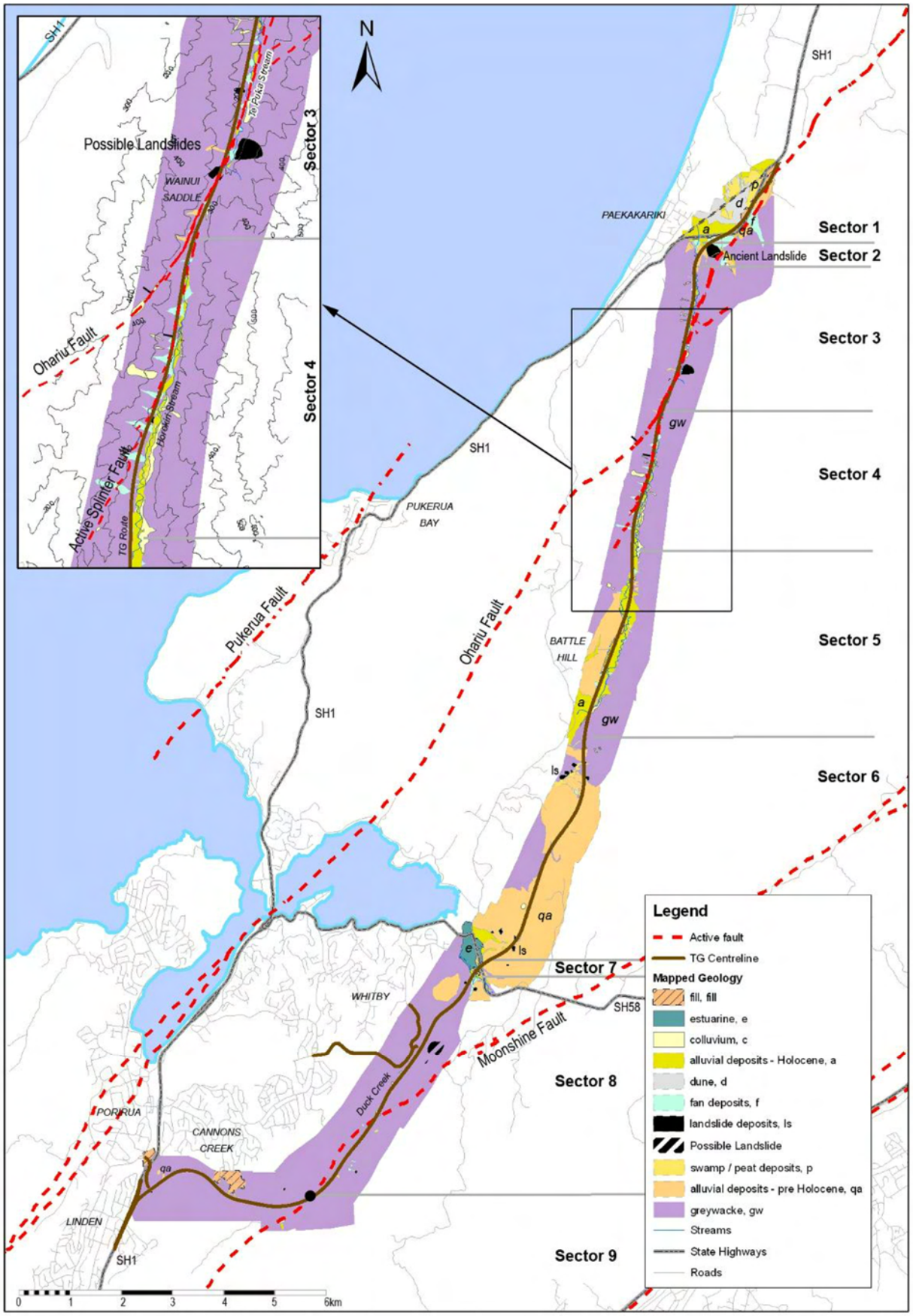
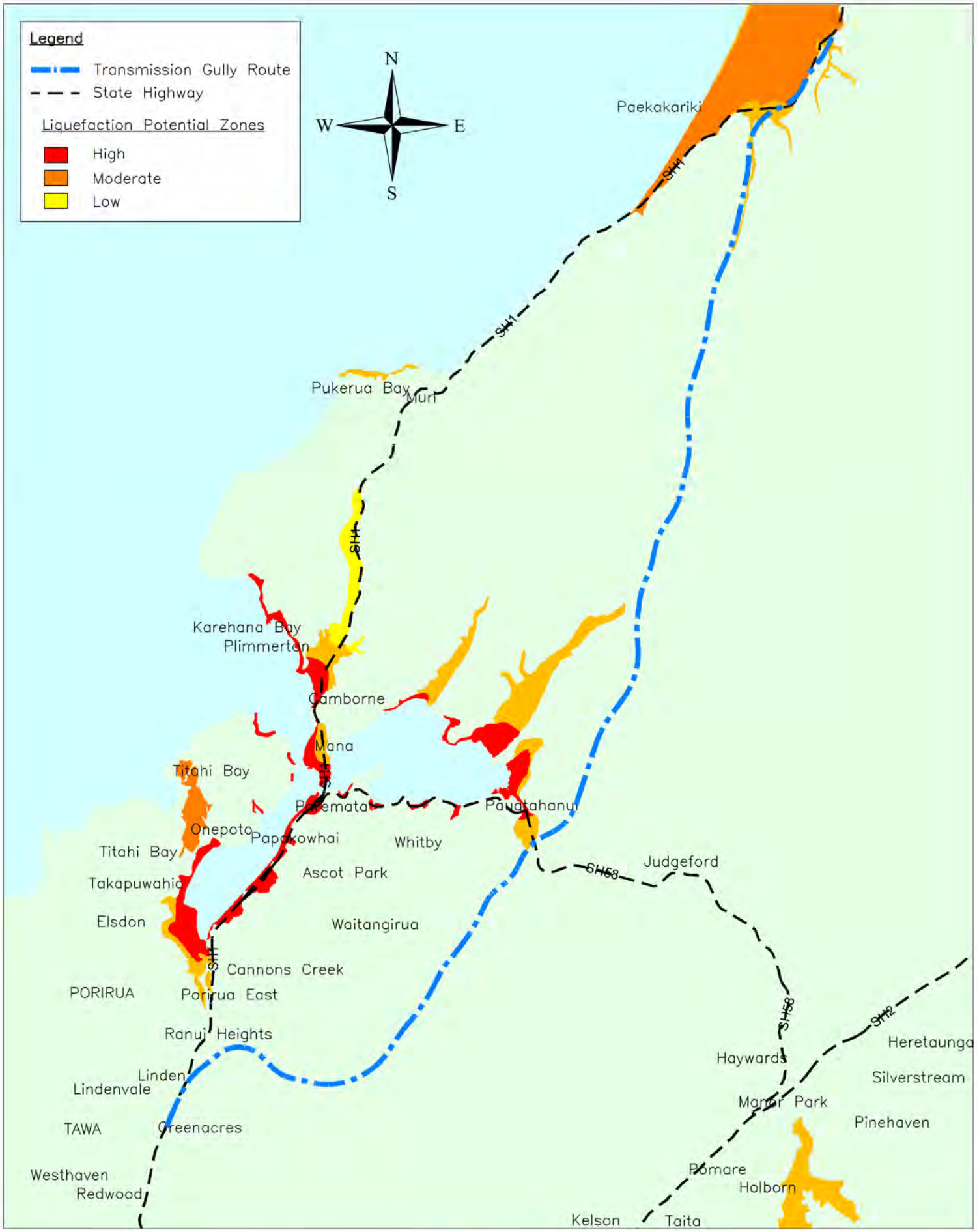
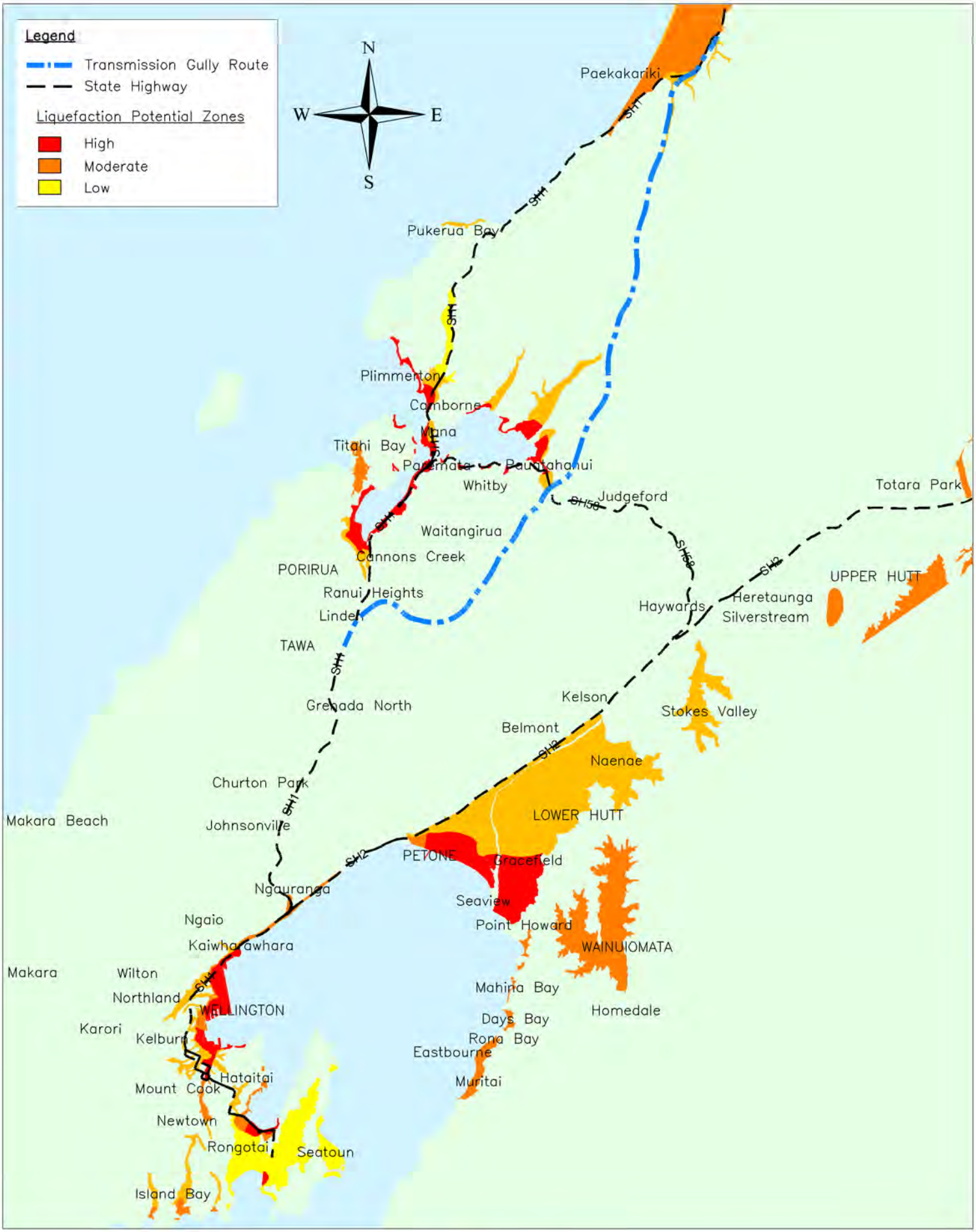
Appendix A



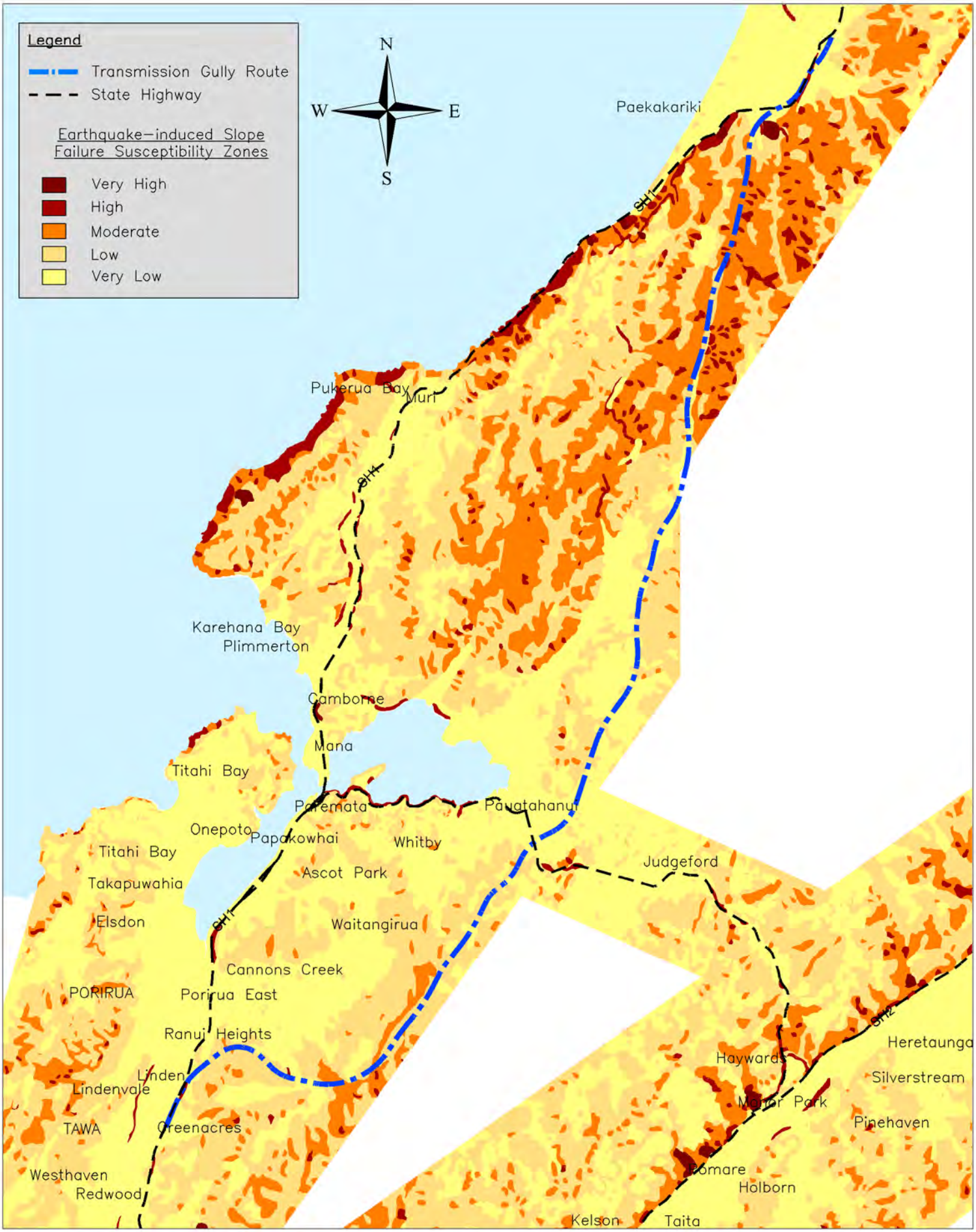
Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Summary Engineering Geology Along the Route	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: As Shown	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* A



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Liquefaction Hazards	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: N.T.S	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* B1



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Liquefaction Hazards	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: N.T.S	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* B2



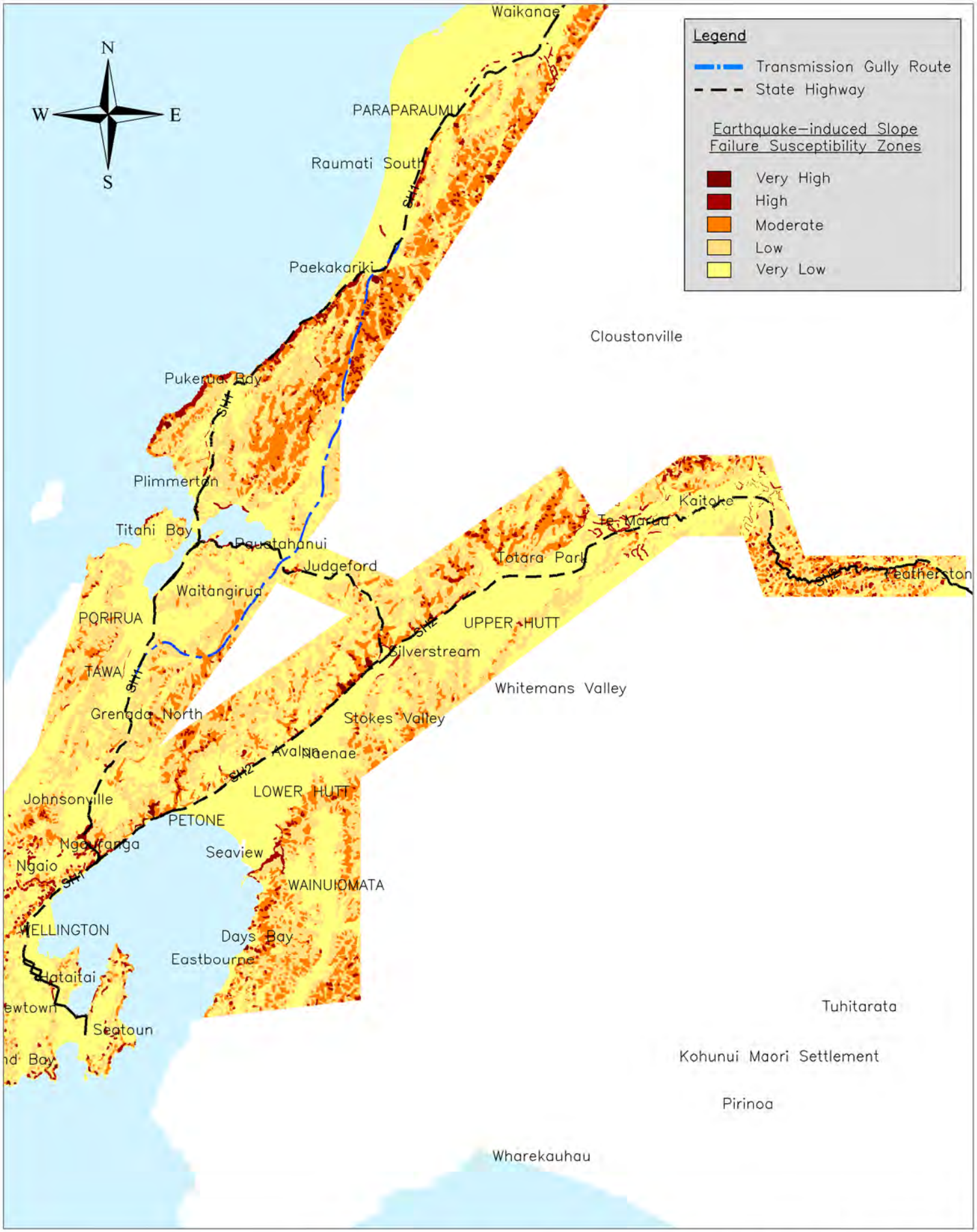
Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI

Prepared by: OPUS

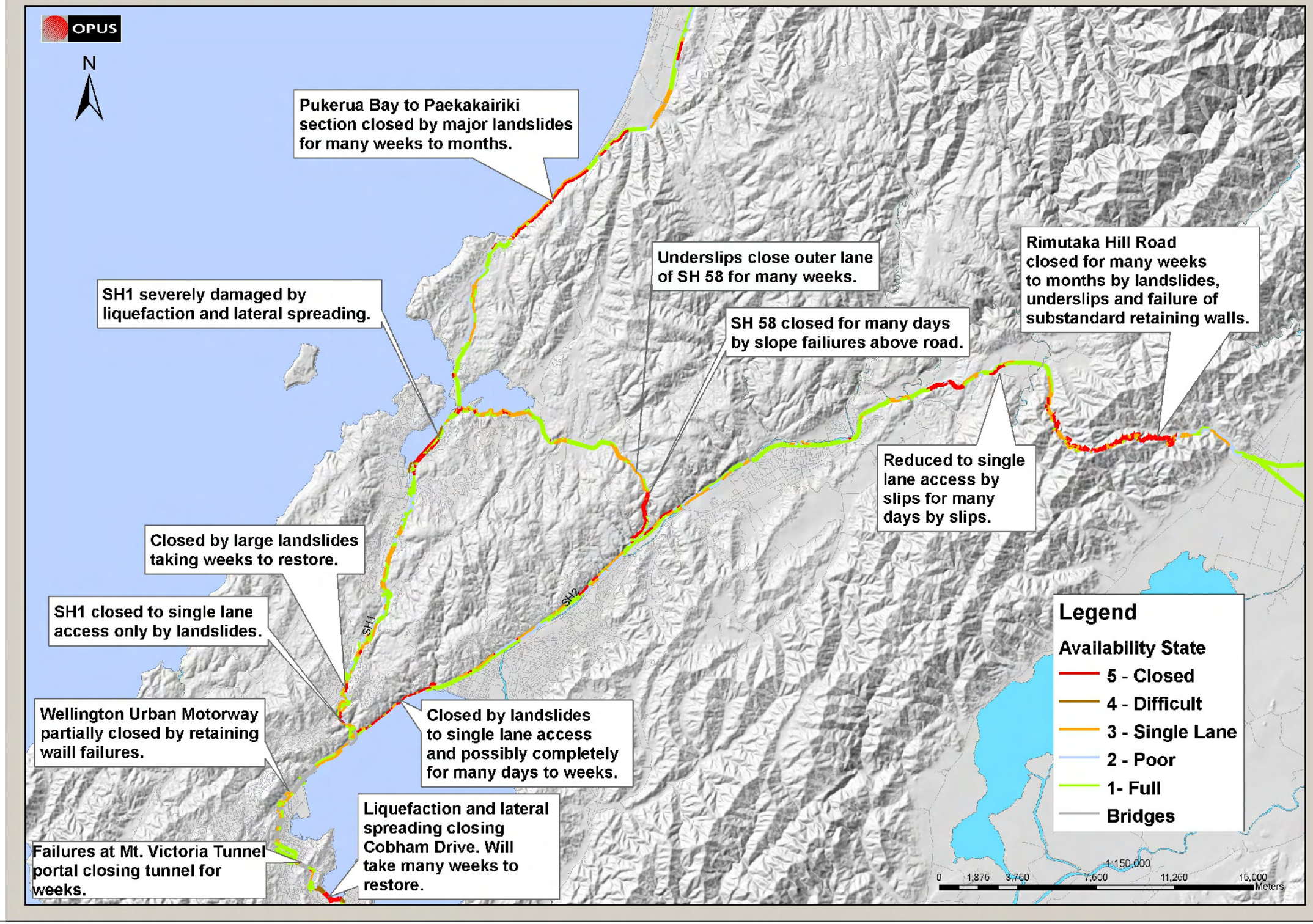
Title: Earthquake Induced Slope Failure Hazards MacKay's Crossing to Linden

Project: Transmission Gully Notice of Requirement and Consents

Scale:	*Date:*	*Project No:*	*Figure:*
N.T.S	November 2011	5C1591.00	C1



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Earthquake Induced Slope Failure Hazards MacKay's Crossing to Linden	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: N.T.S	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* C2



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI

Prepared by: OPUS

Title: Resilience of Road Network in the Wellington Region - Availability State			
Project: Transmission Gully Notice of Requirement and Consents			
Scale: As Shown	*Date:* November 2011	*Project No:* 5C1591.00	*Figure:* D

Figure E – Resilience and Availability and Outage States

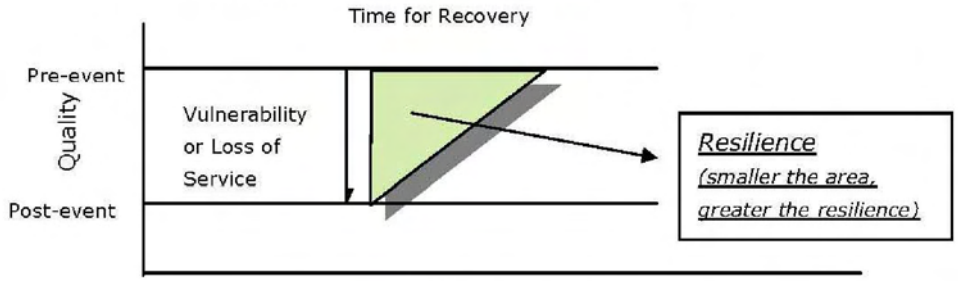


Illustration 1 - Resilience of Network

Resilience States

Table E-1 Availability State

Availability Level	Availability State	Availability Description
1	Full	Full access except condition may require care.
2	Poor	Available for slow access, but with difficulty by normal vehicles due to partial lane blockage, erosion or deformation.
3	Single Lane	Single lane access only with difficulty due to poor condition of remaining road; possible weight restriction on bridges.
4	Difficult	Single lane accessible by only 4x4 off road vehicles, or severe weight restriction on bridges, with access for special vehicles only.
5	Closed	Road closed and unavailable for use.

Table E-2 Outage State

Outage Level	Outage State	Duration of Availability Condition
1	Open	No closure, except for maintenance
2	Minor	Condition persists for up to 3 days
3	Moderate	Condition persists for 3 days to 2 weeks
4	Severe	Condition persists for 2 weeks to 3 months
5	Long term	Condition persists for > 3 months

FAILURE OF ROAD DUE TO LIQUEFACTION AND LATERAL SPREADING IN THE 2011 CHRISTCHURCH EARTHQUAKE

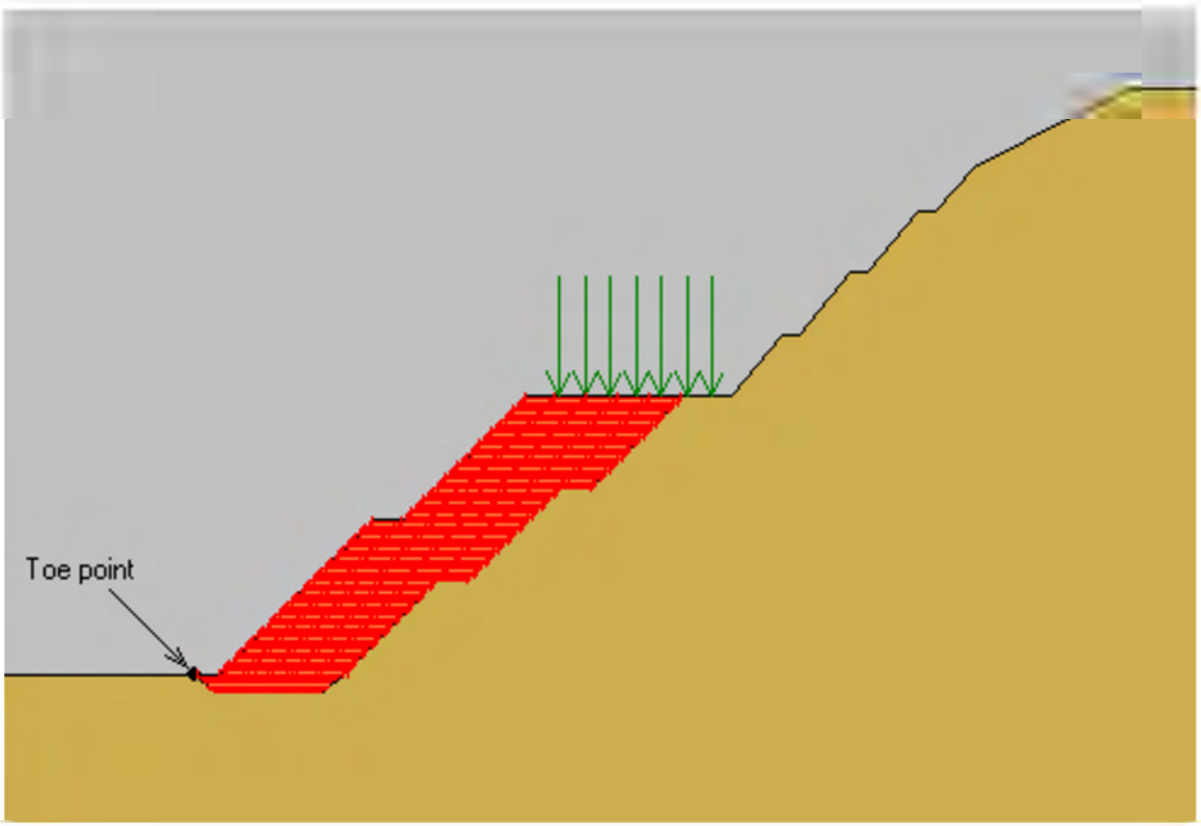
FAILURE OF ROAD EMBANKMENTS DUE TO LIQUEFACTION IN THE 1931 HAWKES BAY EARTHQUAKE

Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Damage to Roads From Liquefaction and Lateral Spreading	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: N.T.S	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* F

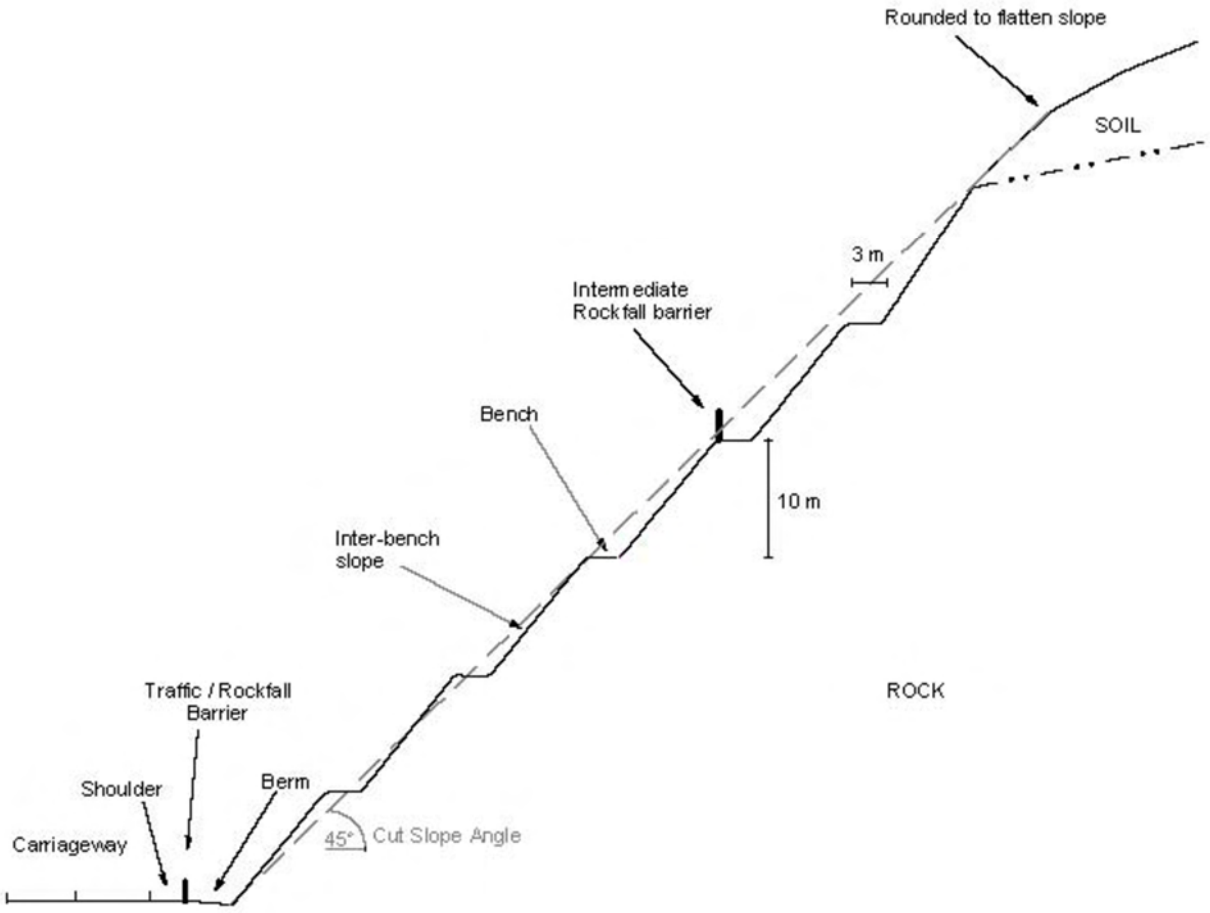
FAULT RUPTURE ACROSS EMBANKMENT, ACCESS RESTORED WITHIN DAYS AFTER THE 2008 WENCHUAN EARTHQUAKE, CHINA

FAULT RUPTURE CAUSING BRIDGE COLLAPSE, ACCESS NOT RESTORED 6 MONTHS AFTER THE 2008 WENCHUAN EARTHQUAKE, CHINA

Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Fault Rupture Effects and Recovery After 2008 Wenchaun Earthquake	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: N.T.S	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* G



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Reinforced Soil Embankments	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: N.T.S	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* H



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Rock Slope Configuration and Rock Fall Protection	
		Project: Transmission Gully Notice of Requirement and Consents	
		Scale: N.T.S	*Date:* November 2011
		Project No: 5C1591.00	*Figure:* I

N

Mackay's Crossing

Paekakariki

SH1 Pukerua Bay to Paekakariki closed by major landslides

Pukerua Bay

Ohariu Fault

Pauatahanui Inlet

Plimmerton

SH1 severely damaged by liquefaction and lateral spreading.

Porirua Harbour

Porirua

Linden

Tawa

Wellington Fault

Lower Hutt

Wellington Harbour

Availability State, Earthquake

- 6 - Closed and affecting opposite carriageway
- 5 - Closed
- 4 - Difficult
- 3 - Single Lane
- 2 - Poor
- 1 - Full

References:

Availability State for Earthquake Event -09/05/08 (Date Captured)

NZGD 2000: New Zealand Transverse Mercator Projection

1:75,000

0 500 1,000 2,000 3,000 4,000 5,000 Metres

Title:
Availability State Map for Transmission Gully In Wellington Fault Rupture Event

Project:
Transmission Gully Notice of Requirement and Consents

Prepared for:
NZ TRANSPORT AGENCY
WAKA KOTAHI

Prepared by:
OPUS

Job No:	Date:	Figure:
5C1951.00	Nov 2009	J1

N

Mackay's Crossing

Transmission Gully route affected by fault rupture in Ohariu Fault event.

Paekakariki

SH1 Pukerua Bay to Paekakariki section closed by major landsliding with debris extending into the sea.

Pukerua Bay

Ohariu Fault

Pauatahanui Inlet

Wellington Fault

Lower Hutt

Plimmerton

Paremata bridges collapse due to Ohariu Fault rupture.

SHI severely damaged by liquefaction and lateral spreading.

Porirua Harbour

Porirua

Linden

Tawa

Wellington Harbour

Availability State, Earthquake

- 6 - Closed and affecting opposite carriageway
- 5 - Closed
- 4 - Difficult
- 3 - Single Lane
- 2 - Poor
- 1- Full

References:

Availability State for Earthquake Event -09/05/08 (Date Captured)

NZGD 2000: New Zealand Transverse Mercator Projection

1:83,699

0 650 1,300 2,600 3,900 5,200 6,5

Title: Availability State Map for Transmission Gully In Ohariu Fault Rupture Event

Project: Transmission Gully Notice of Requirement and Consents

Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI

Prepared by: OPUS

Job No:	Date:	Figure:
5C1951.00	Nov 2009	J2

N

Mackay's Crossing

Paekakariki

Pukerua Bay to Paekakariki section closed by major landslides.

Pukerua Bay

Ohariu Fault

Pauatahanui Inlet

Wellington Fault

Lower Hutt

Wellington Harbour

Plimmerton

Porirua Harbour

Porirua

Linden

Tawa

Outage State, Earthquake

- 6 - Very Long Term (> 6 months)
- 5 - Long Term (3 - 6 months)
- 4 - Severe (2 weeks to 3 months)
- 3 - Moderate (3 days to 2 weeks)
- 2 - Minor (up to 3 days)
- 1 - Open (no closure)

References:

Availability State for Earthquake Event -09/05/08 (Date Captured)

NZGD 2000: New Zealand Transverse Mercator Projection

1:75,000

0 500 1,000 2,000 3,000 4,000 5,000 Metres

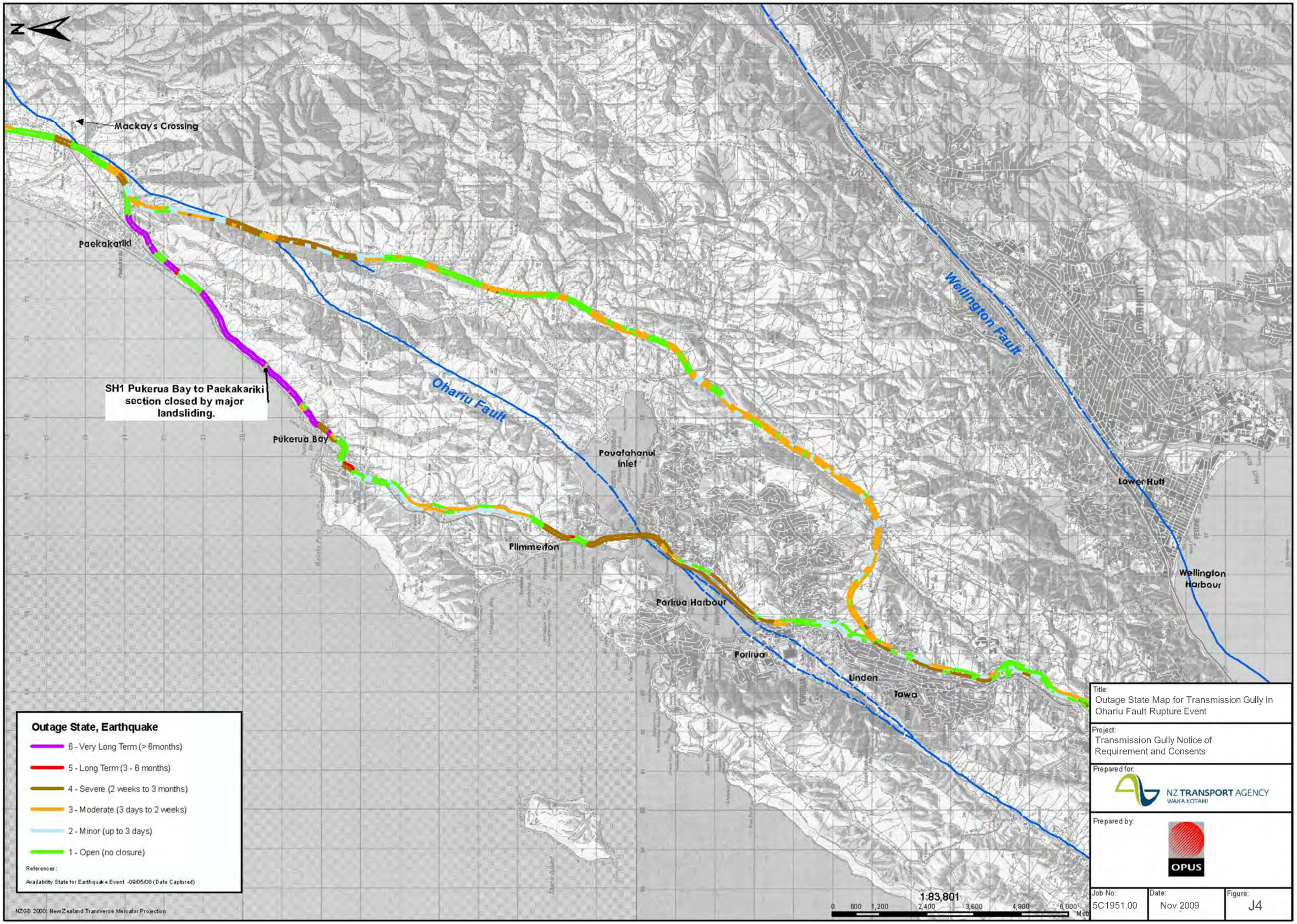
Title:
Outage State Map for Transmission Gully In Wellington Fault Rupture Event

Project:
Transmission Gully Notice of Requirement and Consents

Prepared for:
NZ TRANSPORT AGENCY
WAKA KOTAHI

Prepared by:
OPUS

Job No:	Date:	Figure:
5C1951.00	Nov 2009	J3


N
Mackay's Crossing
Paekakariki
SH1 Pukerua Bay to Paekakariki section closed by major landsliding.
Pukerua Bay
Ohariu Fault
Pauatahanui Inlet
Wellington Fault
Lower Hutt
Plimmerton
Porirua Harbour
Porirua
Linden
Tawa
Wellington Harbour
Outage State, Earthquake
6 - Very Long Term (> 6months)
5 - Long Term (3 - 6 months)
4 - Severe (2 weeks to 3 months)
3 - Moderate (3 days to 2 weeks)
2 - Minor (up to 3 days)
1 - Open (no closure)
References:
Availability State for Earthquake Event -09/05/08 (Date Captured)
NZGD 2000: New Zealand Transverse Mercator Projection
1:83,801
0 600 1,200 2,400 3,600 4,800 6,000 Metres
Title:
Outage State Map for Transmission Gully In Ohariu Fault Rupture Event
Project:
Transmission Gully Notice of Requirement and Consents
Prepared for:
NZ TRANSPORT AGENCY
WAKA KOTAHI
Prepared by:
OPUS
Job No:
5C1951.00
Date:
Nov 2009
Figure:
J4