

## Schedule 22: Natural Events Regime

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### 1. Definitions

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In addition to the definitions set out in clause 1 (Definitions) of the Base Agreement:

**Accelerometer** means an accelerometer situated in the TG Operating Site used for the purpose of administering the Natural Events regime and located in accordance with Appendix 2 (Accelerometer Locations);

**Accelerometer Table** means the table set out in Appendix 1 (Accelerometer Table);

**Level 2A Seismic Event** means an earthquake which meets the criteria set out in column 2 of the Secondary Seismic Event Table, as measured in accordance with paragraph 3 (Measurement of Secondary Seismic Events);

**Level 3A Seismic Event** means an earthquake which meets the criteria set out in column 3 of the Secondary Seismic Event Table, as measured in accordance with paragraph 3 (Measurement of Secondary Seismic Events);

**Level 4A Seismic Event** means an earthquake which meets the criteria set out in column 4 of the Secondary Seismic Event Table, as measured in accordance with paragraph 3 (Measurement of Secondary Seismic Events);

**PGA** means peak horizontal or vertical ground acceleration (considered separately);

**Secondary Seismic Event Table** means the table set out in Appendix 1A (Secondary Seismic Event Table); and

**Seismic Recurrence Interval** means the recurrence interval adopted in design to determine the PGAs applicable to the Natural Events Table and the Accelerometer Table.

### 2. Measurement of Natural Events

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#### 2.1 Measurement of Earthquakes

- (a) For the purposes of this Agreement, in respect of a Natural Event, the intensity of any earthquake will be calculated by comparing the maximum PGA measured at each Accelerometer with the PGAs specified for that Accelerometer in the Accelerometer Table.
- (b) Where the comparison undertaken under paragraph 2.1(a) would result in the earthquake being categorised within different bands of Natural Event based on different Accelerometer readings, the highest band will prevail.
- (c) In the absence of manifest or proven error, the Accelerometer readings in respect of an earthquake will be taken as conclusive evidence of the maximum PGA for that earthquake.

#### 2.2 Measurement of Rockfall Material

For the purposes of determining whether a Rockfall Event constitutes a Level 1 Natural Event, a Level 2 Natural Event, a Level 3 Natural Event or a Level 4 Natural Event in

accordance with the Natural Events Table, the Rockfall Material shall be determined and measured as follows:

- (a) for the purpose of determining the Rockfall Material to be measured:
  - (i) it is limited to the material that falls as a result of a Rockfall Event, from a slope adjoining the TG Main Alignment and over a side protection barrier or where there is no side protection barrier, onto the Shoulder or the Lane; and
  - (ii) it excludes any material that falls over the side protection barrier or onto the Shoulder or the Lane in the process of clearing the material from the Rockfall Event; and
- (b) for the purpose of measuring the volume of Rockfall Material:
  - (i) the volume shall be calculated from a vertical line directly above the centre of the side protection barrier or the external edge of the sealed Shoulder (as applicable) and include all Rockfall Material on the road side of that line from any one slip escarpment;
  - (ii) the Rockfall Material from each individual slip escarpment will be separately measured;
  - (iii) the measurement of any Rockfall Material will be limited to Rockfall Material within a [REDACTED] period after the initial Rockfall Event that caused the Rockfall Material; and
  - (iv) the calculation of the volume of Rockfall Material will be made assuming that the Rockfall Material from previous Rockfall Events (for the avoidance of doubt, including any Rockfall Material outside of the [REDACTED] period as described in paragraph 2.2(b)(iii)) was already removed.

### 3. Measurement of Secondary Seismic Event

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- (a) For the purposes of this Agreement, in respect of a Secondary Seismic Event, the intensity of any earthquake for the relevant event will be calculated by comparing the maximum PGA measured at the relevant Accelerometer with the PGAs specified for that Accelerometer in the Secondary Seismic Event Table.
- (b) In order to qualify as a Secondary Seismic Event, the readings from the Accelerometer(s) in closest proximity to the repair work(s) being undertaken after the relevant Natural Event must be within the range of PGAs specified in the Secondary Seismic Event Table for the relevant event.
- (c) In the absence of manifest or proven error, the Accelerometer readings in respect of an earthquake will be taken as conclusive evidence of the maximum PGA for that earthquake.

## 4. Natural Events Table

Natural Events Table				
Performance Level	Level 1 Natural Event	Level 2 Natural Event	Level 3 Natural Event	Level 4 Natural Event
<b>Earthquakes</b>				
<b>Seismic Recurrence Interval</b>	Up to 25 years  The PGA being that as set out in the Accelerometer Table.	Up to 100 years  The PGA being that as set out in the Accelerometer Table.	Up to 2,500 years  The PGA being that as set out in the Accelerometer Table.	Greater than 2,500 years  The PGA being that as set out in the Accelerometer Table.
<b>Rockfall Events</b>				
<b>Rockfall Material</b>	≤ [redacted] m <sup>3</sup>	> [redacted] m <sup>3</sup> ≤ [redacted] m <sup>3</sup>	> [redacted] m <sup>3</sup> ≤ [redacted] m <sup>3</sup>	> [redacted] m <sup>3</sup>
<b>Maximum Closure Periods (Days, measured on a rolling 24 hour basis from the time of the Natural Event)</b>				
<b>Access for Emergency Vehicles</b>	0	0	1	3
<b>One Segment or Segments (North Bound or South Bound) meets the Availability Criteria and provides access to and through the affected areas (Total)</b>	0	1	1	<i>Subject to negotiation at the time of the Natural Event.</i>
<b>Two Segments (North Bound or South Bound (or one of each)) meet the Availability Criteria and provides access to and through the affected areas (Total)</b>	0	1	1	<i>Subject to negotiation at the time of the Natural Event.</i>
<b>All Segments meet the Availability Criteria</b>	0	3	3	<i>Subject to negotiation at the time of the Natural Event.</i>

## Appendix 1: Accelerometer Table

Accelerometer Table						
Accelerometer ID	Relevant GNS Sector	Relevant Site Class (as per GNS)	Natural Event PGA Range			
			<25 year	<100 year	<2,500 year	>2,500 year
			Level 1	Level 2	Level 3	Level 4
Accel 01	Sector 3	B-Rock	Up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g
Accel 02	Sector 5	C-Shallow Soil	Up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g
Accel 03	Sector 7	C-Shallow Soil	Up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g
Accel 04	Sector 9	B-Rock	Up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g up to [redacted] g	> [redacted] g

## Appendix 1A: Secondary Seismic Event Table

Secondary Seismic Event Table			
Accelerometer ID	Secondary Seismic Event PGA Range		
	Level 2A Seismic Event	Level 3A Seismic Event	Level 4A Seismic Event
Accel 01	[redacted] g to [redacted] g	[redacted] g to [redacted] g	[redacted] g to [redacted] g
Accel 02	[redacted] g to [redacted] g	[redacted] g to [redacted] g	[redacted] g to [redacted] g
Accel 03	[redacted] g to [redacted] g	[redacted] g to [redacted] g	[redacted] g to [redacted] g
Accel 04	[redacted] g to [redacted] g	[redacted] g to [redacted] g	[redacted] g to [redacted] g

## Appendix 2: Accelerometer Locations

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1. Accelerometers will be located so that:
  - (a) the locations are consistent with those specified in the “Relevant GNS Sector” section of the Accelerometer Table (as proposed in GNS Reports 2008/92 and 2013/106);
  - (b) the locations are representative of both Site Class B – Rock and Site Class C – Shallow Soil (as defined in GNS Reports 2008/92 and 2013/106) (as specified in the “Relevant Site Class (as per GNS)” section of the Accelerometer Table); and
  - (c) the monitored site conditions are representative of those applicable to the design PGAs as defined in Schedule 11 (Works Requirements); and
  - (d) they are positioned away from the crest of steep slopes to negate the effect of topographic amplification.
  
2. The preliminary location of the Accelerometers will be as set out in the following table and as shown on the maps set out in Appendix 3 subject to Finalisation under the Review Procedures in connection with the Accelerometer Design Plan.

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

**Appendix 3:** [REDACTED]

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[REDACTED]