

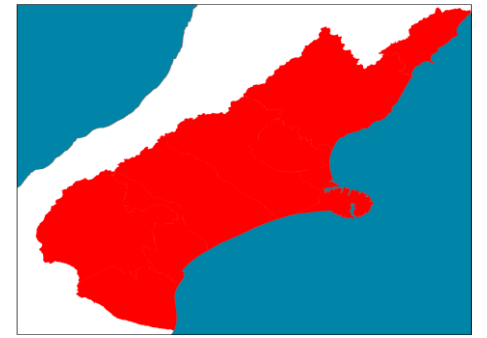
Canterbury Lifeline Utilities Group

Infrastructure Research Day – Canterbury Update

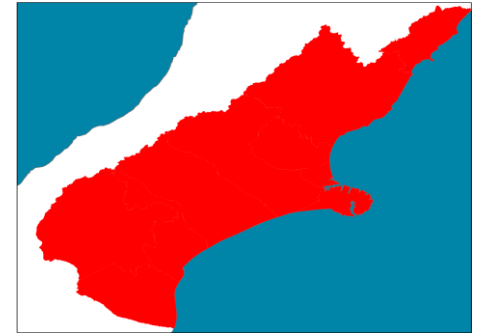
30 June 2021

Mark Gordon
Canterbury Lifelines Group Project Manager

LUC team in the EOC



Risks and Resilience



Emergency Management Canterbury

DRAFT CANTERBURY LIFELINE UTILITIES DRAFT GROUP

Risks and Resilience:

Phase 1 - Lifelines Vulnerability Assessment

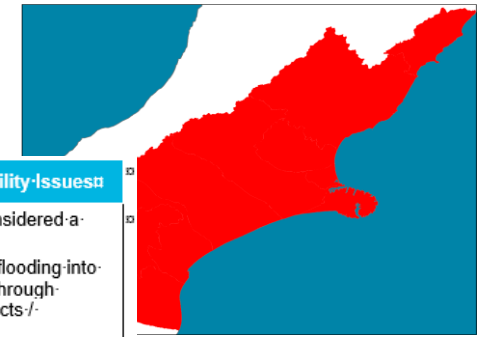
Canterbury Civil Defence Emergency Management Group

An aerial photograph showing a rugged coastline. A large, steep, rocky cliffside dominates the right side of the frame, meeting a sandy beach and a rocky shore. The ocean is a vibrant blue, with white waves crashing against the rocks. In the distance, more land and mountains are visible under a clear sky.

Outline Contents List

1. Summary
2. Introduction
3. Lifelines Sectors – national/regional/local
4. Lifelines Interdependencies
5. “Hotspots” and “Pinchpoints”
6. Important Community Sites
7. Description of the Hazards
8. Infrastructure Vulnerability to Hazards
9. Resilience Gap Analysis
10. Building Resilience
11. Next Steps

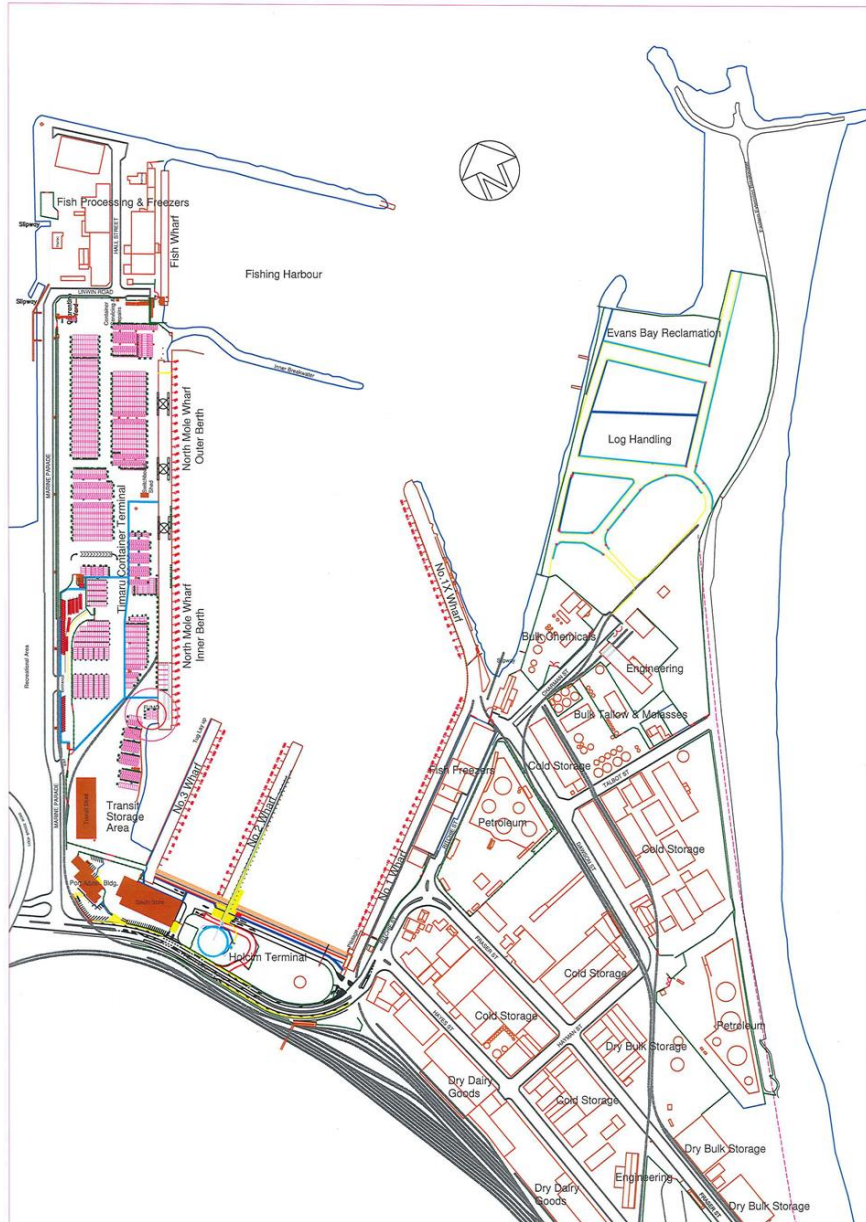
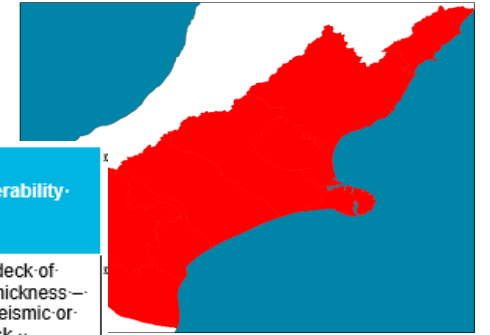
Vulnerabilities of Electricity Generation Assets – Example



Asset/- Site ^α	Gen· MW ^α	Criticality ^α	Summary ^α	Key-Vulnerability-Issues ^α
GENESIS- ^α				
Lake-Tekapo-Outlet-Control-Structure ^α	NA ^α	National ^α	Built-in-the-1950s-this-concrete-dam-and-gate-structure-controls-water-levels-in-Lake-Tekapo. ^α	Potential-seismic-(e.g.-Irishman-Creek-fault)-and-lake-seiche-vulnerability.-Has-3-4m-overflow-protection-above-highest-lake-level.-Currently-in-early-stages-of-investment-in-protection-measures,-including-rip-rap-for-high-flow-rates-into-canal. ^α
Tekapo-A-Power-station-intake ^α	NA ^α	National ^α	Intake-comprises-structure,-tunnel,-surge-chamber-and-head-gate.-Complex-interaction-between-lake-outlet-and-this-structure. ^α	Seismic-vulnerability--2019-completing-new-gate-structure-at-the-lake-intake-to-mitigate ^α
Tekapo-A-Power-Station ^α	27-MW ^α	National ^α	Power-station-comprises-building,-turbines,-separate-spill-structure-to-Tekapo-River,-and-connection-to-Transpower-grid.¶ Note-that-Tekapo-A-can-only-operate-if-Tekapo-B-is-also-operational. ^α	Good-seismic-resilience.¶ Heavy-snow-can-be-an-issue-for-access--2012-event-1.5m-snow-depth-compromised-access-for-5-days,-similar-in-2006.-Station-continues-to-generate-however. ^α
Canal--Lake-Tekapo-to-Tekapo-B-(at-Lake-Pukaki) ^α	NA ^α	National ^α	Open-canal,-partly-in-cut-and-partly-elevated-above-natural-ground.-¶ Note-presence-of-several-bridges-(including-SH-8)-and-salmon-farm. ^α	Bridges-(inc)-on-SH-8)-have-been-strengthened-for-AF8-EQ-event.¶ Managed-under-dam-safety-requirements--Potential-Impact-Categories-(PIC)-have-been-mapped-based-on-canal-breakout-scenarios-and-impacts-on-people-and-other-assets.¶ Vulnerable-reaches-have-been-lined-with-PVC-overlay-to-mitigate-cracking-/rupturing-effects.¶ Worst-case-scenarios-are-mapped-in-Council-documents-as-potential-inundation-zones. ^α

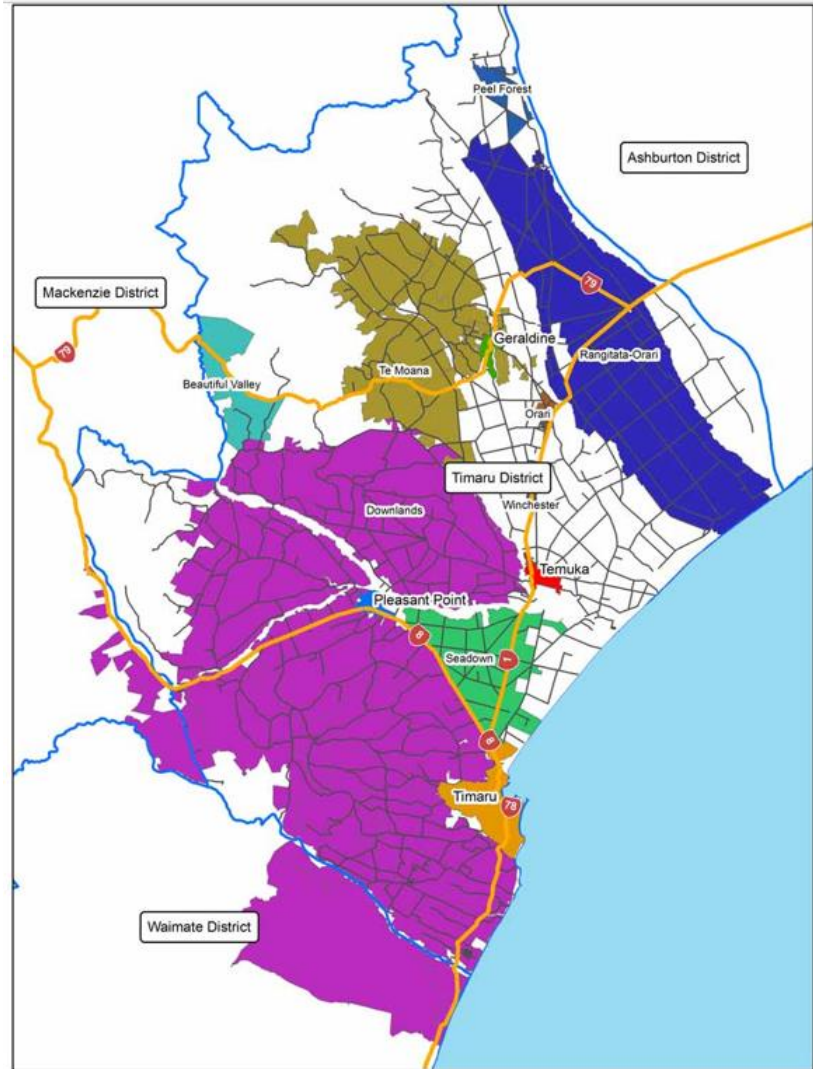
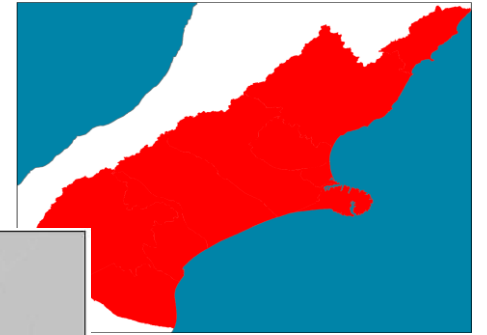
Asset/- Site ^α	Gen· MW ^α	Criticality ^α	Summary ^α	Key-Vulnerability-Issues ^α
Tekapo-B-Power-Station¶ (adjacent-to-Lake-Pukaki-into-which-it-spills) ^α	160-MW ^α	National ^α	Power-station-comprises-intake,-steel-penstocks,-powerhouse-structure-built-on-the-lake-floor,-turbines,-and-overhead-cables-connecting-to-Transpower-grid. ^α	Seiche-not-considered-a-threat.¶ Potential-lake-flooding-into-power-house-through-ventilation-/ducts-/windows.¶ Wind-not-considered-an-issue-for-overhead-cables.¶ Penstocks-have-not-yet-been-evaluated-(ACTION?) ^α
MERIDIAN ^α				
Twizel-Control-Centre ^α	NA ^α	National ^α	Located-beside-SH-8-near-Twizel.-1980s-building-previously-used-as-Meridian-offices. ^α	Access-due-to-heavy-snow. ^α
Lake-Pukaki-Outlet-Control-Structure-(Gates-18,19) ^α	NA ^α	National ^α	Gate-18-is-the-only-outlet-from-Lake-Pukaki-to-the-canal,-and-is-essential-to-Qhau-system-generation.¶ Gate-18-has-three-independent-gates.¶ Gate-19-is-a-separate-spill-gate. ^α	Gate-18-has-high-PIC-rating,-it-has-been-evaluated-and-considered-satisfactory. ^α
Lake-Pukaki-Outlet-(Dam) ^α	NA ^α	National ^α	Earth-dam.-Various-technical-reports,-confirm-constructed-as-per-drawings. ^α	Considered-robust ^α
Pukaki-DSF???? ^α	^α	^α	^α	^α
Canal--Lake-Pukaki-to-Qhau-A-Power-Station ^α	NA ^α	National ^α	Open-canal,-partly-in-cut-and-partly-elevated-above-natural-ground.-¶ Note-presence-of-two-bridges-including-SH-8 ^α	As-for-Tekapo-Canal-above.¶ Potential-vulnerability-to-Ostler-EQ-fault--elevated-canal-rupture-and-loss-of-Qhau-system-generation-(approx.-690MW)--high-PIC-rating.- ^α
Lake-Qhau-Outlet-Control-Structure¶ (Gate-20??) ^α	NA ^α	National ^α	Concrete-structure-to-control-lake-level-and-amount-of-water-entering-canal-system ^α	Considered-robust ^α
Canal--Lake-Qhau-to-confluence-with-Pukaki/Benmore-Canal ^α	NA ^α	National ^α	Open-canal,-partly-in-cut-and-partly-elevated-above-natural-ground.-¶ Note-Salmon-farm-at-confluence-point. ^α	As-for-Tekapo-Canal-above.¶ Potential-vulnerability-to-Ostler-EQ-fault--elevated-canal-rupture-and-loss-of-Qhau-system-generation-(approx.-690MW)--high-PIC-rating ^α

Prime Port Timaru - Example

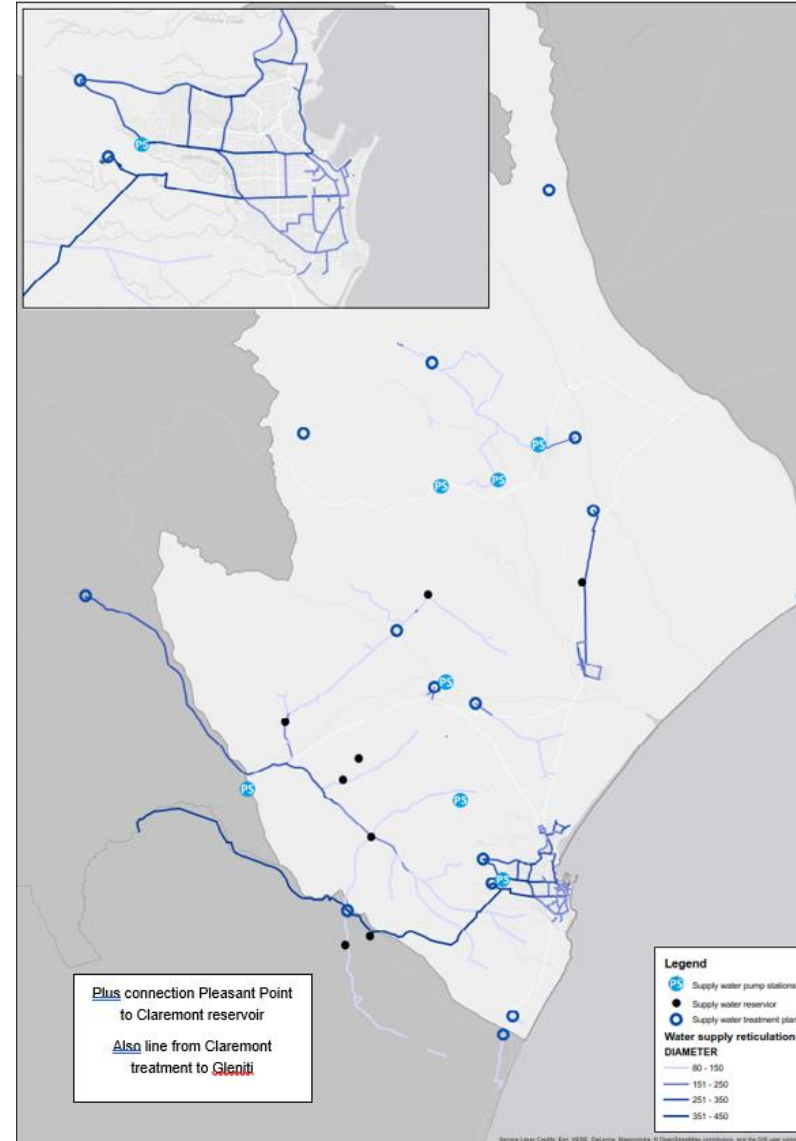
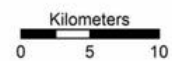


Facility#	Length Depth-at- CD Max-Vessel- LOA#	Description#	Key-Vulnerability- Issues#
No. 1- Extension- Wharf#	215m# 10m# 200m#	Timber-built wharf with a reinforced concrete deck on timber piles, constructed on the inside of a concrete-block breakwater. The wharf is equipped for handling oil, tallow, acids, palm oil, molasses and logs. The wharf is also used for discharging bulk dry products. Includes major fuel lines along the back of the wharf, bunker point for incoming ships, and it is used by trucks.	Concrete deck of marginal thickness – potential seismic or tsunami risk. Vulnerable to “punching” failure. Petroleum pipework vulnerable.
No. 1- Wharf# East# #	270m# 9.9m# 100m#	Timber-built wharf with a reinforced concrete deck. Block retaining wall under deck, considered stable. Fill materials used littoral drift gravels. This is a general-purpose wharf and is used by the fishing industry, general cargo, vessel layup and cruise ships.	Wharf could “pull away” from the hardstand area under seismic or tsunami-type load – inspections and repair regime in place.
No. 1- Wharf# West#	270m# 9.9m# 200m#	Adjacent to No. 1 East is a fishing industry owned and operated cool store. Wharf has had recent (2019) extensive re-beaming works to improve structural capacity. Includes 2 bunker points for fuel. Fuel lines for smaller vessels run along the wharf – approx. 40-50m of 150mm dia.	Fuel lines vulnerable to breakage – stop valve exists.
No. 2- Wharf# North# #	200m# 10.3m# 180m#	A heavy-duty concrete and steel finger wharf constructed in 2015 for priority discharge of international cement bulk carriers and loading of coastal cement vessels (currently operated by Holcim New Zealand Limited). Good seismic design.	Considered robust but expect possible concrete spalling in major earthquake.
No. 2- Wharf# South#	200m# 8.3m# 180m#	The North Berth is used for unloading bulk carriers and the South Berth is used for loading coastal cement vessels. The South Berth is home to the Milburn carrier. The North Berth doubles as a berth for unloading bulk dry product, including fertiliser and stock feeds.	
No. 3- Wharf# North#	190m# ??# 180m#	Older timber-built finger wharf with a reinforced concrete deck in reasonable condition. This wharf is used extensively by the in-shore fishing fleet and as a layup and maintenance berth for corporate fishing vessels. This is also the berth for PrimePort’s two tugs.	Expect significant damage in earthquake or tsunami event – but lower priority structure.
No. 3- Wharf# South-#	190m# 9.5m# 180m#		
North Mole- Wharf-# Inner# #	460m# 10.5m# 260m#	The North Mole is a continuous 460m berth, with 385m being timber construction and the remaining 75m heavy-duty precast concrete. Made up of 6 compartments which are filled with “puggy” dredgings and an AP65 gravel-crust overlaid with 100mm AC surface.	This is the Port’s most vulnerable wharf and expected to be compromised especially by major earthquake.
North Mole- Wharf-# Outer#	460m# 11.8m# 260m#	Investigating strengthening options – replacing upper timber deck with reinforced concrete,	Deformation of timber structures –

Timaru District – Water example



Timaru District Council Water Schemes



Timaru District – Water example

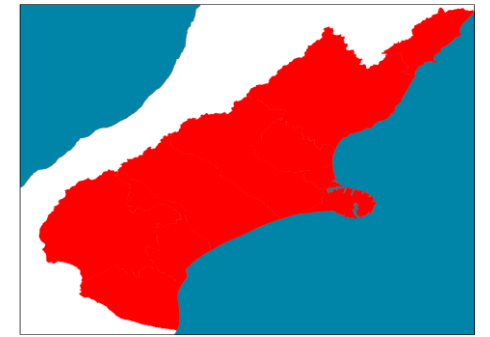


Table 4-61 Timaru District Water Supply Schemes

Scheme	Summary	Key Vulnerability Issues
URBAN ON-DEMAND SCHEMES		
Timaru City	<p>Sources – Pareora River and Opihi River (2 locations).</p> <p>Treatment Plant at Claremont.</p> <p>Reservoirs – 113,000 m3 raw (Claremont), 120,000 m3 treated (Gleniti). 4-6 days storage capacity.</p> <p>Pump stations at Rosewill and Gleniti. Generators connected.</p> <p>Single supply lines – Gleniti PS, Washdyke pair which cross Washdyke Creek on SH1 bridge. 100 year old CI pipe under Saltwater Creek near North St.</p> <p>Reticulation 330km, AC 138km, CI 84km, PVC 57km, with some PE and ST.</p> <p>Various improvements and renewals planned, including new sources and duplicate mains and strengthening of two connections to the Port.</p> <p>Supply line (steel 450dia) from Pareora source largely being replaced with 500 dia PE or GRP. Involves drilling through gorge and various landslide areas to traverse including stream crossings.</p> <p>Also supplies to Downland-Hadlow and Seadown networks.</p> <p>Population – 26,830</p>	<p>Security of supply.</p> <p>Ageing reticulation.</p> <p>Single main into and out of (150dia AC) Gleniti PS.</p> <p>Buildings vulnerable to EQ</p>
Temuka	<p>Supplies three distinct areas – Temuka (urban), Orari (restricted supply), Winchester (small, on-demand).</p> <p>Various bore sources Orari River. New sources being considered.</p> <p>Treatment plant and pumping station. Generator fitted. Small PS feeds Orari.</p> <p>Storage 1650m3, old concrete, half day supply.</p> <p>New reservoir and pumping station being built (north of Temuka).</p> <p>Supply main 300dia PVC to Baby Rd.</p> <p>Supply main 450dia PE to Temuka (AC replaced).</p> <p>Reticulation mostly AC and PVC, some PE and ST, gravity from reservoir.</p> <p>Population - 4,620</p>	<p>Security of supply</p> <p>Low storage capacity</p> <p>EQ damage to brittle pipes</p> <p>Reservoir EQ vulnerable</p>
Geraldine	<p>Source – 4 shallow bores near Orari River, with treatment plant and pumping station.</p> <p>Single AC 200 dia supply main to township</p>	<p>EQ damage to brittle pipes.</p> <p>SH bridge crossing.</p>

Scheme	Summary	Key Vulnerability Issues
Geraldine	<p>Source – 4 shallow bores near Orari River, with treatment plant and pumping station.</p> <p>Single AC 200 dia supply main to township reservoir along SH79 and across SH bridge in Geraldine (thought to be steel pipeline).</p> <p>Reservoir – 2275 m3, equivalent to 12 hours storage.</p> <p>Reticulation 28km mostly AC and PVC, some PE.</p> <p>Various improvements / renewals planned.</p> <p>Also supplies part of the Te Moana area - Geraldine Flat (restricted) and Geraldine Downs (restricted).</p> <p>Generators fitted where required.</p> <p>Population - 2,400</p>	<p>EQ damage to brittle pipes.</p> <p>SH bridge crossing.</p> <p>Reservoir vulnerable to EQ damage.</p>
Pleasant Point	<p>Shallow wells, treatment plant, new second reservoir (total 2400m3) and 2 pumping stations. Located on north bank of Opihi River.</p> <p>Generators fitted??</p> <p>Single supply main to township – crossing under the river.</p> <p>Separate connection 300dia AC to Timaru Scheme via Claremont covered reservoirs (Opihi Creek) – these have 10 days normal storage</p> <p>Reticulation 16km mostly PVC, some AC, PE and CI.</p> <p>Population – 1,200</p>	<p>Reservoir (old) vulnerable to EQ</p> <p>Treatment plant EQ risk</p> <p>Supply main under river – scour / erosion</p> <p>AC pipes to EQ shaking</p>
Winchester	<p>Supply ex Temuka.</p> <p>8 storage tanks 240m3, pumping station.</p> <p>Single supply main.</p> <p>4.4km reticulation, mix of AC, PVC, PE</p> <p>Population - 264</p>	<p>Supply pipe under SH1 (north end of town) and south to Temuka.</p>
Peel Forest	<p>Small township on-site storage scheme.</p> <p>Source spring-fed. Treatment plant, pumps, 3 storage tanks, PE-HD pipes.</p> <p>4 days storage plus customer storage.</p> <p>Has generator plug.</p> <p>Population - 130</p>	
RURAL / RESTRICTED SCHEMES		
Downlands	<p>Jointly owned by Timaru (82%), Waimate (14%) and Mackenzie (4%) District Councils.</p> <p>Primarily stockwater with restricted domestic supply.</p> <p>Approx 1000km reticulation. Mostly PVC, with ST, PE, AC, CC</p> <p>Sub-scheme details:</p>	<p>Ageing trunk main</p> <p>Ageing reservoirs</p> <p>River crossings (e.g. Opihi River)</p>

Waimakariri District Roads - Example



Waimakariri District Roads - Example

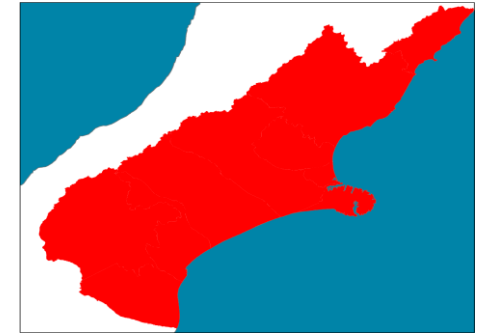


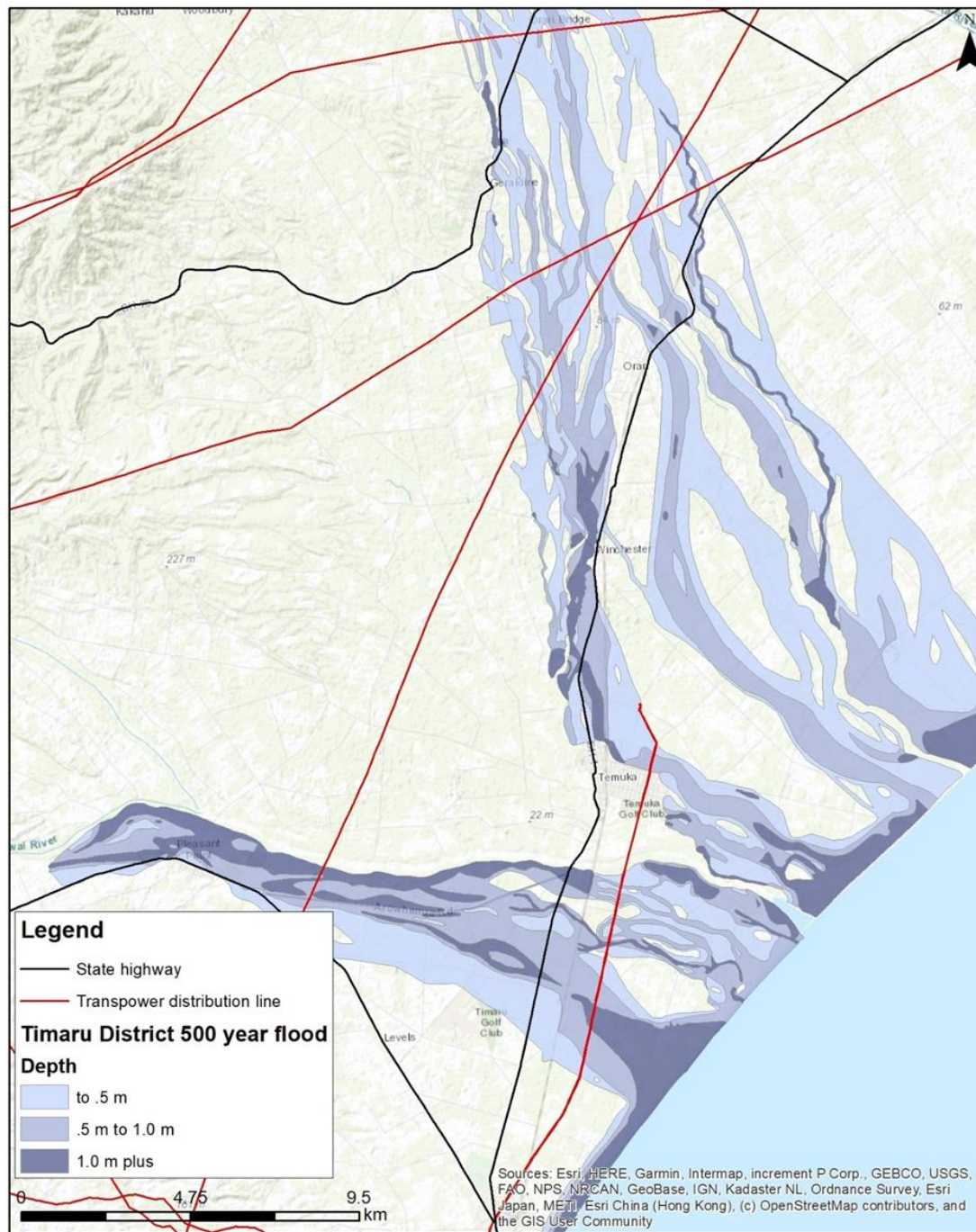
Table 4-38 Key Waimakariri District Routes

Route	Summary	Vulnerability
SH 71 – Lineside Road – Kaiapoi to Rangiora	NZTA highway. 2 lane road, elevated carriageway parallel to railway line.	Extensive flooding effects from Kaiapoi to Southbrook and Flaxton. Also affects the Motorway and SH1 to the north of the Ashley River. Detours are a poor alternative. <u>Approx</u> 1-2 days duration but effects of high groundwater can linger for many weeks/months.
Williams Rd and Main North Road - Kaiapoi to Belfast	Sealed road, alternative route via Kaiapoi to SH1 across the Waimakariri River	Flooding, tsunami, sea level rise
Route 72 Waimakariri Gorge to Rangiora	Sealed road, provides alternative intra-regional route to SH 73, West Coast and Mid Canterbury	Snow, flooding, wind. Ashley River breakout – south bank to west of Rangiora (less likely than north bank breakout).
Route 72 Rangiora to HDC boundary	Sealed road – part of intra-regional route linking to SH1 at Amberley	Flooding Ashley River breakout – north bank
Arterial and Collector routes – north of Route 72	Sealed roads	Flooding <u>Loburn</u> and west – rolling country, various rivers and bridges whose abutments could be undermined disrupting access – days-weeks? Confluence of <u>Okuku</u> and Ashley Rivers a potential breakout point – affecting Southbrook to Kaiapoi. Eastern low-lying areas - Ashley River breakout – north bank.
Arterial and Collector routes – south of Route 72	Sealed roads. Some low lying.	Flooding. Waimakariri or Ashley River breakout. High groundwater levels.

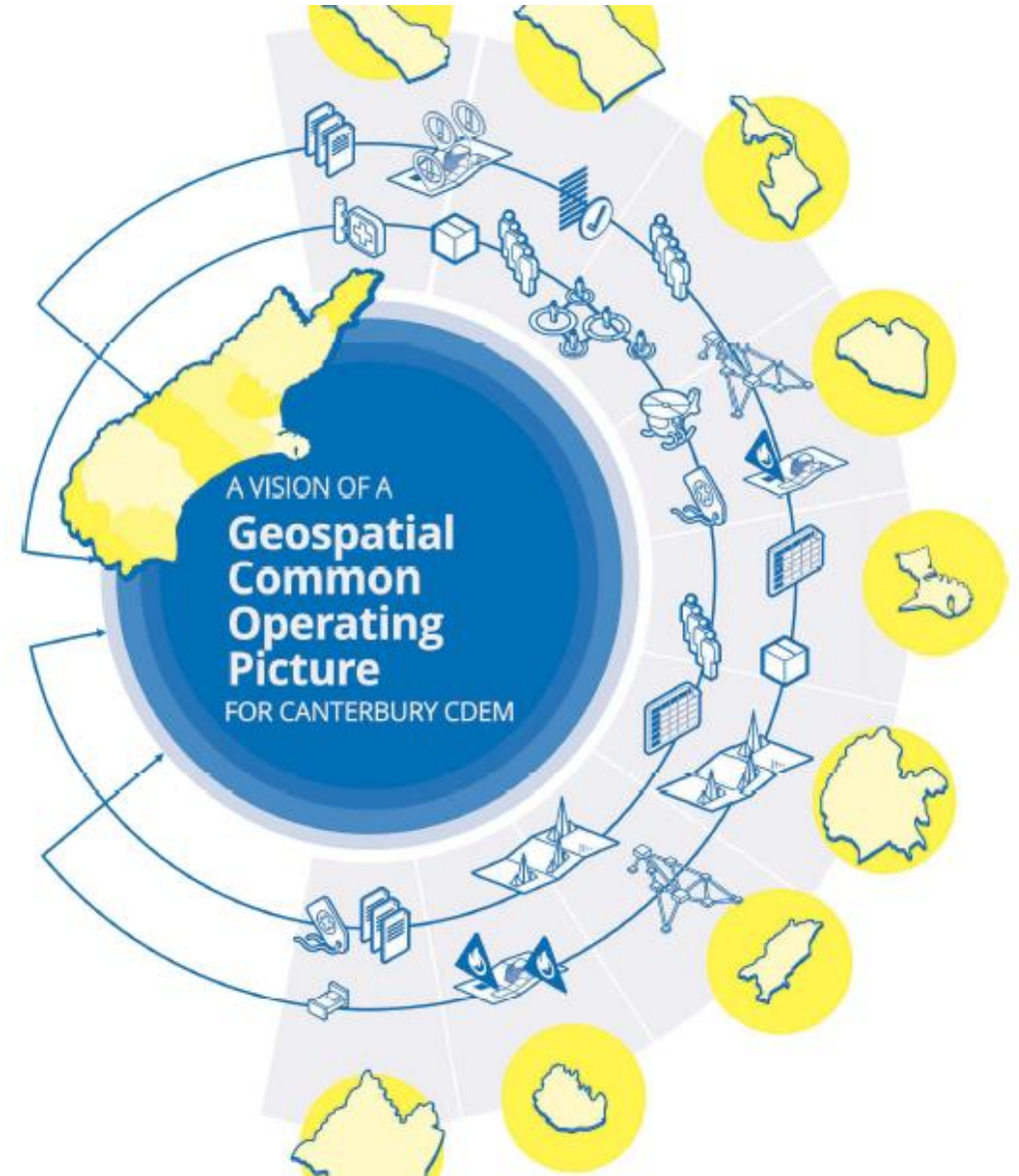
Table 4-39 Key Waimakariri District Major Bridges / River Crossings

Bridge Location	Summary	Vulnerability
Old Waimakariri River Bridge	Two lane concrete structure, multi-span. Jointly owned with CCC.	Shallow piles used to present a potential scour risk during high river floods, earthquake shaking
Kaipoi River Bridge (Williams St)	Older concrete structure, ex SH1	Flooding – Waimakariri back-up. Utility services failure.
Route 72 Waimakariri Gorge Bridge	Cast iron structure (old) with multiple spans and high piers. Single lane. Jointly owned with Selwyn DC.	Earthquake shaking, landslide movements
Route 72 Eyre River Bridge (Depot Rd)	Concrete structure, single lane.	Potential scour risk
Route 72 Ashley River Bridge	Very recent, modern concrete structure.	Note that secondary banks will isolate the bridge in event of major Ashley River flood. Note scour risk to adjoining railway bridge.
Ashley Gorge	Multi-span 1990s bridge	Potential for slips
<u>Makerikari</u> River Bridge (North <u>Loburn</u>)		Scour risk – has HDC water main to <u>Loburn</u> on the bridge
Garry River Bridge		Potential scour risk
<u>Okuku</u> River Bridge		Potential scour risk
Eyre River ford (West <u>Eyreton</u>)		Potential scour risk
Urban bridges	While generally minor / modest in scale they typically carry utility services. Example – Williams St Kaiapoi	

Rangitata River/ Orari River breakout modelling – near Temuka



Geospatial Common Operating Picture for Civil Defence in Canterbury



Five Priorities:

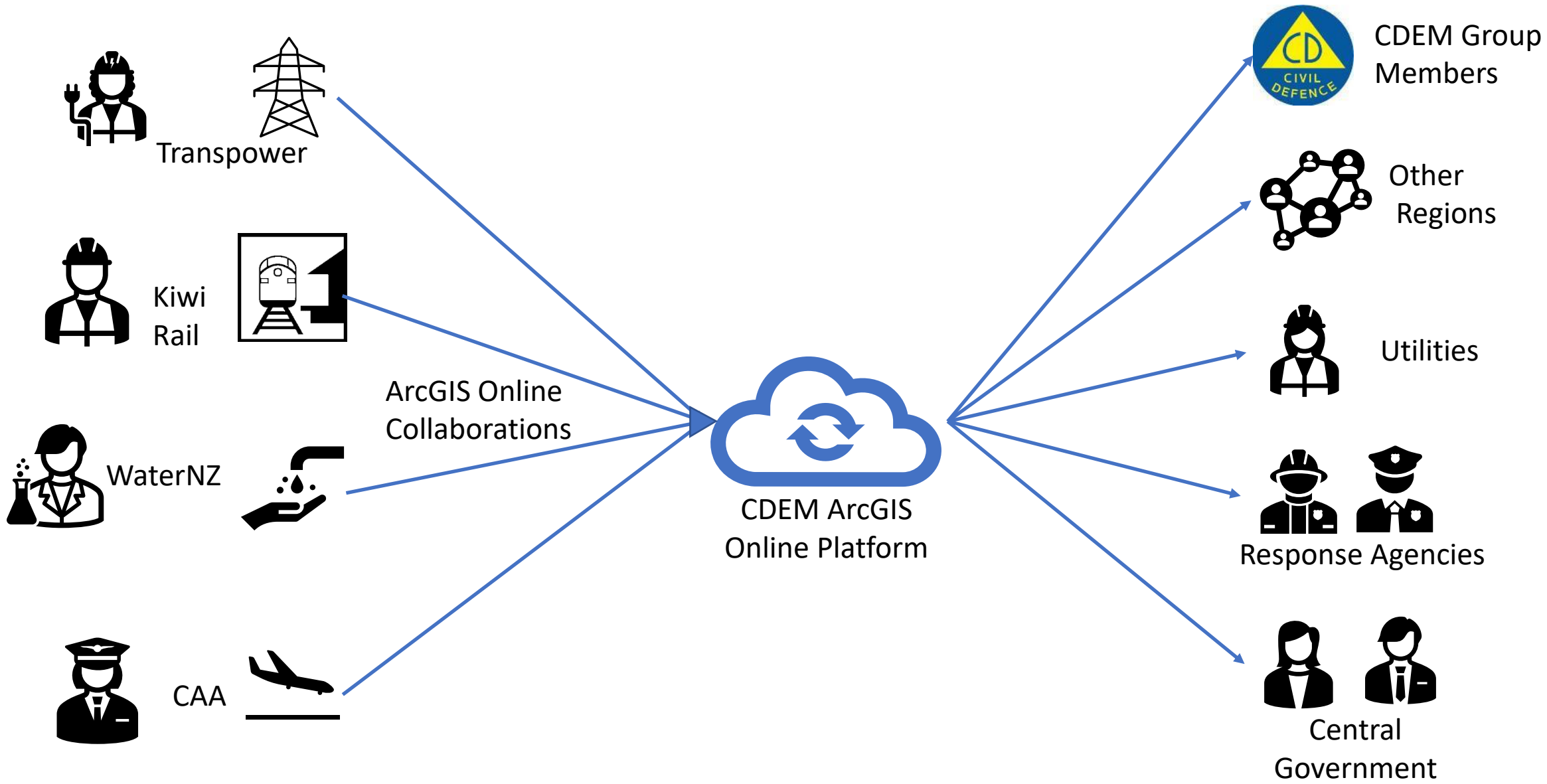
1. Lifelines Data Hosting
2. Situational Awareness
3. Cordon Management
4. Public Information
5. Welfare assessment (Āwhina)



Digital First Sharing



- Single source of truth
- Timely and Authoritative
- Security by design
- Utility defined by the user



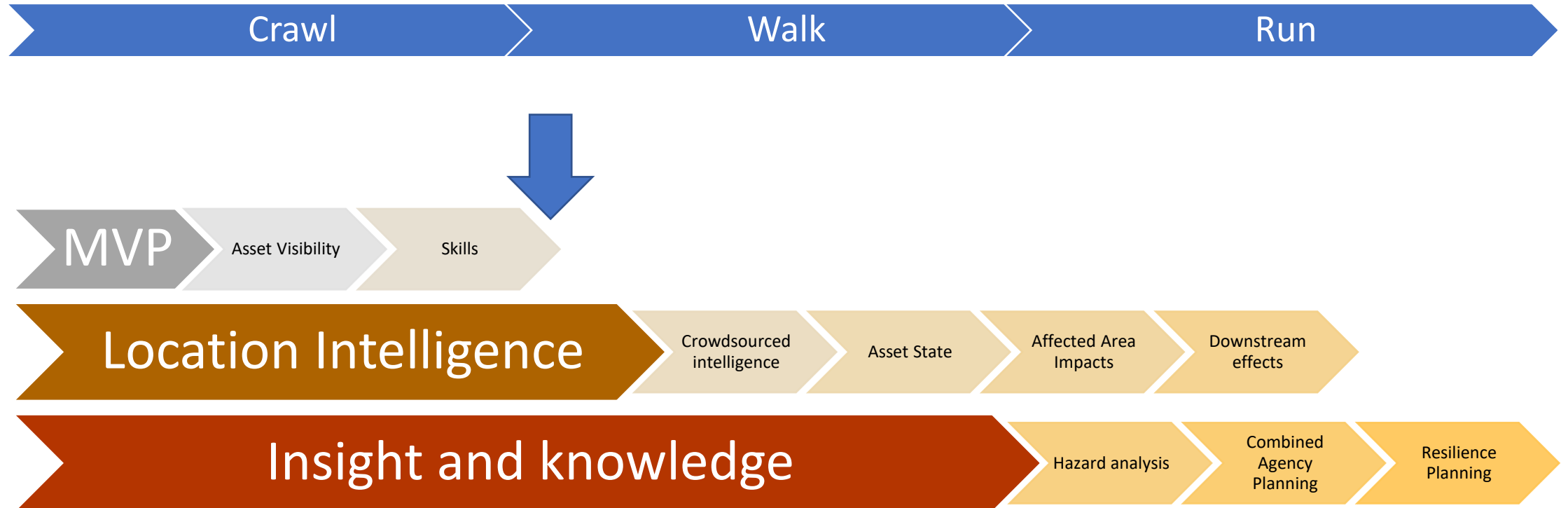
Owner/Publisher

Federation Hub

Consumer



Geospatial Roadmap



Lifelines

- Efficient data gathering processes
- Live asset condition data where available
- Trusted relationships between partner agencies
- Data gathered for reduction, readiness, response and recovery processes
- Hazards analysis coordinated with lifelines partners



FUTURE



Geospatial Applications for Emergency Managers

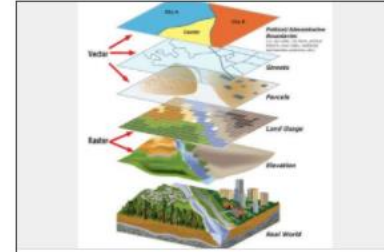
Find and use maps and dashboards for specialist topics in this area



Canterbury Severe Weather Ev...



GCOP App gallery Geospatial intelligence for Emergency Managers. Come to this gallery to access apps built as p...



GCOP Datasets Gallery Use this gallery to locate feature datasets used in the Geospatial Common Operating Picture for



Incident Briefing Dashboard Map series for EOC application in collating various sources of intelligence into a tabbed series



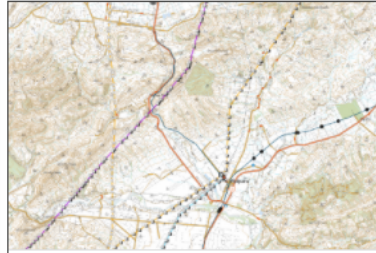
Incident Data editing series
Apps and maps for editing incident management spatial data
Admins come here to find source



Lifelines Data Dashboard
A tabbed series of lifelines data themes designed for a discussion piece around lifelines deliverable



Lifelines Impact Assessment
Proof of concept app providing a rapid desktop first look at key considerations for immediate act



Lifelines Risk & Resilience
App providing a risk and resilience view of Lifelines. This app is live and uses real data, therefore it is a

Geospatial Data Resources for GIS specialists

A curated collection of reliable GIS data sources, suitable for your own use. Be sure to check the metadata for any limitations that may apply!



Feature Layer
Above Ground Hazardous Stora...
Records showing a summary of a consented activity related to the storage of hazardous materials in



Feature Layer
Active Hurricanes, Cyclones an...
This layer describes the observed path, forecast track, and intensity of tropical cyclone activity (hurricane




Feature Layer
ADC Road Closure Points



Feature Layer
ADC Road Closures




Feature Layer
Ashburton Area of Concern
Ashburton area of concern, received 2000hrs 30-5-2021




Feature Layer
Ashburton_03062021_Evacuati...
Sent from Shaun McCracken 3:30pm 03062021.



Feature Layer
Ashley area of concern
Ashley Area of concern received 30-5-2021



Feature Layer
Bridges (LINZ 50k)
Bridge Centrelines from the LINZ Data Service Topo 1:50,000 data



Feature Layer
BuildingAssessments_gdb
Building assessments related to May 2021 flooding in Canterbury. Data provided by Territorial Authorities



Feature Layer
Canterbury CDEM Movement C...
Cordons, Evacuation Areas and Road closure feature class for collection of spatial locations for




Feature Layer
Canterbury Emergency Status
This feature class represents a live summary of emergency declarations within the Canterbury Civil Defe




Map Image Layer
Canterbury Liquefaction Susce...
Canterbury Liquefaction Susceptibility




Feature Layer
Canterbury Significant Industry
Significant industry and employers in the Canterbury Region



Feature Layer
CDEM Group boundaries
CDEM Group boundaries



Feature Layer
CDEM Public Information
CDEM Public Information



Feature Layer
Census 2018 - usually resident ...
Census 2018 population data at the Statistical Area 2 (SA2) level

Lifelines Data Dashboard

Canterbury CDEM Geospatial Common Operating Picture



- Intro to Lifelines Data Explorer
- Transportation
- Electricity**
- Communications
- Potable Water
- Waste Water
- Storm Water
- FMCG
- Solid Waste
- BRANZ Environmental Conditions

What's present?

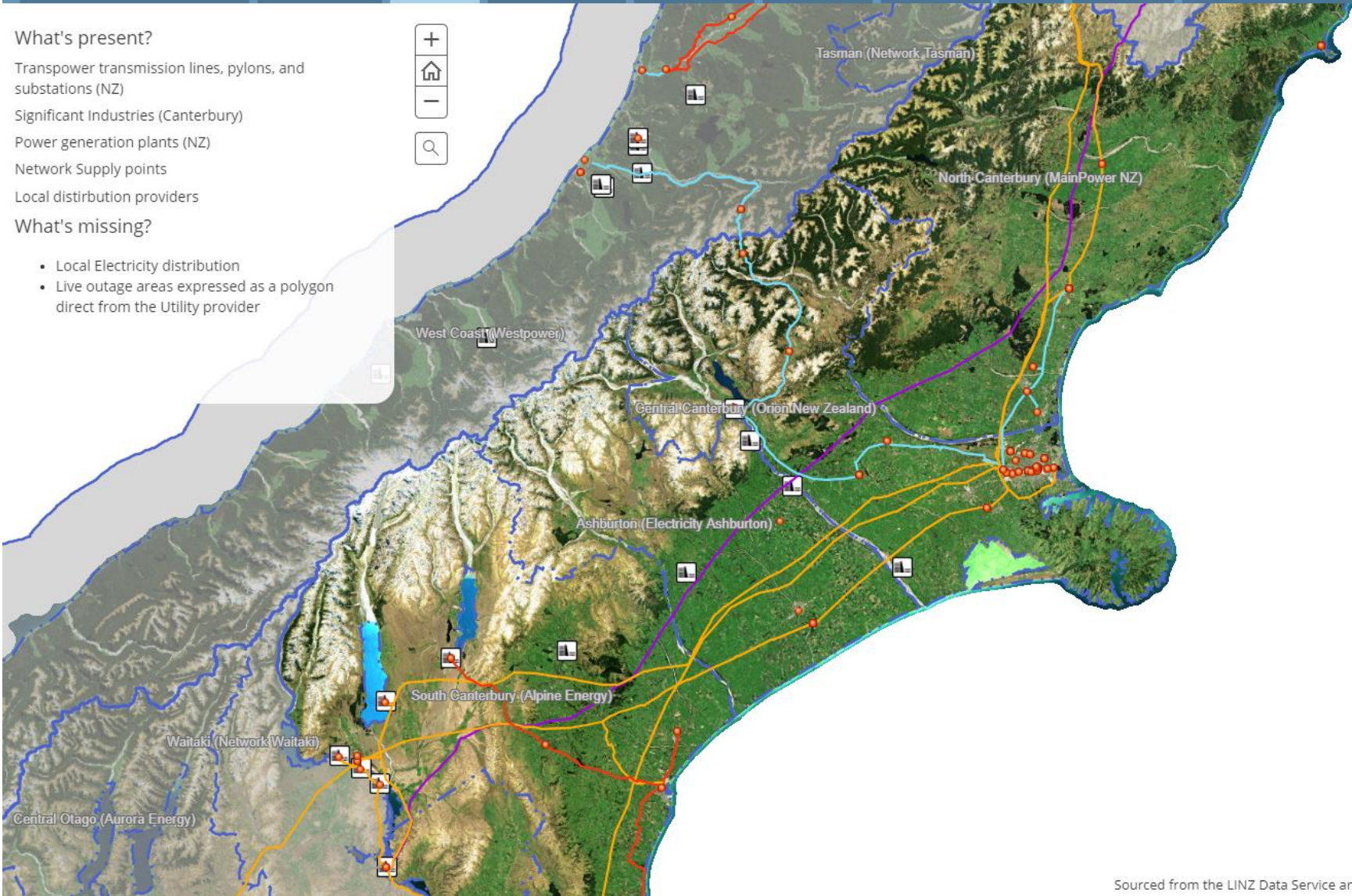
- Transpower transmission lines, pylons, and substations (NZ)
- Significant Industries (Canterbury)
- Power generation plants (NZ)
- Network Supply points
- Local distribution providers

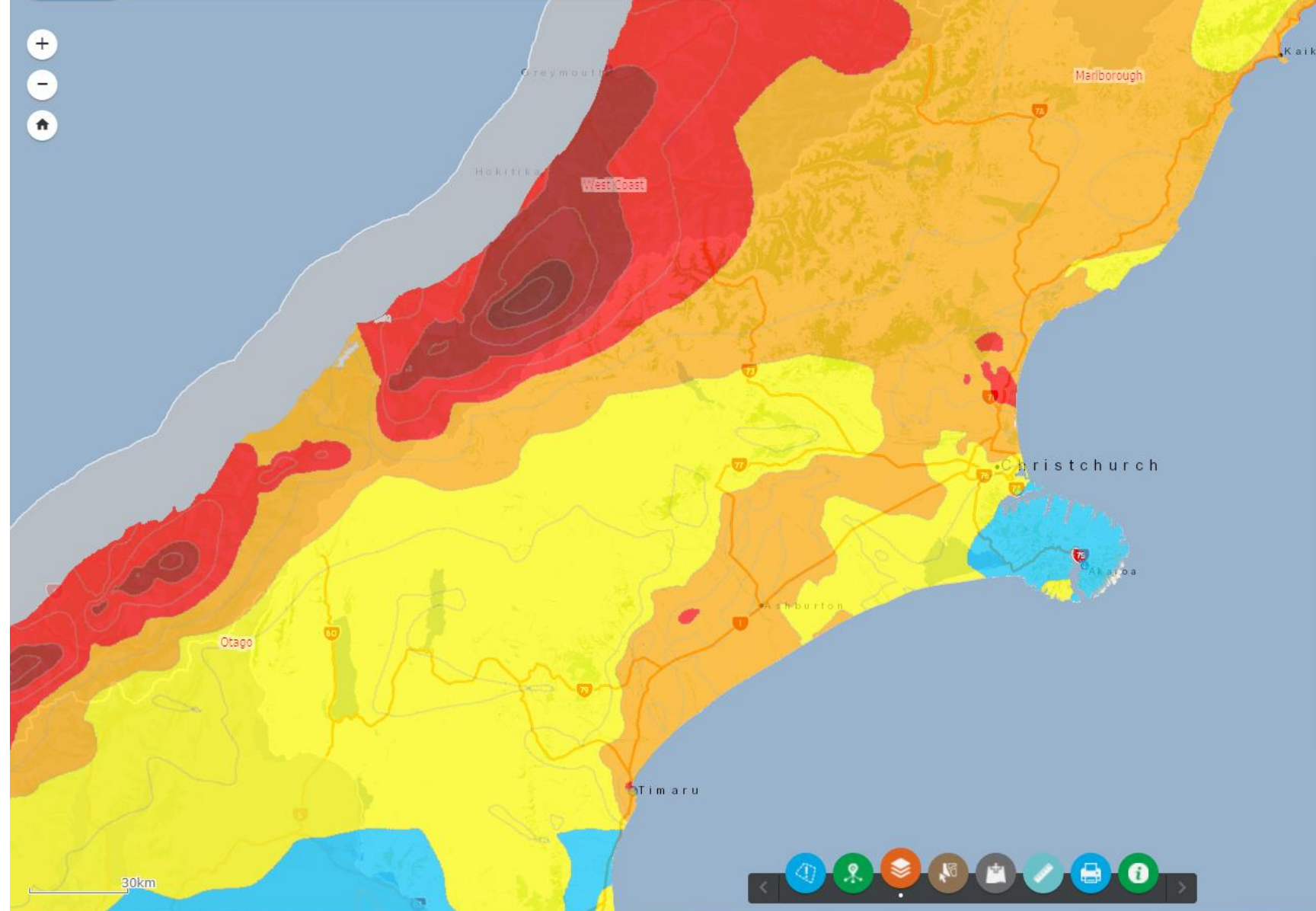
What's missing?

- Local Electricity distribution
- Live outage areas expressed as a polygon direct from the Utility provider



LEGEND





Layer List

Layers

- Kaikoura Shakemap November 14 2016 (USGS) ...
- AF8 South to North MM8 Shakemap ...
- Canterbury Tsunami Evacuation Zones ...

Legend for AF8 South to North MM8 Shakemap:

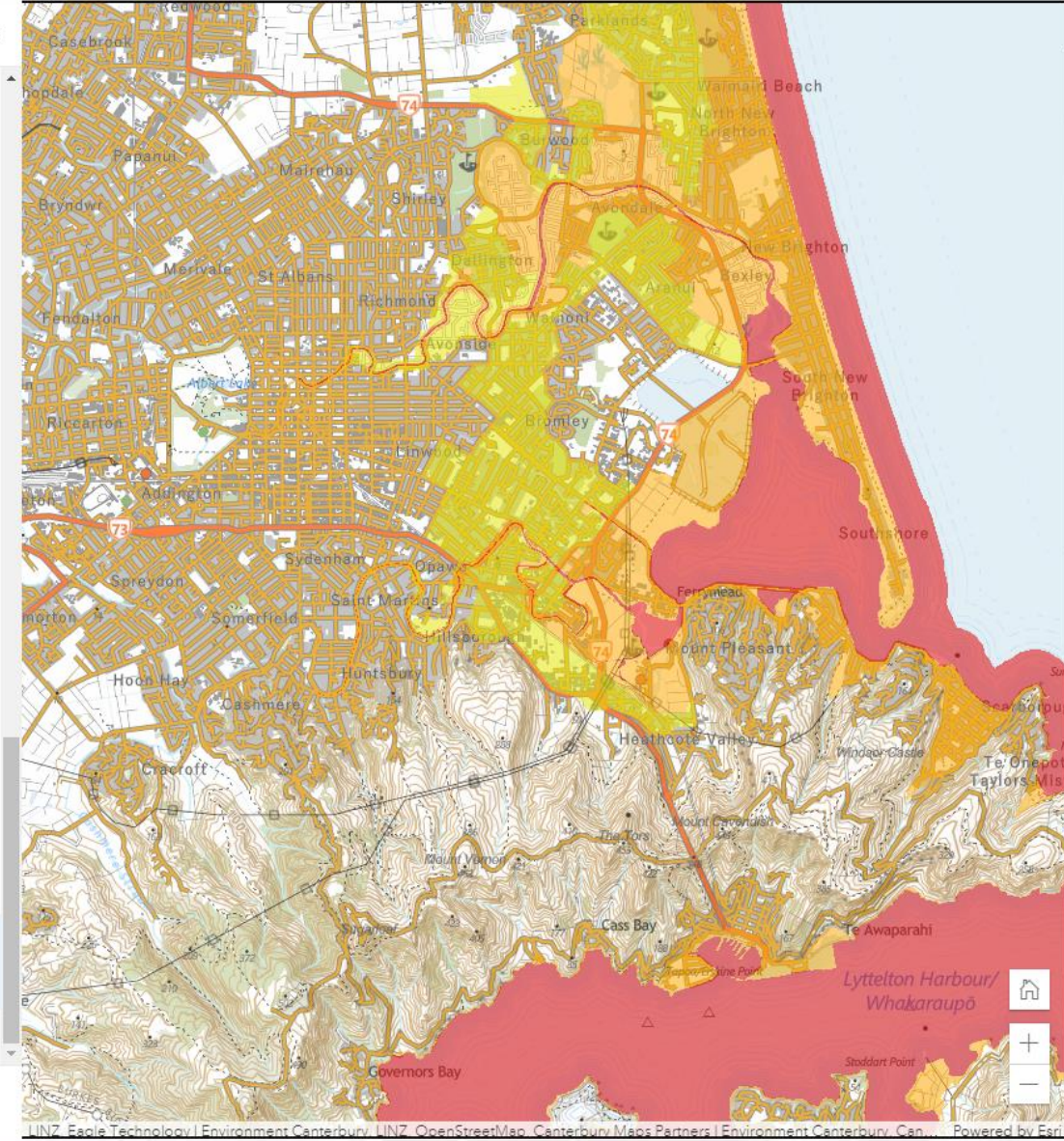
- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2

Basemap

- Imagery with Labels and Transportation
- Latest Aerial Imagery
- Latest Imagery - labelled
- Latest Imagery - labelled (vector)
- NZ Community Basemap (Classic)
- NZ Geology (Classic)
- NZ Imagery (Classic)
- NZ LINZ Topographic (Classic)
- OpenStreetMap Vector Basemap (Esri Light Gray Canvas)
- Topo

Living Atlas

Change background color



Tsunami Evacuation Zones

Properties

Information

Symbology

Show in map legend

Tsunami Evacuation Zones

Status

- No zone
- Orange
- Red
- Yellow

Edit layer style

Appearance

Blending

Normal

Transparency

48%

25% 50% 75%

Visible range

World Room

Lifelines Data Dashboard

Canterbury CDEM Geospatial Common Operating Picture



- Intro to Lifelines Data Explorer
- Transportation**
- Electricity
- Communications
- Potable Water
- Waste Water
- Storm Water
- FMCG
- Solid Waste
- BRANZ Environmental Conditions

What's Present?

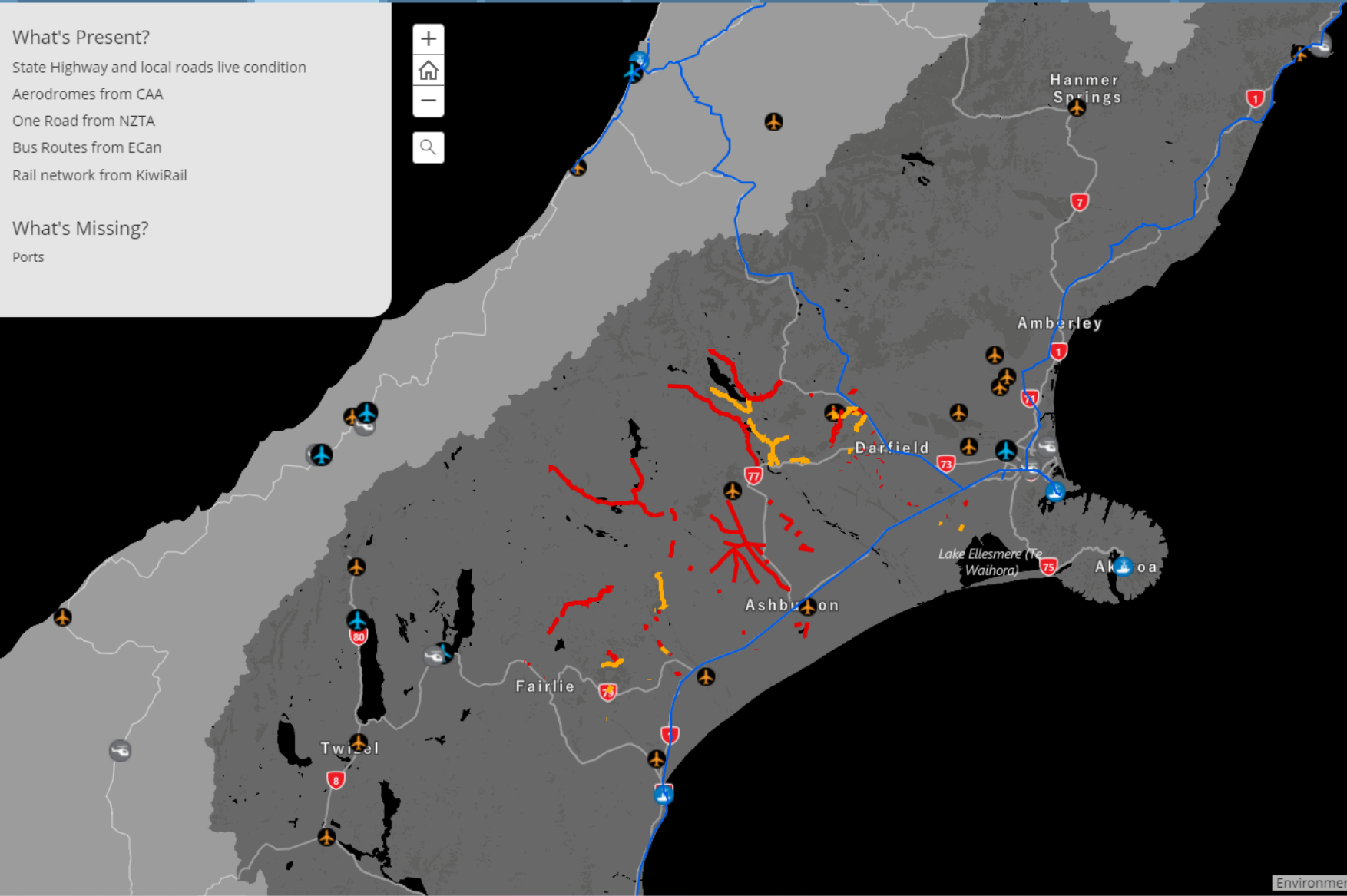
- State Highway and local roads live condition
- Aerodromes from CAA
- One Road from NZTA
- Bus Routes from ECan
- Rail network from KiwiRail

What's Missing?

- Ports

+
Home
-
Search

LEGEND

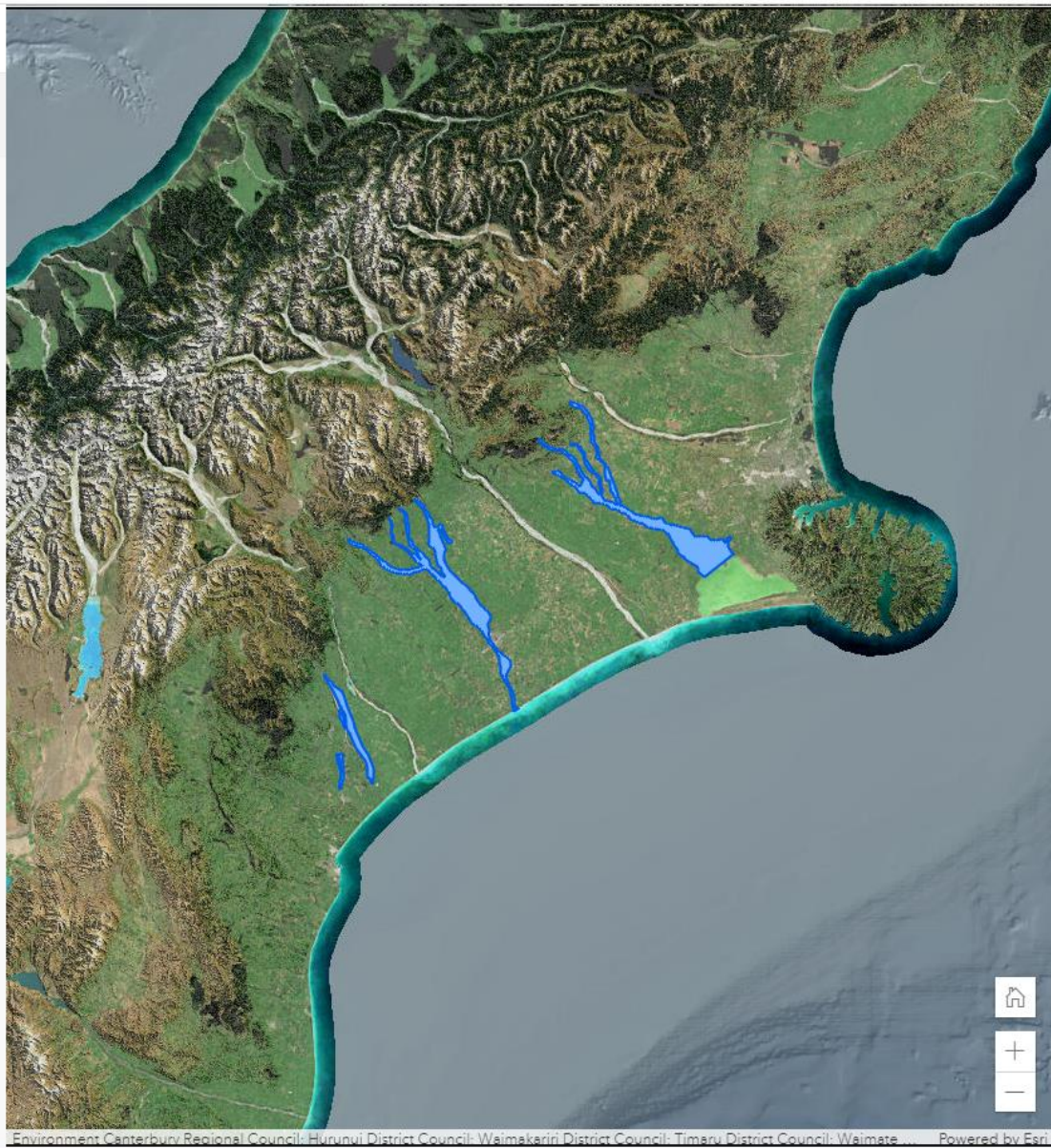


Layers

- Flood Areas (Approximate)

+ Add layer

- Add
- Layers
- Tables
- Basemap
- Charts
- Legend
- Bookmarks
- Save
- New map
- Open map
- Map properties
- Hide interface
- Share map
- Create app
- Print
- Information
- Collapse



Flood Areas (Approximate)

Properties

Information

Symbology

Show in map legend

Flood Areas (Approximate)

Edit layer style

Appearance

Blending

Normal

Transparency

0% 25% 50% 75%

Visible range

World Room

Custom parameters

Properties

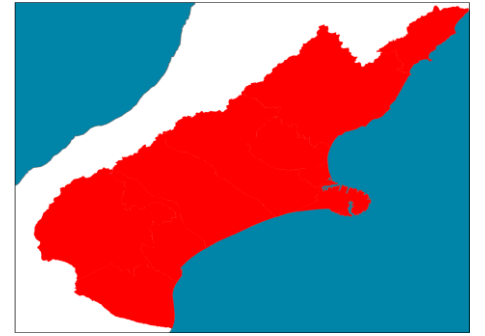
- Styles
- Filter
- Clustering
- Configure pop-ups
- Configure fields
- Labels
- Configure charts

Search

- Measurement
- Directions
- Location
- Edit
- Time

Collapse

Next Stage



- Publication of the Vulnerability Assessment “stocktake”
- Application to NEMA for Resilience Fund support:
 - Further develop the GIS lifelines portal and populate qualitative data from above
 - Data schema / standardisation
 - Describe “maturity-based” pathway to move from traditional vulnerability assessment towards Wellington business case approach
 - Collaborate with science community to develop an “intermediate” level methodology and apply research knowledge
 - Use MERIT to explore economic and social impacts