A guide to reading Recovery Office geotechnical risk assessment reports.

This guide provides a description of the content you will find in each standard section of geotechnical reports prepared by geotechnical engineers working for the Tāmaki Makaurau Recovery Office.

Please note that the reports are written using a standard template. Any sections not relevant for your property will be left blank or say: "*not applicable*".

Technical terms likely to be used are explained in each section description and are also listed in the glossary found at the end of this guide.

1: Introduction and scope
This section lists the details about your property and the people who worked on the report. It also tells you the professional guidelines the engineers used for their inspections and assessment. You will see the terms "*AGS 2007*" and/or "*AKLCGEO-1790012875-3847*." These are references to the specific guidelines the engineers have used, which is the Australian Geomechanics Society (AGS) "*Guideline for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning*" and the "*Guidelines on the use of AGS2007 for Landslide Risk Assessment in Auckland Following the 2023 Flooding and Cyclone"*
2: Summary of inspections undertaken
This section lists information about the inspections the engineers did when they visited your property. It also lists the dangers (hazards) on your property for us to consider if we need to do future site work). The technical terms you may see in this section are: *Geotechnical investigations*: This is the work the engineers or geologists do using different methods to understand the physical properties of soil and rock below the surface of the earth. *Geotechnical assessment:* This is a review of your property by a qualified geotechnical engineer or professional engineering geologist, to identify and assess everything (including information from any investigations) that might affect the land's stability and safety. *Ground deformation:* Visible changes to the ground/soil such as cracks and slips.

Slope stability: This refers to the condition of a sloping area of land, specifically whether it can carry its own weight and external forces such as rainfall without moving.

Inclinometer monitoring: A slope inclinometer is a tool buried in the ground used to measure the size, direction, and depth of landslide movement.

Moving plant; operating plant: The word "*plant*" means construction machinery such as diggers and trucks.

Geomorphological features: The visible features in the land which indicate how it was formed, for example springs, slopes, ridges, and valleys.

3: Summary of documentation reviewed

This section lists any relevant documents the engineer reviewed before preparing the report, for example any reports prepared on behalf of the Earthquake Commission (EQC) or privately commissioned by the property owner.

4: Site description

This section describes your property. The topics in this section are:

Topography: This is the description of the shape of the land surface, for example hills or valleys.

Geology: This describes the type of rock and soils that form your property.

Surface indications of instability: This describes the signs of land instability that the engineer can see on your property, such as cracks in the ground or in buildings.

Cut / Fill areas: This describes any areas on your property where earth has been cut away or added to change the shape of your section for landscaping or building work.

Water, springs and overland flow paths: This section describes any water on your property. For example, from underground springs or streams, a flood zone or 'overland flow paths' which are the paths followed by rainwater during a storm event.

Site use history: This describes how your land has been used.

Vegetation: This describes the planting on your property, for example trees, lawns or bush.

Buildings: This describes the building(s) on your property.

Other structures including retaining walls: This describes structures such as retaining walls, decks, driveways and fencing.

Other relevant features: This describes any other relevant property features such as public water or sewerage pipes.

5: Damage summary

This section describes the damage the early 2023 storms caused on your property.

5.1 Homeowner comments	This notes key comments you have provided to the council about your property and storm damage.
5.2 Building / structure damage from the event	This describes how the storms damaged your home and other structures on your property.
5.3 Land damage from the event	This describes how the storms damaged the land on your property.
5.4 Pre-existing condition of the land	This describes any known land instability or land damage that occurred before the early 2023 storm events. The technical terms you may see in this section are: *Retrolens:* A library of old aerial photographs available online. *Geomorphological evidence:* This describes any evidence based on land, which can often indicate how the land has changed and moved in the past. *Toe of the slope:* This is the name used for the bottom of a slope. It is also used to describe the outermost edge of a landslide. *Main scarp:* The steep surface between the undisturbed ground and the landslide at the upper edge of the landslide. *Head scarp:* Same meaning as main scarp. *Rotational landslides:* Landslides that occur along a curved or spoon-shaped surface. Also called 'slumps', *Soil creep:* The gradual downhill movement, under the force of gravity, of soil and loose rock material on a slope.
5.5: Repairs undertaken	This section describes any emergency, temporary or permanent repairs to your property since the storm events.
6: Land stability assessment This section describes how the geotechnical engineers assessed your property for geotechnical hazards.	
6.1: Engineering geological model	A comprehensive knowledge framework that helps us to interpret and assess the engineering geological conditions and enables us to evaluate the interaction of these conditions, so we can make appropriate engineering decisions.

	The model for your property is presented in simplified form as a drawing in the appendices. This section also includes a list of 'key risks' that may affect the accuracy of the model for your property.
6.2: Geotechnical parameters used	The types of measurement used to assess the land. For example, shear strength, compressibility, density, natural moisture content and permeability of different types of soil. These are needed where detailed modelling of slope stability is undertaken. They are not usually needed where a qualitative stability assessment is sufficient to assess the risk.
6.3: Qualitative stability analysis	In geotechnical engineering, stability analysis is used to predict the maximum load that can be supported by the land without the land failing. The qualitative assessment is when the engineer uses experience and expert judgement to assess the land based on looking at the land and other information such as maps and aerial photographs.
6.3.1 Methodology	This describes the actions the engineers or geologists took to investigate your property. For example, looking at maps and visiting your property.
6.3.2: Results / findings	This section lists the landslide hazards the engineers found on your property, and the "*likely instability triggers*" – these are the things that could cause a landslide on your property. It also lists the "*potentially vulnerable features.*" These are the building(s) such as your home, and structure(s) such as retaining walls, your driveway or underground pipes that would likely be affected by a future landslip. The technical terms you may see in this section are: *Inclinometer data:* Information from a slope inclinometer, which is a tool buried in the ground to measure the size, direction, and depth of landslide movement.
6.4: Quantitative stability analysis	In geotechnical engineering, stability analysis is used to predict the maximum load that can be supported by the land without the land failing. The quantitative assessment is when the engineer uses technical data (numbers) to assess the

	probability of a slip on your land, how vulnerable buildings and people might be in a slip, and the likely consequences. This analysis is based on numerical values and results in a numerical value of the stability. It is commonly presented as a Factor of Safety, where 1.0 is on the verge of failure. Any number greater than 1.0 is more stable, and any number less than 1.0 is less stable.
6.4.1: Methodology	This describes the actions the engineers took to investigate your property.
6.4.2: Calculations	This is the mathematical work completed by the engineer.
6.4.3: Results / findings	This describes what the engineer found from their assessment.
7: Unmitigated risk assessment This section describes the calculated risks to your property without any changes (mitigation) to reduce those risks. The engineers have used the Australian Geomechanics Society (AGS) "Guideline for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning" to complete this assessment.	
7.1: Risk of loss of life	This section describes the risk of people dying as a result of a potential future landslide on your property. The risk calculation is described in a table with the following information: Scenario description: Describes the risk using the following: • Estimated annual probability (frequency) of each landslide – listed as P(H) – this is the estimated annual probability (frequency) of each landslide. • Probability of spatial impact – listed as P(S:H) – this is based on the distance the landslide mass will travel. This determines the extent to which the landslide will affect property and people downslope and people's ability to take evasive action. • Temporal spatial probability – listed as P(T:S) – this is the probability that people will be in the area affected by the landslide. • Likelihood of death, injury or vulnerability of people impacted by a landslide - listed as

	V(D:T). • The risk that a person dies from a landslide – listed as R(LoL) - annual probability of loss of life (death) of an individual. Best estimate value: The best estimate of frequency, shown as a value (number), based on expert judgement. Plausible Range: The range of frequency value, based on expert judgement. Justification for selected values: The reasons for / an explanation to support the frequency values. The results of the risk calculation are described below the table.
7.2: Risk of loss of property	This section is set out in the same way as the previous section but describes the risk to your home as a result of a future landslide on your property.
8: Mitigation methodology This section describes the changes to your property (mitigations) that could be made to reduce the risk to life from landslides for people in homes on your property. It includes all of the options the engineers have identified and considered, and the recommended option(s).	
8.1: Long-term mitigation options available	All the options the engineers have identified to reduce the long-term risk to people living in your home.
8.2: Short-term mitigation options available	Options for actions to reduce the risk at your property for a short period of time. These are usually quick and cheap but might not last long or survive a major landslide.
8.3: Preferred long-term mitigation option details	The engineer's recommendation of the most cost-effective and practical option to reduce the risk to people living in your home to at least a tolerable level.
9: RBA placard This section describes your property's building placard status on the date when the engineer inspected your property. Building placards are placed on properties in emergency situations after doing a Rapid Building Assessment (RBA) to assess immediate risk. Placards are very different to the property categorisation process, which considers the future, long-term risk to life if another extreme weather event occurs.	
9.1: Summary of current situation	This notes whether your property currently has a placard, the type of placard, whether any work has been done to reduce the risk at your property, and

	if the risks have changed since council issued the placard. This was valid at the time the engineer was writing their report but may have changed since. It is not used in categorisation decision-making.
9.2: Recommended mitigation actions	This describes any work or changes to your property (mitigation) the engineer recommends be completed before the placard is downgraded or removed. This is not used in categorisation decision-making. Recommended actions will be listed showing the long-term (L) or short-term (S) option numbers shown in the lists of long-term and/or short-term mitigations in Section 8.
10: Additional information required This section describes the things the engineers don't yet know about the landslide risks on your property, and the additional information that would be useful.	
10.1: Uncertainty	This describes the things about your property that the engineers don't fully understand, and the reasons for this.
10.2: Additional information required	This describes the additional information that would help the engineers understand your property in more detail. It also explains the work that would be needed to get this information and if this work needs to be done or not. This section may also include estimated costs for additional investigation work.
11: Limitations This section explains the limits of the report's findings.	
Glossary This section provides descriptions of the main technical terms you are likely to find in your geotechnical report.	
Retrolens: A library of old aerial photographs available online. *Cut / Fill areas:* This describes any areas on your property where earth has been cut away or added to change the shape of your section for landscaping or building work. *Colluvium:* Soil and debris that accumulate at the base of a slope. *Deformation:* A change of form/shape. *Failure mechanism:* The method by which a landslide occurred.	

Geology: This describes the type of rock and soils that form your property.

Geomorphological evidence: This describes any evidence based on features of the land, which can often indicate how the land has changed and moved in the past.

Geomorphological features: The visible features in the land which indicate how it was formed, for example springs, slopes, ridges, and valleys.

Geotechnical investigations: This is the work the engineers and geologists do using different methods to understand the physical properties of soil and rock below the surface of the earth.

Geotechnical assessment: This is a review of your property by a qualified geotechnical engineer, to identify and assess everything (including information from any investigations) that might affect the land's stability and safety.

Ground deformation: Visible changes to the ground/soil such as cracks and slips.

Ground displacement: Ground movement

Head scarp: This is the name used for the upper parts of a landslide between the soil and the 'main scarp.'

Inclinometer monitoring: A slope inclinometer is a tool buried in the ground to measure the size, direction, and depth of landslide movement.

Main scarp: The steep surface between the undisturbed ground and the landslide at the upper edge of the landslide.

Metastable: On the boundary between stable and unstable, needing only a small change in conditions to become unstable.

Moving plant; operating plant: The word "*plant*" means construction machinery such as diggers and trucks.

Other relevant features: This describes any other relevant property features such as public water or sewerage pipes.

Other structures including retaining walls: This describes structures such as retaining walls, decks, driveways, and fencing.

Palisade wall: Palisade walls are similar to retaining walls but are completely buried in the ground. They are designed to intersect a landslide and protect the land up-slope from them.

Rotational landslide: Landslides that occur along a curved or spoon-shaped surface (see diagram on page 10).

Site use history: This describes how your land has been used.

Slope stability: This refers to the condition of a sloping area of land, specifically whether it can carry its own weight and external forces such as rainfall without moving.

Soil creep: The gradual downhill movement, under the force of gravity, of soil and loose rock material on a slope.

Surface indications of instability: This describes the signs of land instability that the engineer or geologist can see on your property, such as cracks in the ground or in buildings.

Toe of the slope: This is the name used for the bottom of a slope. It is also used to describe the outermost edge of a landslide.

Topography: This is the description of the shape of the land surface, for example hills or valleys.

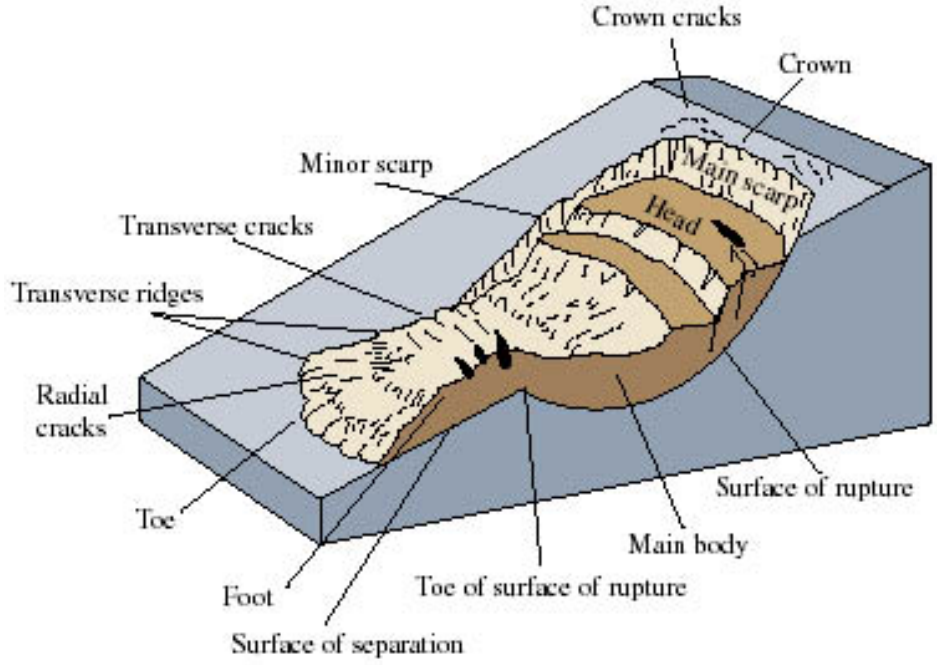
Translational landslide: In this type of slide, the landslide mass moves along a roughly planar surface with little rotation or backward tilting (see diagram on page 10).

Vegetation: This describes the planting on your property, for example trees, lawns or bush.

Water, springs and overland flow paths: This section describes any water on your property. For example, from underground springs or streams, a flood zone or 'overland flow paths' which are the paths followed by rainwater during a storm event.

Diagram showing the features of a complex landslide:

(From U.S. Geological Survey Fact Sheet 2004-3072, July 2004)



Pictures showing the major types of landslide movement:

(From U.S. Geological Survey Fact Sheet 2004-3072, July 2004)