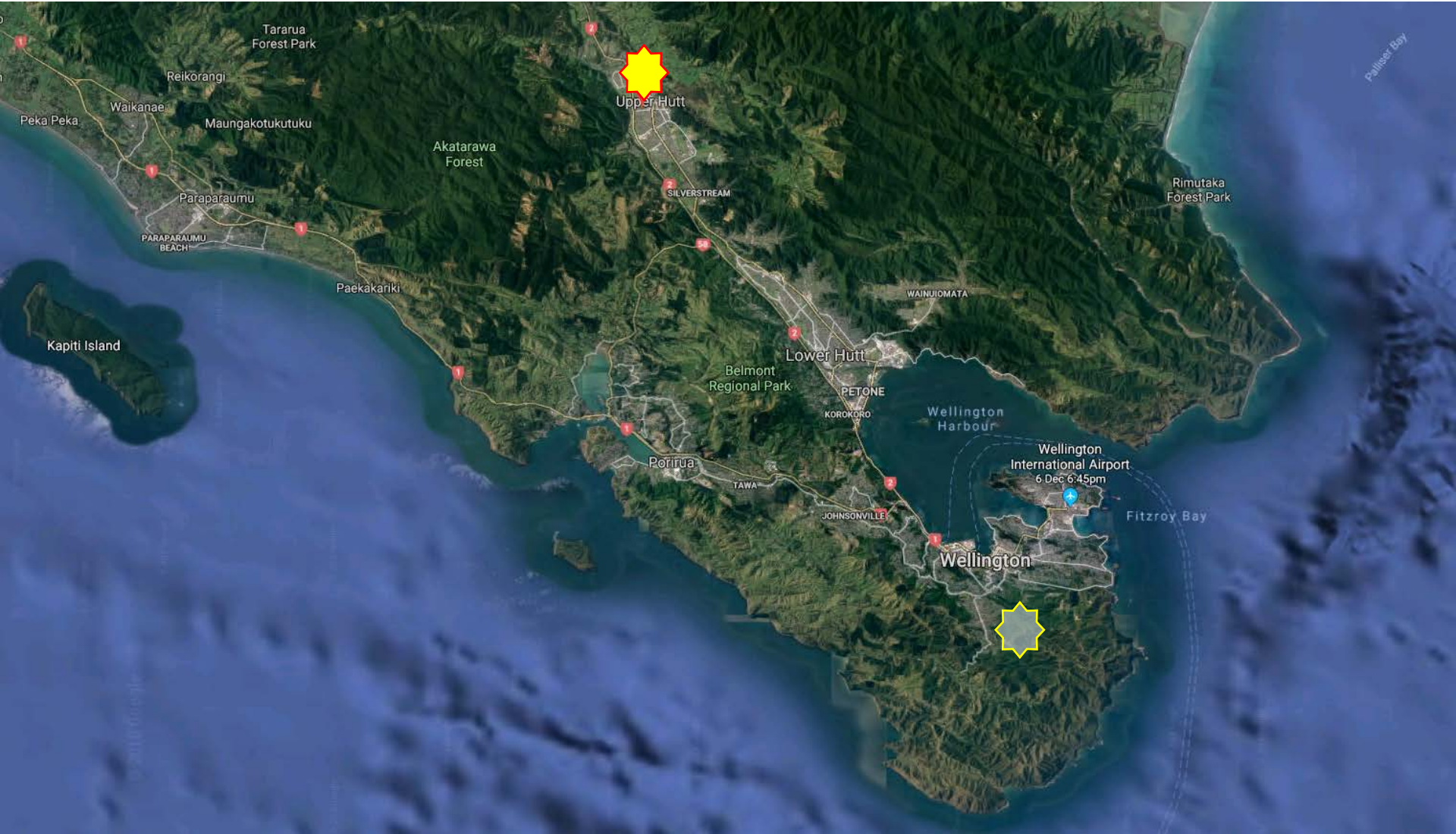


Rehabilitation of Stormwater Culverts

Jonathan Morris, Jayesh Dhanjee

Culvert Location



Gibbons Street



Intake



Outlet



Construction History

- Built in 1987
- Made of helical corrugated aluminium
- Twin barrel, DN1600 and DN1700
- 30m long, straight

Timeline

- 1987 - Constructed
- 2006 – Some pitting noted
- 2008 – More pitting observed
- 2010 – More and worse pitting,
Specialist corrosion investigation
- 2014 – March, started lining
April, practical completion

2006



2010



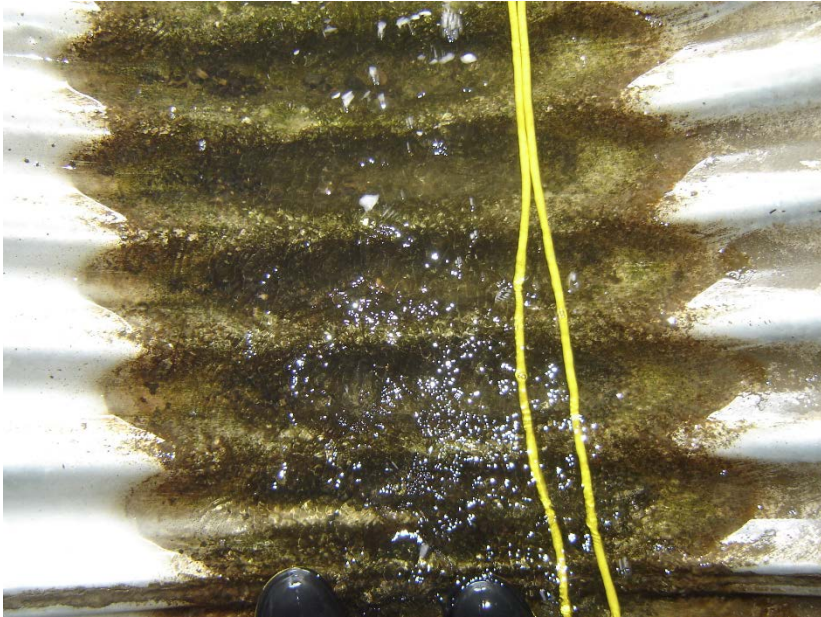
2010



Inspection

- Preliminary
 - Scoped out site
 - Preliminary samples
 - Suspected chlorides
- Sampling of backfill
 - Repair
 - Timing
 - Confirmation and check

Managing site hazards



The cause



Remedial Options

	<u>Cost (NZ\$)</u>	
1. Replace culvert *	550k	
2. Rehabilitation		
a) Gunite with steel mesh	260k	H3
b) PVC spiral wound	250k	H1
c) GRP lining *	200k	H2
d) Flush jointed concrete pipe *	170k	H4
e) Corrugated galvanized steel pipe	150k	H5

Preferred Option

GRP was recommended as a preferred option:

- Good hydraulic performance
- Good constructability
- Cost effective option
- No resource consent required
- Good durability

Construction



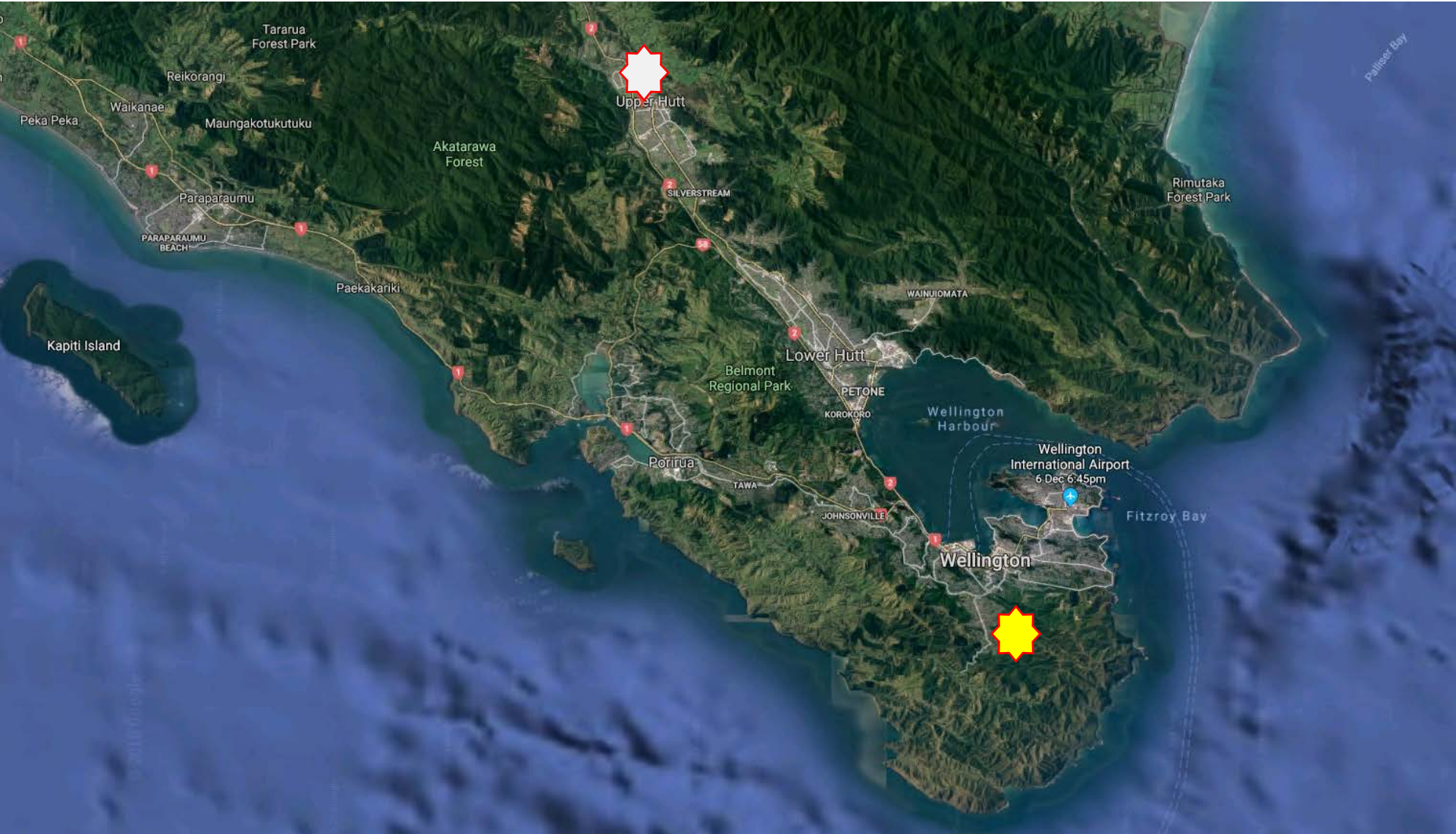
Construction



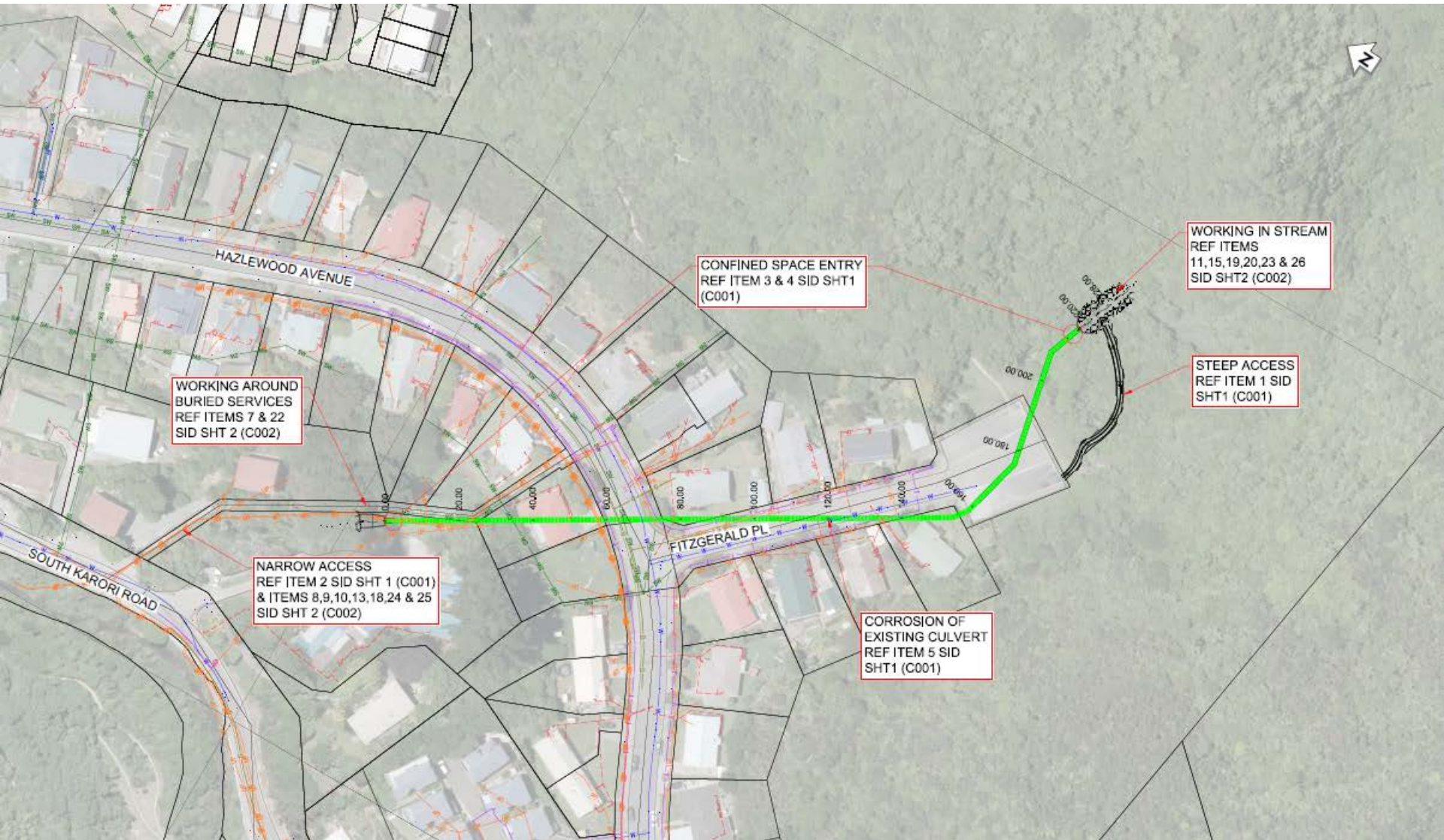
Completed repair (\$183k)



Culvert Location



South Karori



Intake



Outlet



Construction History

- Built in 1978
- Made of corrugated galvanized steel
- DN1300
- 220m long, bends
- Gully filled after construction

Timeline – South Karori

- 1978 - Constructed
- 2011 – Corrosion first identified
- 2014 – Opus engaged
- 2016 – April, HSAW Act
 - November, Kaikōura Seddon event
- 2018 – Practical completion

2014





Initial inspection

- Culvert route
- Difficult access
- Confined space
- Condition (invert and deformation)
- Change to HSE legislation

Issues

- No advance warning from inspections
- Consequence of failure
- Safety hazards (long, deep, poor condition)
- Difficult access/working space
- Earthquake and legislation change
- Environmental (consents, fish)

Access



Working space



Procurement

- Two stage procurement (ROI plus tender)
- Delayed by earthquake
- Performance based (design component)
- Acceptance criteria

Remedial option

Invert stabilisation followed by

- Sprayed alumino-silicate (Geopolymer)
- Designed using declared values
- Higher-risk areas use thicker coating

Sprayed lining



Completed



Summary

Gibbons Street

- Good access
- Few challenges
- Many options
- Completed successfully

South Karori

- Poor access
- Many challenges
- Few options
- Completed successfully