

A469 Troedrhiwfuwch

The Nature of the Landslide and Proposed Remedial Works



TETRA TECH



Llywodraeth Cymru
Welsh Government

The Nature of the Landslide

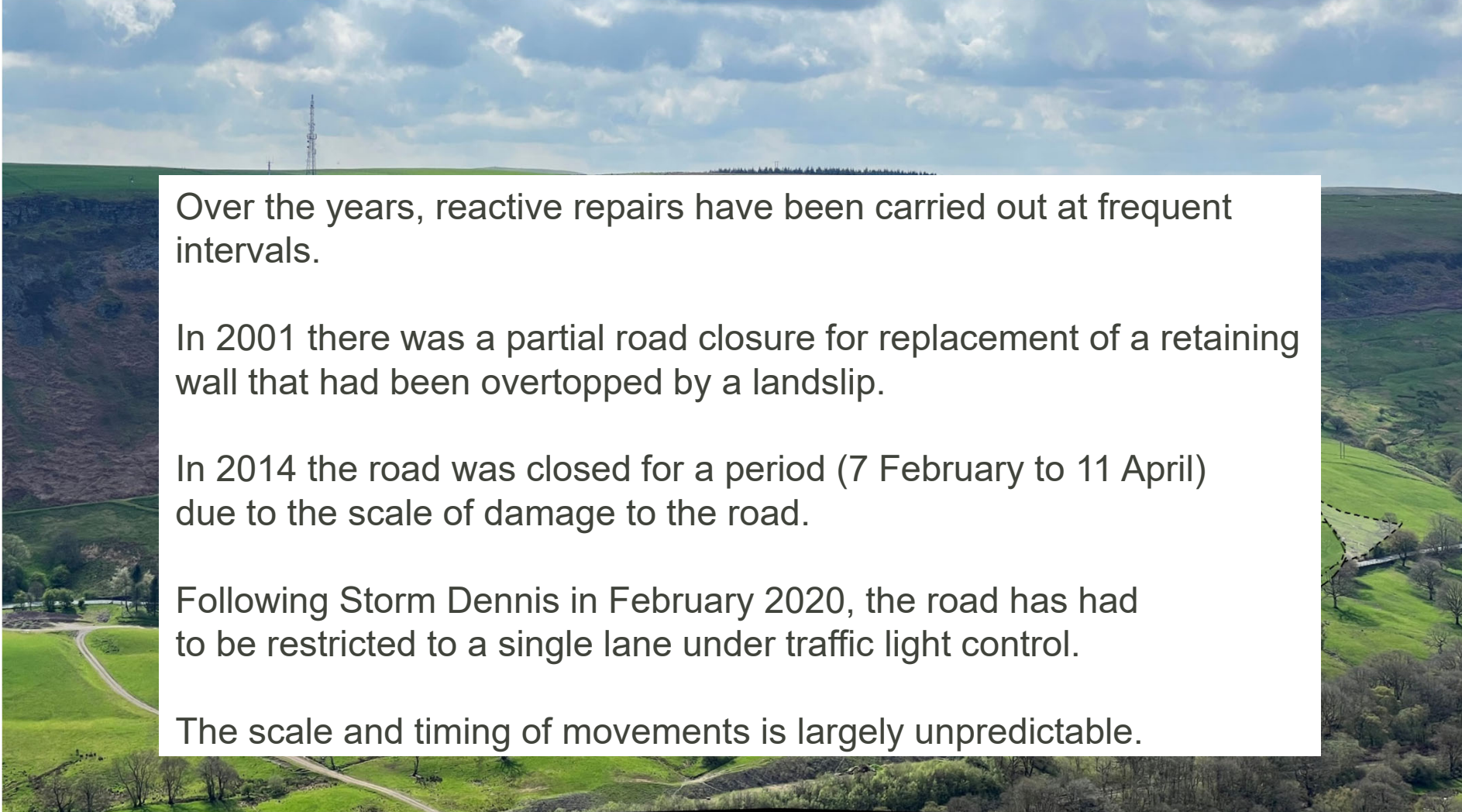


The A469 at Troedrhifwch is frequently affected by landslides.

In 1906 ground movement lifted the road by up to ten feet.

In the 1980s the village was abandoned and demolished.

The Nature of the Landslide



Over the years, reactive repairs have been carried out at frequent intervals.

In 2001 there was a partial road closure for replacement of a retaining wall that had been overtopped by a landslip.

In 2014 the road was closed for a period (7 February to 11 April) due to the scale of damage to the road.

Following Storm Dennis in February 2020, the road has had to be restricted to a single lane under traffic light control.

The scale and timing of movements is largely unpredictable.

The Nature of the Landslide

Overtopping of retaining wall 2001



The Nature of the Landslide

Example of damage to road surface

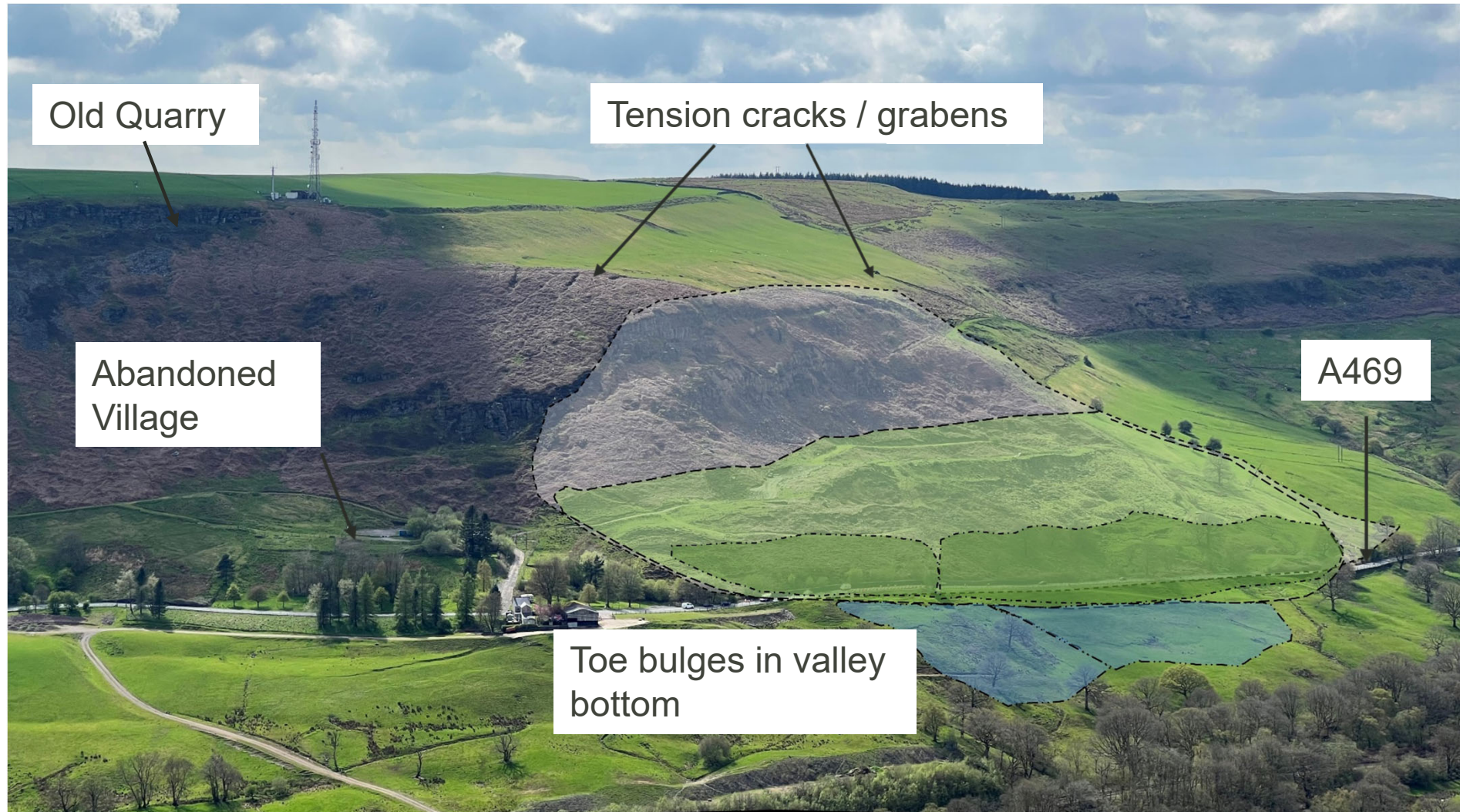


The Nature of the Landslide

Example of ground loss adjacent to footway



The Nature of the Landslide



The Nature of the Landslide



Example of toe bulge



The Nature of the Landslide

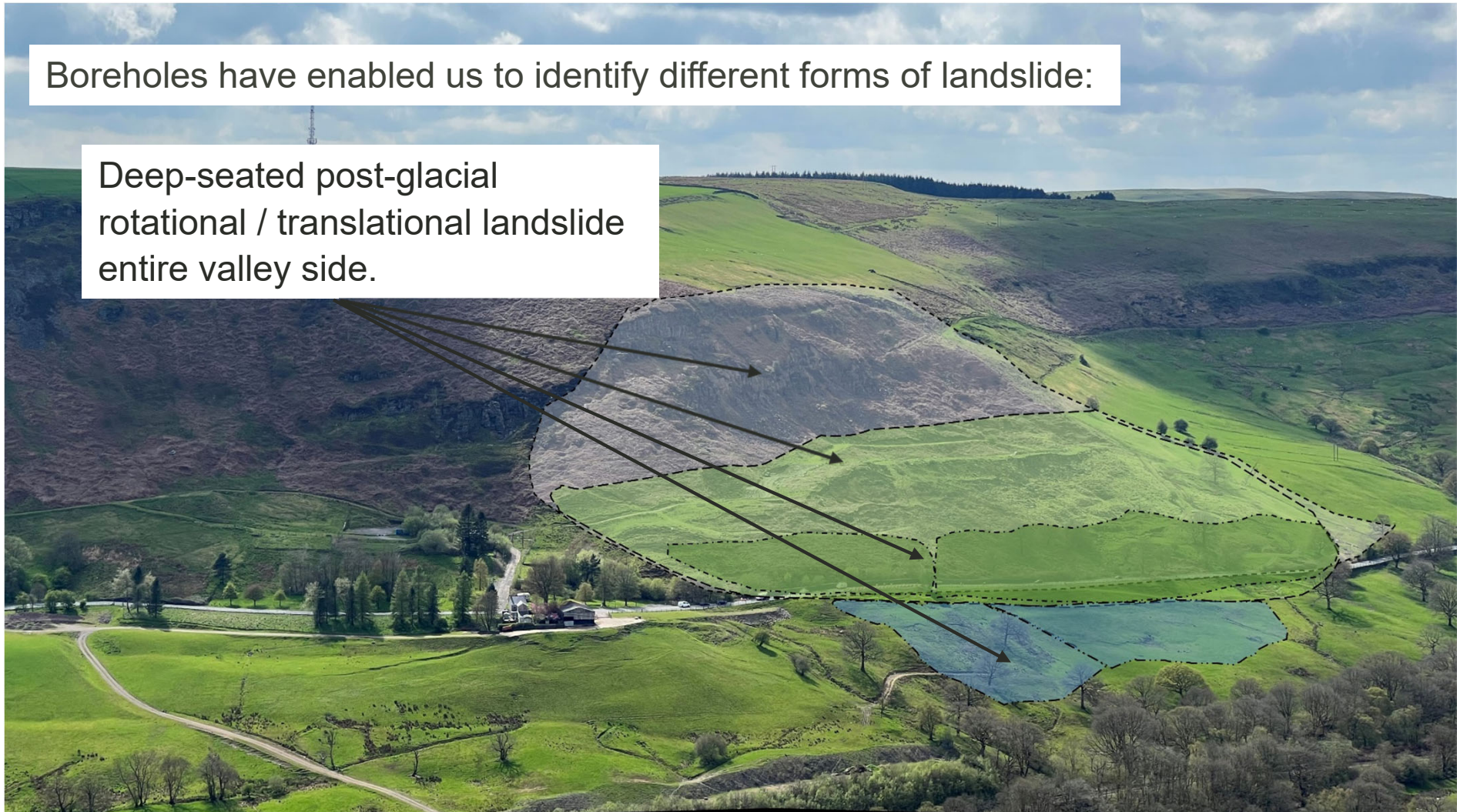
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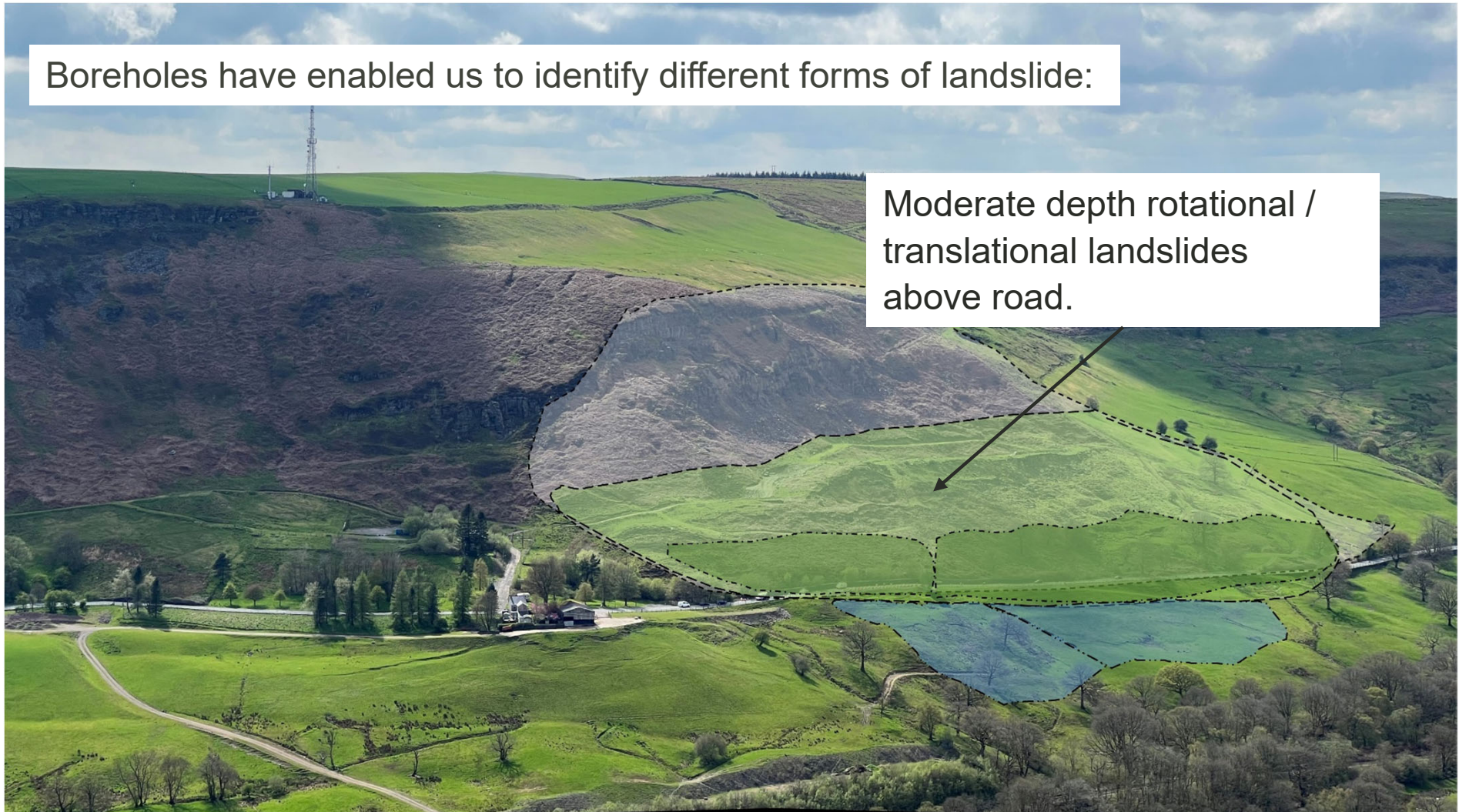
Deep-seated post-glacial
rotational / translational landslide
entire valley side.



The Nature of the Landslide

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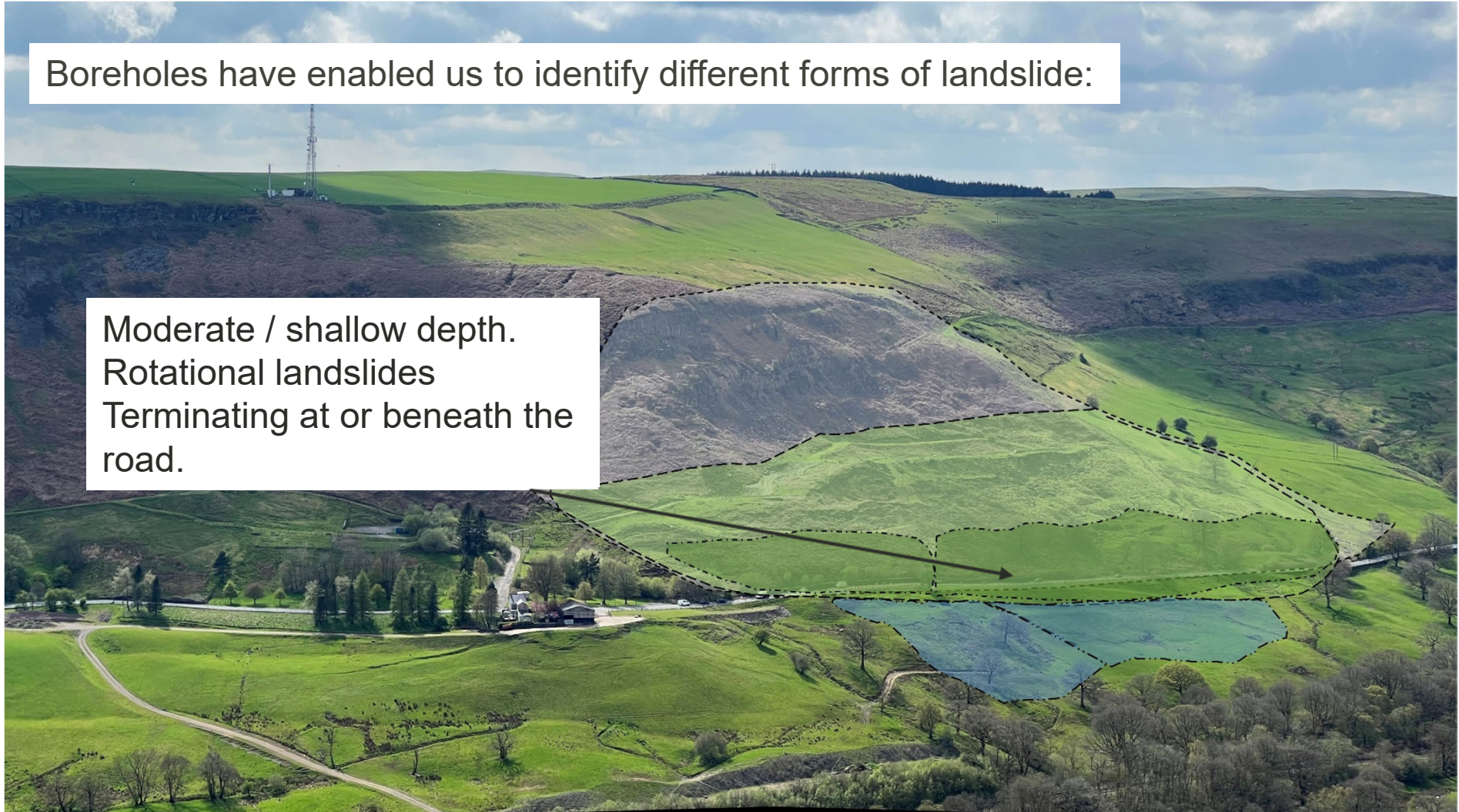
Moderate depth rotational /
translational landslides
above road.



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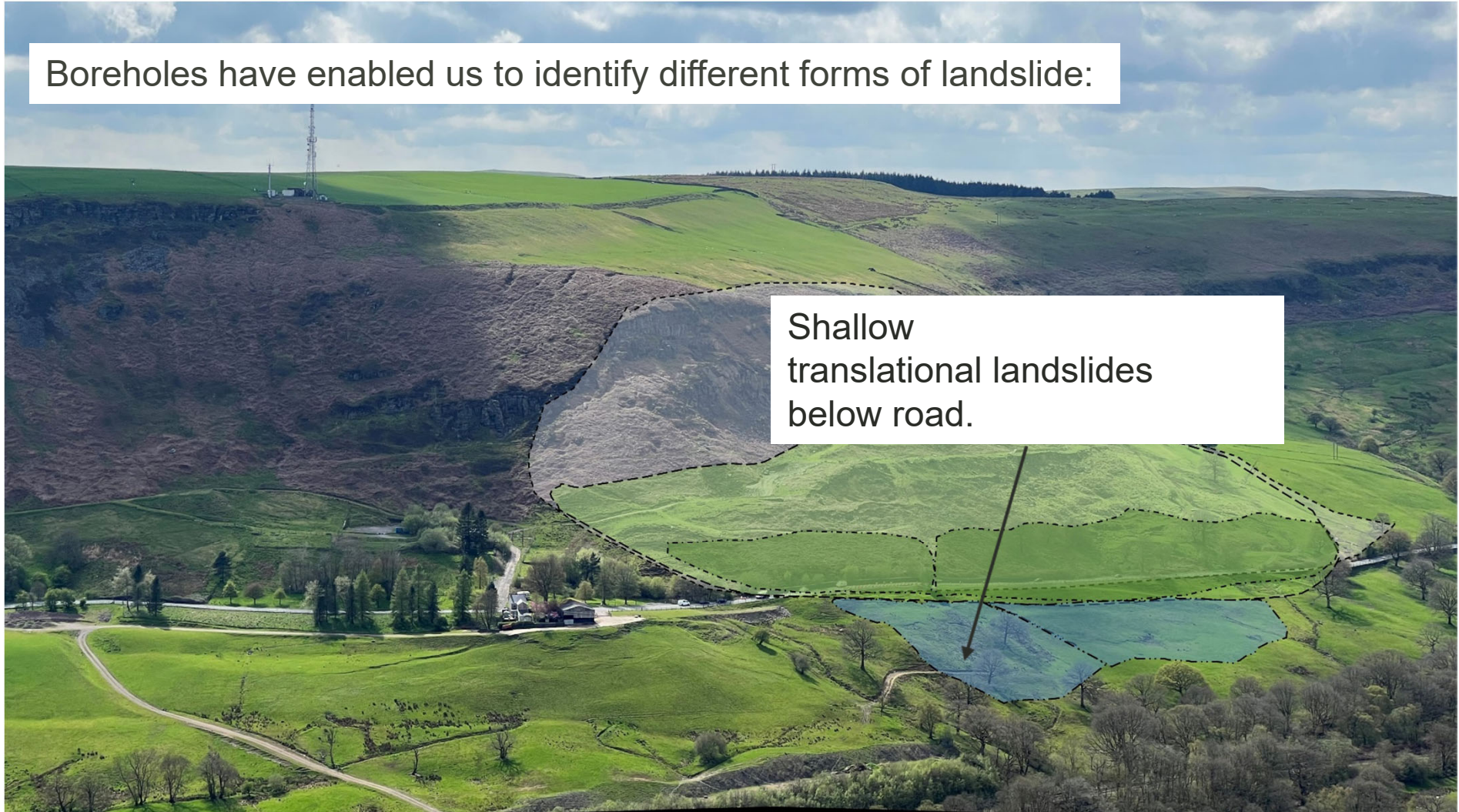
Moderate / shallow depth.
Rotational landslides
Terminating at or beneath the
road.



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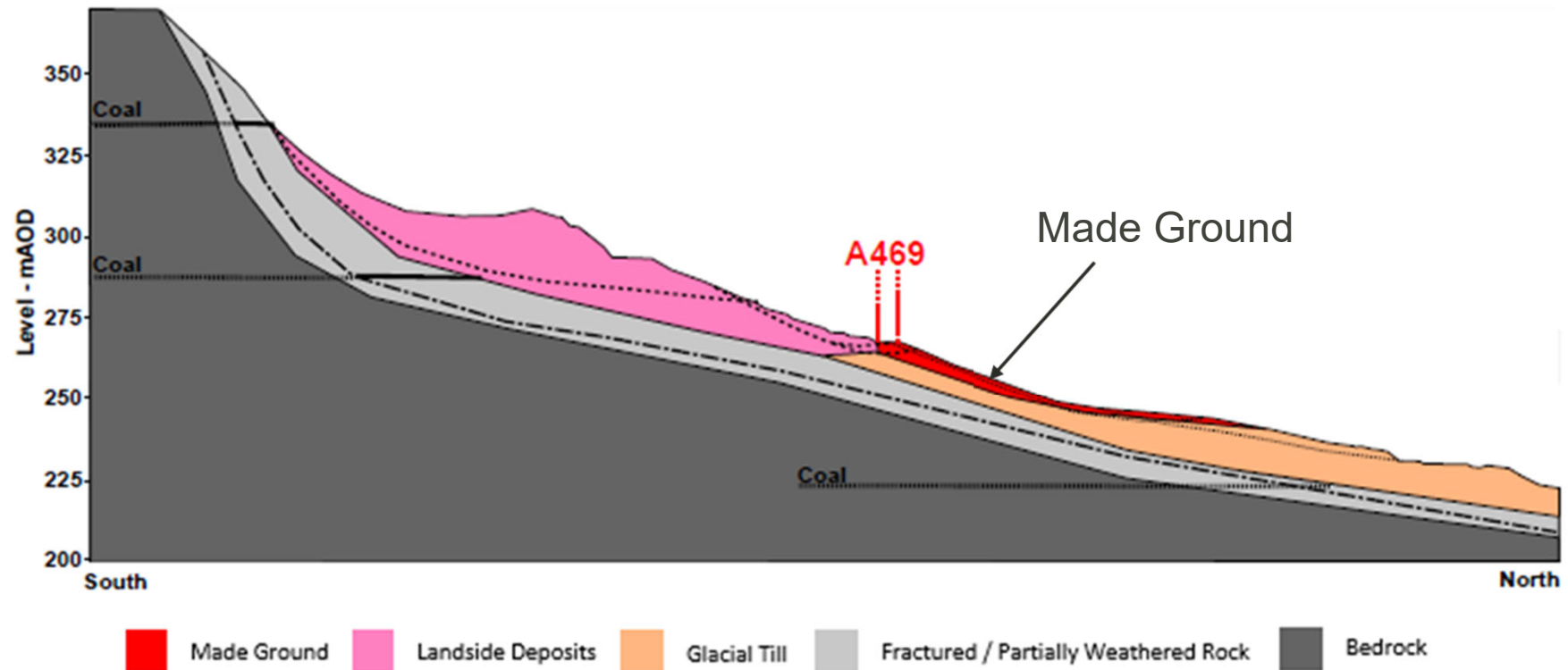
Boreholes have enabled us to identify different forms of landslide:

Shallow
translational landslides
below road.



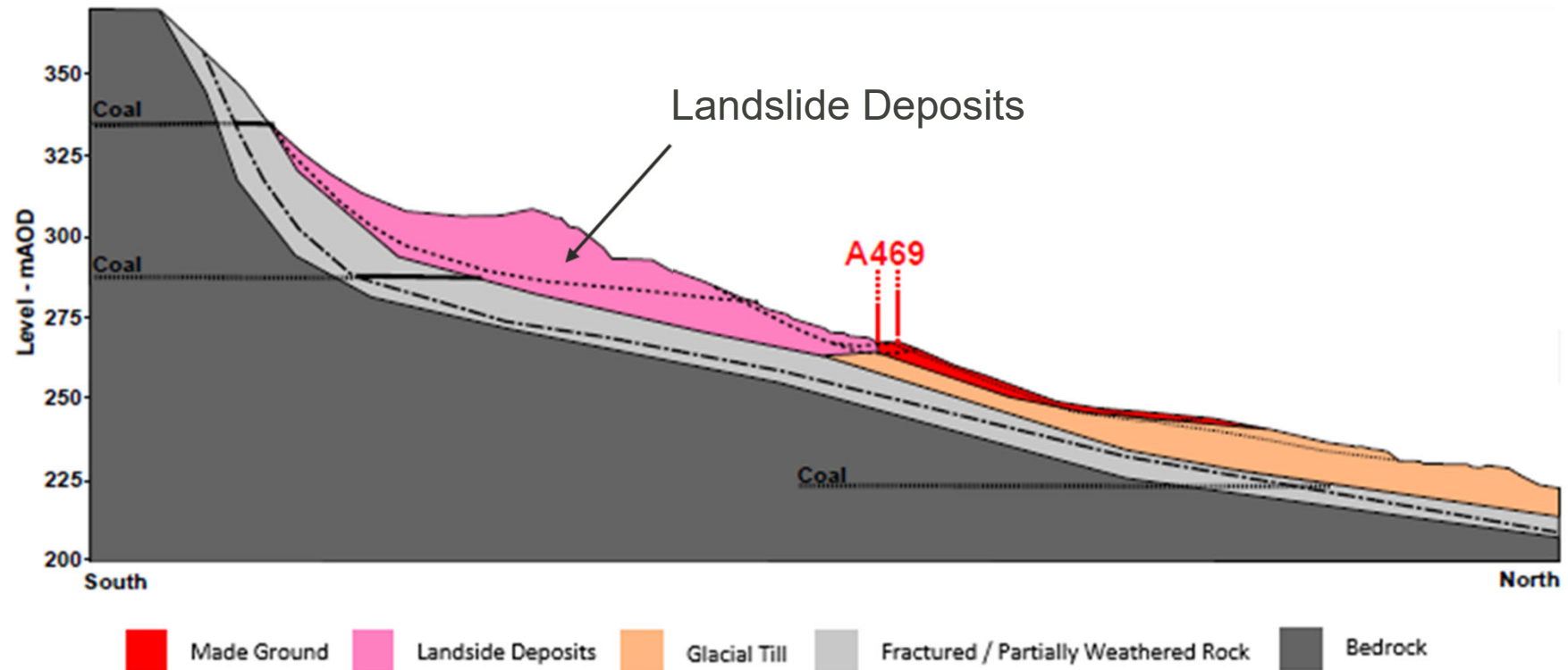
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Geology:



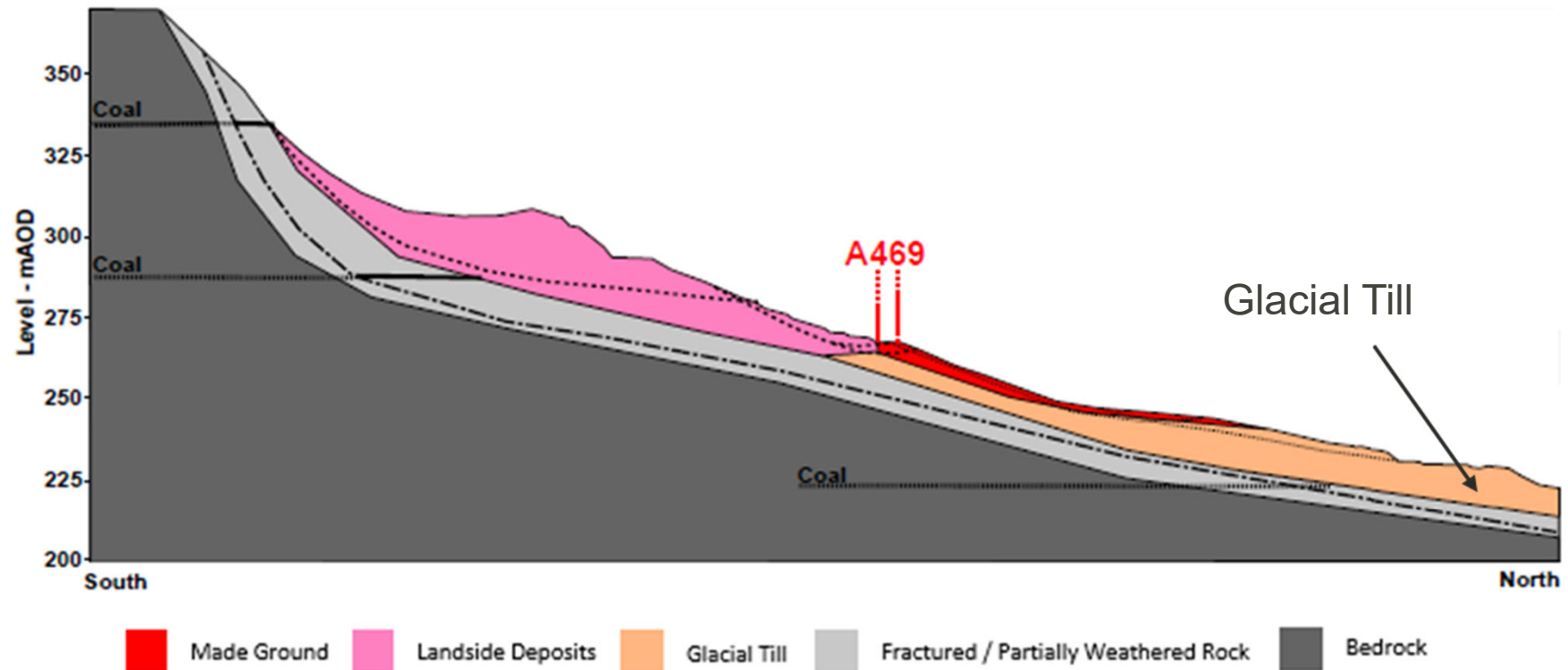
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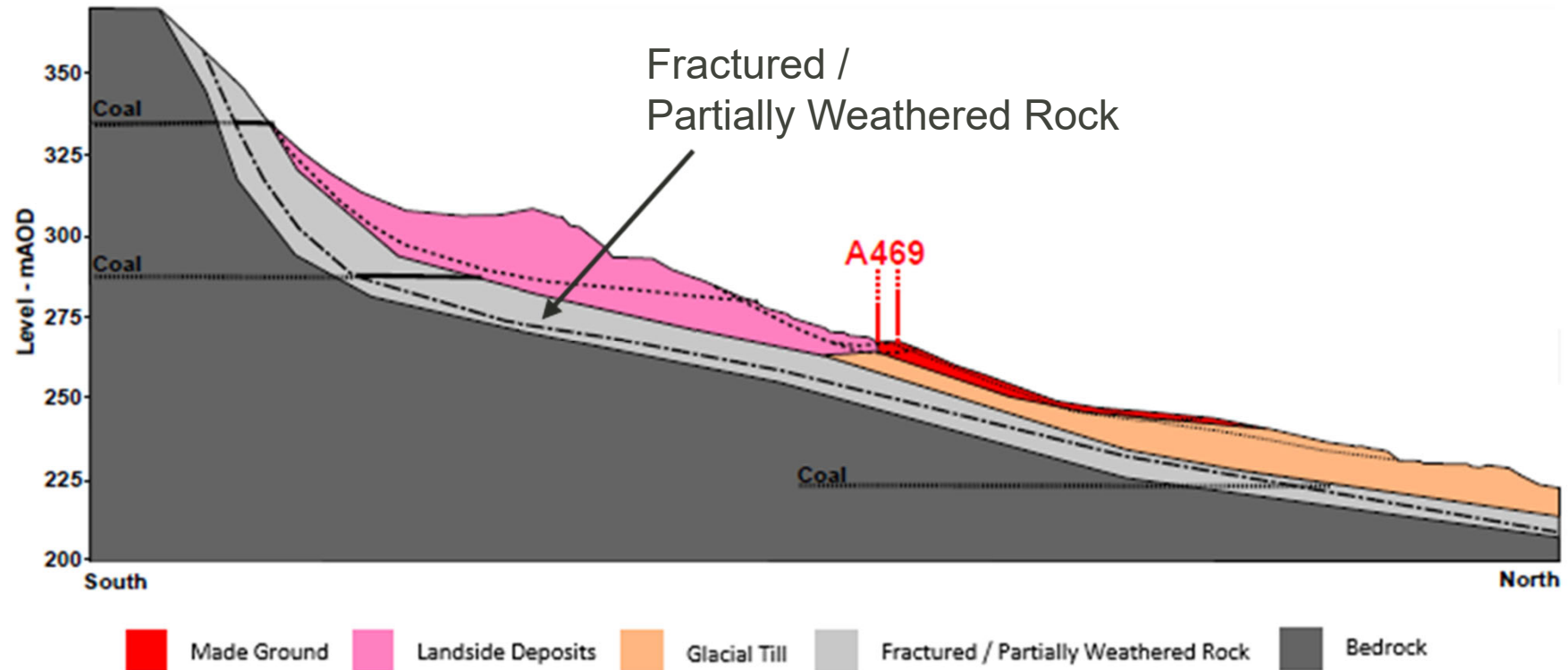
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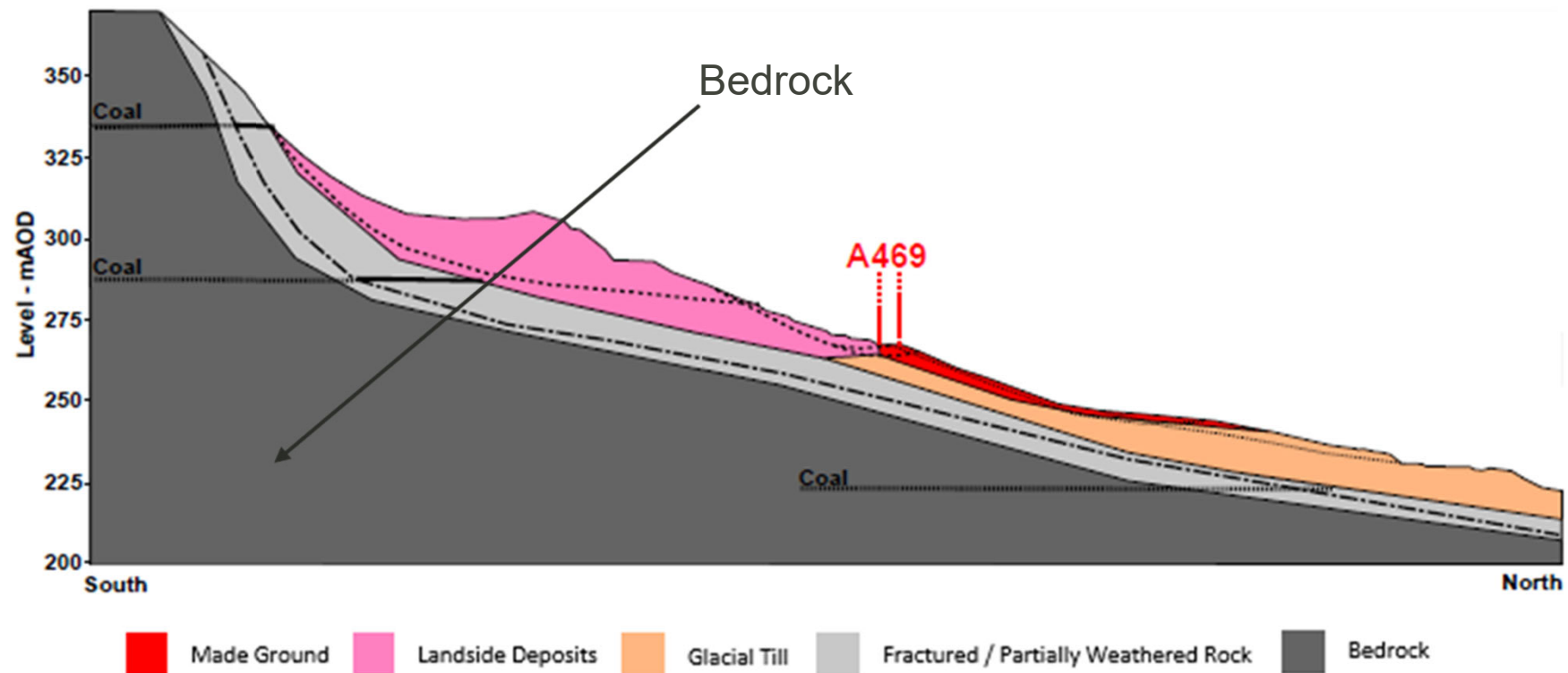
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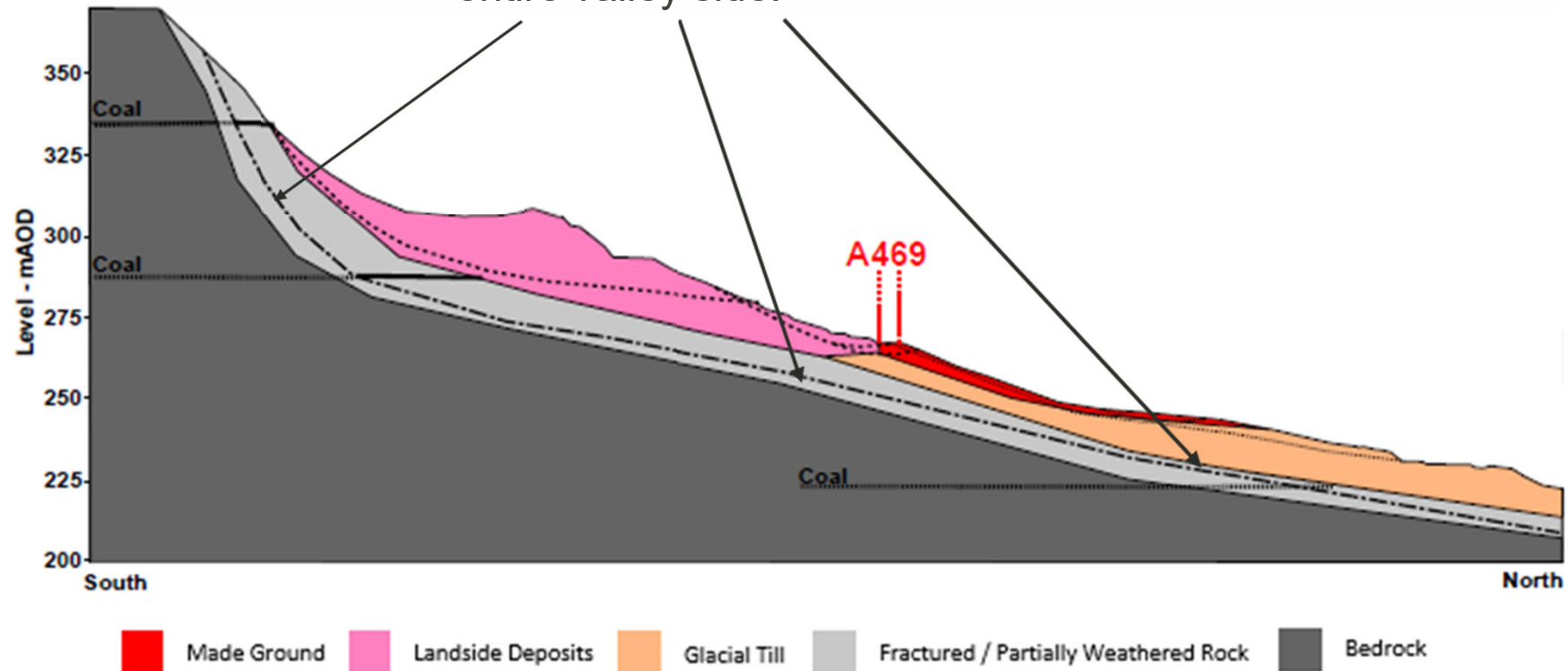
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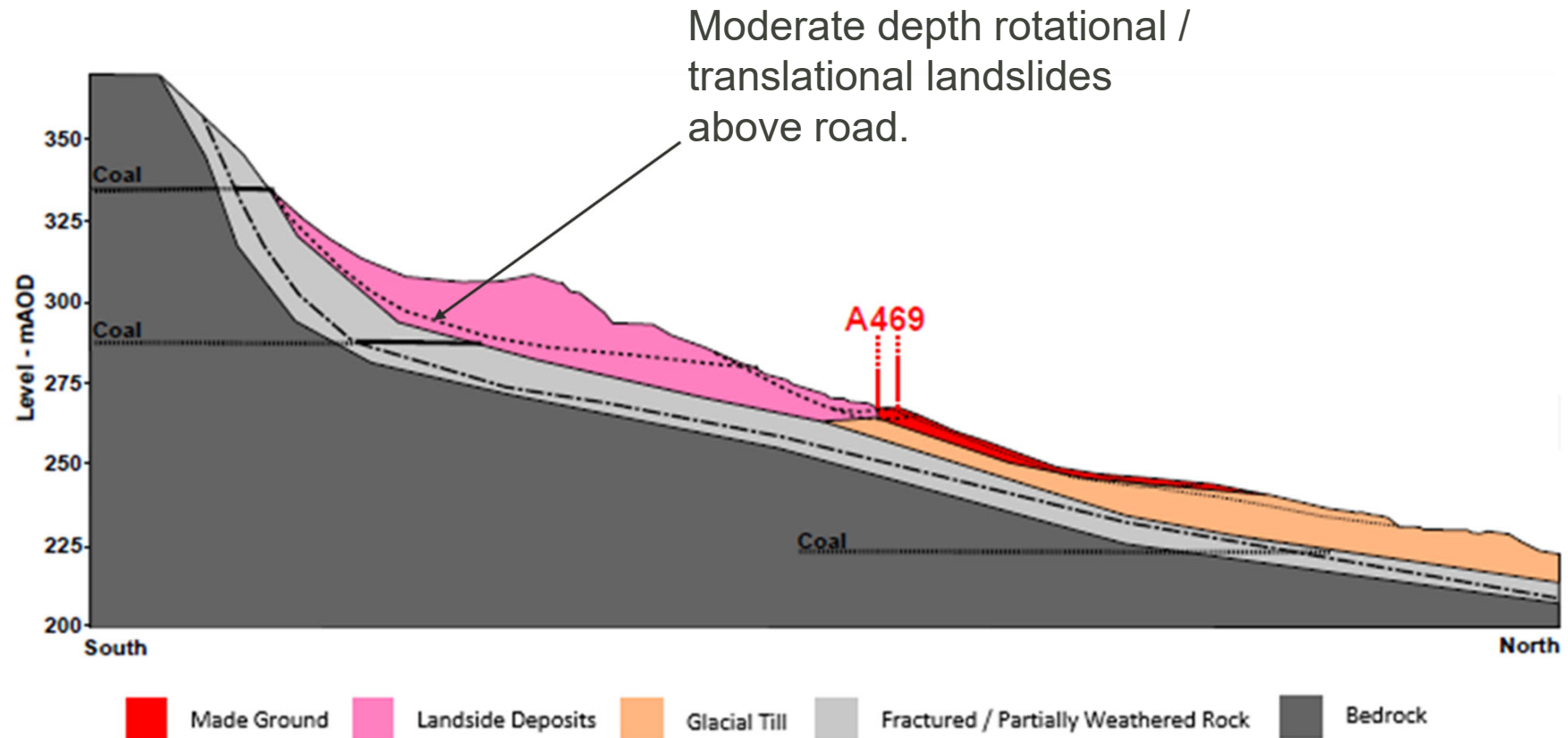
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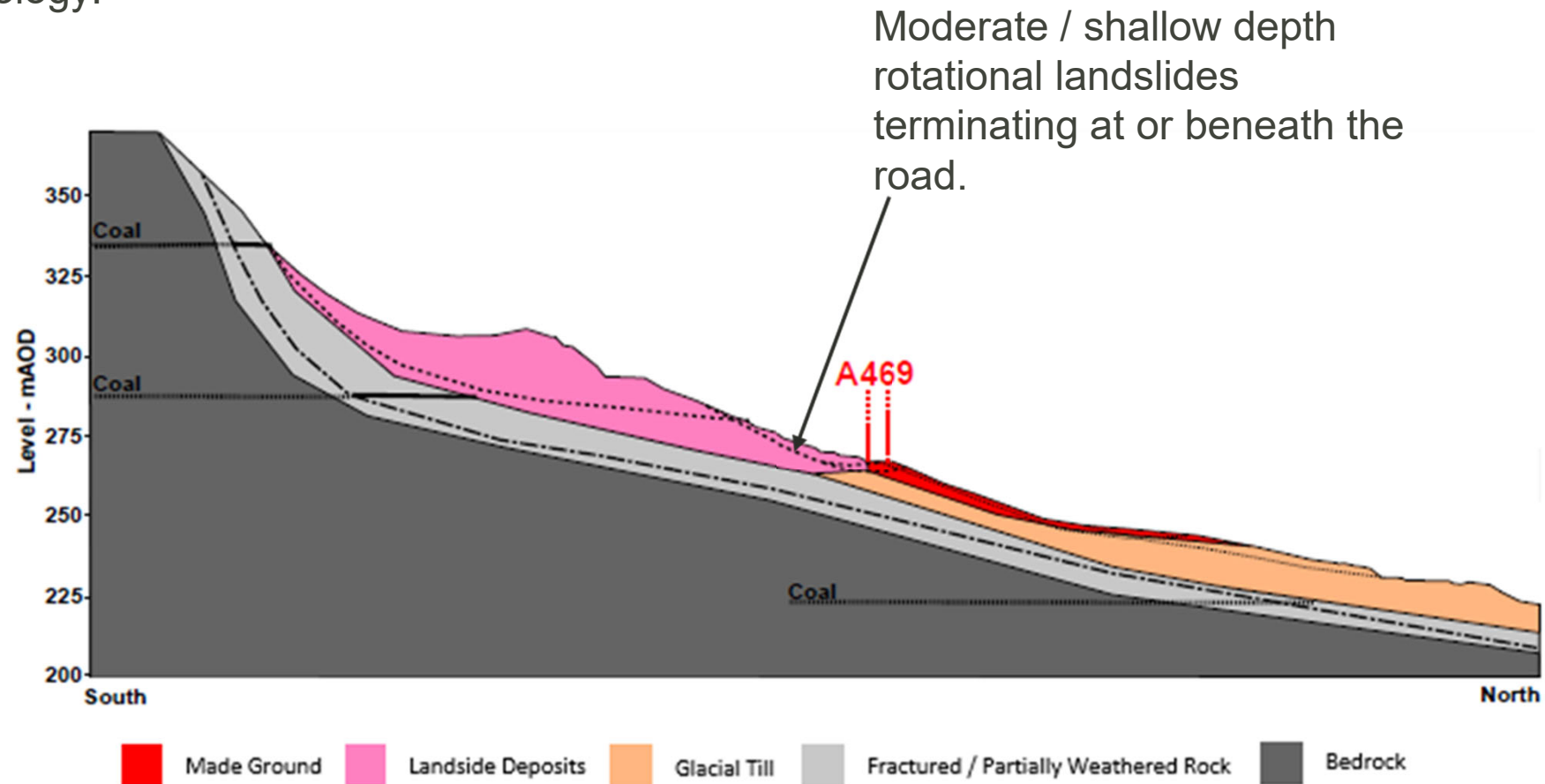
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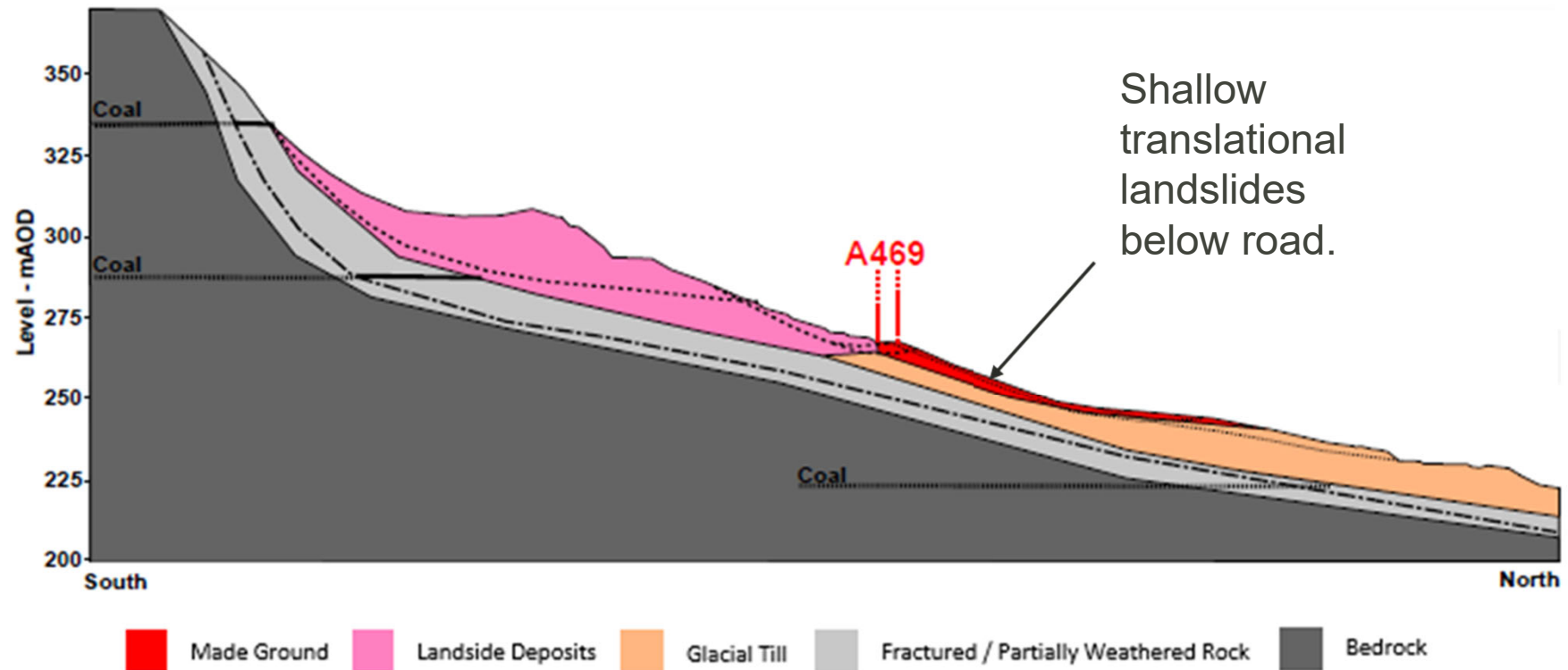
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Geology:



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Sensitive instruments have been installed in some of the boreholes capable of measuring groundwater levels and ground movements of just a few millimetres.

These have helped us to understand the nature and extent of the movements.

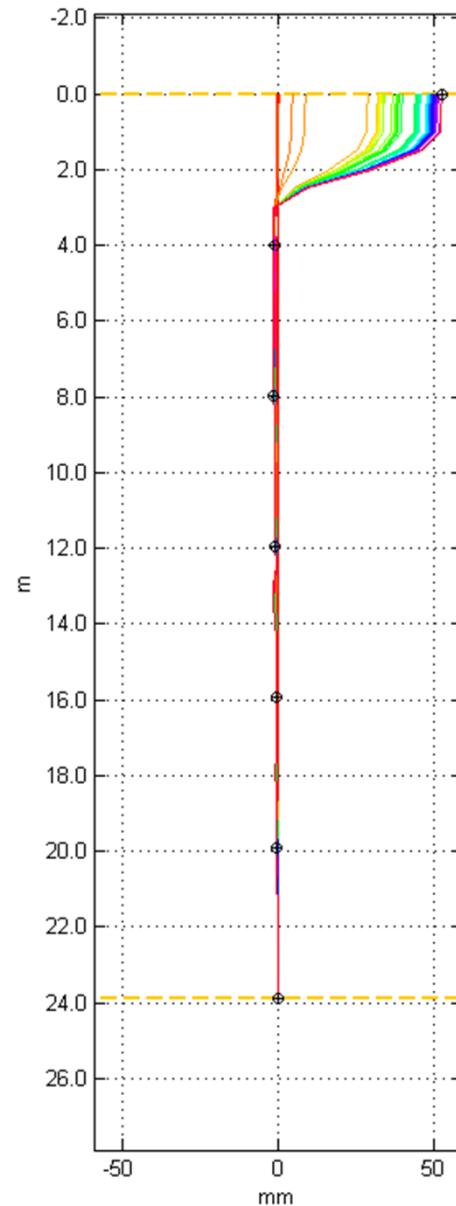
And show that the largest ground movements are in response to storm events.

Over the winter of 2023-24:

Moderate depth movements were up to 70mm per month and occurred mainly during periods of rainfall.

The Nature of the Landslide

Example of
movement in a
borehole



Road pin monitoring



coffey
A TETRA TECH COMPANY

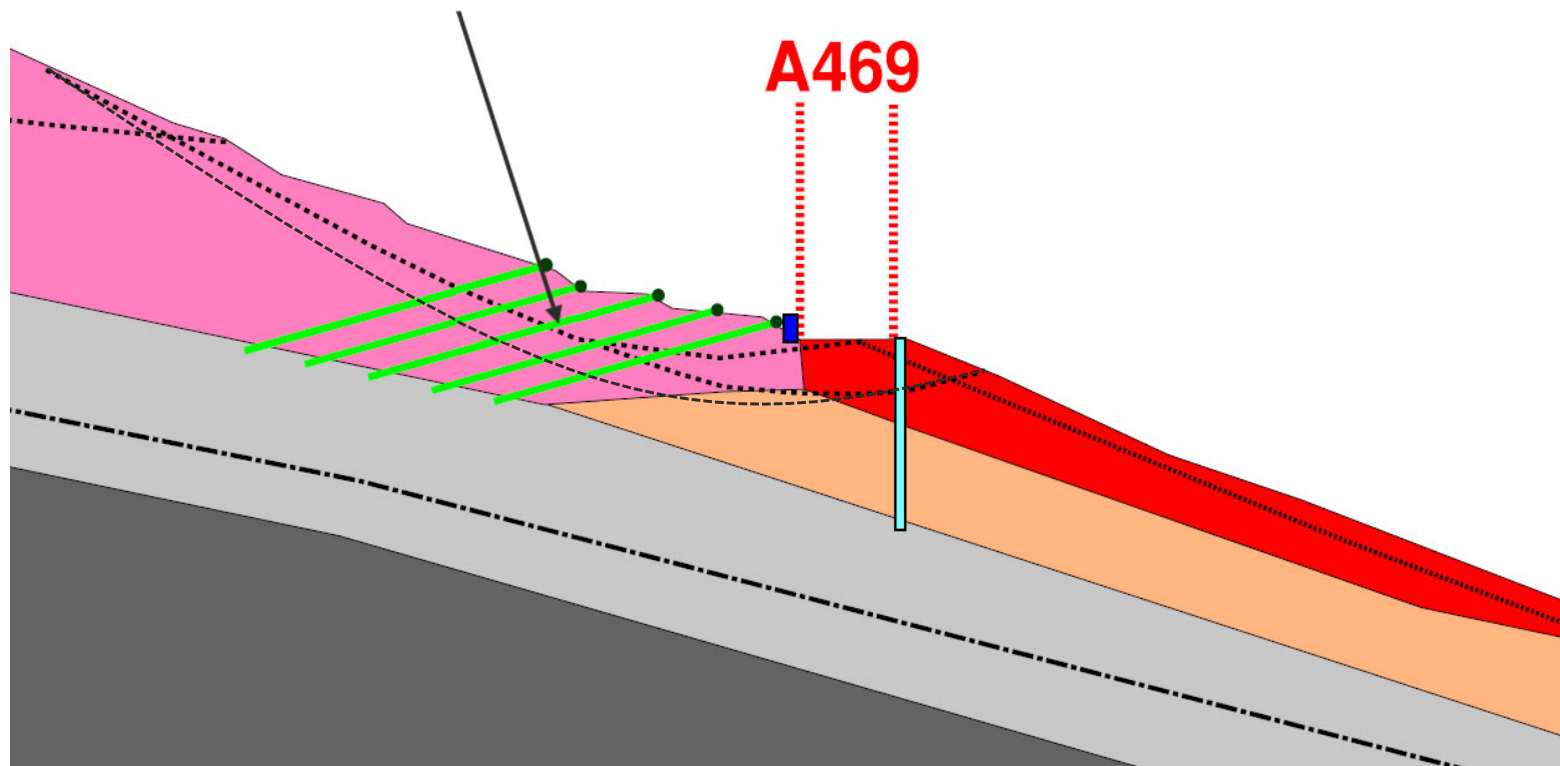
A geological cross-section diagram illustrating a fault system. The diagram shows a grey basement rock at the base, overlain by a sequence of orange and red sedimentary rocks. A prominent fault zone is highlighted in pink, containing several green lines and black dots representing fault segments. A blue square marks a specific location on the fault, labeled 'A469' in red text. Two vertical red dotted lines extend upwards from this location. A dashed black line represents a fault trace extending from the pink zone into the orange and red rocks. A light blue vertical bar is positioned near the fault zone, possibly representing a borehole or a specific geological feature.

The Proposed Remedial Works

The proposed stabilisation works comprise:

Soil nails

Soil nails to stabilise medium depth failures immediately above and passing below the road

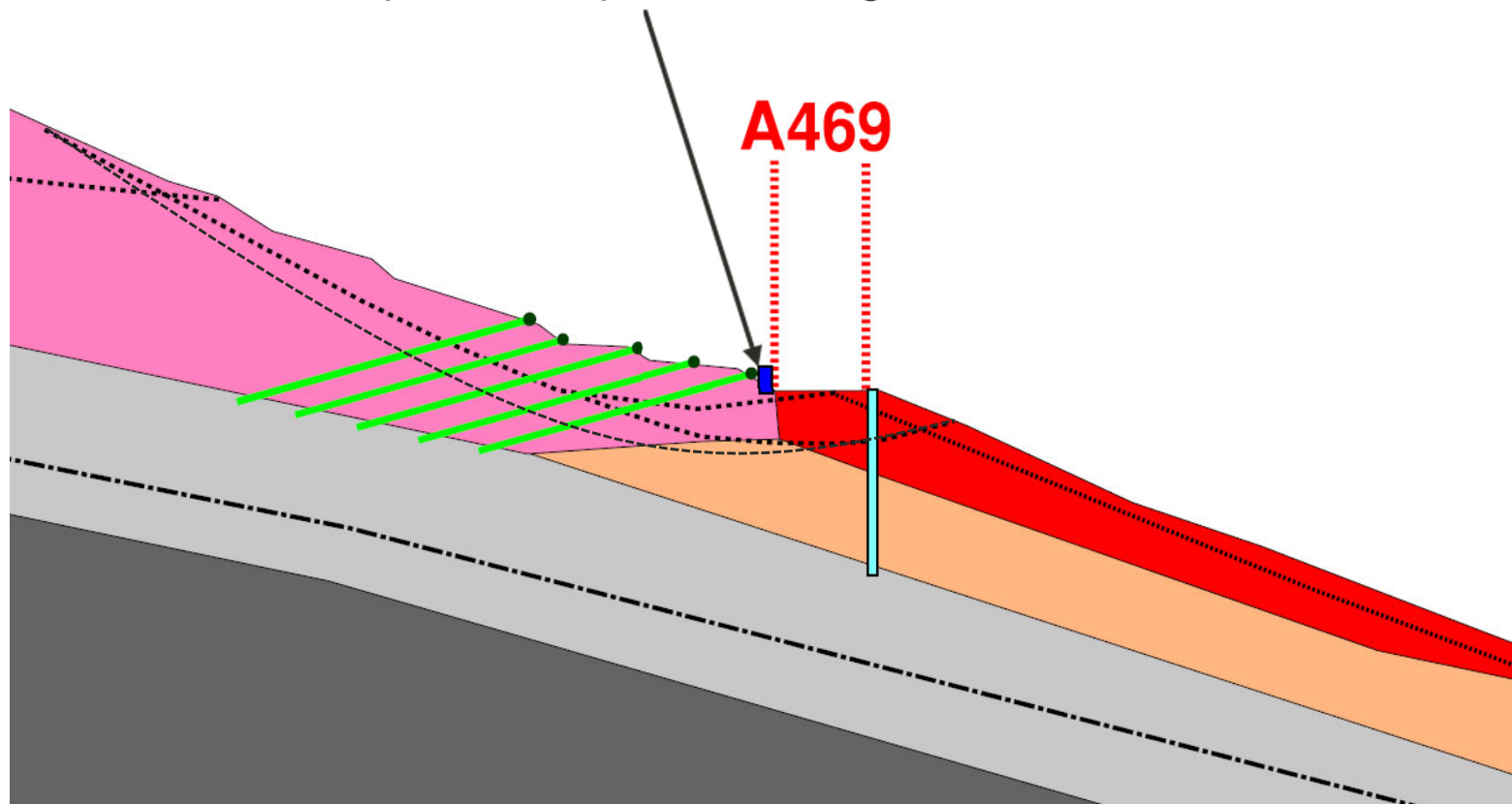


The Proposed Remedial Works

The proposed stabilisation works comprise:

Rock-filled gabion walls

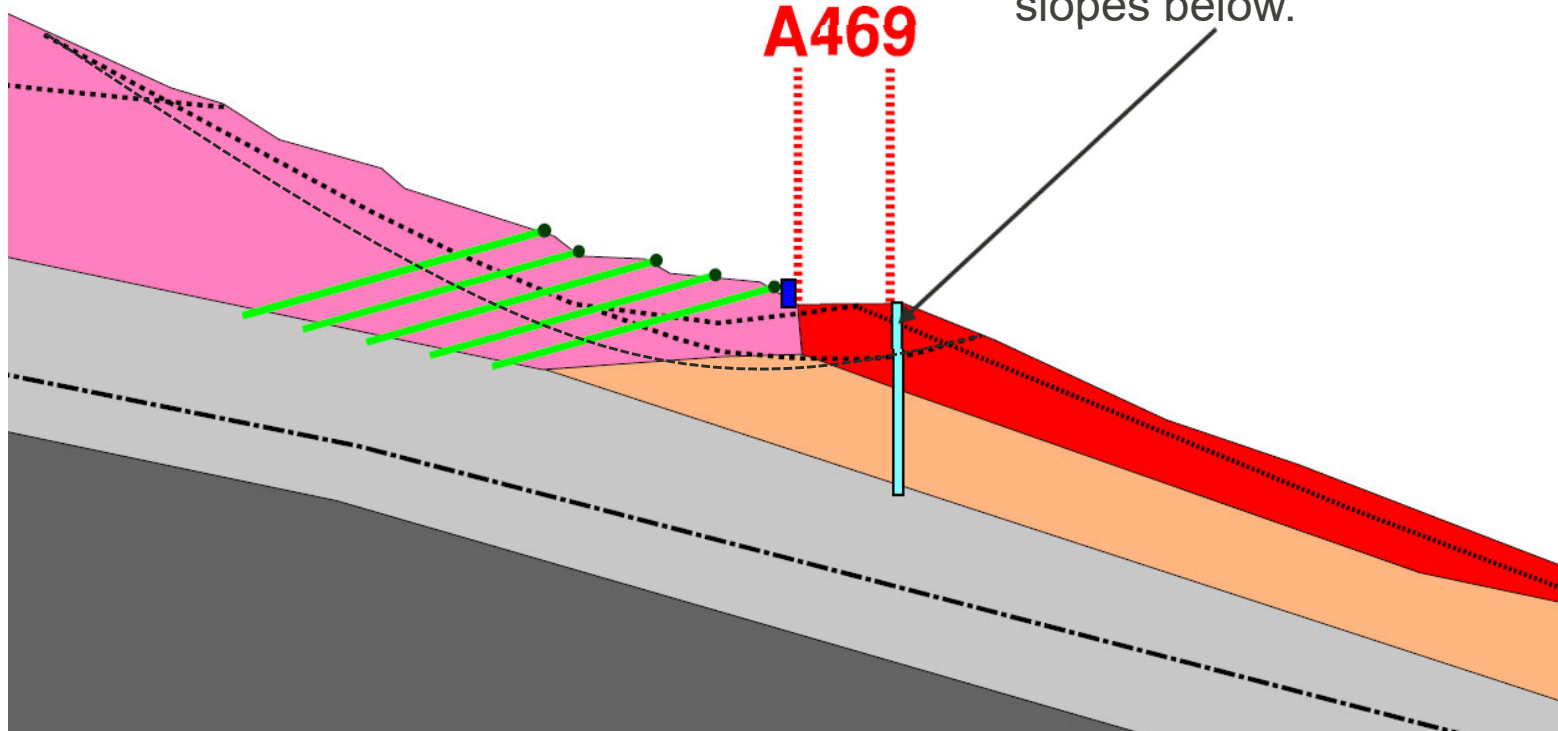
to retain the toe of the slope at the uphill road verge



The Proposed Remedial Works

The proposed stabilisation works comprise:

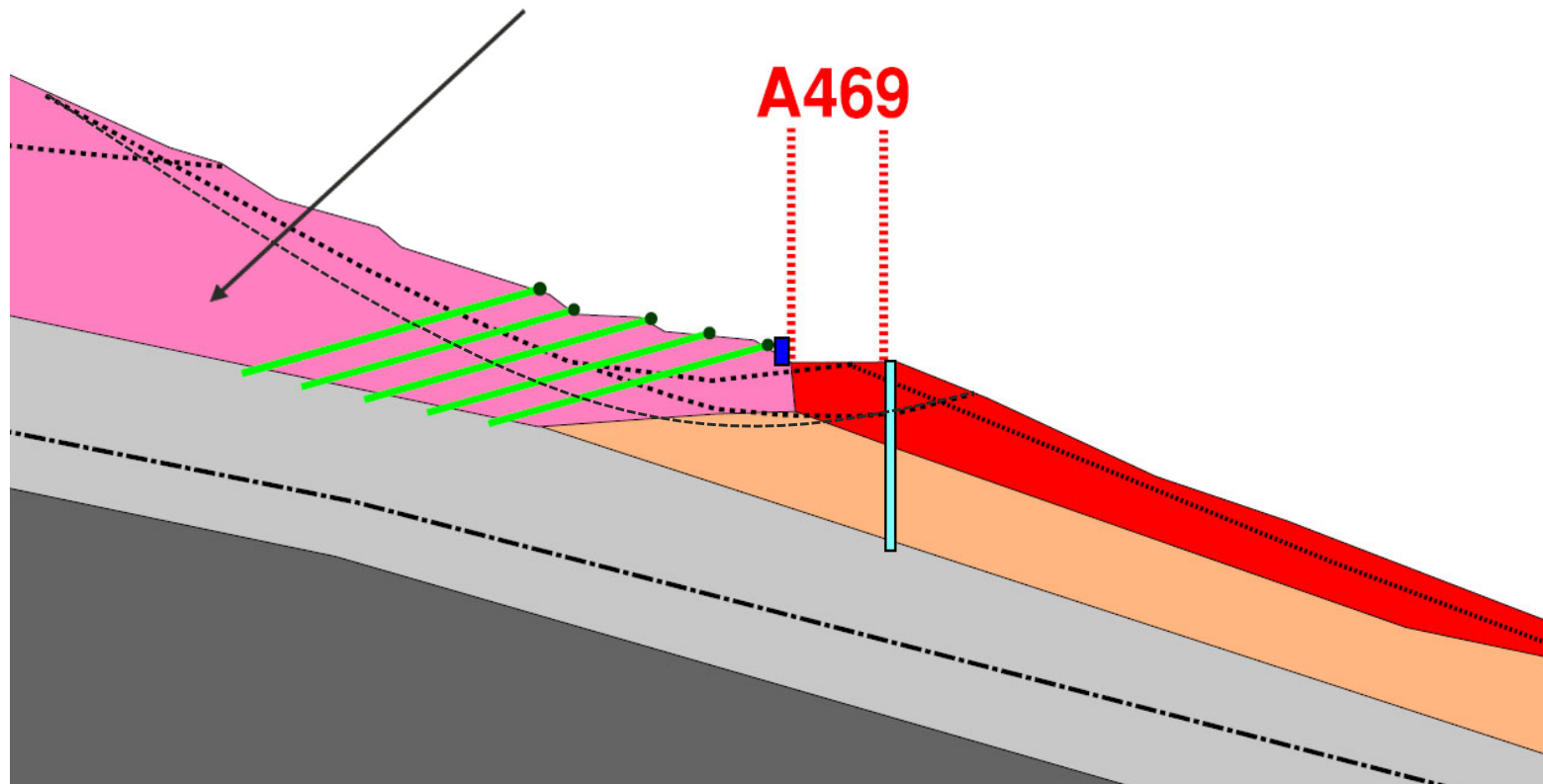
A **contiguous pile wall** to stabilise medium depth failures passing below the road and to allow for ground loss at the downhill verge as shallow failures continue on the slopes below.



The Proposed Remedial Works

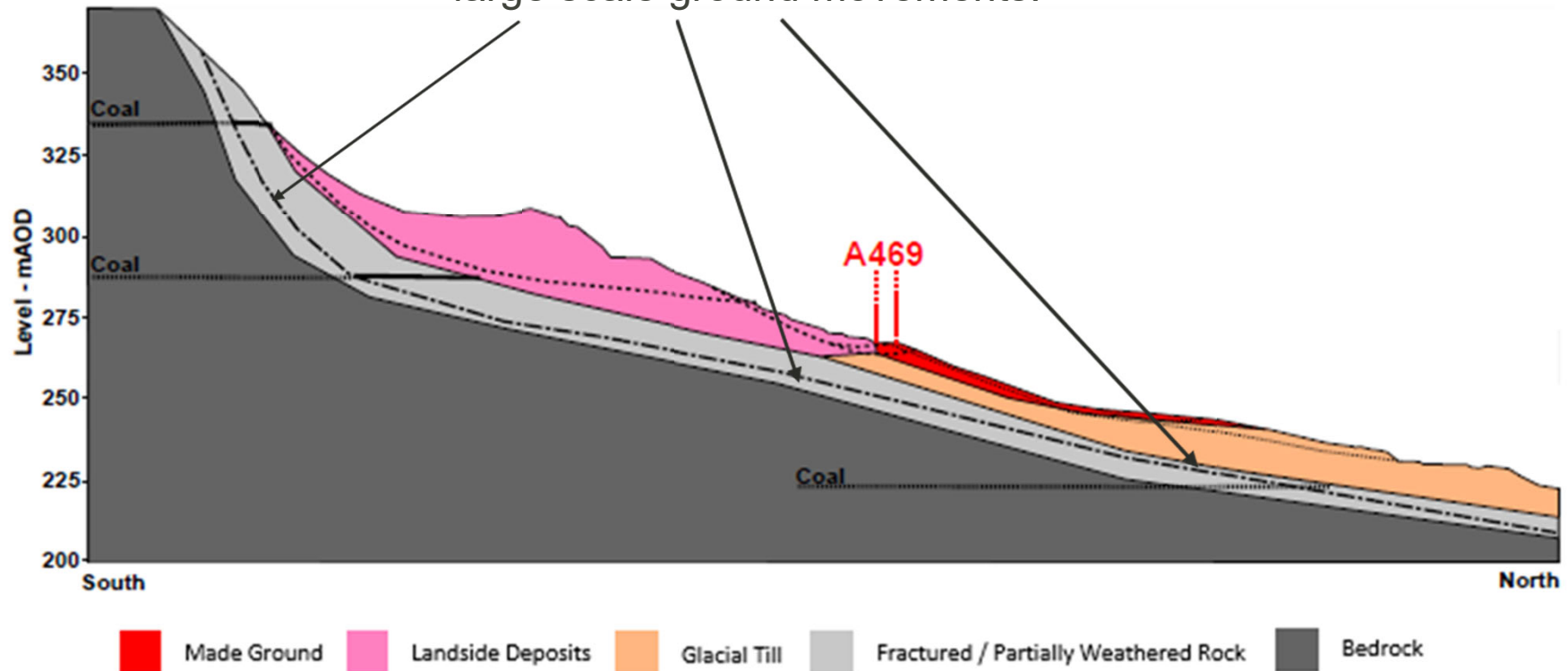
The proposed stabilisation works comprise:

Enhanced **drainage** to lower the water table above the road.



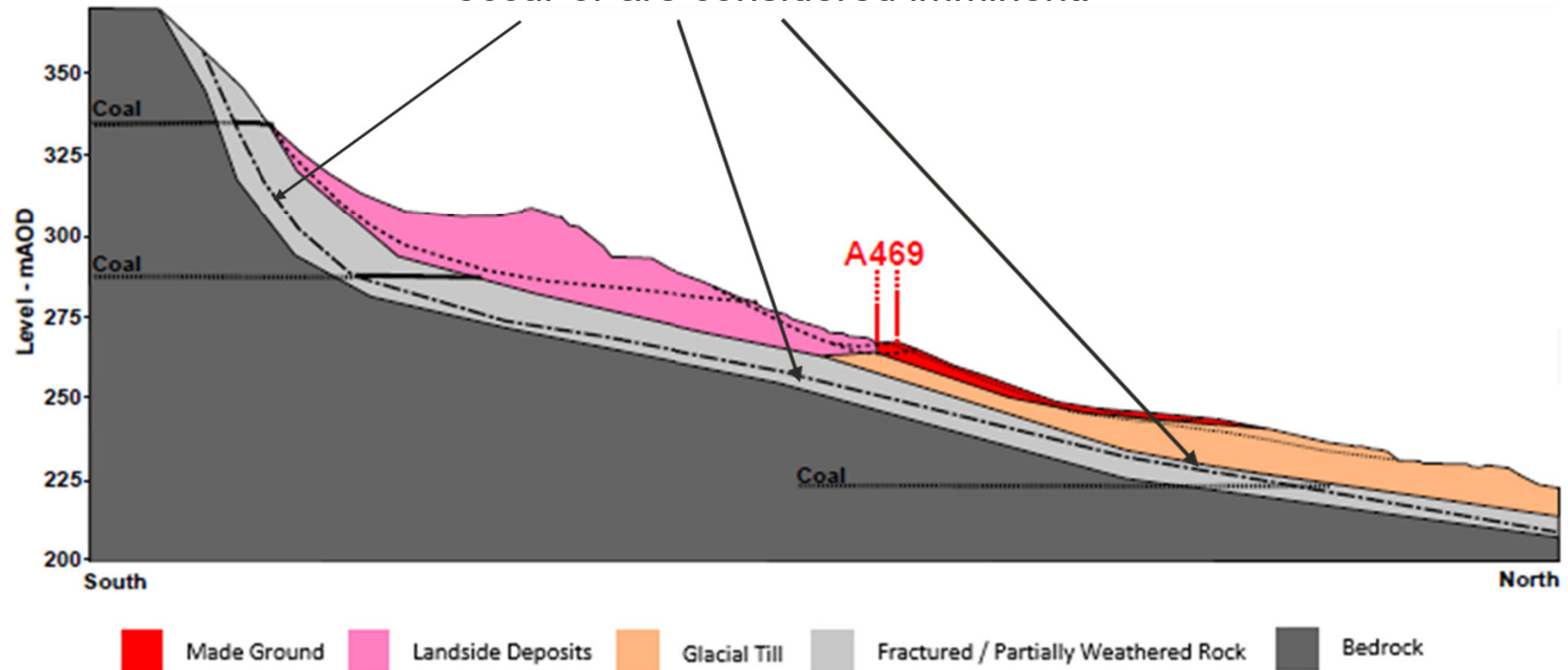
The Proposed Remedial Works

These proposed works are unlikely to be able to withstand large scale ground movements.



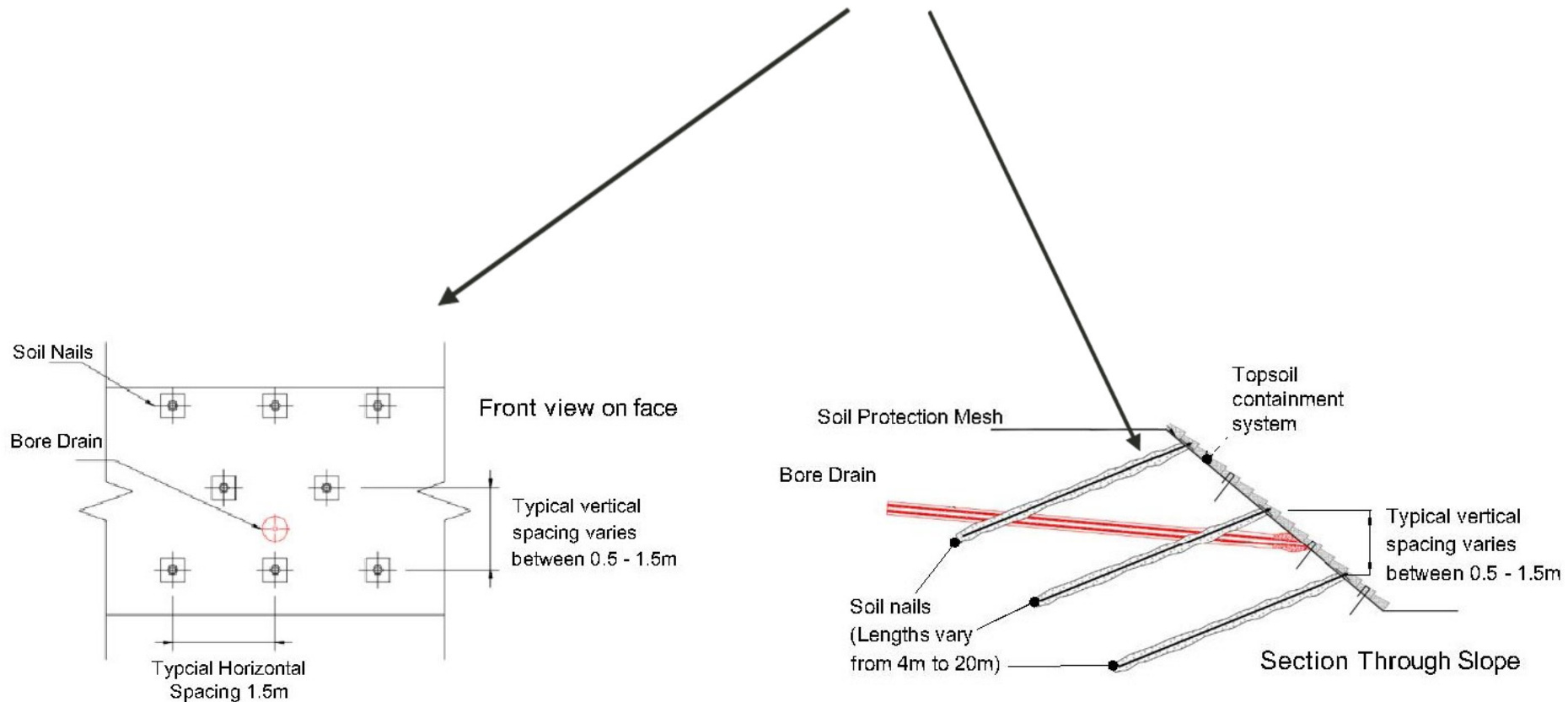
The Proposed Remedial Works

An early warning system will therefore be considered so that action can be taken if large scale movements occur or are considered imminent.



The Proposed Remedial Works

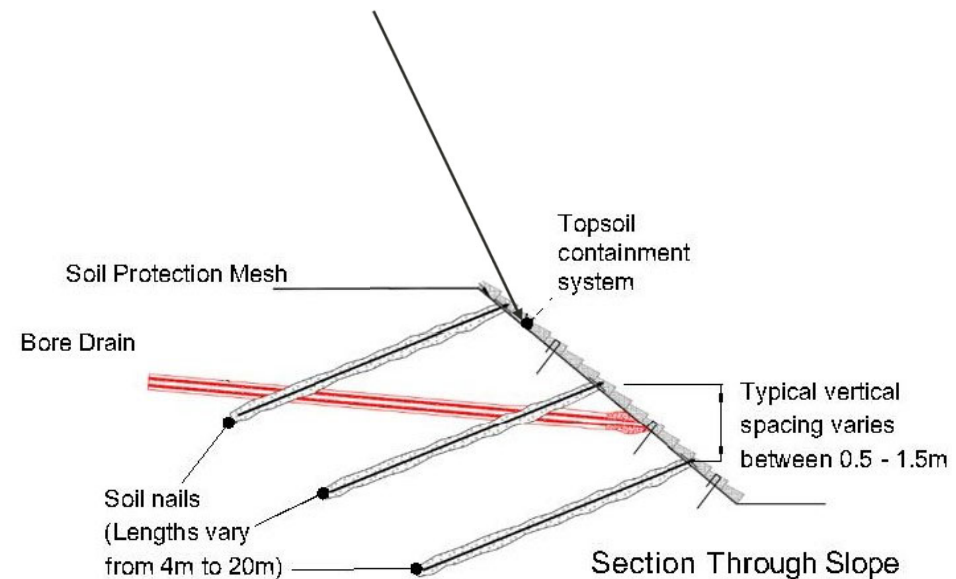
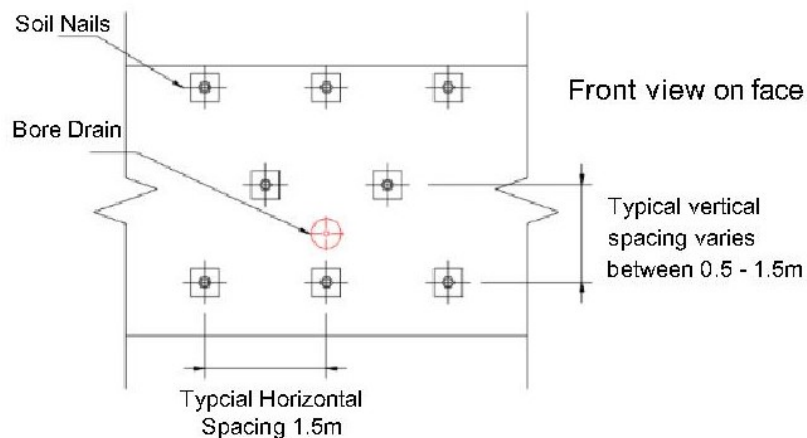
Soil nails are installed in holes drilled into the ground
Cement grout is pumped into the borehole to surround the nail.



The Proposed Remedial Works

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Cement grout is pumped into the borehole to surround the nail.

A mesh is laid on the ground to prevent local erosion
and is held in position by head plates bolted to each nail.



The Proposed Remedial Works

Soil nails can be installed using drills mounted on an excavator arm or suspended from a secure place above.



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The Proposed Remedial Works

A **contiguous pile wall** contiguous pile wall consists of reinforced concrete columns bored into the ground at close spacings.

The small gaps between the piles allow groundwater to flow past while retaining the ground behind.



The Proposed Remedial Works



The concrete piles will be along the edge of the road and will initially be buried by the slope below.

They may become exposed as material on the slope below continues to move.

The wall will be designed to accommodate up to 4m of ground loss in front of the piles.

