Reverse Faulting in Hawke's Bay, New Zealand, as defined by LiDAR mapping

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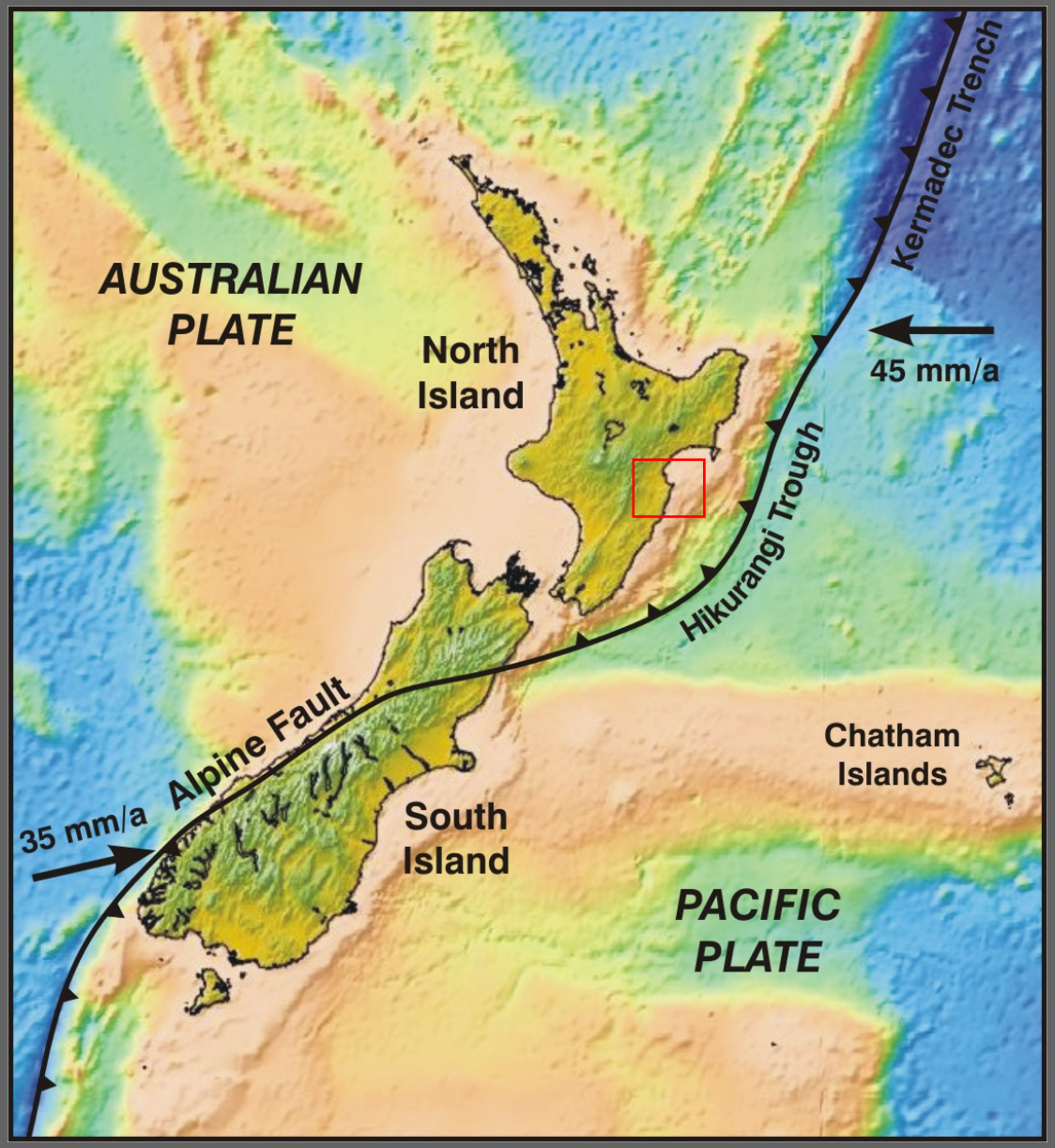
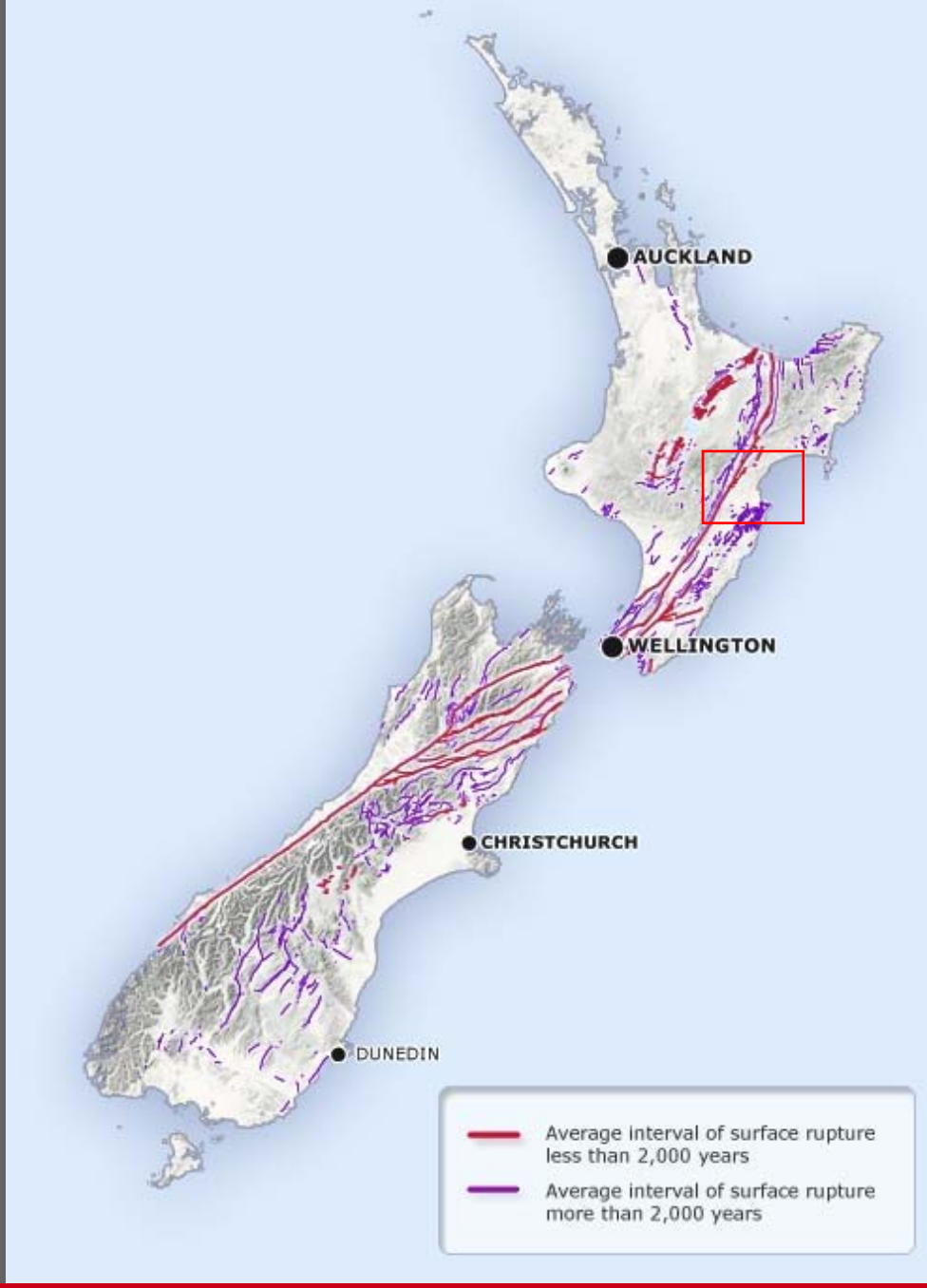
New Zealand's Tectonic setting

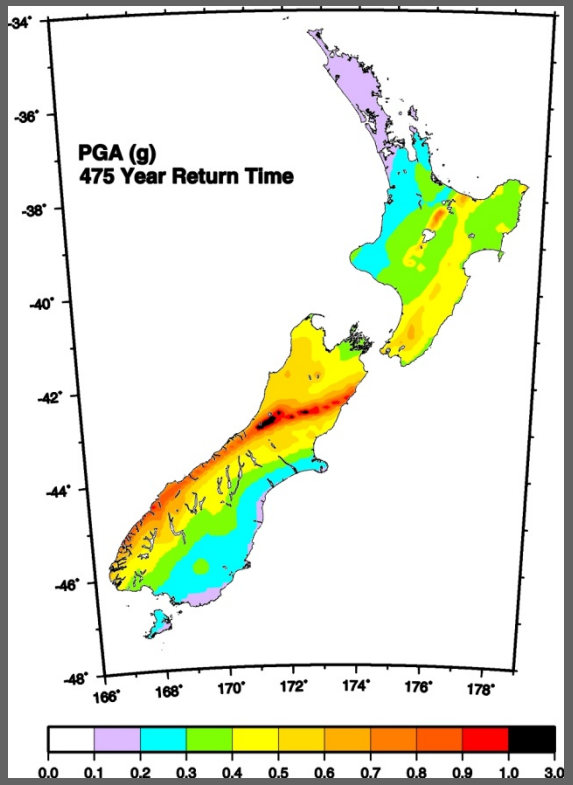


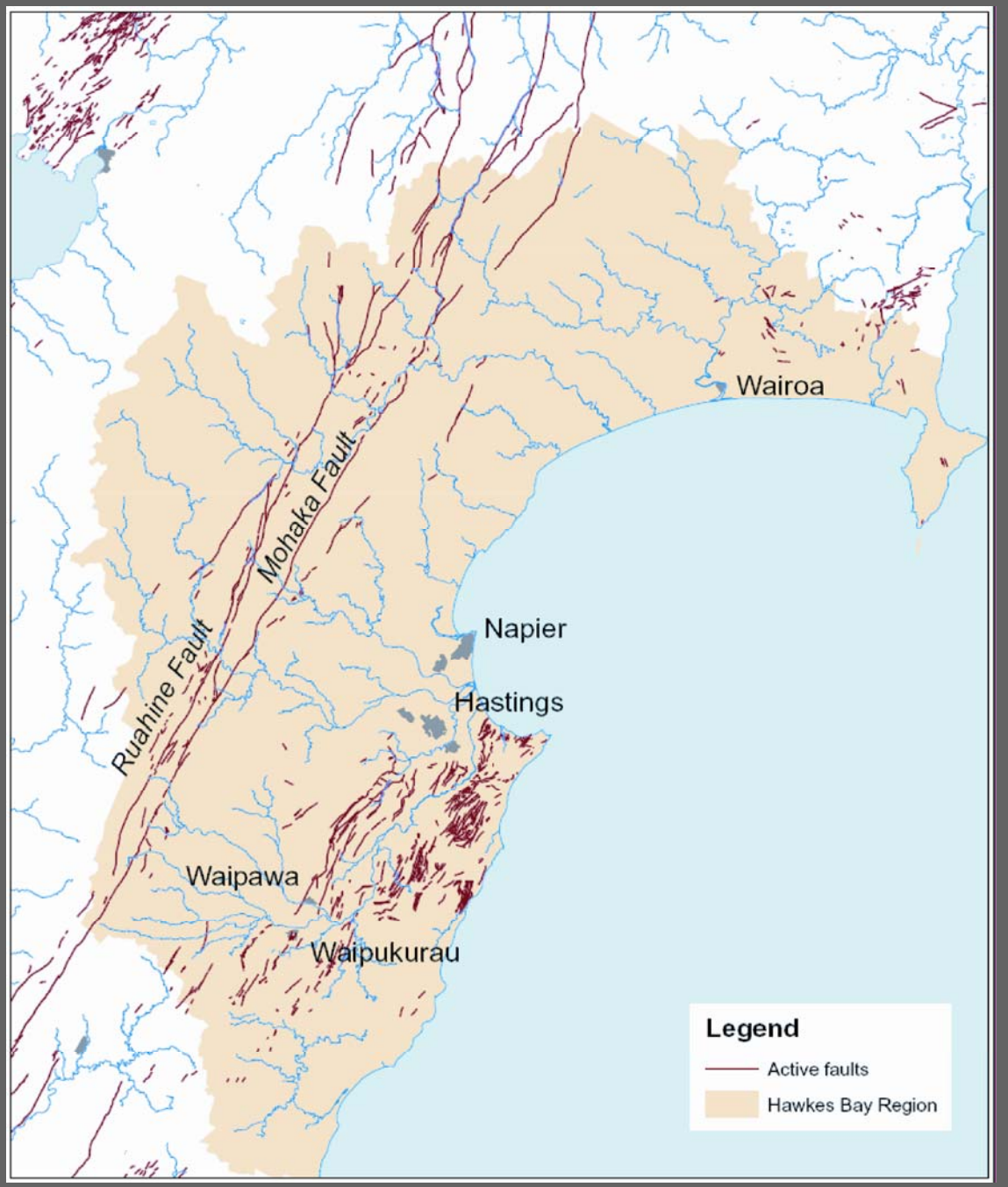
New Zealand's Active Fault Network

Earthquakes occur on **faults** or other planes of weakness, as stresses from the plate boundary are first stored up and then relieved along these zones



Hawke's Bay Region active faults





The MfE Guidelines*

- Designed to reduce the risk of fatalities from surface faulting earthquakes
- Not all faults are equal ! It's a Risk-based approach
- 3 main criteria for decision making
- **Recurrence Interval Class** which relate to the repeat time of large surface faulting events
- **Fault Complexity** which deals with how well we can define or map the fault
- **Building Importance Class** dealing with the type of structure planned

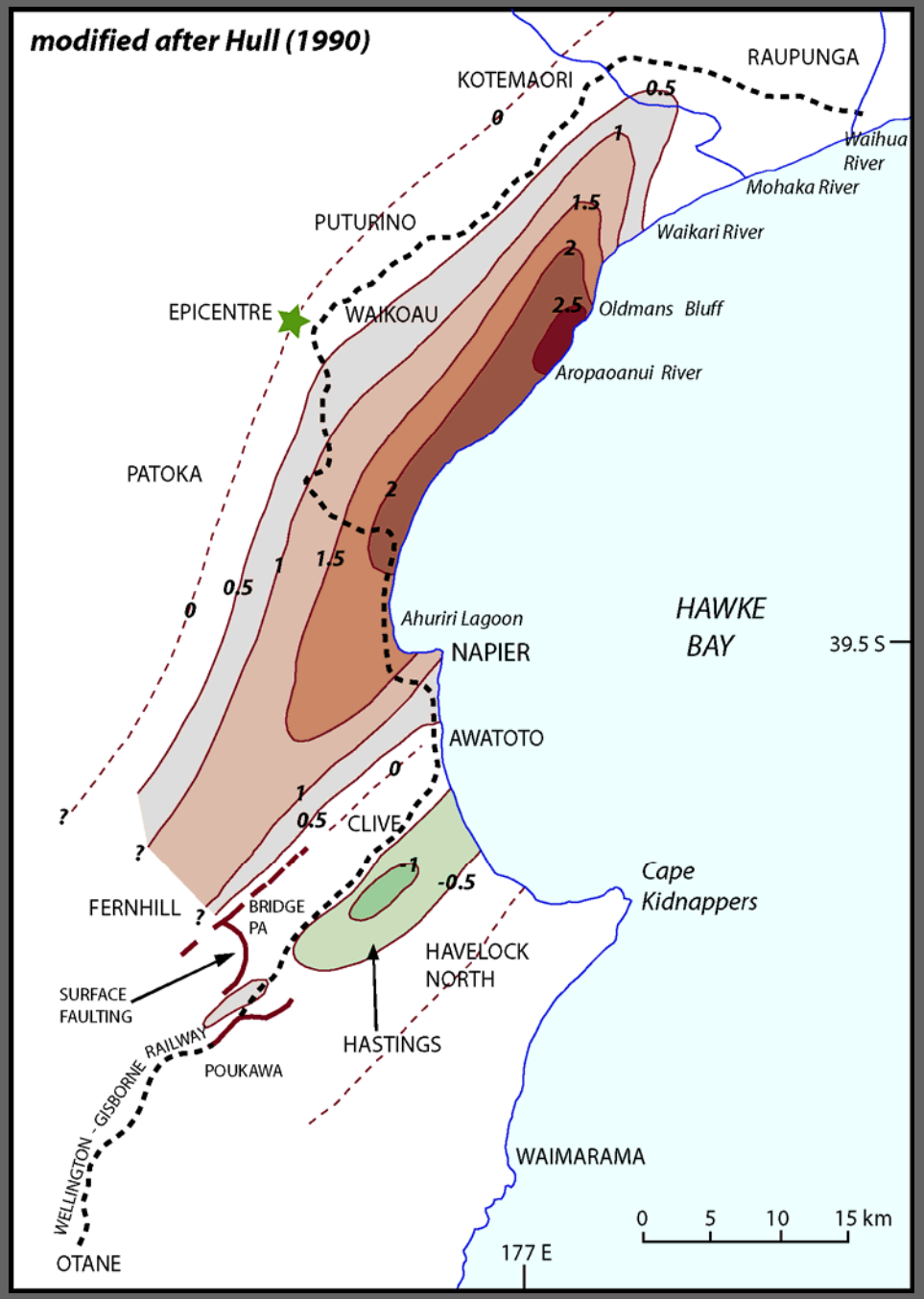
Why should we concern ourselves with fault rupture ?

The September 1999 Chi-Chi earthquake, Taiwan

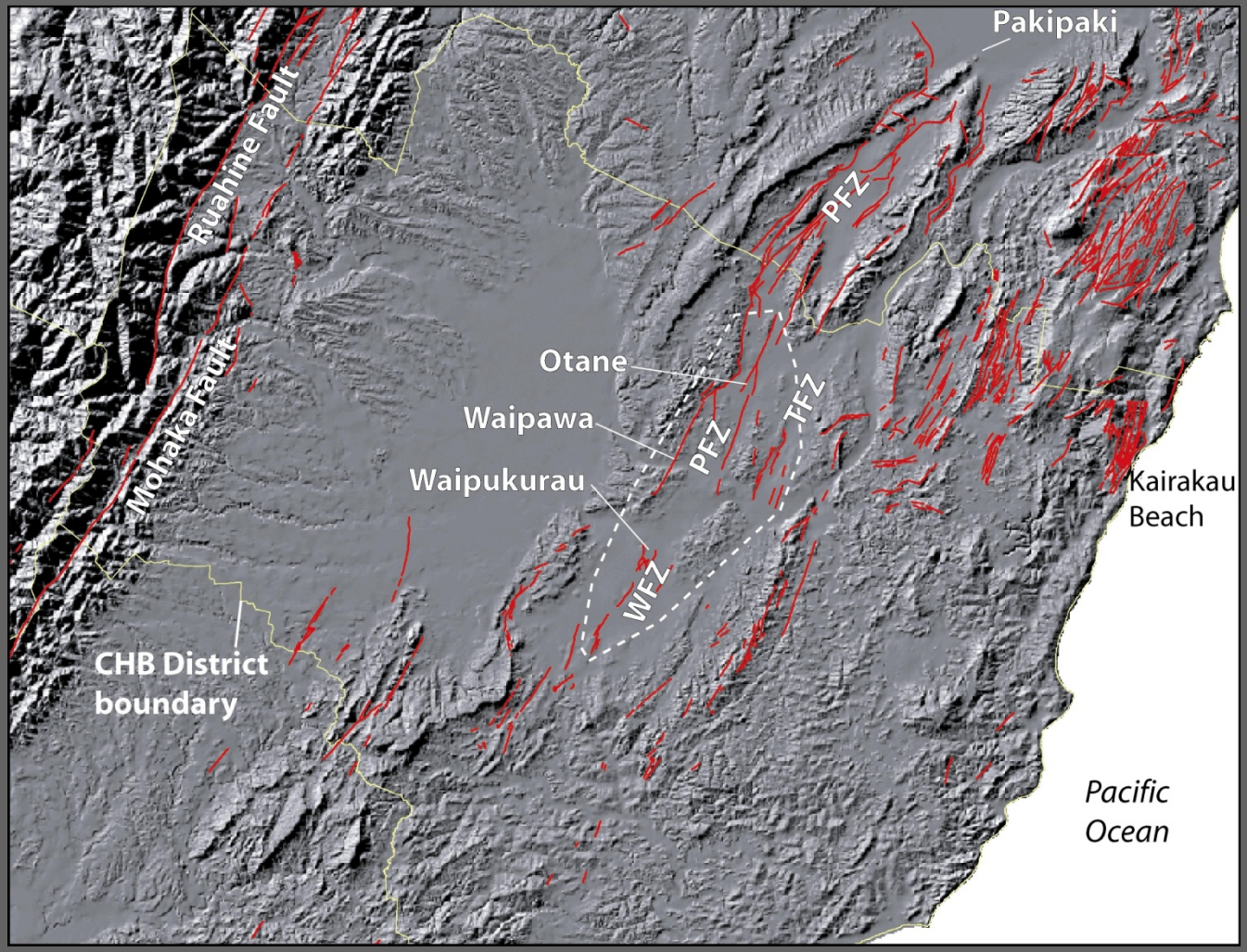
-Reverse fault scarp formed
-Tilted buildings on hangingwall

1931 Hawke's Bay earthquake (M 7.8) - examples of surface faulting

The record of vertical deformation (and rupture) associated with 1931 quake

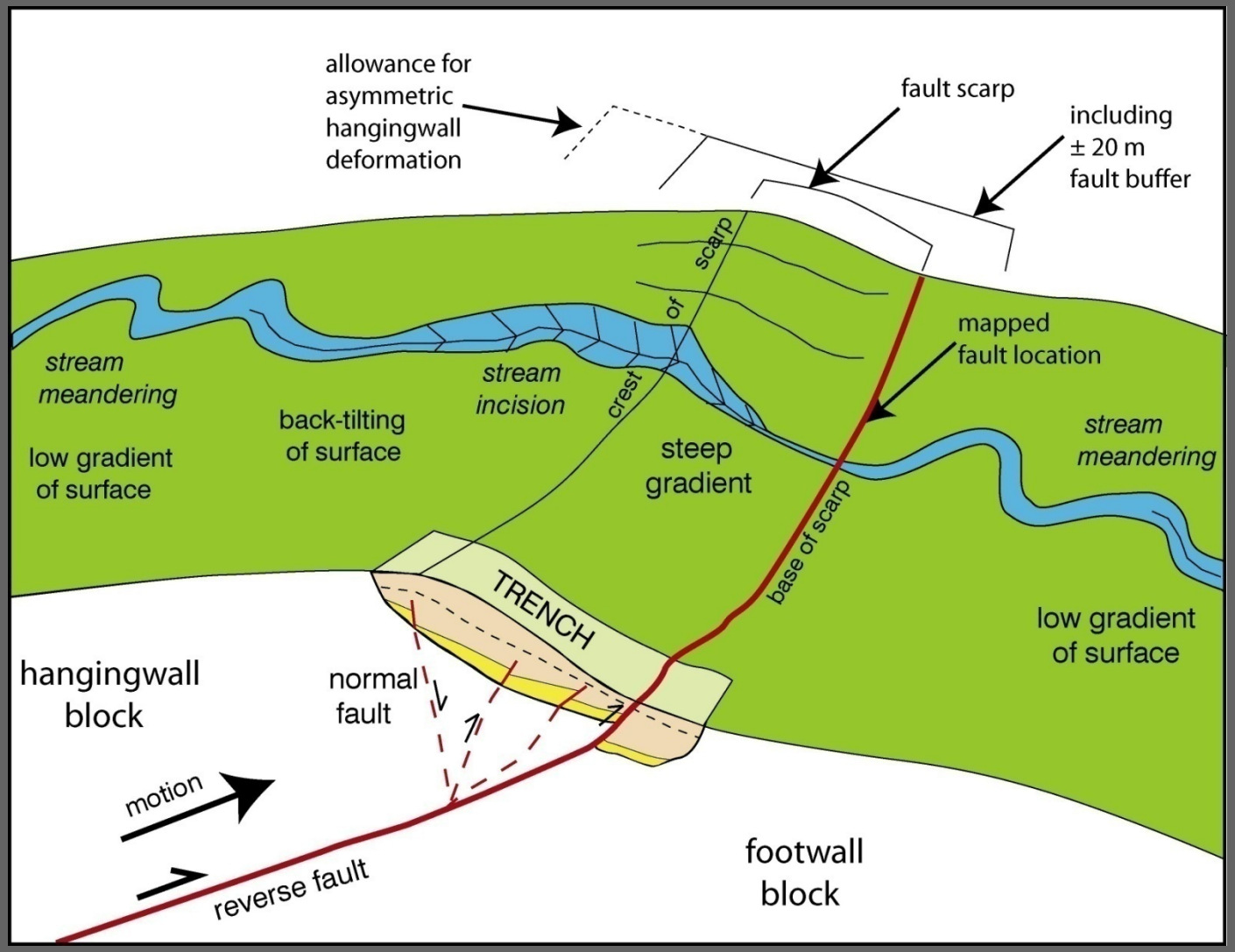


Central Hawke's Bay faults



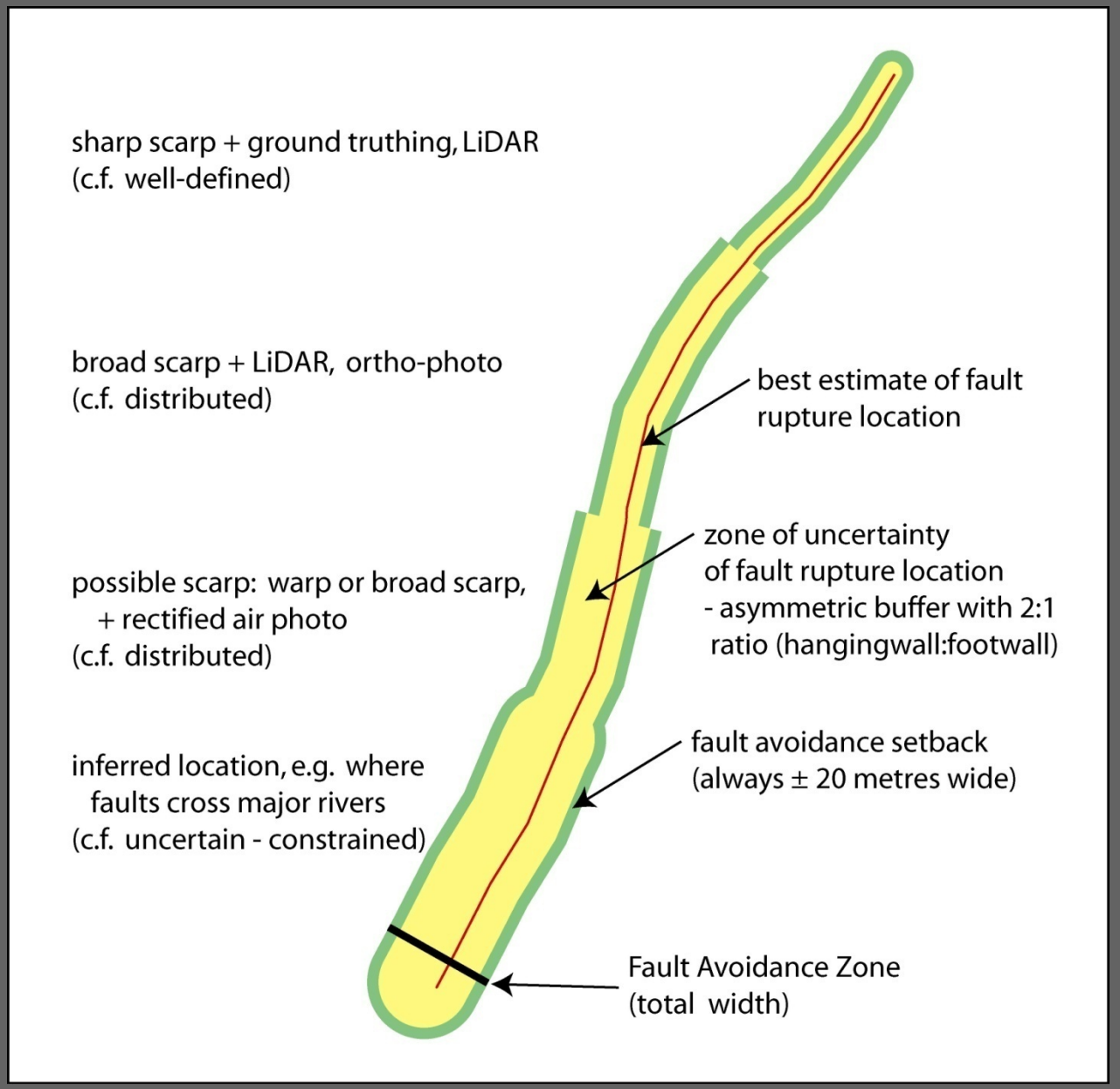
Waipukurau
- reverse faults at low sun-angle

How do we identify reverse faults?

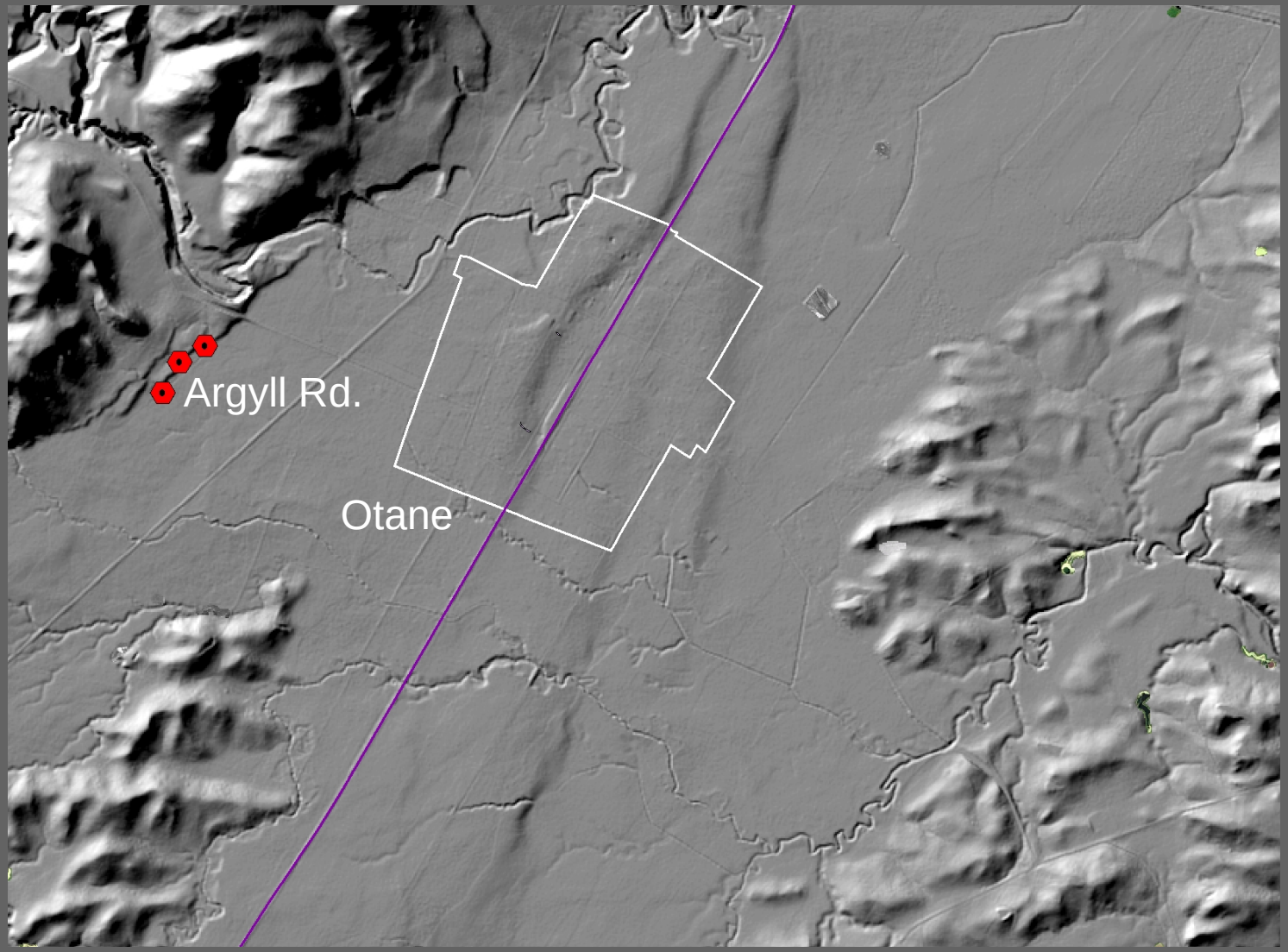


Active Fault Avoidance Zones

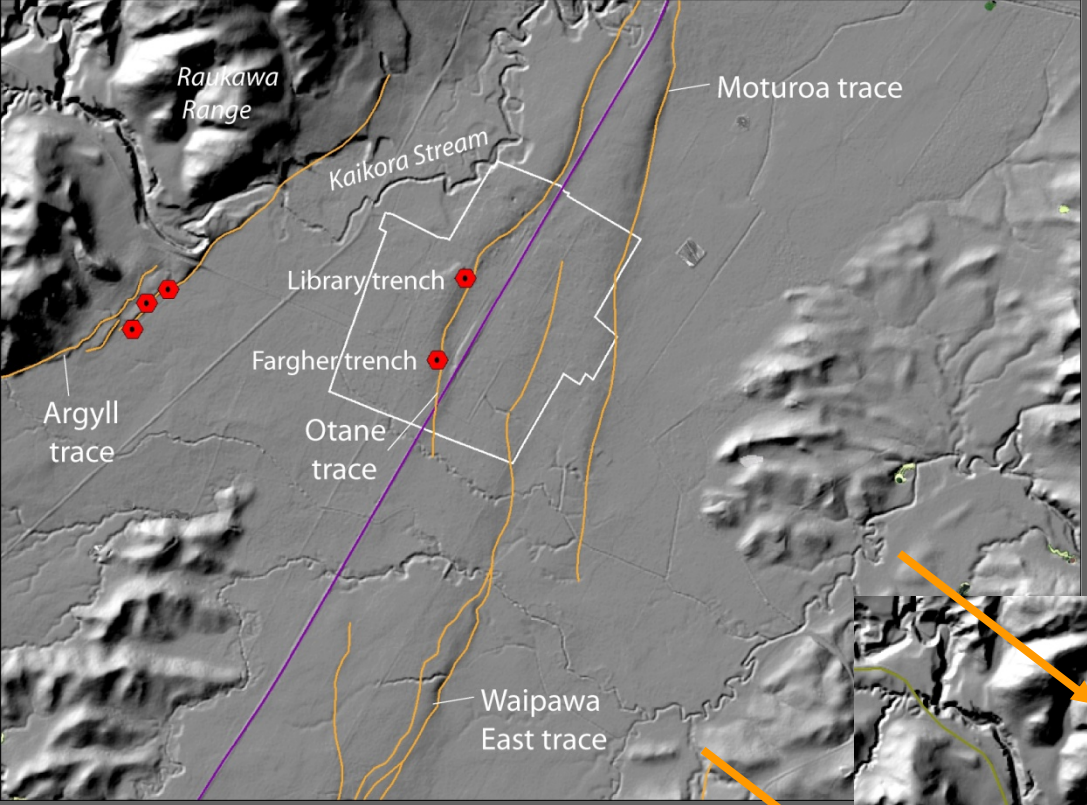
- For reverse faults in Hawke's Bay

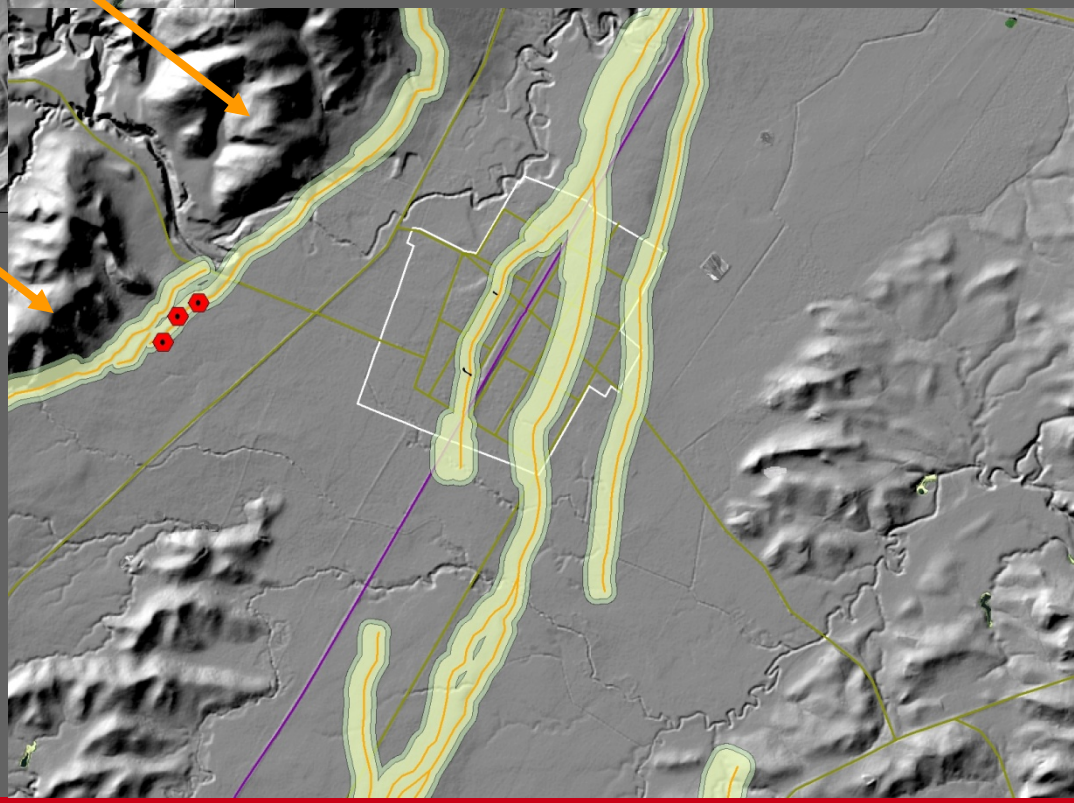


Otane – Raw LiDAR image

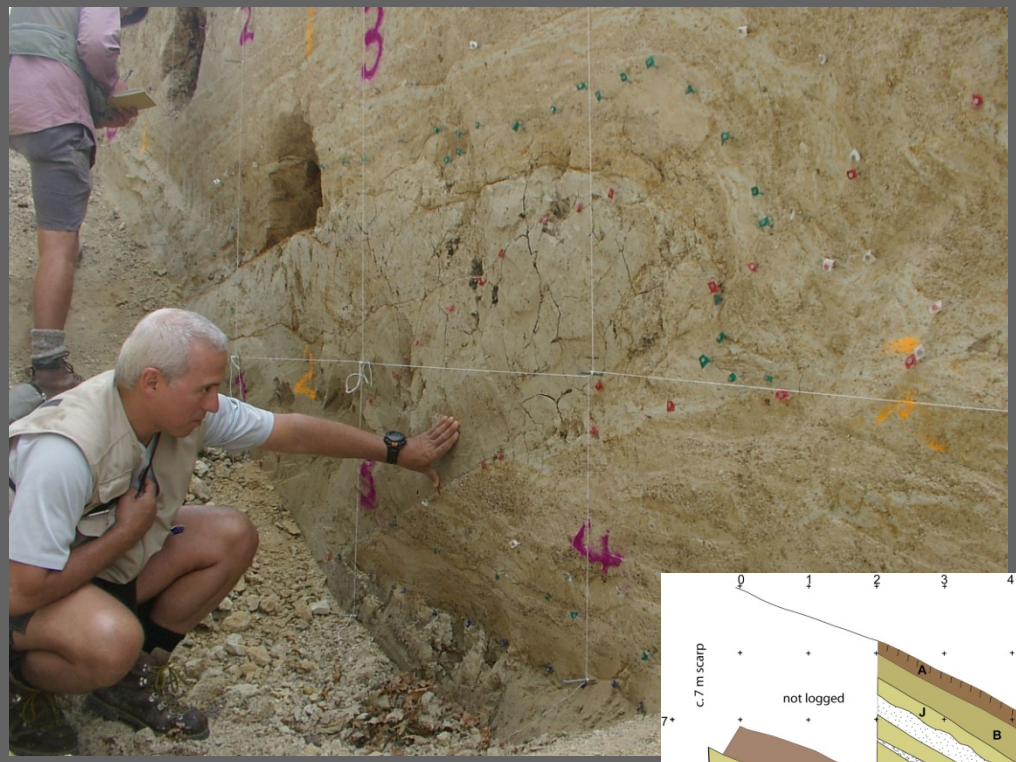


From Raw LiDAR to a Fault trace map to a Fault Avoidance Zone map



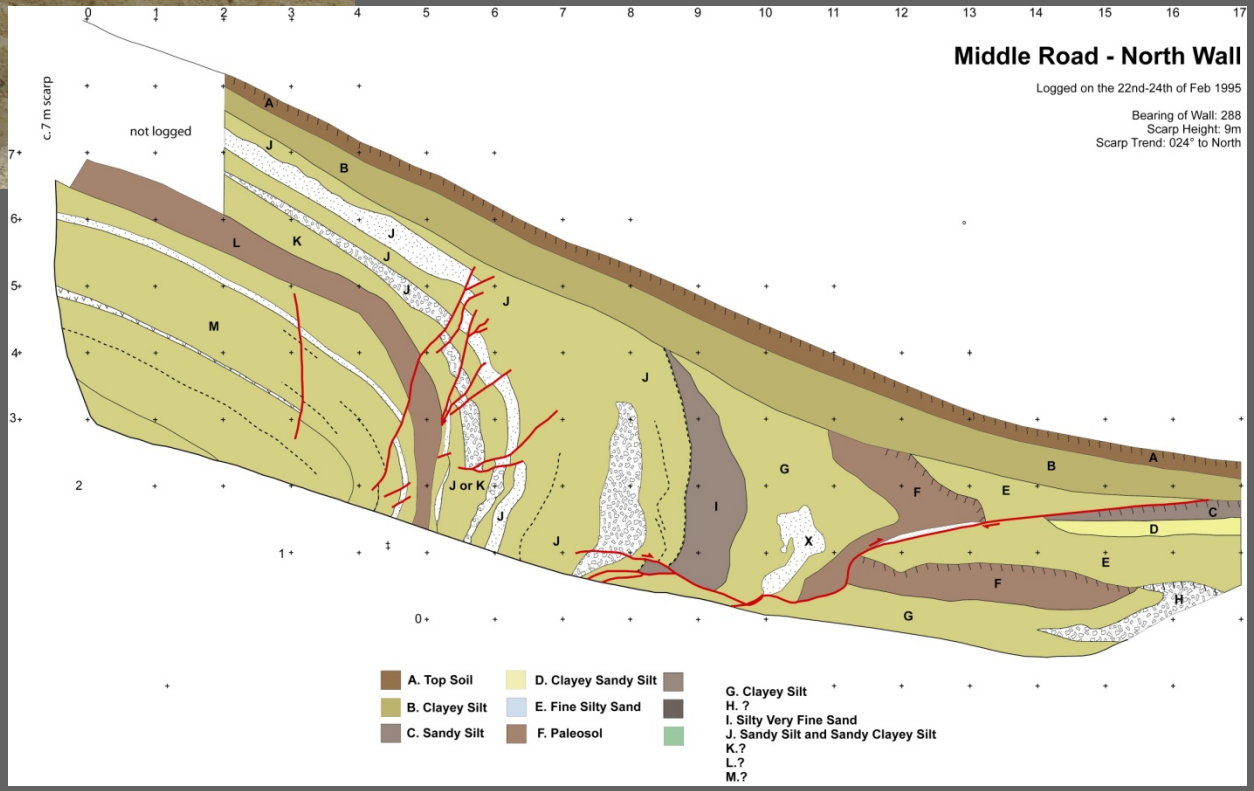


…of course we can trench



Tukituki Thrust Fault
- shallow dip
reverse faulting

Poukawa Fault Zone
- Waipawa Fault



Recurrence Interval Classes

- I – recurrence <2000 yr, e.g. Alpine, Wellington, Mohaka
- II – recurrence 2000-3500 yr, e.g. Ohariu, Ruahine
- III – RI 3500-5000 yr, e.g. Poukawa FZ, Tukituki FZ
- IV – RI 5000-10,000 yr, e.g. Maraetotara faults, Parkhill
- V – RI 10-20,000 yr, e.g. some Otago faults, White Creek
- VI – RI 20-125,000 yr, e.g. virtually inactive by NZ standards

MfE permitting guidelines for Poukawa, Tukituki FZ

POUKAWA*, WAIPUKURAU, or TUKITUKI FAULT ZONES** ***(based on Fault Recurrence Interval Class III, >3500 to ≤5000 years) ***Developed and/or Already Subdivided Sites***					
Building Importance Category	**1**	**2a**	**2b**	**3**	**4**
Fault Complexity	**Resource Consent Category**				
Well Defined	Permitted	Permitted*	Permitted*	*Non-Complying*	Non-Complying
Distributed, & Uncertain - constrained	Permitted	Permitted	Permitted	*Discretionary*	Non-Complying
Greenfield Sites					
Building Importance Category	**1**	**2a**	**2b**	**3**	**4**
Fault Complexity	**Resource Consent Category**				
Well Defined	Permitted	Permitted*	*Non-Complying*	*Non-Complying*	Non-Complying
Distributed, & Uncertain - constrained	Permitted	Permitted	*Discretionary*	*Discretionary*	Non-Complying

Notes:
* Indicates that the Resource Consent Category is permitted, but could be controlled or discretionary given that the fault location is well defined.
Italics: The use of italics indicates that the Resource Consent Category – activity status of these categories is more flexible. For example, where *discretionary* is indicated, *controlled* may be considered more suitable by Council, or vice versa.

Summary

- The MfE Guidelines are there to assist with the management of natural hazards
- In Hawkes Bay many of the faults have been re-mapped at c. 1:10,000 scale or better using LiDAR data made available by Hawkes' Bay Reg. Council
- Fault Avoidance Zones have been assigned to the fault traces
- We apply the MfE Guidelines to problems of land use and planning

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