what liner system I consider would be appropriate for the Smooth Hill site. The design standards I am proposing generally derive from the Victoria BPEM, which is a more stringent standard than the WasteMINZ standard for a Type 1 landfill.
15. To achieve a low seepage rate would require a 1000mm thick compacted clay liner with a hydraulic conductivity less than 1×10^{-9} m/sec overlain by a GCL and an intact HDPE geomembrane of 2mm thickness with a hydraulic conductivity of 1×10^{-14} m/sec and extending up the sides as well as the base. Note the Type 1 proposal from the application was for 600mm of compacted soil with a hydraulic conductivity of 1×10^{-8} m/sec overlain by a GCL and a 1.5mm HDPE geomembrane on the base. The design also indicated that the GCL would only extend 5m up the sides of the landfill.
16. For the design I'm proposing, the compacted clay liner should be placed in 4 to 6 lifts, separately compacted and with no rock fragments or soil clumps greater than 50mm in any dimension.
17. The clay should have a soil plasticity index of >10 and a cation exchange capacity (CEC) greater than 10 mEq/100g.
18. The liner should be placed on the sides as well as the base of the landfill since the slopes are between 4% (1 vert: 25 horiz) and 25% (1 vert: 4 horiz). This will prevent lateral migration of leachate from the landfill.
19. The leachate collection system should be 300mm thick and comprise granular material (coarse gravel or aggregate) with fines content less than 1 percent and comprising no calcareous (limestone) fragments.
20. The leachate collection pipes should be sloped at no more than 1 percent towards the leachate sump and should be made accessible for inspection and cleaning periodically or as required.
21. The open area of the landfill should be kept to a minimum and I accept that 300m^2 to minimise incursion of rainfall into the waste mass.
22. The groundwater underdrain should be designed and spaced based on hydrogeological conditions of the site. The underdrain should

gravitate to a sump or sumps which can be sampled periodically to check for any fugitive leachate emissions.

23. The open area of the landfill should be bunded to prevent stormwater runoff during rainfall events mixing with leachate and hence contributing to the leachate flows.

David Ife

20 May 2022