



**Board of Inquiry**  
into the McCrae landslide

## **Inquiry into the McCrae Landslide - Joint report arising from Supplementary Expert Conclave on Geochemistry**

Conclave held at via Audio Visual Link

1 August 2025 10:00 to 11:30

In attendance:

<b>Name</b>	<b>Company</b>	<b>Title</b>	<b>On behalf of</b>
Darren Paul (DP)	WSP	Technical Director – Engineering Geology	Board of Inquiry
Hong Vu (HV)	WSP	Senior Associate Geochemist	Board of Inquiry
Phil Hitchcock (PH)	Australian Environmental Auditors Pty. Ltd.	Principal Hydrogeologist	Mornington Peninsula Shire Council
David Hartley (DH)	SMEC	Senior Associate - Geotechnics	South East Water
Hugo Bolton (HB)	SMEC	Technical Principal - Hydrogeologist	South East Water
Chris Jewell (CJ)	CMJA	Principal Hydrogeologist	South East Water

### **Minutes of Discussion**

1. HV - SW05 sample is considered as one of the two representative samples of the seepage originating from the landslide. This sample was collected by PSM base of slide Jan 20 in Penny Lane - water from Bayview Rd Burst travelled along pathway through ground and issued from headscarp. This sample has more parameters compared to the one collected on 6<sup>th</sup> January 2025 and this sample should be used for the assessment.
2. CJ – sample taken on day after landslide on 6 Jan 25 from headscarp. Only sample from headscarp around the time EC and Chloride tested (SEW took this sample). Limited information on chemistry. Not typical of mains water that could have leaked from Bayview Rd. 20 Jan.
3. PH – Seepage water is similar in geochemistry of shallow aquifer which is near top of granite and in contact with granitic material. Mains water could pick up minerals within the aquifer in a similar way to natural water and has picked up ions on the pathway. This has resulted in part to the increase in salinity.



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4. CJ – modelling indicates reaction between mains water and the minerals in embedment sand or colluvium could not enrich that water sufficiently to produce the salinity measured in landslide seepage water within the approximately 60 day time available. To get the measured salinity in mains water thus requires mixing with groundwater. If water flows through fill, it is still a short flow path and might not have been sufficient to have dominated the composition of the water.
5. PH – Prior evapotranspiration in the landslide escarpment could also be a salinity source.
6. PH – An important fact not mentioned in my original report was the flow rate that came from the landslide area. On 6 January 2025 (i.e., just after the first landslide on January 5th, 2025) flow was estimated at 17,000 litres/day then and has reduced to about 50 litres/day on 16th June 2025. In my opinion, considering the lower than normal rainfall between these times and the timing of the repair of the Bayview Road mains water leak, the June 2025 flows are likely to be representative of normal baseline flow. Therefore, the January 5th 2025 flows being over 2 orders of magnitude higher just prior to the first landslide event are most likely due to an abnormally high recharge event) prior to the landslide such as the Bayview Road leak.
7. HV – Chemistry of sample from 6 Jan is similar to sample taken on 20 Jan.
8. HB – Rainfall might have diluted the sample taken on 20 Jan compared to 6 Jan. EC and CL are lower on 20<sup>th</sup>, this could be because there was rain between those times.
9. Agree there are only 2 samples available 6<sup>th</sup> January has 3 parameters (EC, F, Cl), 20<sup>th</sup> January has more comprehensive suite.
10. Agree water flowed through shallow aquifer which could include sewer embedment material.
11. CJ – mineralogy of gravel used as embedment material and colluvium is similar (embedment material was crushed granite).
12. VH – If aeolian present it is a possible source of chloride and sodium.
13. CJ – Mains water cannot pick up enough TDS if flowing only through sewer embedment material.
14. HV – 60 days is sufficient time to gather the TDS – assuming flow through the various media.



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15. CJ – Colluvium could contribute chloride if it contains aeolian material, due to possible presence of sea salt. There will also be some mixing with native groundwater.
16. HV – insufficient shallow groundwater to provide the mixing with mains water to yield the chemistry shown in the tested samples.
17. CJ – Even when soil is "dry" there is native water retained within non-drainable porosity. Some native water is thus available for mixing into any leaked mains water migrating through the soil. This is an instantaneous mixing.
18. HB – BH4 (PHR) and BH3 (Charlesworth) – these boreholes encountered perched water, also water pumping at 5 and 7 PHR. Coburn Creek was receiving groundwater and flowing at the downstream end, not flowing at the top end.
19. HV – Agree perched water in BH3 and BH4, but this was collected and tested in July 25 and might not be relevant to events of Jan 25 but rather rainfall that occurred since.
20. HB – 'Swamp area' at 5-7 PHR has consistent shallow water. Samples were taken prior to June/July, consistent flow.
21. Agree – water naturally flows through the shallow aquifer.
22. HV – could not find water at 10-12 VP Road wells in June 25. If perched water unrelated to the mains water leak was present but not observed at the landslide site, including in shallow bores, the headscarp, and the toe since January - how could it have contributed to the landslide?
23. HB – PSM installed BH1, BH3 are dry because screen is too high above granite interface and not picking up water.
24. HB – Water quality at upwelling at Charlesworth/Coburn/Waller/7 Prospect, EC and Chlorides increased over time and are similar to those collected in May/June. Dilution occurring in natural water due to dilution of mains water and then going back to background water quality. Upwelling samples in December and early January.
25. HV - The timing of these samples does not preclude water picking up ions as it flowed down towards the landslide. Samples from a pothole at junction of Waller and Charlesworth and Coburn/Charlesworth have similar chemistry to water that issued from headscarp. F is retained in the soil column.
26. HB – Samples from the same location – lower EC and Cl in earlier samples, this is the



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water diluted by the leak. After leak is fixed, water quality returns to background and then so EC and Cl.

27. CJ – Chemistry of water sampled from upwelling is consistent with mixing of mains water with natural water and changes as the mains water input reduces.
28. HV – There was not the rainfall to input natural water to mix back in to the mains water. Water in potholes cannot be from natural or rainwater. Residual water from mains leak continued after repair and was observed on road surface in pothole.
29. PH – While we will never really know the pathways but there are multiple sources that could increase salinity along the flow path. These include but are not limited to, dissolution of aquifer minerals (including aeolian sand, colluvium and clays), mixing with existing groundwater and dissolution of salts in the unsaturated zone (including potential for vegetation to have historically concentrated salts in the landslide escarpment).
30. PH - Samples taken at headscarp and some taken elsewhere lack QA processes raising data reliability issues. This could affect in particular cation analysis critical to geochemical modeling.
31. PH - It was a transient event and samples taken now would not be representative with regard to mains leakage.
32. HB – Parameters like EC and Cl are robust parameters so less susceptible to poor QA. More data would be good to have, but the analytes of interest are robust parameters.
33. CJ – If samples are not filtered it can reduce confidence in analysis, but this should not affect Cl and EC.
34. HV – agree not too concerned with respect given EC, Na and Cl.
35. HB sewer aggregate for LEAF test was taken at Bayview/Outlook Road near burst site.
36. PH – no description of LEAF test method was provided and results are remarkably consistent for different materials raising concerns that preferred pathways were present and short circuiting the column material. There are also anomalous laboratory results shown on the certificate so analysis.



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37. HV - I note some information that was missed in our report due to time constraints which unfortunately was not picked up during our review. Specifically, this includes some edited text for item 183 and an additional note regarding Coburn Creek (SW10).

*Column leaching test results on sewer embedment materials have been provided by SMEC and PSM, ALS report number ES2519076, (PSM.5004.0001.0001 to PSM.5004.0001.0001). The results show that ions such as calcium (Ca), sodium (Na), chloride (Cl) and F can be leached from the sewer embedment materials and other soil materials. In addition, the testing also showed that F was retained in some soils, likely via adsorption. The leached ions (Ca, Na and Cl) are consistent with those observed in the seepage water sample collected from the January 2025 landslide which were chemically enriched in similar ions. The observed retention of F in some soil samples also supports the hypothesis that F was likely retained in soil matter along the pathway.*

Table **Error! No text of specified style in document..1**

Surface water sampling locations

ID	New ID	Location	Note
Pit01	PIT01	Near corner Bayview Road and Outlook Road.	Sampled
Pit02	PIT02	In between corner Bayview Road and Outlook Road and Mornington Peninsula Freeway	Low flowing water, no sample taken, water quality monitoring (WQM) only
Pit03	PIT03	Next to Mornington Peninsula Freeway	Sampled
Pit04	PIT04	Out front of 4-6 Waller Place	Sampled
SW01	PIT05	Out front of 5-7 Prospect Hill Road	No flow - No sample taken
SW02	PIT06	On edge of 5-7 Prospect Hill Road (private pit)	A private sump, asked for permission, water is flowing - sample taken
SW03	PIT07	Front of 4 View Point Road	Flowing - sample taken
SW04	PIT08	Pit at the end of View Point Road	No flowing water, WQM only
SW08	RW01	Rainwater tank, 4 View Point Road	Accompanied by private owner, sampled. Duplicate and triplicate samples taken
SW09	RW02	Rainwater tank, 2 View Point Road	Accompanied by private owner, sampled
SW10		Coburn Creek near 16 Charles Street	Dry, met with Aidan Gallagher from Mornington Peninsula Shire.



### Key Points of Agreement

- Water flowed through shallow aquifer (which contains colluvium and aeolian materials) to some extent and could have flowed through sewer embedment material or stormwater trenches or pipes.
- There were 2 samples taken of seepage from the landslide on 6 (after 5 January slide) and 20 Jan (6 days after 14 January slide). 6 Jan by SEW analysed for EC, Cl, F. 20 Jan, same but also major anions and cations. 6 Jan from on slope near headscarp and 20 Jan from water flowing along Penny Lane at base. There had been some rain between 14 January and 20 January. Chemistry of those two samples broadly similar, 20 Jan sample is slightly less saline.

### Key Points of Disagreement

CJ – Mains water could not have reached the salinity that was measured on 6 or 14 Jan by reaction with either embedment material or colluvium. If it flowed through colluvium and there was aeolian material present it could have picked up sodium and chloride ions by simple dissolution.

HB – Upwelling in Charlesworth/Waller/Coburn area and dilution over time of ions shows mains water from the Bayview Leak was diluting background water that was already there and background water has EC of approximately 1300 and that was diluted when mixed with Bayview Leak mains water. The ion concentration in the samples tested at the landslide is too high given the flow path and time from the Bayview Leak to the landslide site.

HV – Water from mains water did pick up ions as shown by testing in potholes at Charlesworth/Waller/Coburn and picked up further ions between there and the landslide site. Any water flowing through the soils can pick up sufficient ions.

PH – Although there is limited data and uncertainty in actual flow paths, flows of leaked mains water from Bayview Road leak to the landslide had opportunity to increase salinity from a variety of sources along the migration pathway.



### Signatures

<b>Name</b>	<b>Signature</b>	<b>Date</b>
Darren Paul	Irrelevant & Sensitive	1 August 2025
Hong Vu	Irrelevant & Sensitive	1 August 2025
Phil Hitchcock	Irrelevant & Sensitive	1 August 2025
David Hartley	Irrelevant & Sensitive	1 August 2025
Hugo Bolton	Irrelevant & Sensitive	1 August 2025
Chris Jewell	Irrelevant & Sensitive	1 August 2025