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Expert Witness Statement – Final Version

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3. Qualifications Bachelor of Civil Engineering (Hons) - Deakin University 1981
Master of Applied Science Geology - Ballarat University 1999
4. Position Principal Geotechnical Engineer with A.S. Miner Geotechnical
5. Professional Membership Australian Geomechanics Society (AGS) (1998-)
International Association of Engineering Geologists (1998-)
Member of The Institute of Engineers, Australia (2002-)
Member AGS Taskforce on Landslide Risk Management (2005-07).
Member of AGS subcommittee on LRM Education Empowerment (2009-2012)
Member of IAEG C37 Committee on Landslide Nomenclature (2016-)
6. Experience

Education and Early Career

I graduated with honours as a civil engineer (with a focus on geotechnical engineering) from Deakin University in 1981 and later gained a Master's Degree in engineering geology at the University of Ballarat in 1999.

My undergraduate thesis involved theoretical considerations of stabilisation of a landslide on the northern coast of the Bellarine Peninsula using ground anchors. The early part of my working career with P.J. Yttrup and Associates included numerous assessments of landslide risk throughout the Otway Ranges and the Heytesbury region of South West Victoria. I was involved in investigation, design and remedial works installation for a number of landslide projects.

I then worked on a number groundwater and contamination issues with Alcoa at their Point Henry and Portland facilities developing further skills in hydrogeology and groundwater modelling.

I completed a master's degree in 1999 in Engineering Geology at the University of Ballarat studying landslides in the Heytesbury Region and later worked in the UK as a research engineer for the Phi Group, a slope stabilisation and retaining wall consultant and contractor.

Establishing A.S.Miner Geotechnical and Later Career

On my return to Australia in 2001, I started A. S. Miner Geotechnical (a specialist geotechnical consultancy) and continued to work on landslide related projects including susceptibility assessments, landslide inventory mapping, field investigations, slope monitoring remediation and remedial design. As such, landslide and slope stability projects have become the focus of my work over the past 17 years.

I have maintained a specific focus on landslide studies and risk management including numerous residential landslide risk assessments in the South Western Victoria and various coastal instability, hazard and risk assessment studies over a broader region ranging from the Westernport Bay to Portland. I have also been involved with other landslide studies, risk assessments and monitoring programs in Wollongong (NSW) and Tasmania,

Throughout my career, I have also worked on a number of erosion management and planning projects including amendments to the Erosion Management Overlay and planning submissions working directly for a number of local shires including Colac Otway Shire and also as part of the Corangamite Catchment Management Authority's regional soil health strategy. I was commissioned by the Corangamite Catchment Authority to produce landslide and erosion inventories and regional susceptibility maps for the CCMA area including extensive field and desktop mapping throughout the Otway Ranges. I have also been involved in integrating these susceptibility maps into planning control overlays.

I have provided specialist geotechnical referral consulting services to a number of local governments including Colac Otway Shire where I have been involved over the past 10 years in the review and assessment of numerous Landslide Risk Assessments reports submitted under the requirements of the Erosion Management Overlay.

I recently advised various local and state government agencies including Colac Otway Shire, Parks Victoria, DELWP, VicRoads, SES, EMV and Victoria Police on slope stability issues in the region following the disastrous Wye River bushfires in December 2015.

Landslide Research

I have had a long association with landslide research and investigation in the Otway Ranges working in tandem with the then University of Ballarat (as an honorary research fellow) on various student research projects and commercial studies including significant detailed work at Wye River.

I have also been involved in landslide research through a formal association with The University of Wollongong (visiting research fellow) and I was a member of UoW's Landslide Research Team (LRT). I have published a number of landslide and risk related conference papers and I am a contributing author to the chapter on Geological Hazards in the Geological Societies of Australia's Special Publication "Geology of Victoria". I have also had an ongoing relationship with the geohazards team at Geoscience Australia and I was a reviewer and contributor to their publication entitled: "Natural Hazards in Australia".

I have regularly contributed to and attended various local and international landslide theme related conferences throughout the world including the IAEG Congress in Vancouver 1998, The 9th Australia New Zealand Conference on Geomechanics. Auckland 2004, The International Conference on Landslide Risk Management, Vancouver 2005, The International Conference on Landslides and Climate Change, Isle of Wight 2007, 1st North American Landslide Conference, Vail 2007 and more recently the International Symposium on Landslides in Naples, 2016.

Work with the Australian Geomechanics Society

I was a member of the 2007 Australian Geomechanics Society's (AGS) National Taskforce on Landslide Risk Management including being a member of the working group producing the Guideline on Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning and a member of the working group producing the Australian GeoGuides for Slope Maintenance and Management. The outputs from this process serve as the current standard for landslide Risk Management in Australia.

I co-presented a series of landslide risk management seminars on behalf of the AGS aimed at informing and educating both local government regulators and practitioners on aspects of the AGS's landslide risk management guidelines (AGS 2007a, b, c, and d). This national seminar series was presented around Australia in 9 state capitals and major cities from March 2011 to June 2011.

I have also served on the AGS Victorian Chapter subcommittee on Landslide Risk Management and was a member of the steering committee of the Landslide Risk Management Education Empowerment NDMP project initiated by the AGS in 2012 after the national seminar series. More recently I have served as one of the co-presenters for the AGS's professional development course entitled "Field Techniques for Landslide Assessment" which has been conducted in 2014 and 2017.

Anthony Miner states,

Introduction and scope.

1. I was requested by Colac Otway Shire (COS) to provide comments on the advice contained in the geotechnical reports provided as supporting documentation under the requirements of the COS Erosion Management Overlay (EMO1) for the proposed Apollo Bay Resort development at 275-305 Barham River Road, Apollo Bay.
2. The geotechnical reports submitted as supporting documents under the requirements of the Colac Otway Shire EMO1 and which form the basis of my statement are as follows:
 - a. Landslide Risk Assessment. Apollo Bay Resort 275-305 Barham River Road Apollo Bay. Report Number 1787175-002-R-Rev0. Dated 24th October 2017. Prepared for Irwinconsult Pty Ltd by Golder Associates.
 - b. Landslide Risk Assessment. Apollo Bay Resort 275-305 Barham River Road Apollo Bay. Report Number 1787175-002-R-Rev1. Dated 1st November 2017. Prepared for Irwinconsult Pty Ltd by Golder Associates.
 - c. Revised Landslide Risk Assessment. Apollo Bay Resort 275-305 Barham River Road Apollo Bay. Reference Number 1787175-007-L-Rev2. Dated 15th May 2018. Prepared for Irwinconsult Pty Ltd by Golder Associates.
3. In addition, I was also requested by COS to review and provide comment on a stormwater drainage and waterway management (SDWM) report prepared by the applicant.
4. Details of the stormwater drainage and waterway management (SDWM) report are as follows:
 - a. Apollo Bay Resort. Stormwater Drainage and Waterway Management Report. Dated 9th May 2018, Revision H, Job No 15ME0212. Prepared by Irwinconsult.

Requirements under the COS EMO1.

5. The objectives of the EMO1, which are important to the context of this statement, are specifically set out in Schedule 1 to EMO1 and include the following:
 - a. To manage the risk of landslip (otherwise referred to as landslide in this statement).
 - b. To ensure that development can be carried out in a manner which will not adversely increase the landslip risk to life or property affecting the subject land or adjoining or nearby land.
 - c. To ensure that development is not carried out unless the risk associated with the development is a *Tolerable Risk* or lower.
 - d. To ensure that applications for development are supported by adequate investigation and documentation of geotechnical and structural matters.
 - e. To ensure development is only carried out if identified geotechnical and related structural engineering risk to life and property are effectively addressed.

6. In providing this evidence, two of the reference documents included in Schedule 1 to EMO1 are also considered to be very important, these being:
 - a. AGS (2007c) Guidelines for Landslide Risk Management 2007, Journal of Australian Geomechanics Society, Vol 42, No1, March 2007.
 - b. AGS (2007d) Commentary to Guidelines for Landslide Risk Management 2007, Journal of Australian Geomechanics Society, Vol 42, No1, March 2007.

Tolerable risk criteria.

7. As noted, COS specifically adopt a *Tolerable Risk* criteria as defined in Schedule 1 to EMO1. *Tolerable Risk* is described as the risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negotiable and needing to be kept under review and reduced further if possible. *Tolerable Risk* is recommended to include a qualitative level for risk to property and a quantitative measure for risk to life in accordance with the suggested criteria contained in Table 1 in AGS (2007c).
8. The determination of tolerable levels of risk are not based on a single factor but relate to a combination of factors including the situation pertaining to the nature of the slope (existing, new constructed slope and /or existing landslide areas) and the importance level of the structure. For the proposed development (importance level 3) on existing slopes with observed landslides the following tolerable risk criteria apply

a. Tolerable risk to life	1 x 10 ⁻⁵ / annum (1 in 100,000)
b. Tolerable risk to property and infrastructure	Moderate
9. By comparison, the risk of death per participants per year is estimated to be 1 in 23,000 for motor vehicle use, 1 in 70,000 for drowning and 1 in 1,000,000 for scheduled airline use (AGS 2007e GeoGuides).

Requirements of Schedule 1 to EMO1.

10. Schedule 1 to EMO1 has a two tiered assessment process. The initial or base tier is known as a *Geotechnical Assessment* and the second more detailed tier is known as a *Landslide/Landslip Risk Assessment*.
11. The initial tier of assessment designated as a *Geotechnical Assessment* is not required to include any formal risk assessment process, as inherent site risks are considered to be sufficiently low.
12. Schedule 1 includes a number of requirements that must be included in the Geotechnical Assessment.
13. The second, more detailed tier of assessment, designated as a *Landslide/Landslip Risk Assessment* (LRA) is required to include a *full risk assessment* which is deemed to be one that includes both risk to property (usually conducted as a qualitative analysis) and risk to life (usually conducted as a quantitative analysis).
14. The LRA must include all requirements of the Geotechnical Assessment plus the full risk assessment in accordance with the AGS 2007 guidelines. Important elements/tasks include:

- a. A detailed assessment of subsurface conditions including underlying geology.
- b. A statement indicating whether the site investigation requires subsurface investigations or may involve boreholes and/or test pit excavations or other methods necessary to adequately assess the geotechnical /geological model for the subject lot and details of such investigations, boreholes, test pits or other methods.
- c. A statement indicating whether or not the development should only be approved subject to conditions and if so, state recommendations of what conditions should be required including but without limitation, conditions relating to :
 - i. The determination of appropriate footing levels and foundation materials in any structural works, including all footings and retaining walls.
 - ii. The locations of and depths of earth and rock cut and fill.
 - iii. The construction of any excavations and fill and the method of retention of such.
 - iv. Any details of surface and subsurface drainage.
 - v. The selection and design of a building structure system to minimise the effects of all geotechnical hazards.
 - vi. Retention, replanting and new planting of vegetation.
 - vii. Any drainage and effluent discharge.
 - viii. Any necessary ongoing mitigation and maintenance measures and any periodic inspections including performance measures.
 - ix. The time within which works must be completed after commencement and the locations and period in which materials associated with the development can be stockpiled.
 - x. Any requirements for geotechnical inspections and approvals that may need to be incorporated into construction work plan for building approval.

15. The schedule also requires the information is accompanied by a Geotechnical Declaration and Verification Form (Form A).

The role of the AGS (2007) reference documents.

16. Reference to AGS (2007c and 2007d) clearly indicates one of the key functions for any LRA report is to establish a geotechnical slope model that facilitates an understanding of the slope forming processes. In particular, AGS (2007d) indicates the following aspects should be demonstrated as part of a LRA report:

- a. Slope failure mechanism.
- b. Landslide travel distances and speeds.
- c. The relationship between landslides and potential triggers including rainfall.
- d. Landslide hydrogeology.
- e. Landslide formation process rates.

17. AGS (2007d) also states the purpose of *field investigations* is to allow an understanding of the geotechnical slope model, landslide causes and triggers. Such field investigations may involve a staged process, especially for complex projects, ideally starting with a walkover survey including diligent field mapping to record geomorphic features which leads to a preliminary geotechnical slope model and an understanding of slope forming processes. It is noted that subsequent subsurface investigations help to refine the preliminary geotechnical slope model.

18. As a result, different levels of study are identified by AGS (2007d) throughout the overall landslide risk assessment process and these have been defined as:
- a. *Reconnaissance*: to establish the broad topography, evidence of past instability and geology on a regional scale.
 - b. *Walk-over*: to establish site (or area) specific topography and detailed observation of relevant features such as outcrops, topographic and evidence of past instability. Some subsurface investigation may be completed at this stage.
 - c. *Preliminary design*: to provide sufficient data to enable the concept designs to be selected from possible alternatives based on the risk management requirements.
 - d. *Detailed design*: to enable design of risk control measures to be optimised and to remove sufficient uncertainty such that design will be satisfactory.
 - e. *Construction*: to confirm the design assumptions and allow modifications to the design sufficient to address departures from the assumed geotechnical model.
19. AGS (2007d) also recognises that for complex projects, it is likely that there will be a continuum of level of study through the project.

Confirmation of changes made to the overall development as a result of initial risk considerations

20. The revised LRA report by Golder dated 15th May 2018, sets out a revised risk assessment based on the revised master plan (drawing TP-006-F dated 3rd May 2018) prepared by the project architect and is intended to be read in conjunction with the earlier Golder LRA report, dated 1st November 2017. Key components of change to the development as described in the report included:
- a. Deletion of several villas that were located on the north flanks of the northern ridge (these were deleted in the development based on recommendations of “unacceptable risk” as described in the initial Golder LRA report).
 - b. Relocation to the east of the hotel villas situated west of the main dam (again, relocation was in response to recommendations by Golder in the initial Golder LRA report of “unacceptable risk” to these villas in their original location)
 - c. Deletion of the proposed hotel expansion, conference centre and chapel/yoga retreat areas to the south and east of the hotel in response to recommendations in the initial Golder LRA report.
 - d. Some minor changes to the alignment of the proposed new main access road (not immediately obvious on the newly revised masterplan).
 - e. Relocation to the north and east of proposed villa units in the area south of the southern water course, again in response to recommendations in the initial Golder LRA report indicating unacceptable risk in their original location.
 - f. Relocation of minor access roads and tracks for CFA access (not immediately obvious on the newly revised masterplan).
 - g. Dropping of the requirement to upgrade the old access road on the north flank of the northern ridge due to reduced reliance on this access for the running of the development operations.
 - h. Locally deeper excavations (up to 7.0 m deep) at the Hotel site associated with lift well overrun pit and excavations (up to a height of 3 m) for an access path down the slope through the central part of the hotel.
21. Most of these changes made on the revised masterplan were in direct response to risk mitigation recommendations made in the initial Golder LRA report dated 1st November 2017 and as such were aimed at reducing reduced risks for various “elements at risk” from *Unacceptable* to *Tolerable or better*, as required by the COS EMO.

22. However, it is noted that some elements at risk still had high and very high risk (which would be deemed to be Unacceptable) and as such would require risk mitigation measures to reduce risk to *Tolerable or lower* levels. These elements at high risk included:
- a. The hotel complex.
 - b. Villas on the north ridge where deep soil exists.
 - c. New access road on moderate and steeper slopes.
 - d. Old access road.

Further information required from the geotechnical consultant preparing the LRA report.

23. Based on a review of the information provided in the Golder LRA reports and the Irwinconsult SDWM report, it is my opinion that further information is still required to satisfy both the requirements of the EMO1 and the AGS 2007 Landslide Risk Guidelines.
24. My current advice on the requirements for further information relating to a range of issues is contained in the following sections.
25. Provision of this information is considered non-negotiable although the timing of the provision of the information is considered to be a function of the planning process.
26. It is understood that the vast majority of these requirements have now be incorporated into the possible “without prejudice” planning permit condition prepared by COS. Some exceptions due to further considerations by myself in this statement are now noted in paragraphs 55 to 58.

Further information required relating to geomorphological background.

27. As part of the detailed background information provided in both the initial and revised landslide risk assessment (LRA) reports prepared by Golder Associates (Golder), discussion has been included on aspects of the geomorphological and geological setting and conditions at the subject site. However, it is my opinion that further comment be included on the influence of other geological structures such as the Apollo Bay Syncline and the Barham Fault and the implications for the site conditions.
28. Additional comment regarding potential for seismicity in the Otway Ranges and any influence on overall slope stability and landslide risk at the site is also required.

Further information required relating to the role of “Indicative Landslide Risk Zone Mapping” and relocation of villas.

29. The relocation and/or exclusion of certain villas and units was been based on the characterization of various geotechnical hazards at each original location and the risks posed to those villas and units. The understanding of potential risks and the interpretation of the landscape led to a development of an “Indicative Landslide Risk Zone” map for the site. This map has been used to guide the relocation of villas and structures to generally ensure development is only undertaken in moderate, low to moderate or low risk zones.

30. It was noted that a number of the lower risk zones are located immediately adjacent to high and very high risk zones (e.g. the area to the west of the main dam and the areas south of the southern waterway).
31. As a result, in my opinion, clarification is required on a number of issues which may affect siting of development structures. These include:
- a. Is it possible that some of the identified and observed geotechnical hazards can travel out of a higher risk zone into a lower risk zone?
 - b. Have the zones been developed with a buffer to cater for runout or travel distance of some of the hazards noted and observed?
 - c. Is there a minimum distance for development away from the boundary of high and very high risk zones that should be applied?

Further information required relating to the main hotel complex and need for further geotechnical investigation.

32. The main hotel complex straddles a high risk zone with some building components located in this zone. The risk assessment discusses risk mitigation measures minimizing cuts and employing engineering measures to reduce risks but the proposal indicates undertaking an even deeper excavation for the lift well overrun pit as well as a significant cut (3.0 m) for the access path down slope through the central part of the hotel complex.
33. It is recommend by Golder that engineering measures to improve drainage, minimal earthworks and engineered retaining walls for all batters higher than 1.0 m or steeper than 3H: 1V will be required in combination with a formal monitoring and response plan to reduce risk back to a tolerable level.
34. As such, further targeted geotechnical investigation is required to design remedial works aimed at reducing risk levels. Such information is required to inform the detailed design phase of retaining walls, building footings and other infrastructure. Also see further comments on further detail of engineering measures in paragraphs 37 to 38 and comments relating to targeted detailed geotechnical information in paragraphs 44 to 46.

Further information required relating to removed elements of the development.

35. A number of now removed elements at risk (such as the expansion to the hotel complex and high use of the old access road) previously required engineering measures to improve drainage. However changes to aspects of these elements in the newly revised masterplan appeared to suggest such measures were not needed to fulfil requirements for tolerable risk.
36. As a result, further clarification is required on a number of issues relating to this issue which includes:
- a. Is the intent of the revised LRA reports dated and 1st November 2017 and 15th May 2018 now that such engineering measures in the two areas noted above are not now required?
 - b. How does the potential removal of such engineering measures impact the areas immediately adjacent to these areas and would there be any increase in risk in these adjacent areas because these measures are potentially not implemented?

Further information required relating to detail of engineering measures and risk mitigation works.

37. Reference was made to the proposed risk mitigation measures needing to be implemented to reduce *unacceptable risk* to *tolerable levels*. In many cases reference to “engineering measures including drainage” and “engineering measures to improve drainage” has been made.
38. It is my opinion, that further clarification is required relating to the issue of risk mitigation works as follows:
 - a. Given the importance of engineering measures to the overall acceptability of the development, further detail is required in describing what such measures will involve so that Council and the applicant has a better understanding of what is being proposed and how feasible such measures are. It is understood by myself and acknowledged by Golder that much of the initial discussion is conceptual and further detailed investigation and design and further significant detail is considered necessary.
 - b. In particular, confirmation is required that the reference to “engineering measures including drainage” includes both surface and subsurface treatments given the importance of groundwater and surface flows to overall stability at this site. (Also see comments in paragraphs 39 to 43 relating to review of stormwater drainage and waterway management plan).

Further information required relating to stormwater drainage and wastewater management plan.

39. The stormwater drainage and waterway management plan (SDWM) provides important information on civil and stormwater strategies for the site which complement the recommendations in the geotechnical Landslide Risk Assessment reports prepared by Golder.
40. The detail provided in the SDWM report helps to further define the engineering measures including drainage provisions for both surface and subsurface flows recommended to mitigate risks back to tolerable levels to meet requirements of the COS Erosion Management Overlay.
41. Given the importance of both surface and subsurface water management to slope stability at the site, it is my opinion that the SWDM report is required to be specifically reviewed and endorsed by Golder as meeting the intent of required drainage provisions stated in the Golder November and May LRA reports. The endorsement should specify any changes and modifications and provide comment where further detailed design and assessment is required.
42. Whilst it is clear that more detail will be needed to be added so that the plan can be fully implemented, clarification is required from both Irwinconsult and Golder on the following aspects:

- a. Some of the stated strategies are not fully portrayed on the layout plan (CSK 0030) and clarification is required on when full details will be provided in the overall process.
 - b. Confirmation is required that potential leakage /seepage from the existing dam been considered and assessed as an influence on slope stability of the immediate areas?
 - c. It is required that further assessment and improvements already recommended for the main dam should also address potential leakage/seepage.
 - d. Given one of the key aims of stormwater management is to avoid subsurface infiltrations, clarification is required as to what measures are required in the design of grassed swale to prevent subsurface infiltration e.g. lining of swales with impermeable materials.
 - e. Clarification is required on construction details of detention basins and bio filtration swales/cells with respect to potential for preventing subsurface infiltration where stormwater is detained/stored for some period.
 - f. Confirmation is required as to how areas of existing seepage/ damp ground incorporated into the overall plan.
 - g. Given the importance of subsurface groundwater interception drains and their potential to load water back into slopes if not designed or maintained properly, further detail on their construction is required (i.e. details for backfill materials, use of geotextiles, impermeable surface capping, provisions for ongoing maintenance and cleaning).
 - h. Further comment and clarification is required regarding provisions and requirements for ongoing maintenance and upkeep of the overall stormwater management plan given its importance for slope stability.
 - i. Further comment is required in relation to potential for flooding in the lower part of the site and its influence on slope instability.
43. The SWDM report and the need for further details of the scheme are considered to be very important aspects of the slope stability considerations for the development at the site. As such, it is my opinion that the SWDM is required to be reviewed and endorsed by Golder as meeting the intent of the measures referred to in the LRA report.

Further information is required on all aspects of the detailed targeted geotechnical investigation.

44. The current level of subsurface geotechnical investigation is considered to be only preliminary, being based on an earlier investigation by Bruce Hollioake and Associates with 11 x shallow bores to 2.0 m and an anecdotal evidence of deep silty clays at the main dam site in excess of 6.0 m.
45. Whilst this data provides some confirmation for the conceptual slope model provided by Golder based on their geomorphic assessment of the site which assesses shallow rock in the north of the site but a deep profile of silty clays over the remaining sections of the site, detailed confirmation of the overall geotechnical slope model through further detailed targeted geotechnical investigation is required.
46. Further detail is required on the further targeted intrusive geotechnical investigation works which are critical to confirming risks informing design for footing levels and foundation materials for all structural works including footing, retaining walls as well as final excavation design.

Further information required to confirm recommendations on conditions in Schedule 1 to EMO1.

47. Schedule 1 to EMO1 calls for a statement on whether the development should be only be approved subject to a range of geotechnical conditions including footing levels, cuts and fill, drainage, revegetation programs etc. A full list of conditions has been previously provided in paragraph 14.
48. It is required that a further specific statement and recommendation is made for some of these conditions as follows:
- a. The determination of appropriate footing levels and foundation materials in any structural works, including all footings and retaining walls. Current recommendations to found footings on rock for the villas are provided but are non-specific. No recommendation has been made yet for founding levels for the hotel complex.
 - b. Retention, replanting and new planting of vegetation
 - c. The time within which works must be completed after commencement and the locations and period in which materials associated with the development can be stockpiled.
49. It is noted that other conditions referred to in Schedule 1 are covered in other sections of this statement.

Requirements relating to the confirmation and reporting of risk levels and remedial measures in the detailed design phase

50. Following further targeted geotechnical investigations and the detailed design of engineering measures and remedial works, confirmation is required that these engineering measures will in fact achieve mitigation of risk in the high risk zones, such that the level of risk for the hotel complex and in other areas is *Tolerable or lower*.
51. Confirmation is required of the geotechnical slope model, that levels of risk for all identified hazards are maintained at risk levels of *Tolerable or better* and that engineering measures and remedial works are feasible and capable of achieving desired effects, This should be in the form of an additional detailed geotechnical report by Golder (as the author of the current LRA report) which is then submitted to Council for review, assessment and approval.
52. In addition, I also recommend that confirmation of site conditions for all foundations components, engineering measures and remedial works following the construction phase is required and is provided in a separate geotechnical report to Council for review and assessment. Such a report should document any changes required as a result of changed conditions discovered during construction.

Further information required relating to formal monitoring plan.

53. The 1st November LRA report by Golder recommends that a formal slope monitoring and response plan is implemented as part of the proposed development. I fully support this recommendation and note that such a plan is consistent with concepts of keeping risk under review for *Tolerable Risk*.

54. Development and implementation of an appropriate monitoring plan is required with activation immediately post construction and with ongoing monitoring into the operation of the development.

Review of “without prejudice” planning permit conditions.

55. A review of the “without prejudice” draft conditions presented at the Council meeting on the 22nd August 2018 indicates the vast majority of the points of clarification recommended in this statement have been included in the proposed permit conditions.
56. It is noted however, that more detail relating to the stormwater drainage and waterway management plan has been included in this statement and should be cross referenced to the appropriate clauses in the proposed planning permit conditions.
57. It is also noted, that additional comment has been provided in this statement that requires recommendations for some of the geotechnical conditions stated in Schedule 1 to EMO1 (see paragraph 14 for details of these conditions) and these should be added to final planning permit conditions.
58. It is noted that reporting requirements in the proposed planning permit conditions are required to be applied to both the detailed design phase and the construction phase as indicated in paragraphs 50 and 52.

Comment on timing of the provision of further information.

59. It is my opinion that further information as discussed in this statement is required to meet the requirements of EMO1 and the AGS 2007 guidelines.
60. Ideally, all further information, assessment and geotechnical investigations would have already been completed including addressing all points of clarifications included in this statement.
61. However it is my opinion, that in respect to aspects of landslide risk, a credible geotechnical slope model has been provided which has allowed sufficient assessment of the landslide risk to be undertaken at this time. The current geotechnical slope model indicates the proposed development can be established with *Tolerable or better* risks and that development is feasible and practical. This statement is qualified with the proviso that it must be ensured that all further investigations, assessment, design work and monitoring are completed and appropriately evaluated.
62. As such, based on the current information provided I believe it is possible that a planning permit can be issued in respect of the landslide risk issue, but with a full set of planning permit conditions relating to the aspects contained in this statement.
63. However, it should be noted that there is always a potential for unexpected and/or difficult geotechnical conditions to be encountered during more a detailed targeted geotechnical investigation and this may alter current perceptions and requirements of possible remedial works and engineering measures. As such, this is uncertainty and risk that the applicant assumes and accepts by not performing the more detailed work sooner.

64. Final decision for timing of provision of the required information is understood to be a decision within the planning process administered by the Council.

Conclusions.

65. In summary, it is my opinion that based on the detailed geomorphic assessment and onsite mapping and identification of key features at the site, the Golder report has established a credible *preliminary level* geotechnical slope model that has allowed an understanding of the slope forming processes at the site and an assessment of likely landslide hazards at the site. Such a model has allowed a credible landslide risk assessment process to be undertaken which has also allowed conceptual risk measures to be identified.

66. However, it must be acknowledged that further information as discussed in this statement and further targeted geotechnical investigation is required to ensure confirmation of the geotechnical slope model, to assist in reducing uncertainty and to allow detailed design of engineering measures and remedial works. As such, further detailed targeted geotechnical investigation is required to take the process into a detailed design phase and then a construction phase.

Recommendations.

67. Assuming that the process continues with further information being sought as planning permit conditions, it is recommended that all points for clarification detailed in this statement should now be included in any final planning permit conditions.

68. It is recommended that council ensure full compliance with final planning permit conditions through the detailed design phase, the construction phase and the operations phase.

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant, have to my knowledge been withheld from the Tribunal.



Tony Miner
Principal Geotechnical Engineer