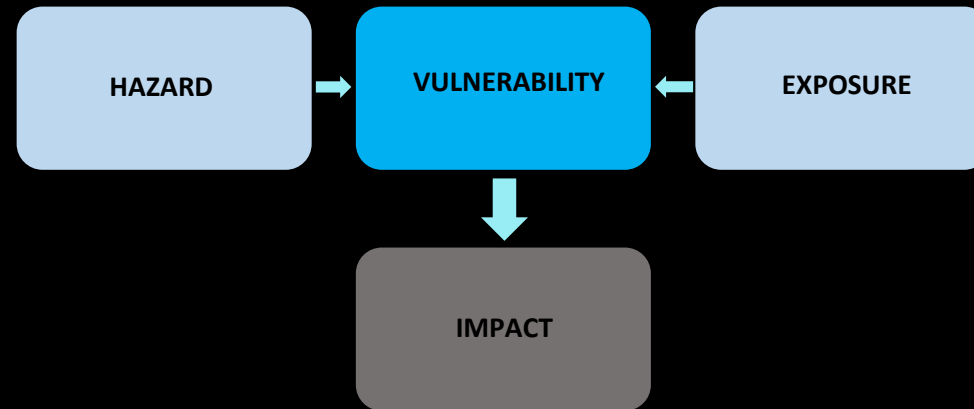


Developing a volcanic multi-hazard impact assessment framework for critical infrastructure and agricultural sectors at Mt Taranaki, NZ

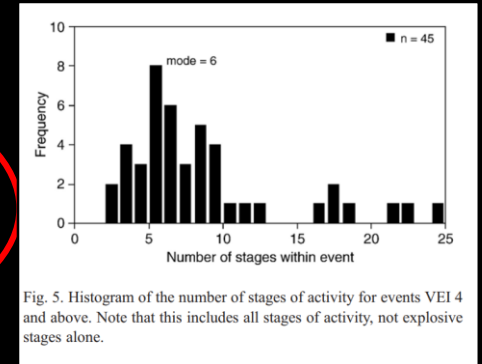
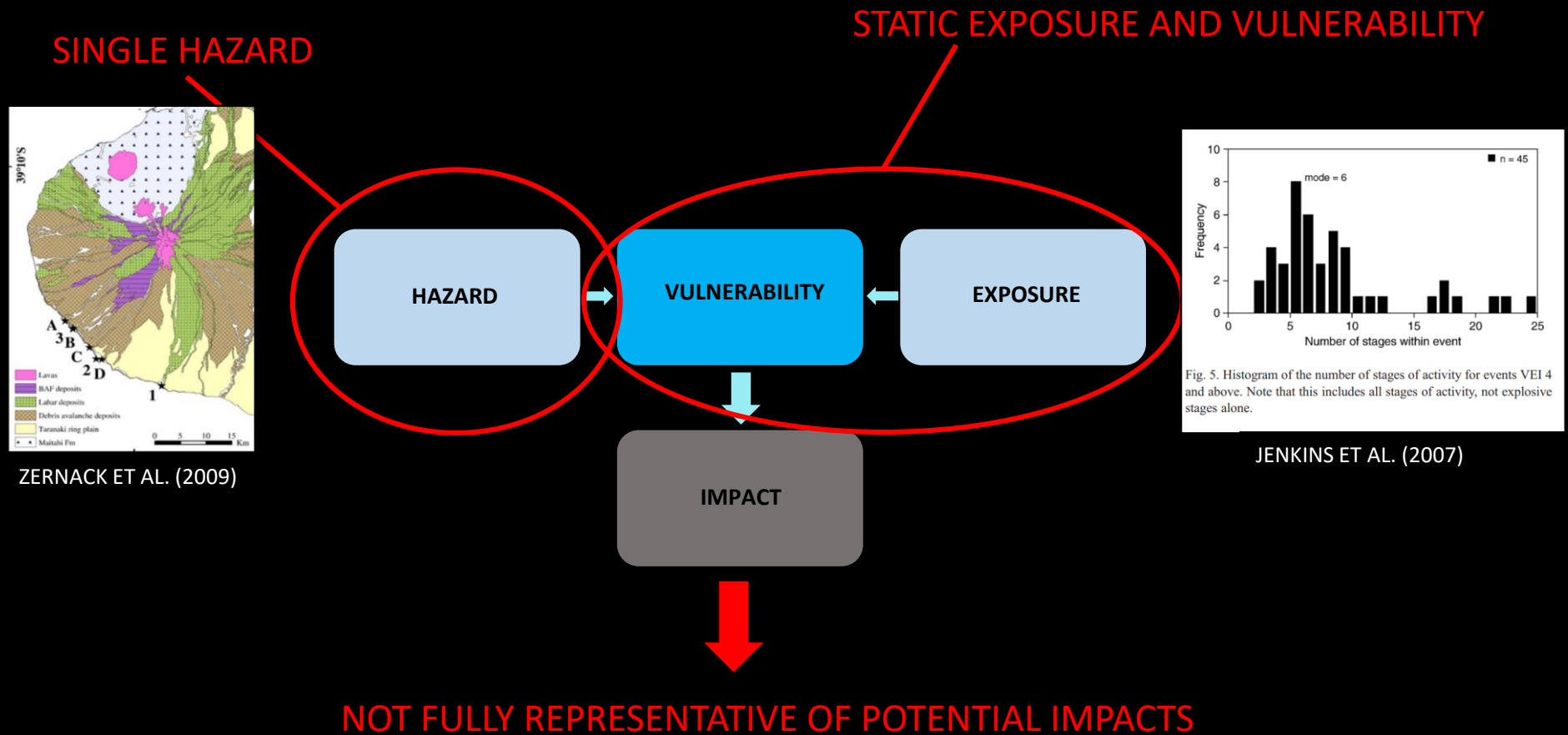
Alana Weir¹, Thomas Wilson¹, Mark Bebbington², Natalia Deligne³, Sarah Beaven¹

¹ University of Canterbury; ² Massey University; ³ GNS Science

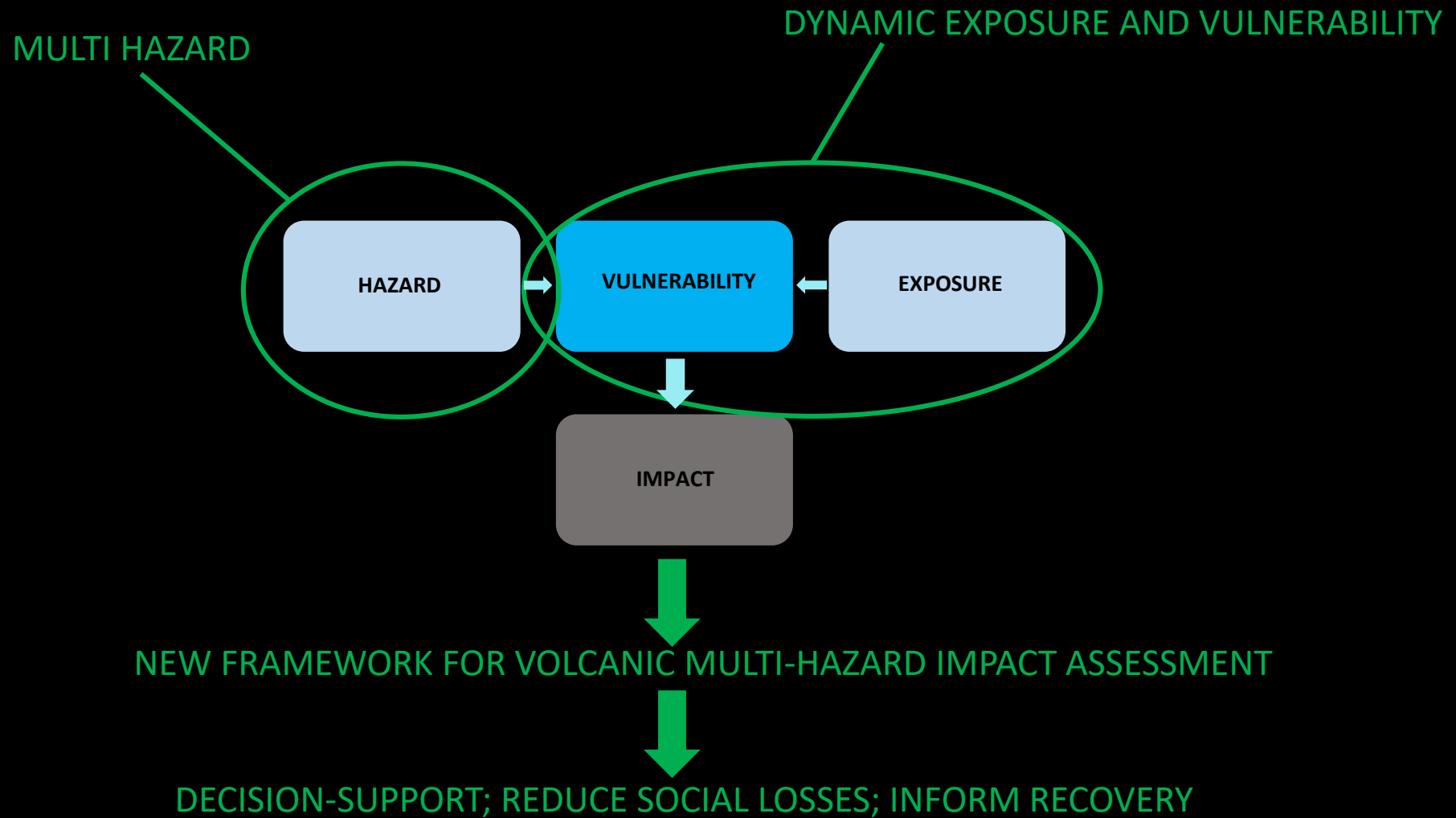
IMPACT ASSESSMENT FRAMEWORK



IMPACT ASSESSMENT FRAMEWORK



IMPACT ASSESSMENT FRAMEWORK

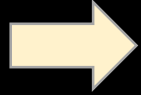
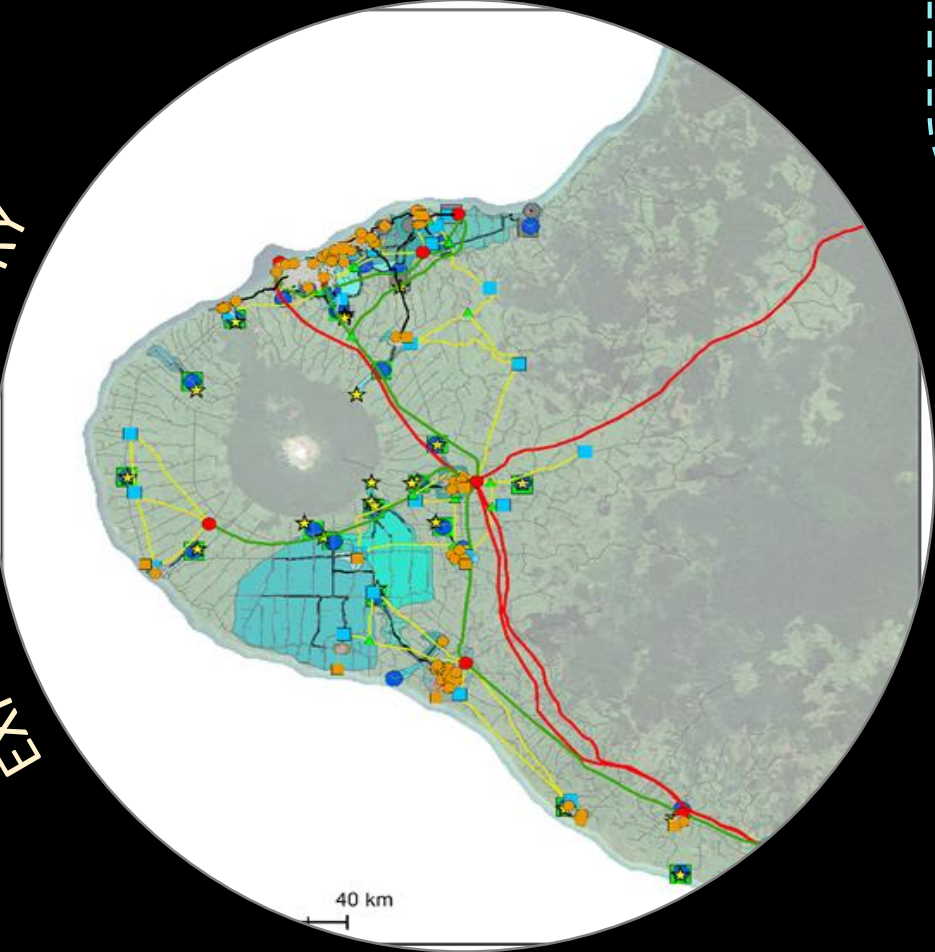


PhD Objectives

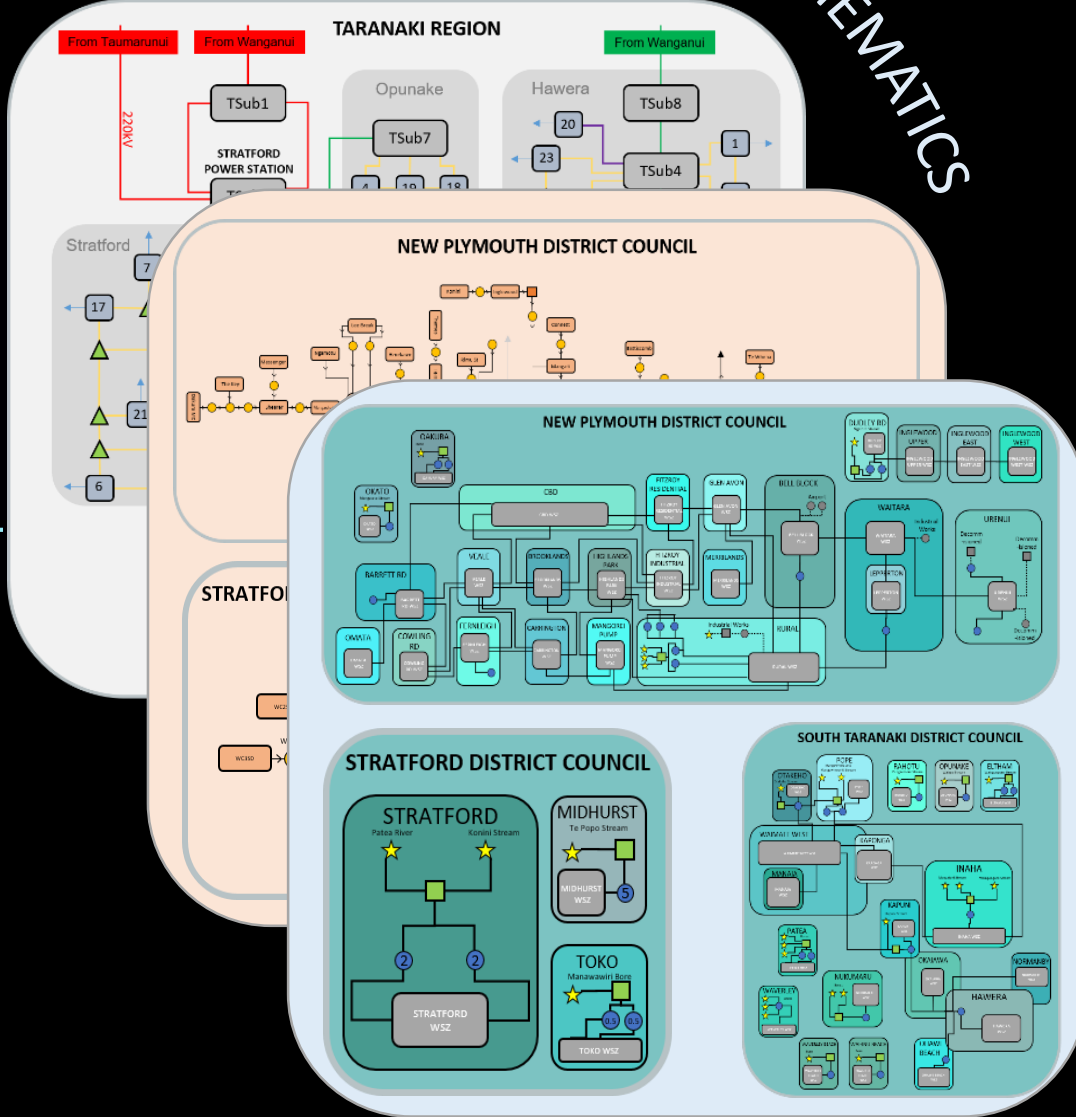
- Develop a methodology to assess **dynamic exposure and vulnerability**, that accounts for the systemic impacts to critical infrastructure and agriculture
- Develop a framework to assess impacts to CI and agriculture from **volcanic multi-hazards**
- Consider the impacts to CI and agriculture from **long-duration, complex** volcanic events
- Suggest soft and hard **mitigation measures** for pre- and syn- eruption
- Develop decision-support tools for **emergency managers and infrastructure managers** in the Taranaki region



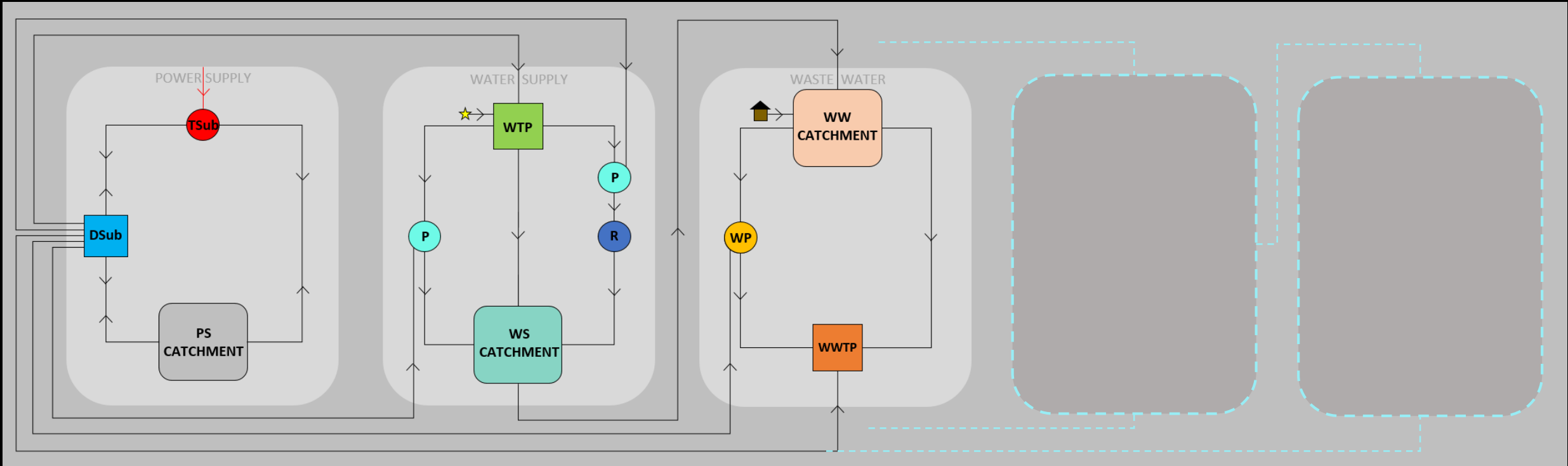
EXPOSURE INVENTORY



SCHEMATICS



INTERDEPENDENCY MAPPING



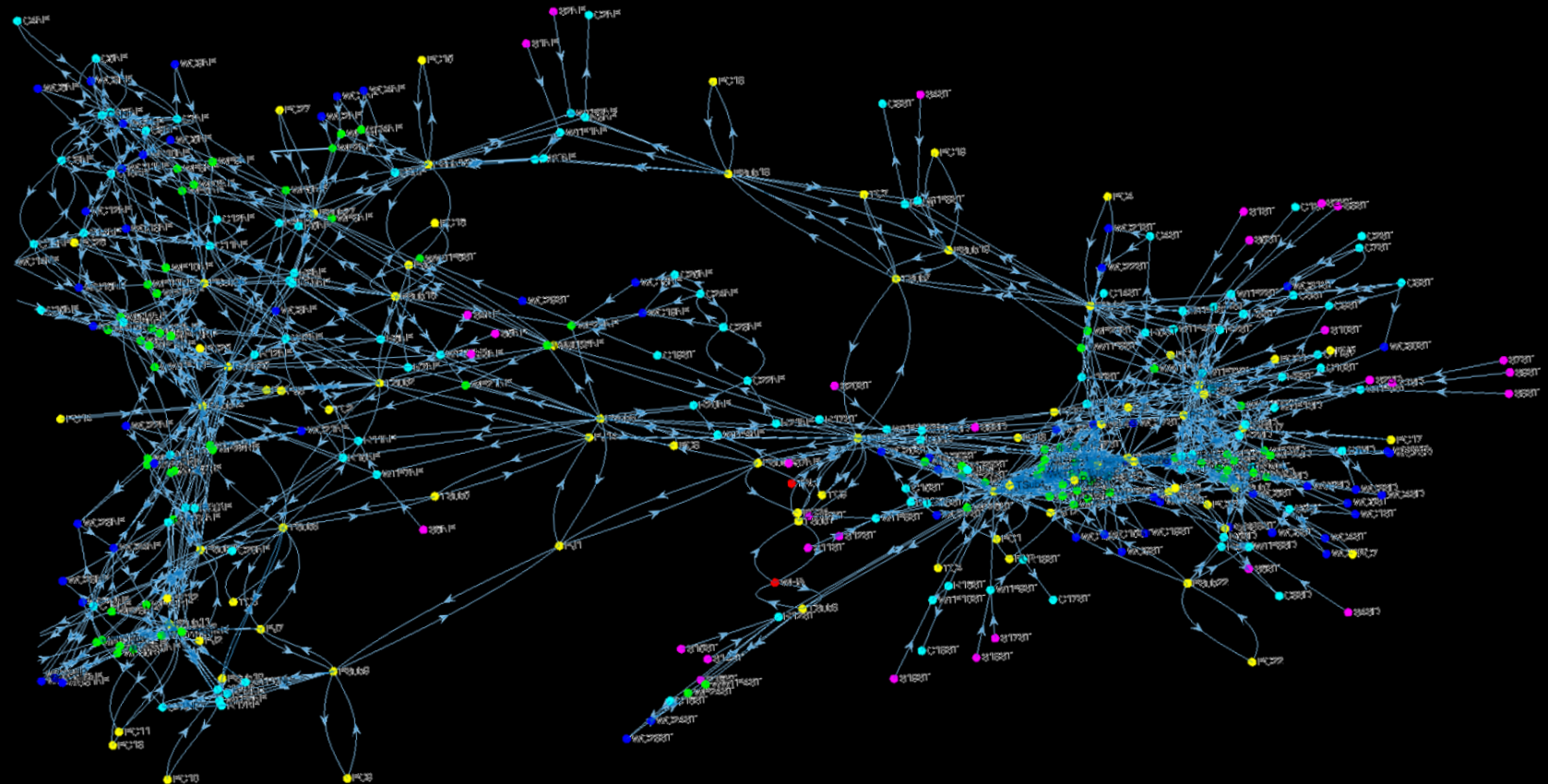
+ non-municipal supply

Nodes	Edges				
S1NP	1	C1SD	73	WC1SD	299
S2NP	2	C1SD	73	WC2SD	300
S3NP	3	C1SD	73	WC3SD	301
S4NP	4	C1SD	73	WC4SD	302
S5NP	5	C5ST	128	WC1ST	309
S6NP	6	C5ST	128	WC2ST	310
S7NP	7	C5ST	128	WC3ST	311
R1NP	8	C5ST	128	WC4ST	312
R2NP	9	C5ST	128	WC5ST	313
R3NP	10	C5ST	128	WC6ST	314
R4NP	11	C12ST	135	WC8ST	316
R5NP	12	C12ST	135	WC17ST	325
R6NP	13	C12ST	135	WC9ST	317
R7NP	14	C12ST	135	WC19ST	327
R8NP	15	C12ST	135	WC15ST	323
R9NP	16	C12ST	135	WC14ST	322
R10NP	17	C12ST	135	WC13ST	321
R11NP	18	C12ST	135	WC10ST	318
R12NP	19	C12ST	135	WC12ST	320
R13NP	20	C12ST	135	WC11ST	319
R14NP	21	C12ST	135	WC7ST	315
R15NP	22	C12ST	135	WC20ST	328
R16NP	23	C13ST	136	WC18ST	326
R17NP	24	C13ST	136	WC16ST	324
R18NP	25	C7ST	130	WC31ST	339
R19NP	26	C8ST	131	WC30ST	338
R20NP	27	C4ST	127	WC21ST	329
R21NP	28	C4ST	127	WC22ST	330
C1NP	29	C15ST	138	WC27ST	335
C2NP	30	C15ST	138	WC26ST	334
C3NP	31	C15ST	138	WC28ST	336
C4NP	32	C15ST	138	WC25ST	333
C5NP	33	C16ST	139	WC23ST	331
C6NP	34	C16ST	139	WC24ST	332
C7NP	35	C19ST	142	WC29ST	337
C8NP	36	C25NP	53	WC18NP	245
C9NP	37	C23NP	51	WC19NP	246
C10NP	38	C24NP	52	WC19NP	246
C11NP	39	C25NP	53	WC19NP	246
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C13NP	41	C1NP	29	WC2NP	229
C14NP	42	C1NP	29	WC3NP	230
C15NP	43	C1NP	29	WC4NP	231
C16NP	44	C3NP	31	WC6NP	233
C17NP	45	C3NP	31	WC7NP	234
C18NP	46	C3NP	31	WC8NP	235
C19NP	47	C7NP	35	WC9NP	236

W-S
W-W

OUTAGE MODELLING

- + TRANSPORT
- + TELECOMMS
- + OIL / GAS
- + CRITICAL FACILITIES

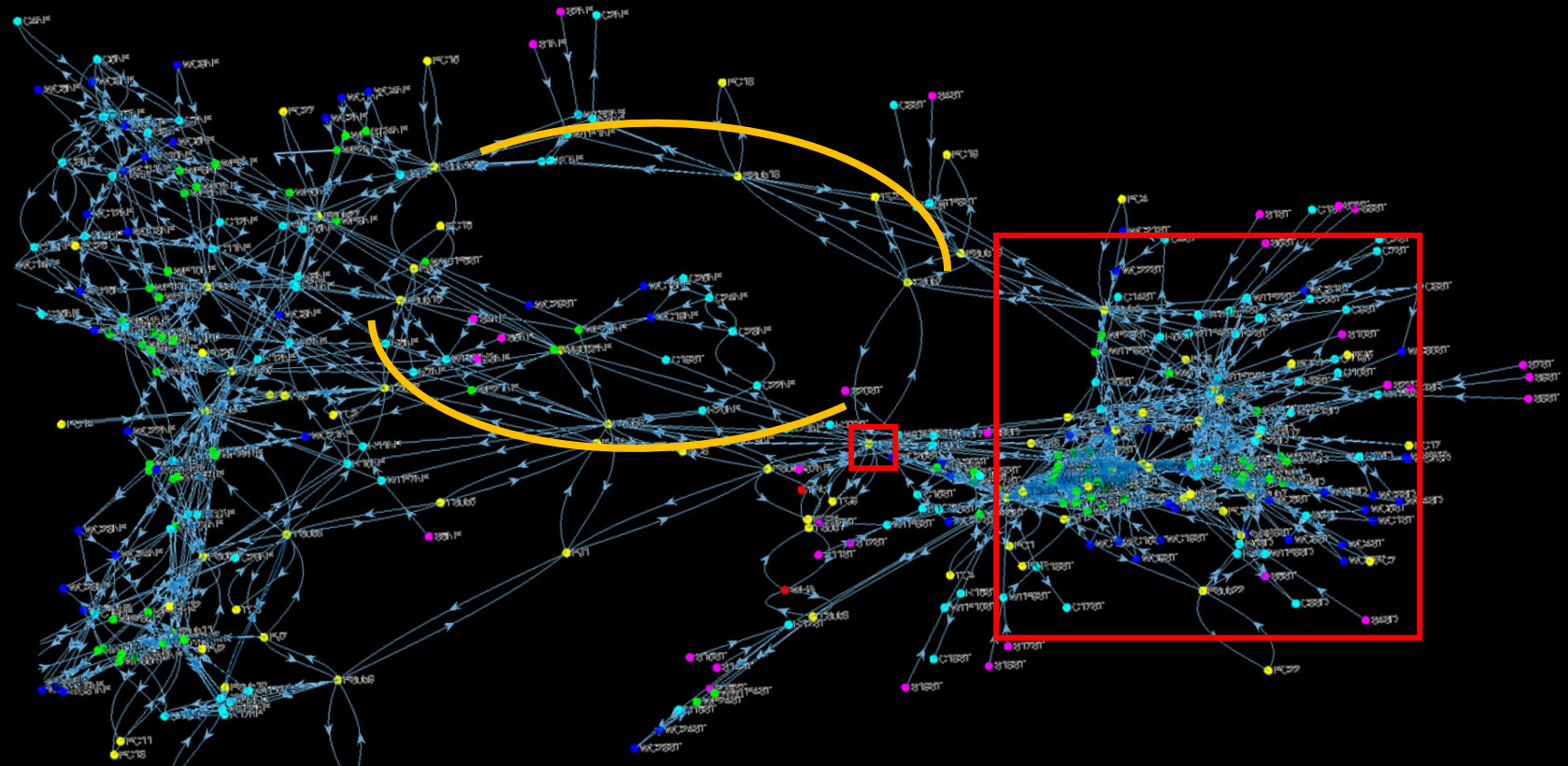


Nodes	Edges				
S1NP	1	C1SD	73	WC1SD	299
S2NP	2	C1SD	73	WC2SD	300
S3NP	3	C1SD	73	WC3SD	301
S4NP	4	C1SD	73	WC4SD	302
S5NP	5	C5ST	128	WC1ST	309
S6NP	6	C5ST	128	WC2ST	310
S7NP	7	C5ST	128	WC3ST	311
R1NP	8	C5ST	128	WC4ST	312
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R14NP	21	C12ST	135	WC7ST	315
R15NP	22	C12ST	135	WC20ST	328
R16NP	23	C13ST	136	WC18ST	326
R17NP	24	C13ST	136	WC16ST	324
R18NP	25	C7ST	130	WC31ST	339
R19NP	26	C8ST	131	WC30ST	338
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C15NP	43	C1NP	29	WC4NP	231
C16NP	44	C3NP	31	WC6NP	233
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C19NP	47	C7NP	35	WC9NP	236

WWS - WWW

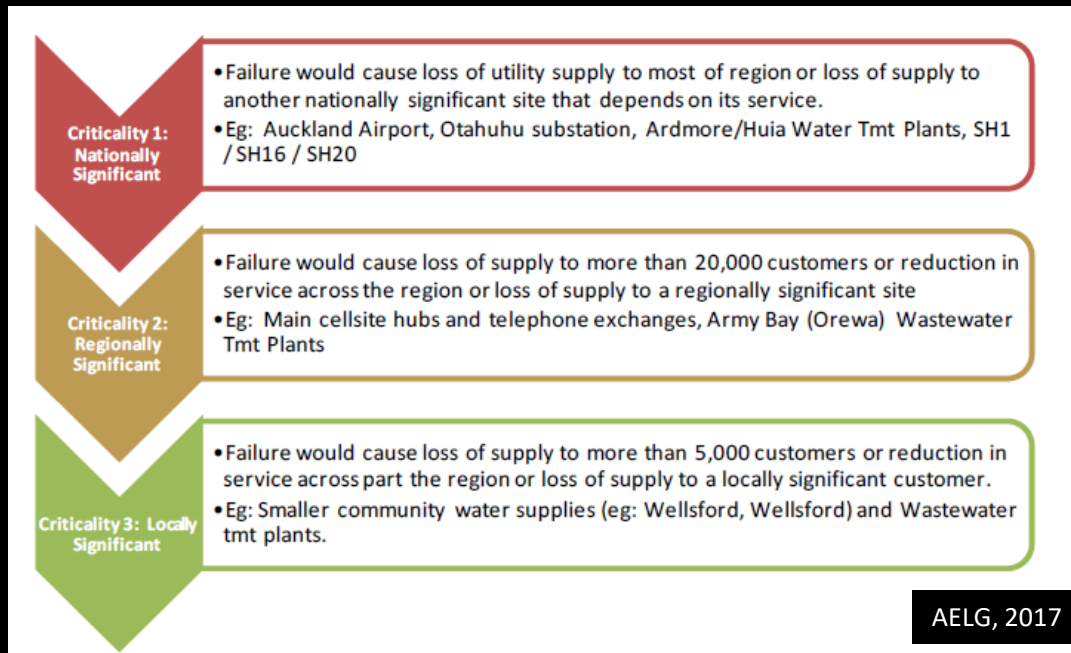
OUTAGE MODELLING

- + TRANSPORT
- + TELECOMMS
- + OIL / GAS
- + CRITICAL FACILITIES



CRITICALITY

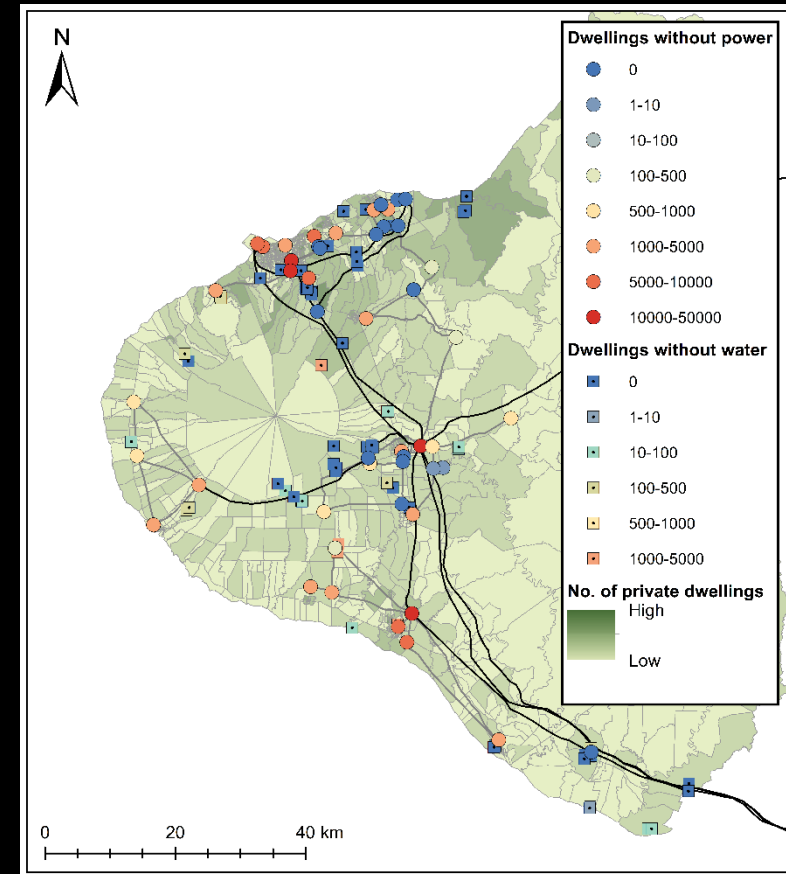
CURRENT METHODOLOGY



- Does not account for interdependencies
- Relies on qualitative estimations of downstream outages

NEW METHODOLOGY

- + TRANSPORT
- + TELECOMMS
- + OIL / GAS
- + CRITICAL FACILITIES

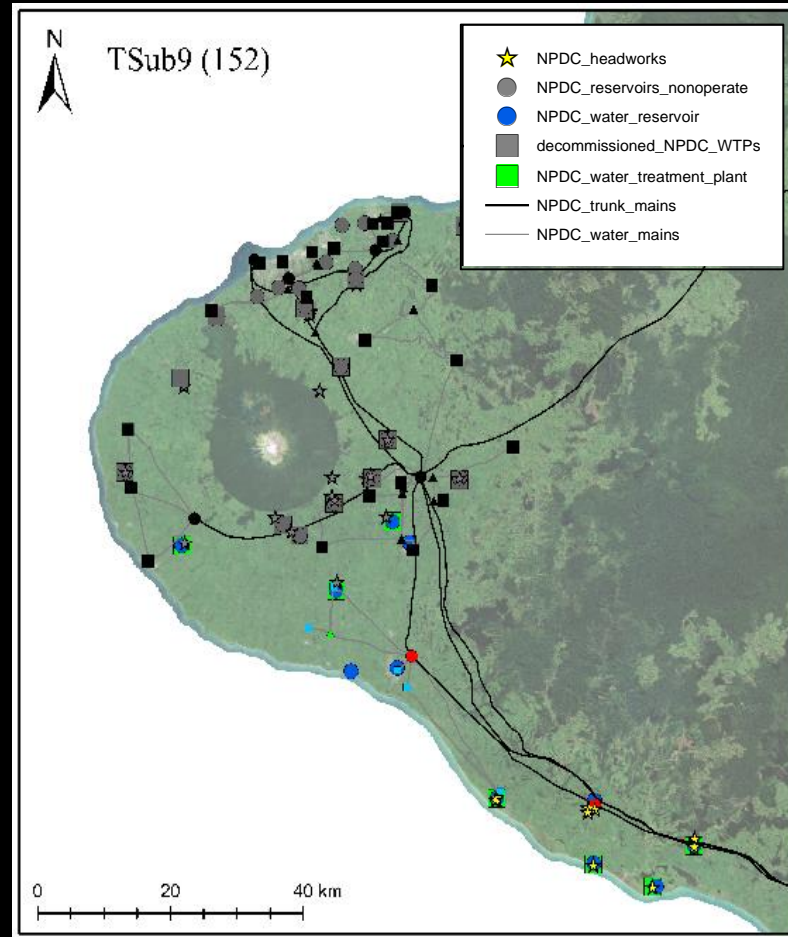


MITIGATION MEASURES

Nodes	Edges				
S1NP	1	XXXX	XX	XXXX	XX
S2NP	2	XXXX	XX	XXXX	XX
S3NP	3	XXXX	XX	XXXX	XX
S4NP	4	XXXX	XX	XXXX	XX
S5NP	5	XXXX	XX	XXXX	XX
S6NP	6	C5ST	128	WC2ST	310
S7NP	7	C5ST	128	WC3ST	311
R1NP	8	C5ST	128	WC4ST	312
R2NP	9	C5ST	128	WC5ST	313
R3NP	10	C5ST	128	WC6ST	314
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R18NP	25	C7ST	130	WC31ST	339
R19NP	26	C8ST	131	WC30ST	338
R20NP	27	C4ST	127	WC21ST	329
R21NP	28	C4ST	127	WC22ST	330
C1NP	29	C15ST	138	WC27ST	335
C2NP	30	C15ST	138	WC26ST	334
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C19NP	47	C3NP	31	WC9NP	236

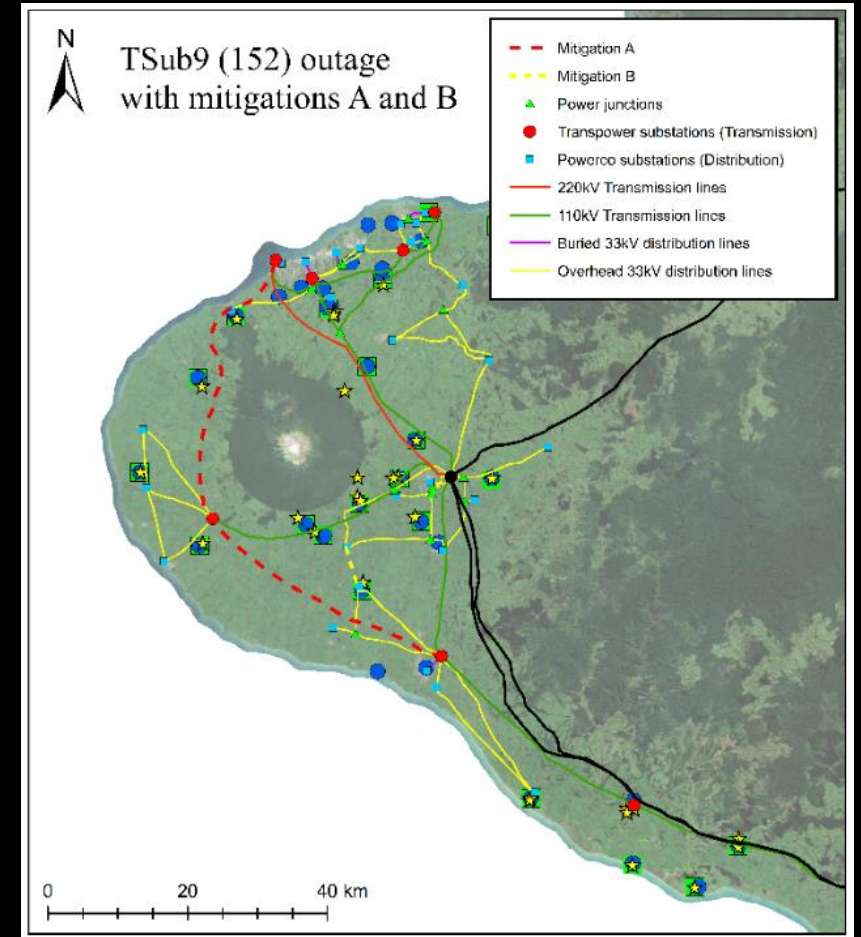
WS - WW

STRATFORD POWER PLANT OUTAGE
NO MITIGATION



50,030 private dwelling without power
28,310 private dwellings without water

STRATFORD POWER PLANT OUTAGE
+ MITIGATION A and B

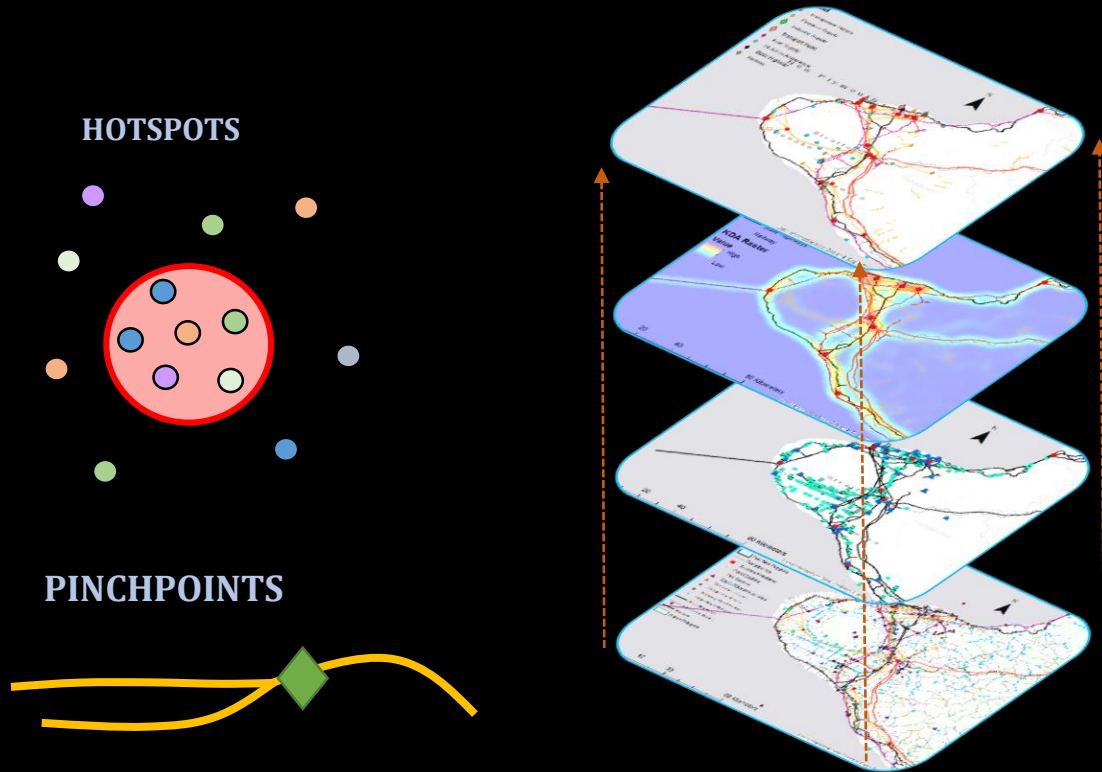


0 private dwelling without power
0 private dwellings without water

SYSTEMIC VULNERABILITY

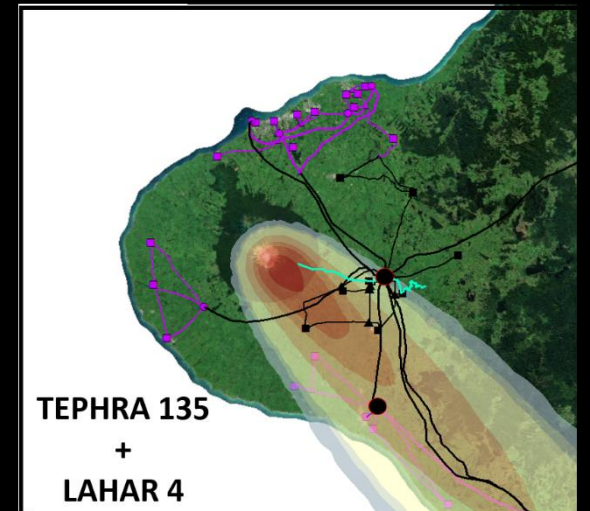
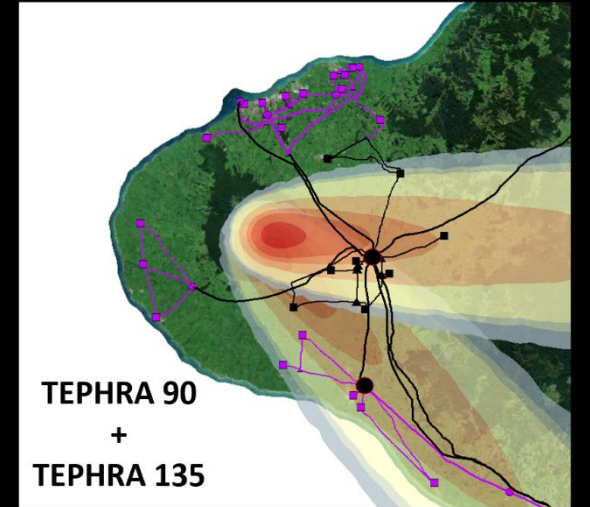
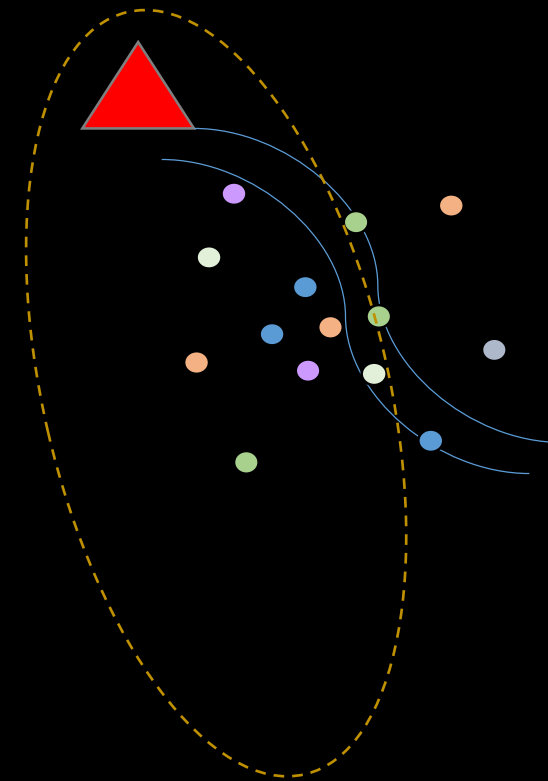
+ MORE HAZARDS
+ MORE LIFELINES

CURRENT METHODOLOGY

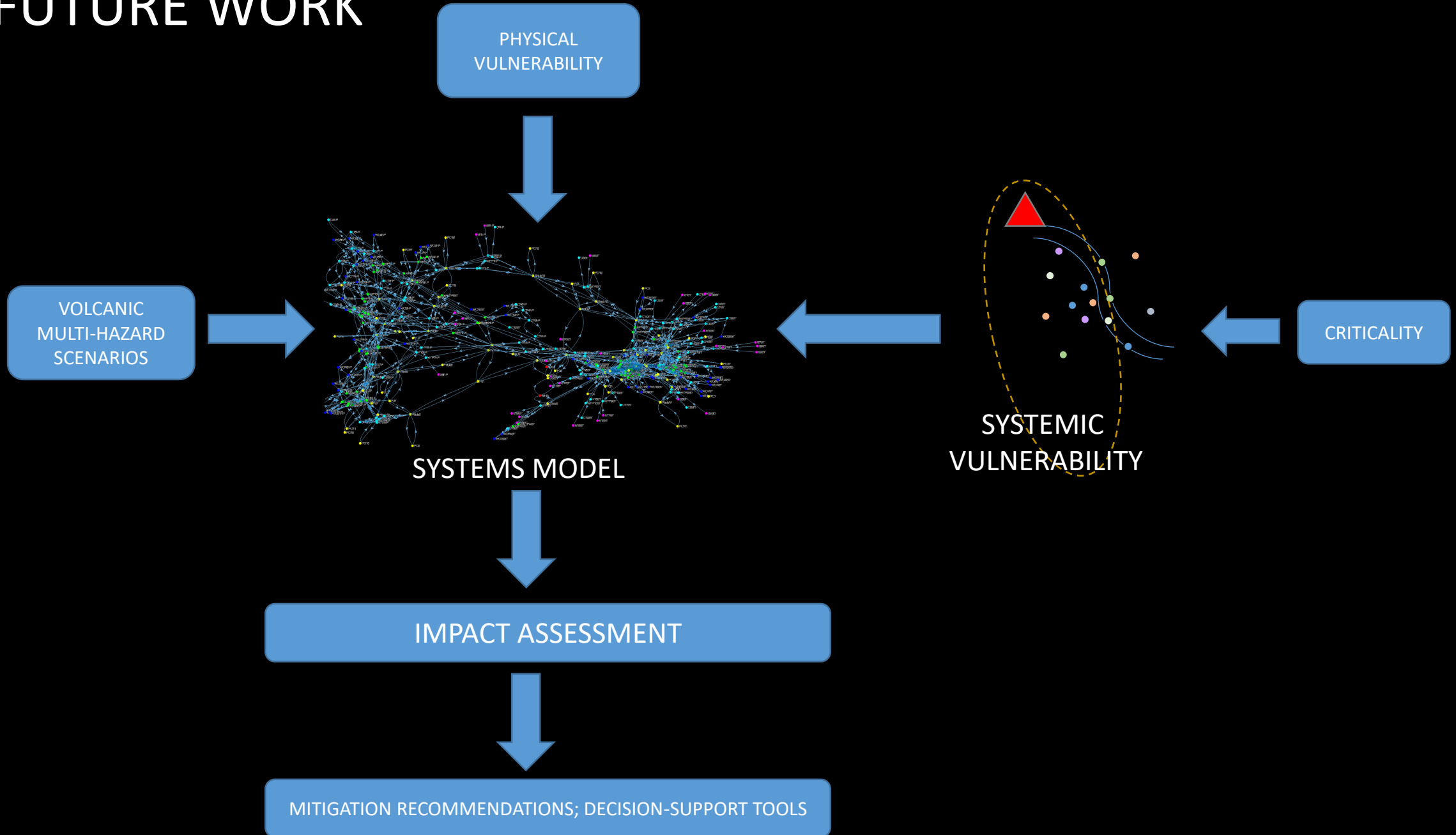


- Is hazard independent, and therefore assumes 'point locality perturbation'
- Not representative of volcanic multi-hazard spatial extent

NEW METHODOLOGY



FUTURE WORK



Thanks!

alana.weir@pg.canterbury.ac.nz

Expected submission: Sept 2020



WANGANUIVALUER, 2019

Auckland Lifelines Group. (2015). Auckland's Infrastructure Hotspots;
Jenkins SF, Magill CR, McAneney KJ (2007) Multi-stage volcanic events: A statistical investigation. J Volcanol Geotherm Res 161:275–288. doi: 10.1016/j.jvolgeores.2006.12.005;
Zernack A V, Procter JN, Cronin SJ (2009) Sedimentary signatures of cyclic growth and destruction of stratovolcanoes: A case study from Mt. Taranaki, New Zealand. Sediment Geol 220:288–305;
<http://www.wanganuivaluer.co.nz/>;
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