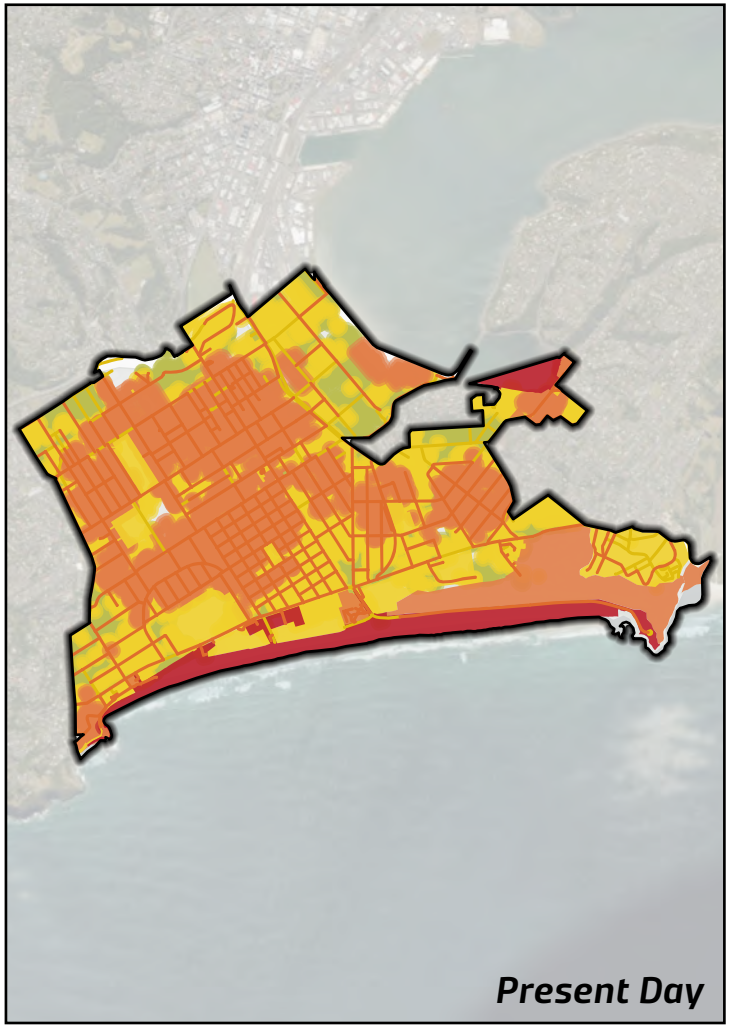
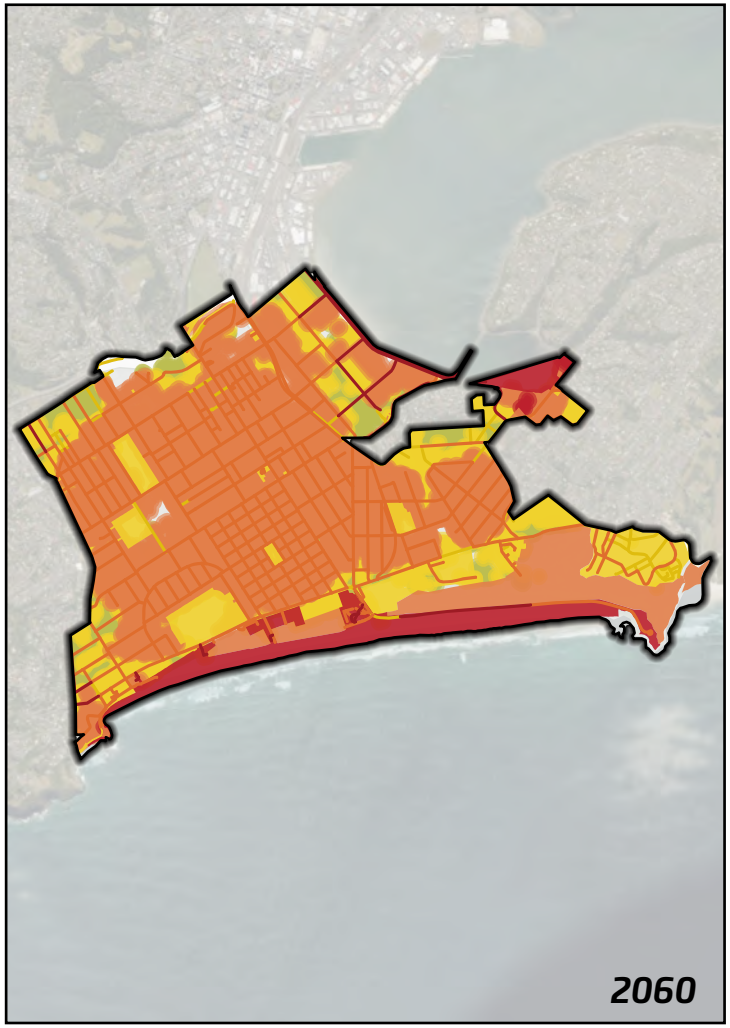
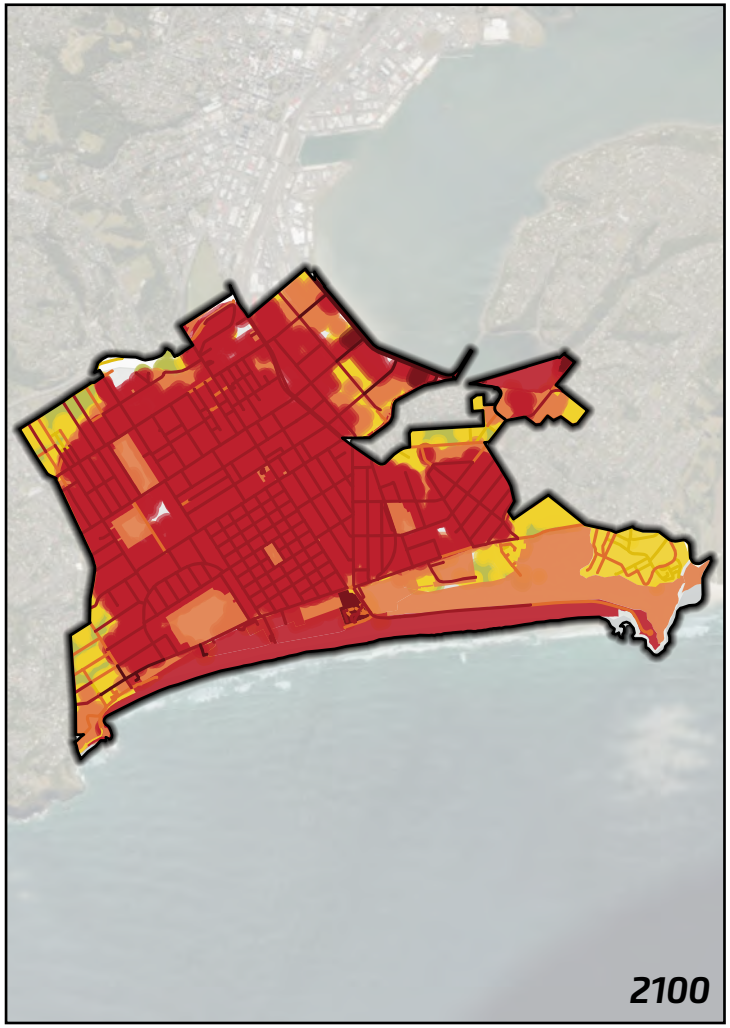
Summary of Risks to South Dunedin

Buildings, Parks & Transport







South Dunedin Future Boundary

Buildings, Transport & Parks

- 0 hazards
- 1 hazard
- 2 hazards
- 3 hazards
- 4 hazards

Hazards

Coastal erosion
Coastal inundation
Groundwater
Landslide
Liquefaction
Pluvial flooding

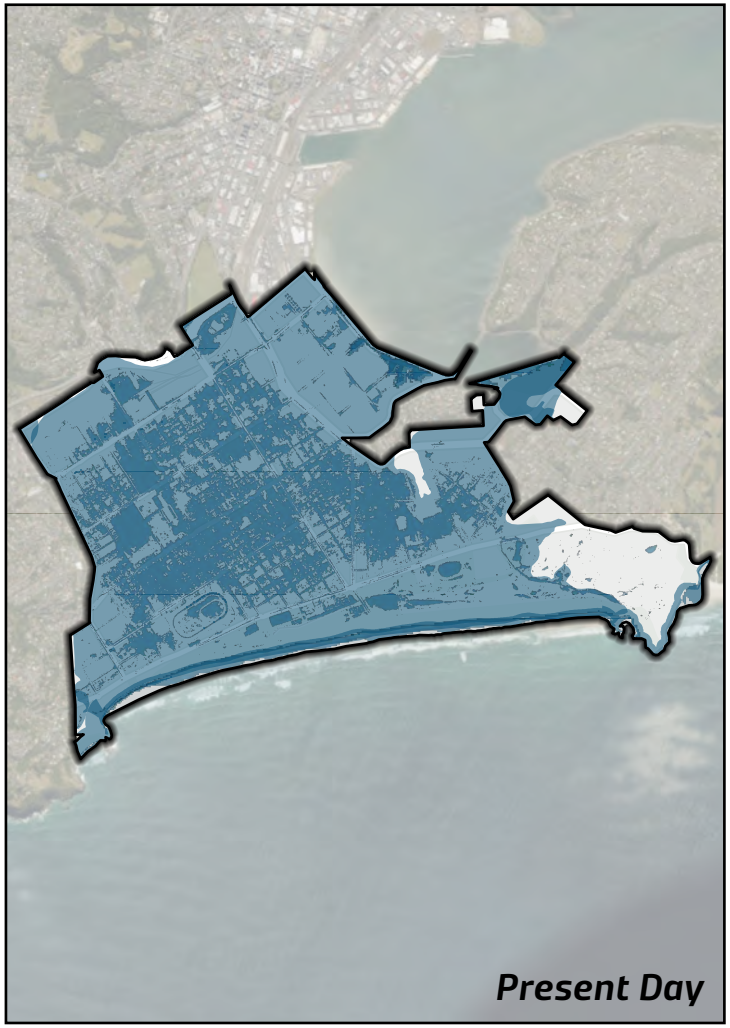
N

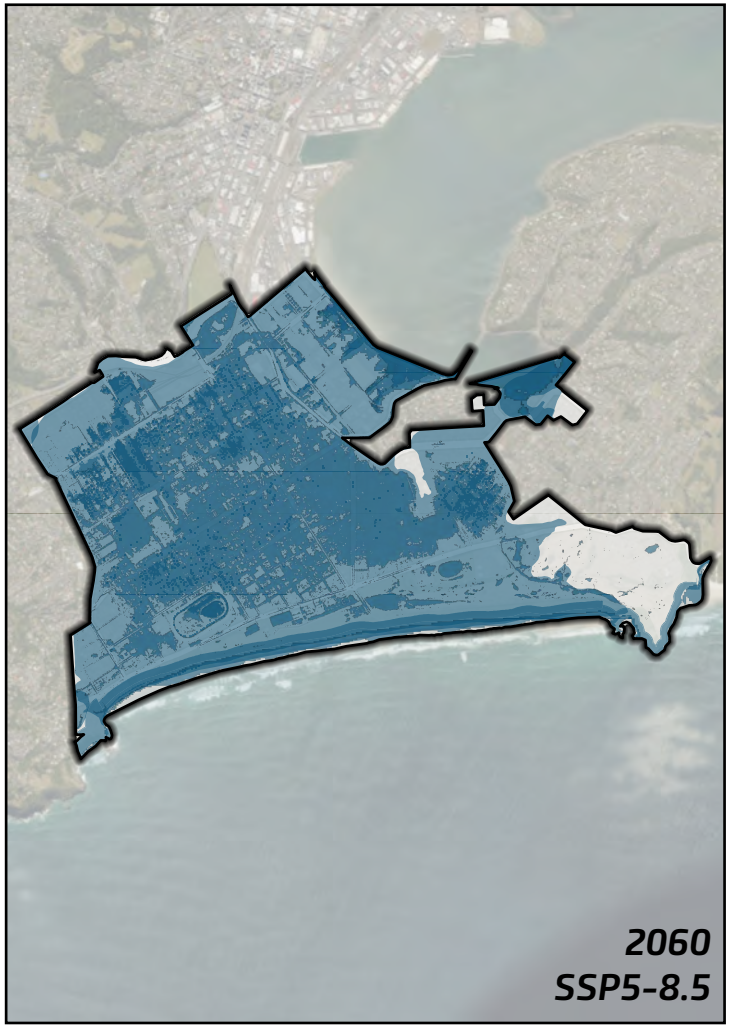
0 0.4 0.8 1.2 1.6 2 (km)

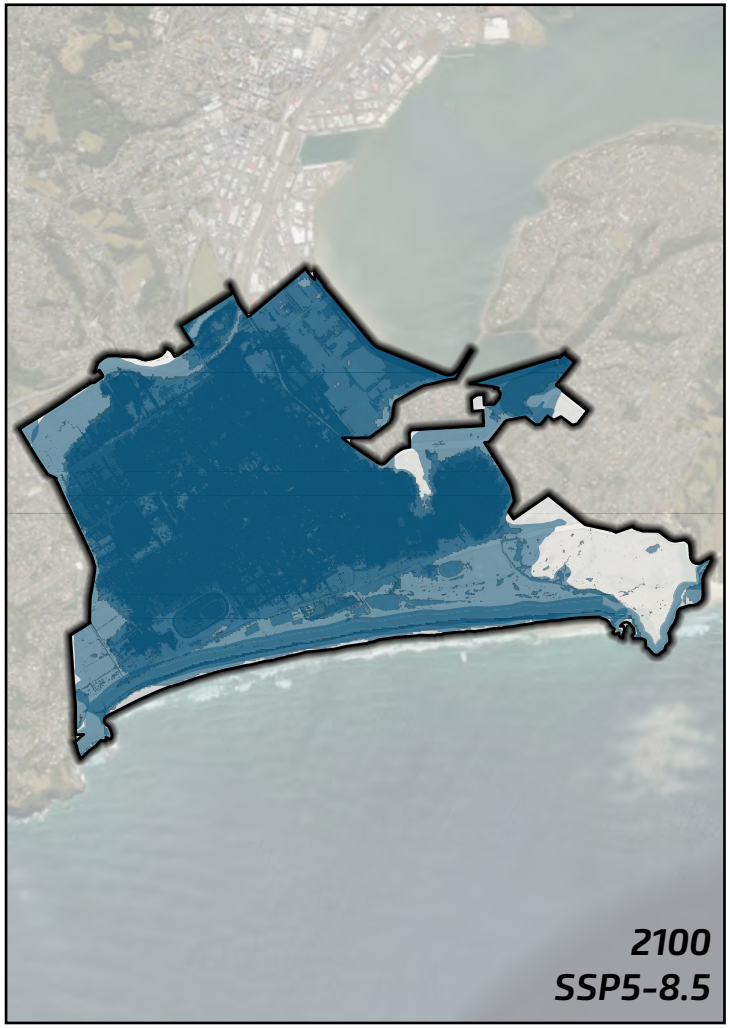
Explainer: These hotspot maps show locations in South Dunedin where buildings, roads, and parks are at high or medium risk due to one or more hazards. They show that many areas of South Dunedin are already subject to such risk from two or more hazards, which increases to three or more hazards over time, particularly on The Flat. Note: Illustrating an 'overall picture' of risk can be problematic in a South Dunedin context, given the large number of hazards assessed (6) and elements at risk (11) (i.e. 66 different risk layers would be needed, resulting in a convoluted image). Using a subset of selected risks can help illustrate a clearer overview. For example, buildings, roads, and parks are three elements at risk that collectively represent 100% of the geographical area in South Dunedin, so they offer a useful overview and can act as a proxy for identifying risk hotpots. Disclaimer: These hotspot maps are intended to provide a visual overview of risk in South Dunedin but are not intended to be an accurate property-level assessment of risk, which requires much more detailed information and analysis. Using these hotspot maps in this way could lead to false or misleading conclusions about property-level risk (e.g. high risk areas may include many low risk properties, or the reverse).

Hazard Extents

Coastal Erosion, Coastal Inundation, Emergent Groundwater, Landslide, Liquefaction & Pluvial Flooding







South Dunedin Future Boundary

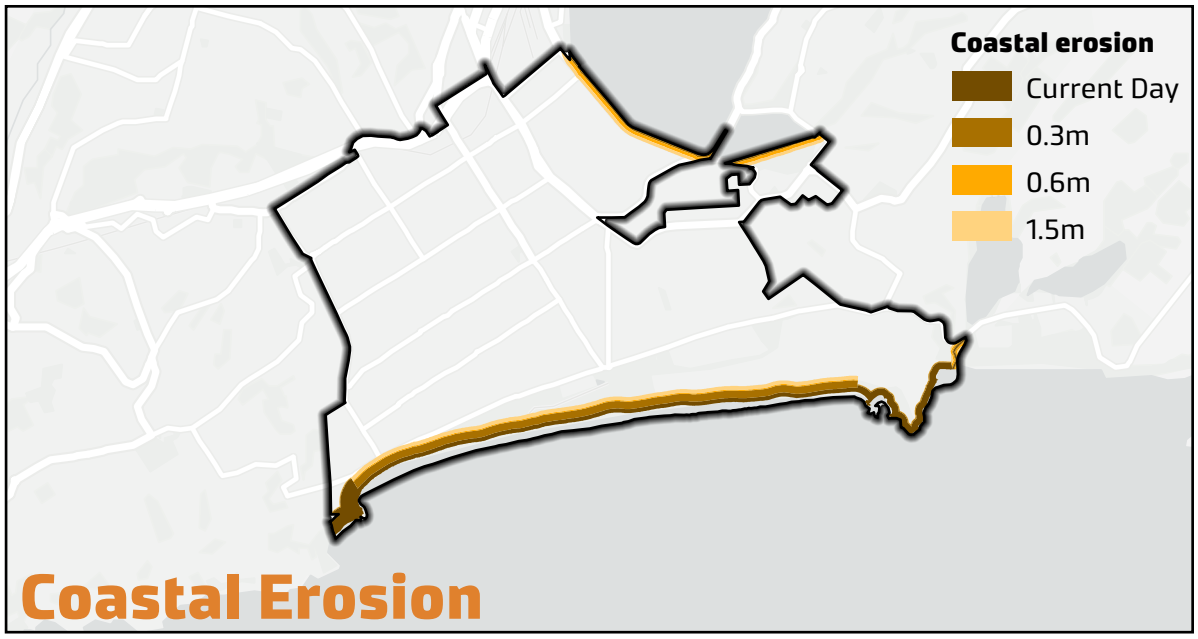
One Hazard
Two Hazards
Three Hazards
Four Hazards

0 0.4 0.8 1.2 1.6 2 (km)

Hazard and data sources:
Pluvial flooding: Scenario: 1% AEP, Source: DCC ICMP Flood Model (Beca, WSP, 2024)
Coastal inundation: Scenario: 1% AEP, Source: Paulik, 2023
Emergent groundwater: Scenario: Median emergent, Source: Cox, et al., 2023
Coastal erosion: Source: WSP, 2024
Liquefaction: Source: Barrell, 2014
Landslide: Source: DCC Hazard database data provided for South Dunedin Future programme.

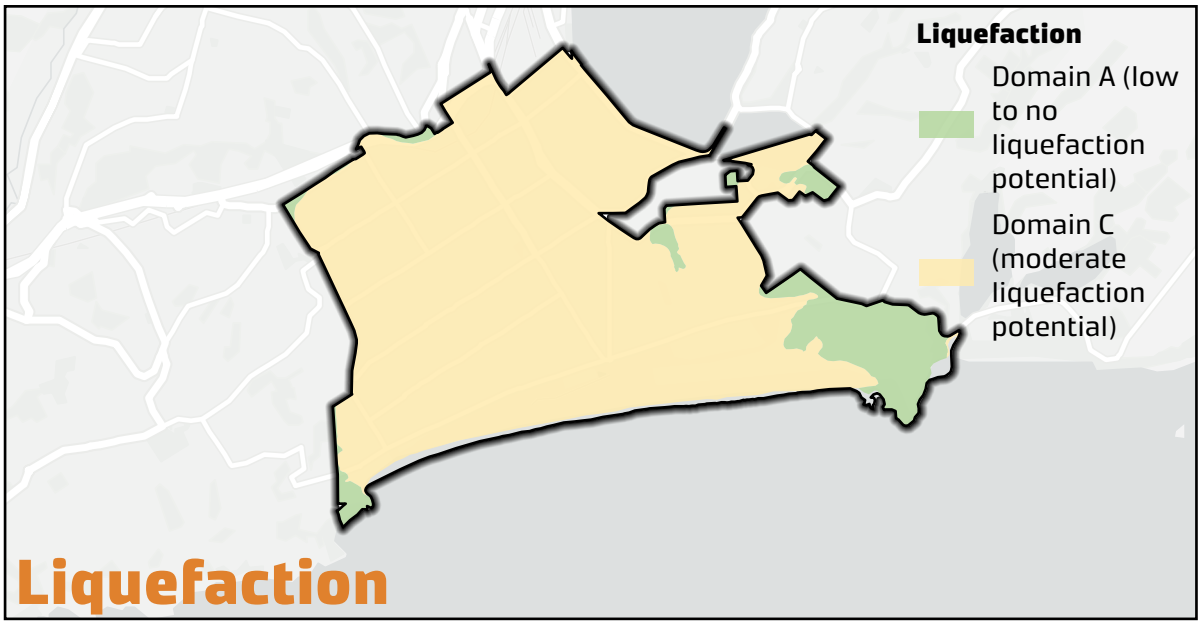
Explainer: These maps show the hazard extents for coastal erosion, coastal inundation, emergent groundwater, landslide, liquefaction, and pluvial flooding, over three timeframes and under one climate change scenario (SSP 5-8.5). Areas shaded in a darker blue indicate those areas that are exposed to more hazards. The map indicates that at the present day around half of South Dunedin is exposed to two or more hazards, particularly in The Flat. At mid-century areas that are exposed to three or more hazard are more dispersed throughout the study area, while at end of century the majority of South Dunedin will be exposed to four hazards.
Note: Liquefaction and landslide hazards showing in future timeframes do not account for the influence of climate change.

Other Hazards



Coastal Erosion

Land Instability

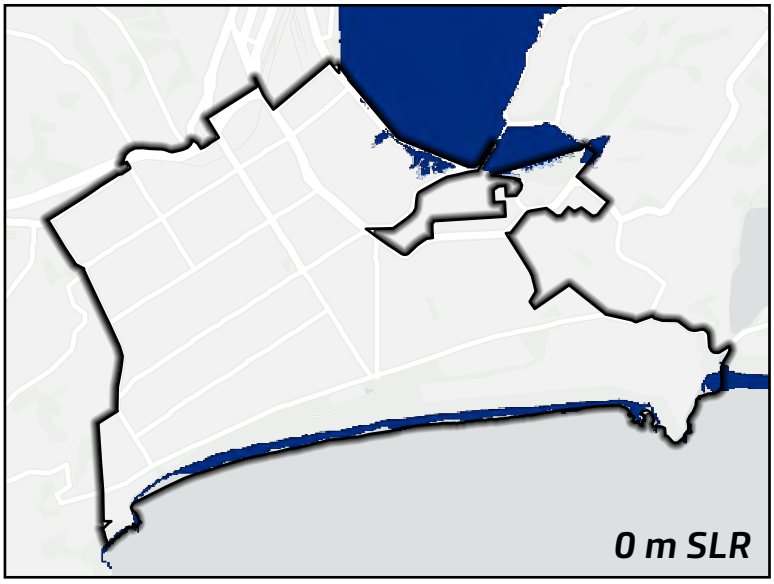


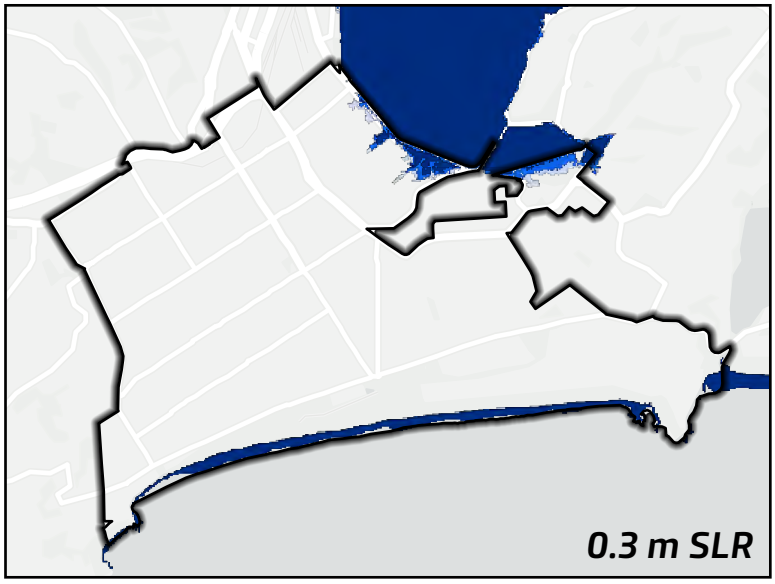
Liquefaction

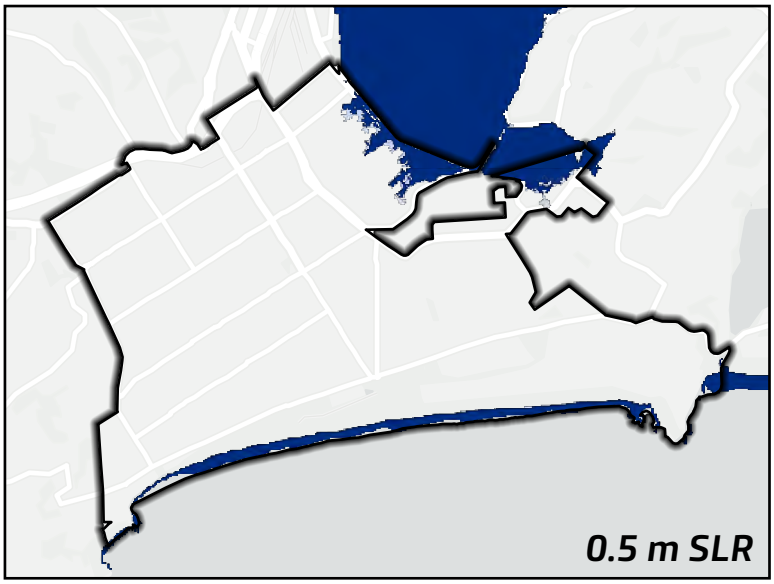
0 0.5 1 1.5 2 2.5 (km)

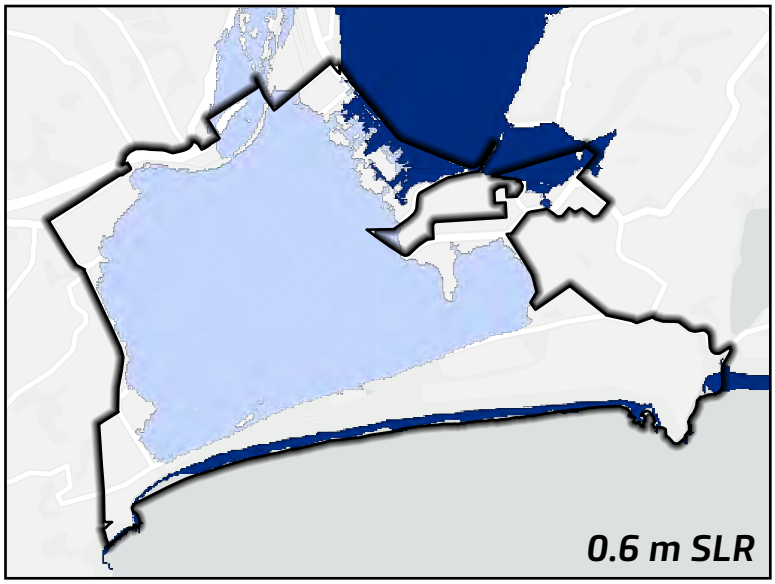
N

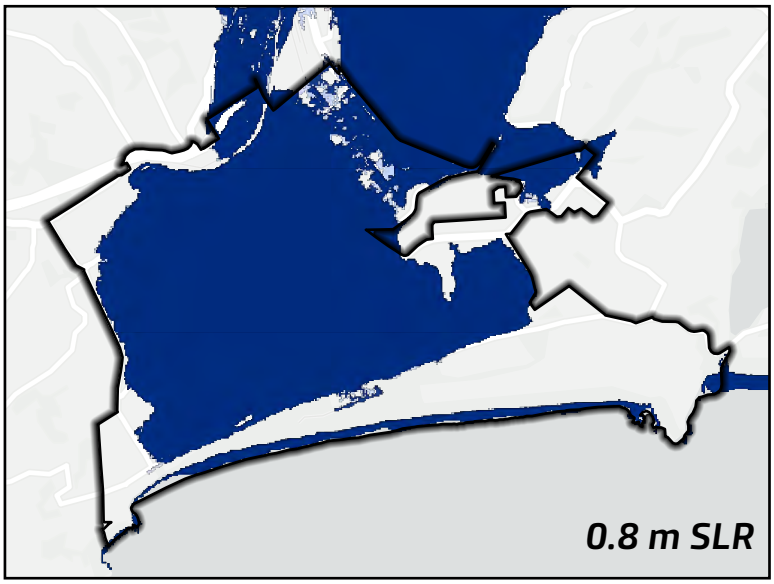
Coastal Inundation Hazard

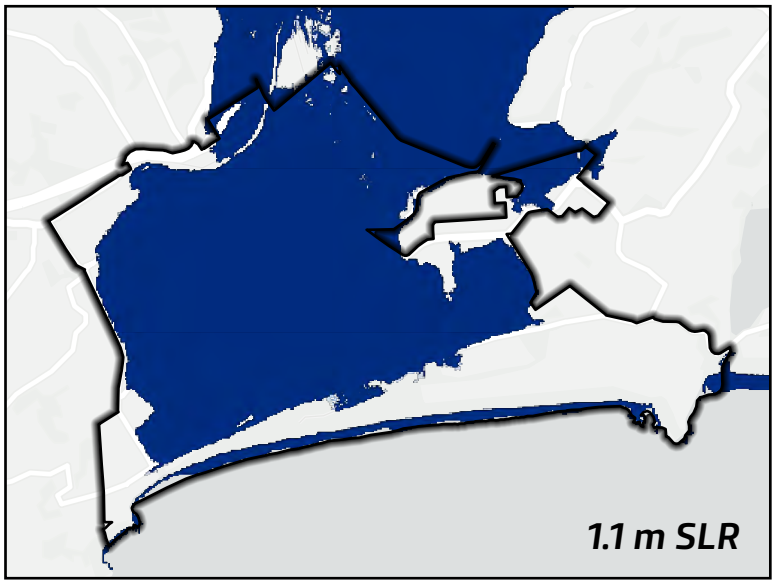












South Dunedin Future Boundary

20% AEP

10% AEP

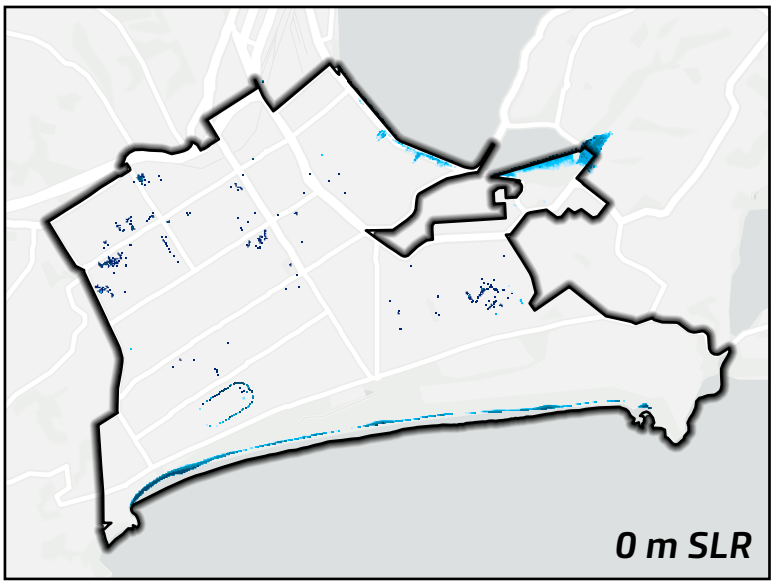
2% AEP

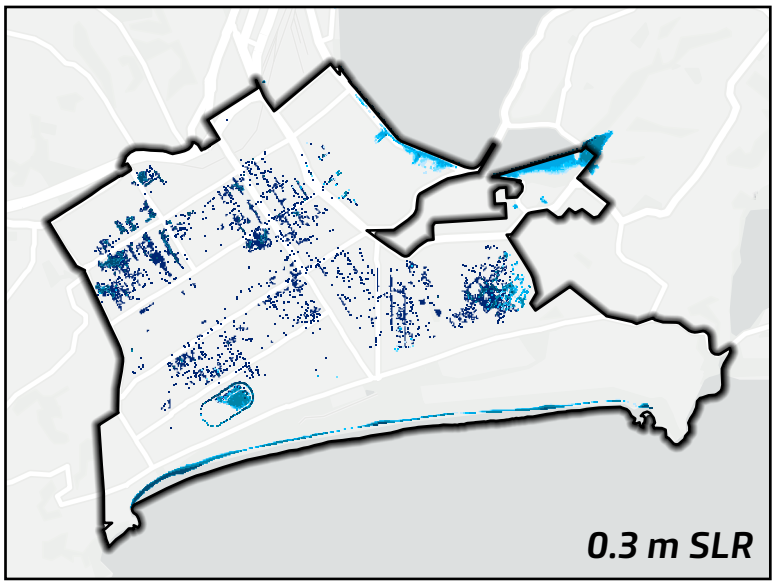
1% AEP

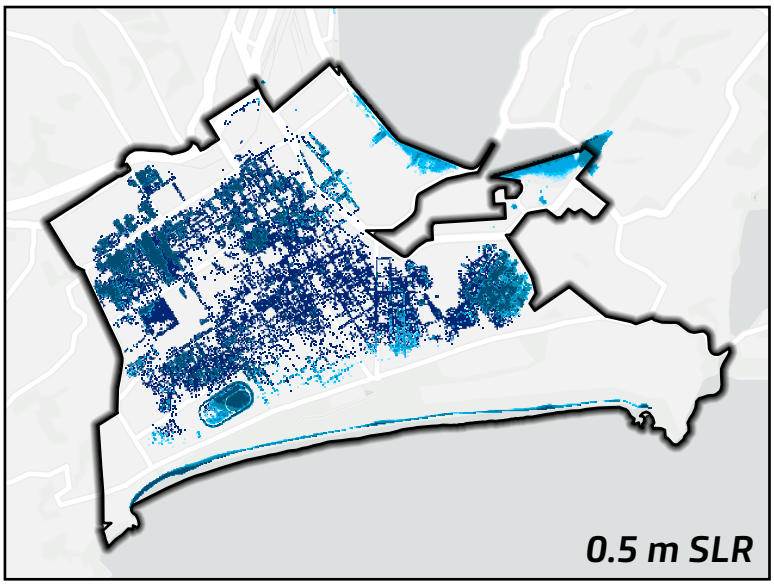
0 0.4 0.8 1.2 1.6 2 (km)

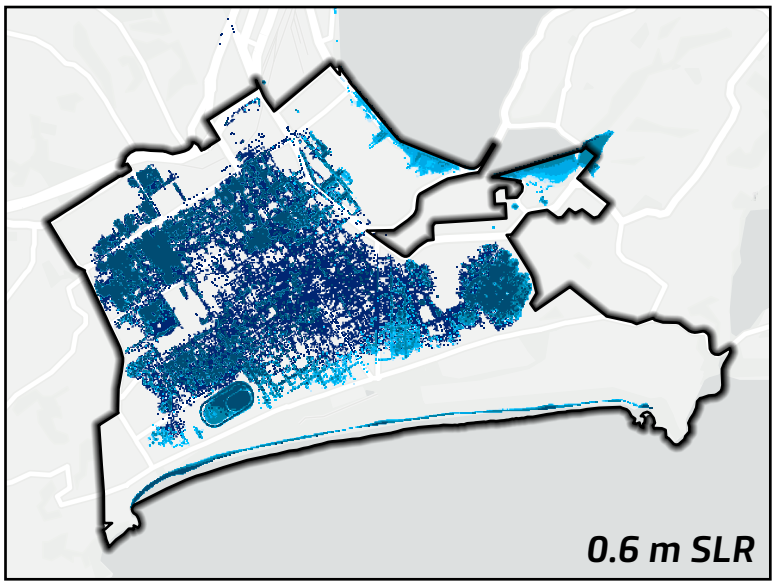
N

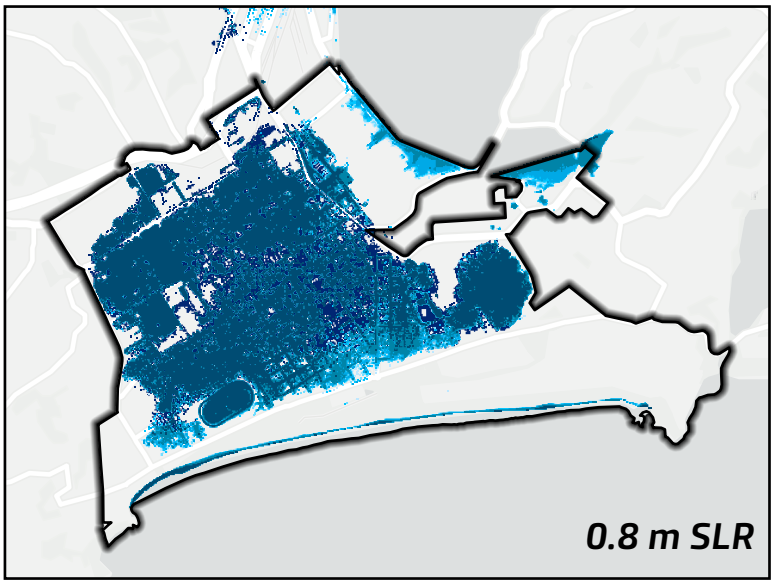
Emergent Groundwater Hazard

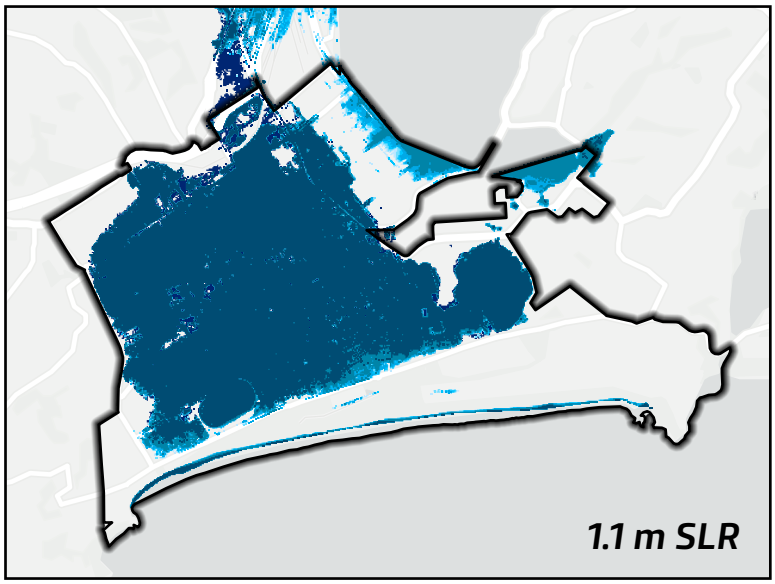












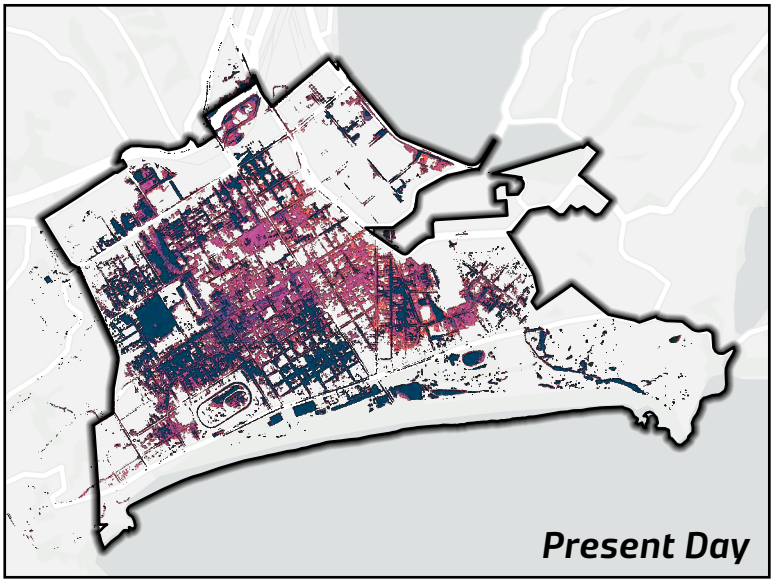
South Dunedin Future Boundary

Median
MHWS
ESL 99% AEP
ESL 10% AEP
ESL 1% AEP
ESL 0.1% AEP
95th percentile

0 0.4 0.8 1.2 1.6 2 (km)

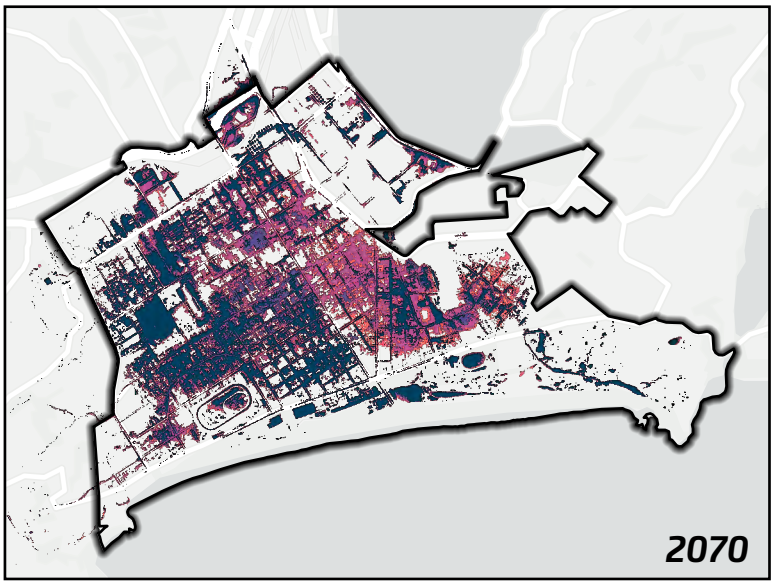
N

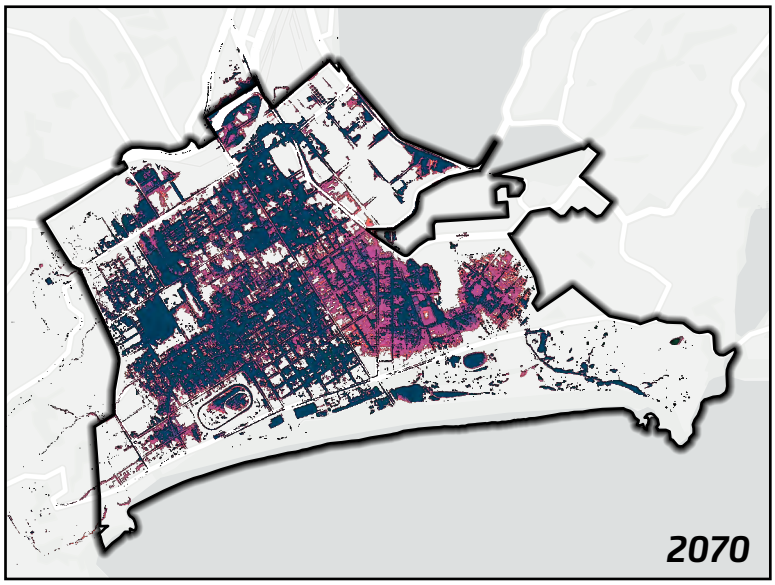
Pluvial Flood Hazard

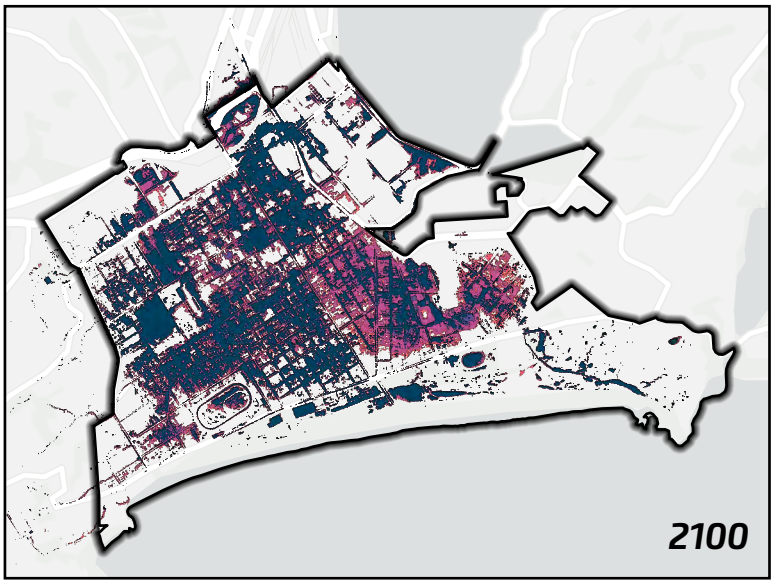


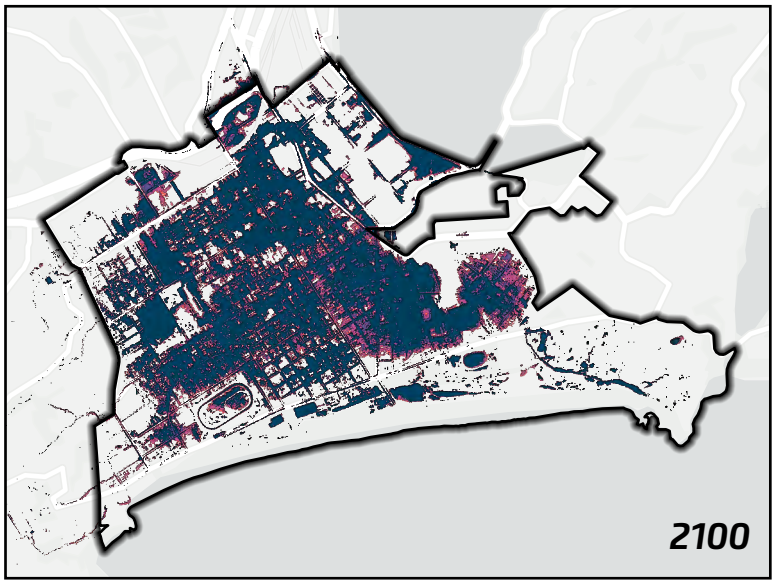
SSP2-4.5

SSP5-8.5









South Dunedin Future Boundary

20% AEP

10% AEP

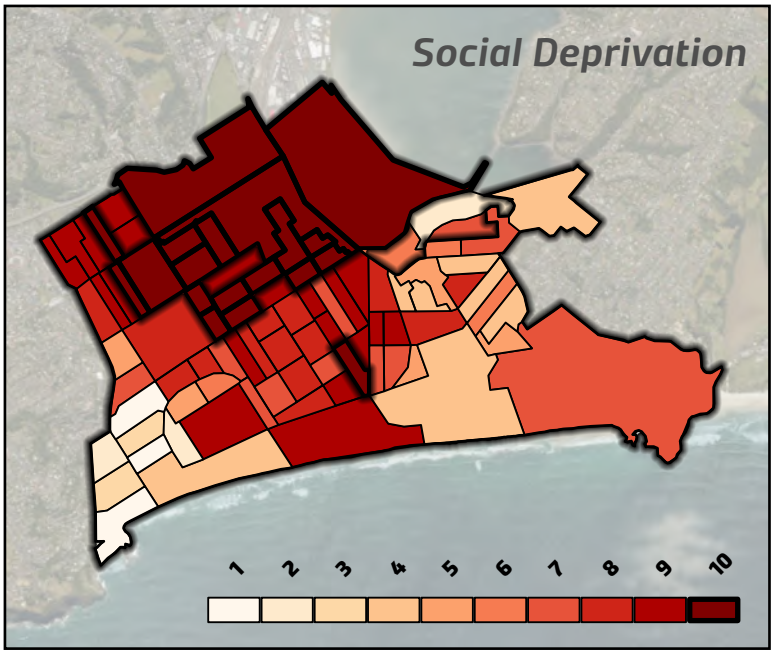
2% AEP

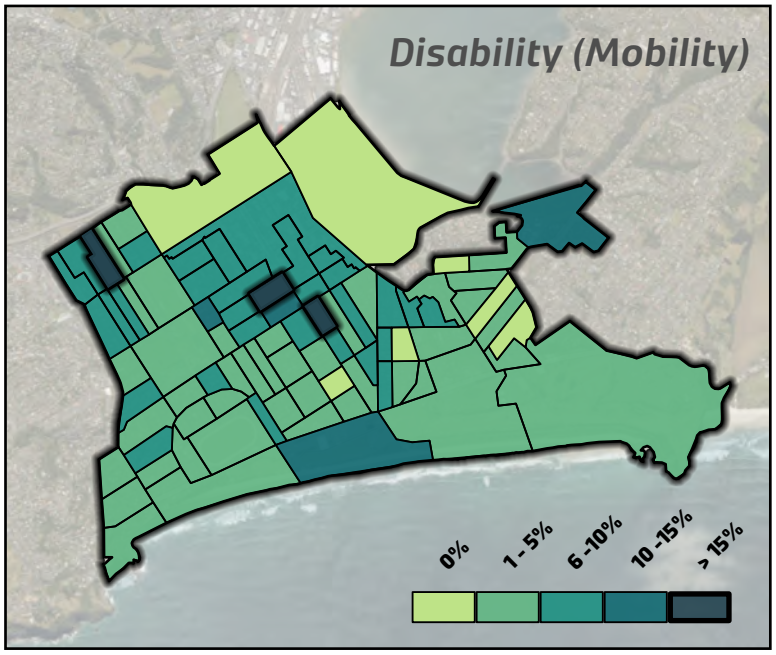
1% AEP

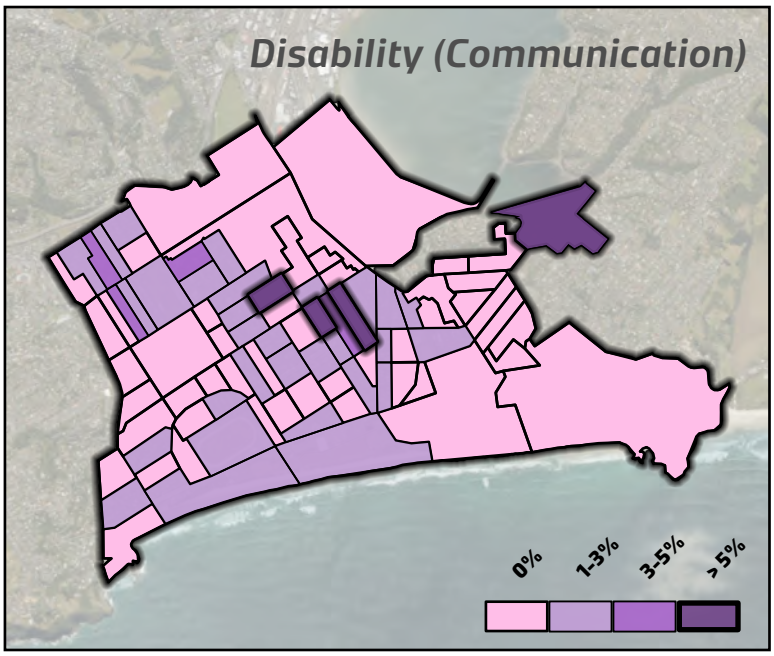
0 0.4 0.8 1.2 1.6 2 (km)

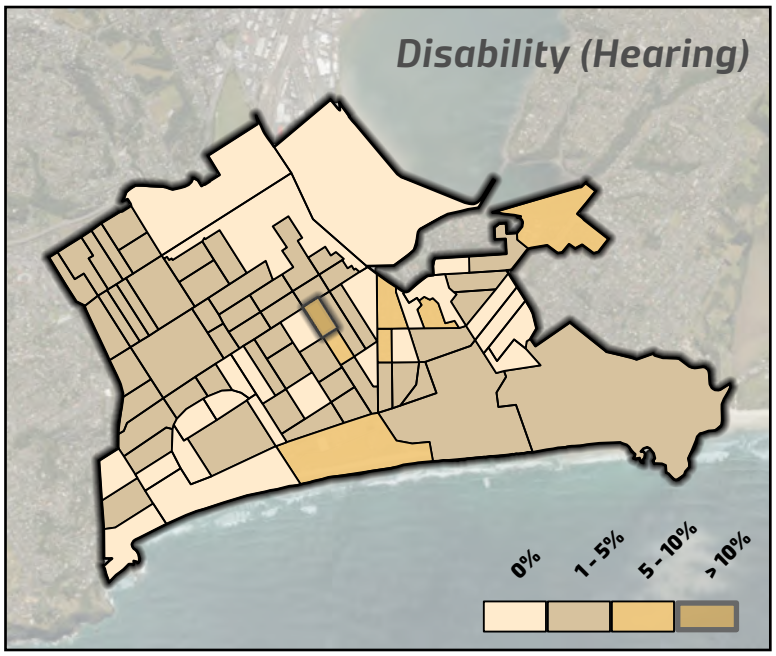
N

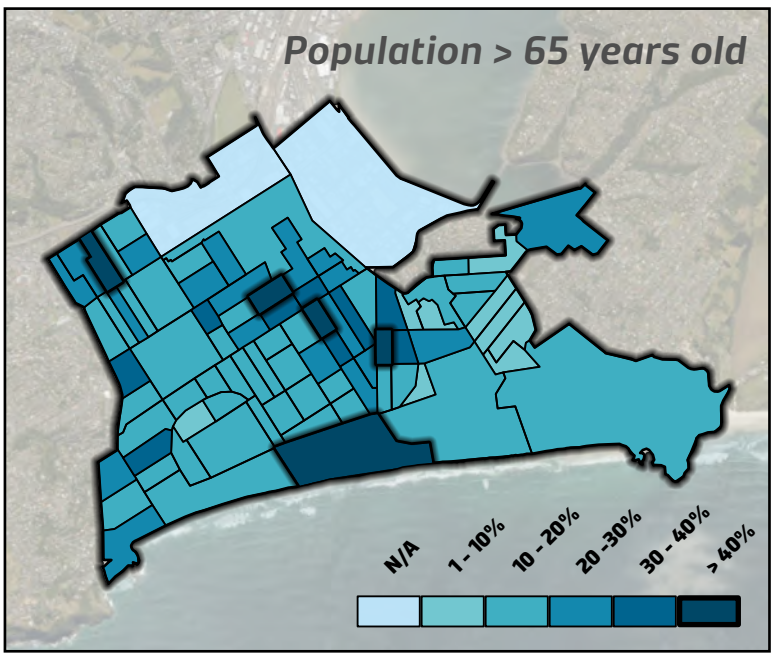
South Dunedin Future: Social Demographics

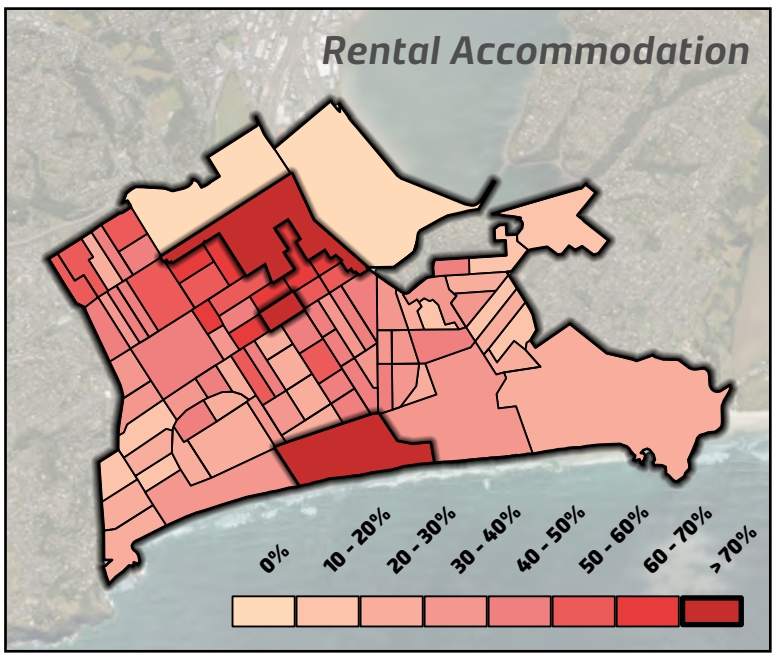


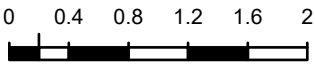






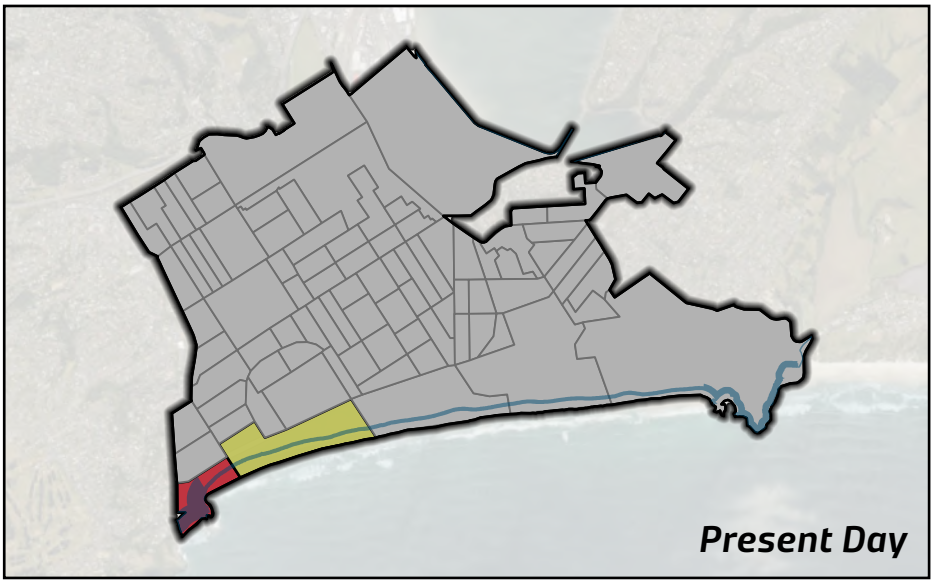


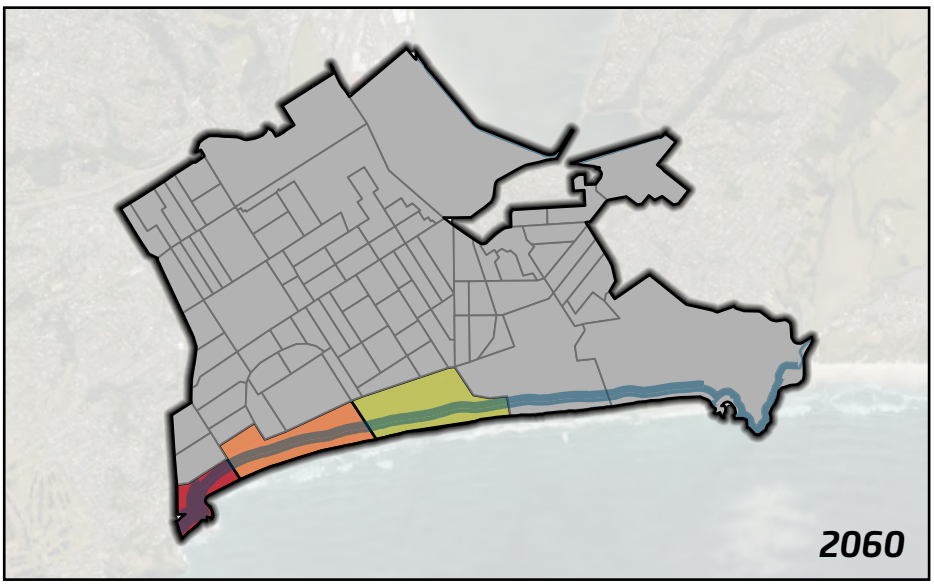


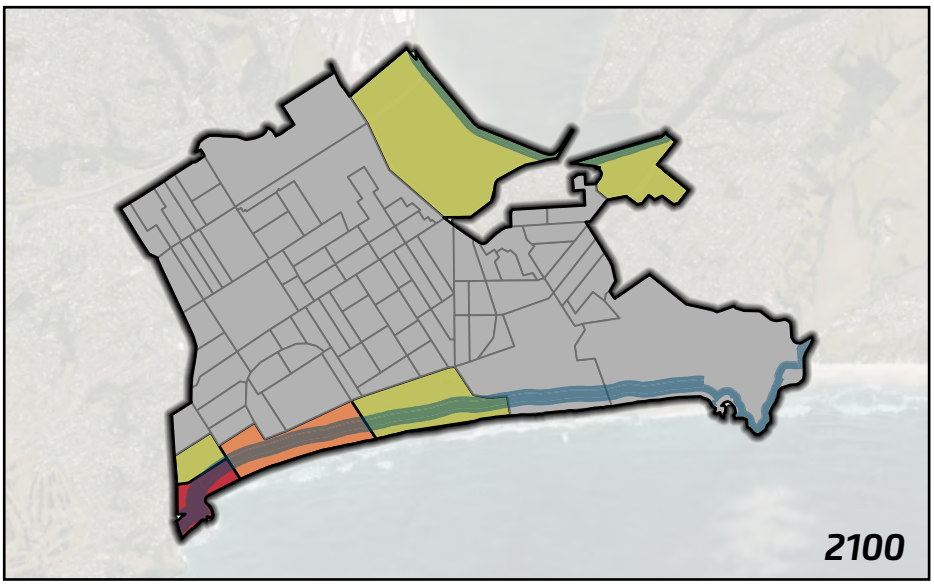


The SA1 boundaries have an ideal size range of 100-200 residents and a maximum population of 500.

Figure 5.6 Building risk due to coastal erosion aggregated to SA1 units







Explainer: These maps show the risk to buildings due to coastal erosion (blue shading), where risk ratings for individual buildings have been aggregated up to SA1 area level, to reflect available information and confidence levels. The maps indicate that coastal erosion risk to buildings is confined to the St Clair-St Kilda coastline at present day and mid-century, with higher risk of erosion at the St Clair end of the beach. There is a high level of uncertainty regarding coastal erosion risk due to data limitations at present e.g. scale of screening study and accounting for the impact of engineered structures). More detailed coastal hazard assessments are underway as part of the St Clair-St Kilda Coastal Plan, these will be completed in late-2025, after which the coastal erosion risk ratings will be reviewed.
Disclaimer: The aggregation or site specific risk supports the purposes of the South Dunedin Risk Assessment, including by enabling adaptation planning at a suburb-level, however it is not intended to assess risk at an individual building level – which requires more detailed hazard data and consideration of a range of building-specific factors (e.g. foundation type).
Hazard data source: WSP, 2024

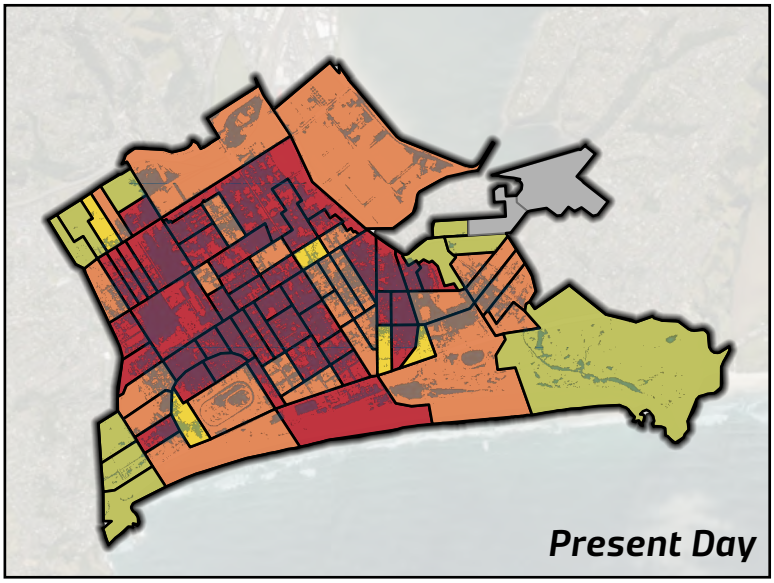
South Dunedin Future Boundary

Coastal erosion

0 0.4 0.8 1.2 1.6 2 (km)

Building (SA1 Boundary) Risk					
Risk Description	Very High	High	Moderate	Low	Not Exposed
Percentage of buildings in SA1 area located within a coastal erosion zone (high risk).	≥ 50%	21% - 49%	11% - 20%	1% - 10%	< 1%

Figure 5.7 Building risk due to pluvial flooding aggregated to SA1 units

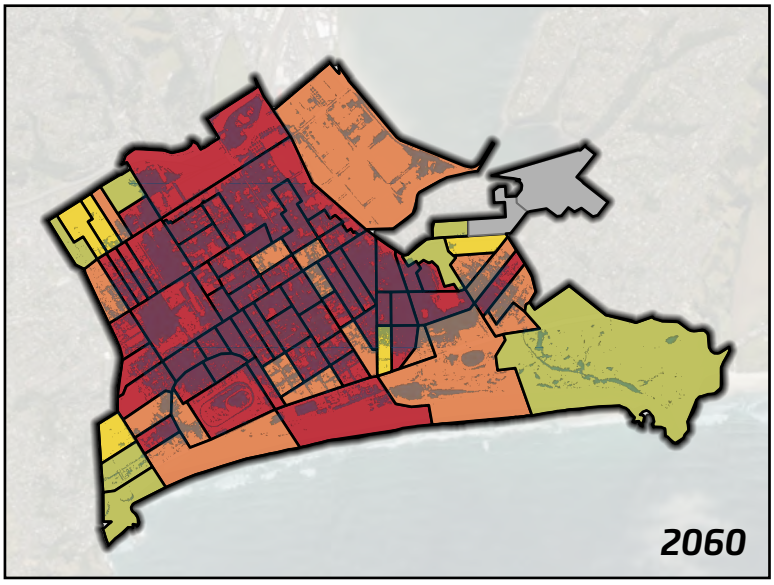


Explainer: These maps show the risk to buildings due to pluvial flooding (blue shading), where risk ratings for individual buildings have been aggregated up to SA1 area level, to reflect available information and confidence levels. The maps illustrate pluvial flood risk is already medium or high for most SA1 areas in South Dunedin, expanding to nearly all SA1 areas by 2100, particularly on The Flat. Flooding above floor level can result in significant damage to affected buildings, rendering them temporarily uninhabitable and in need of extensive and costly repairs. Flood damage can negatively impact building quality, value, and insurability, among other impacts (as outlined in Figure 6.1).

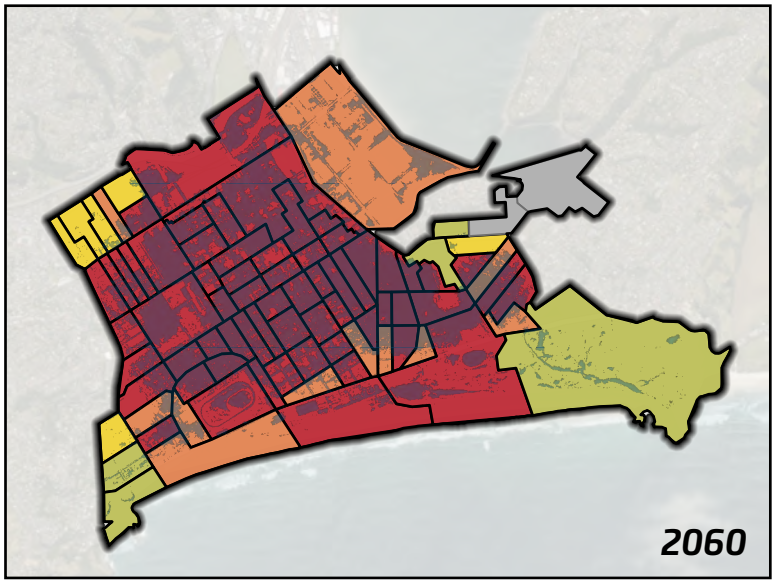
Disclaimer: The aggregation of site specific building risk to SA1 areas supports the purposes of the South Dunedin Risk Assessment, including by enabling adaptation planning at a suburb-level. However, it is not intended to assess risk at an individual building level – which requires consideration of a range of building-specific factors (e.g. floor level, construction material, building age, adjacent property, etc).

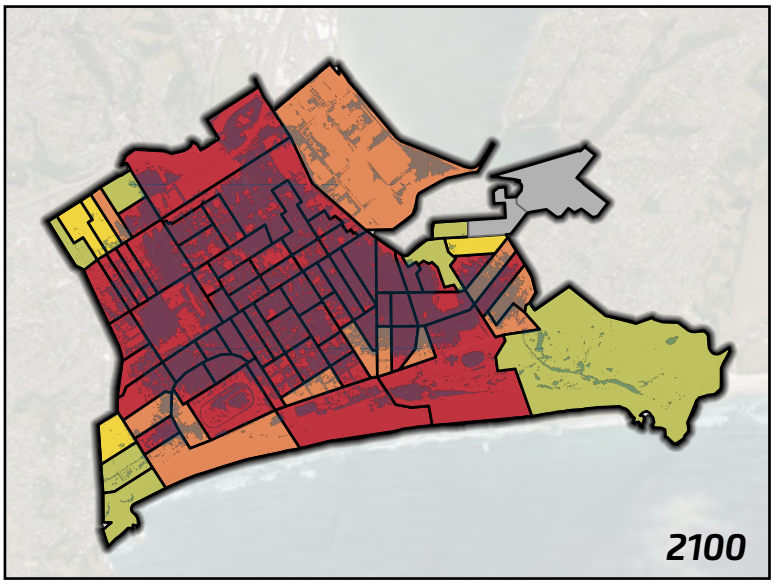
Hazard data source: DCC ICMP Flood Model (Beca, WSP, 2024)

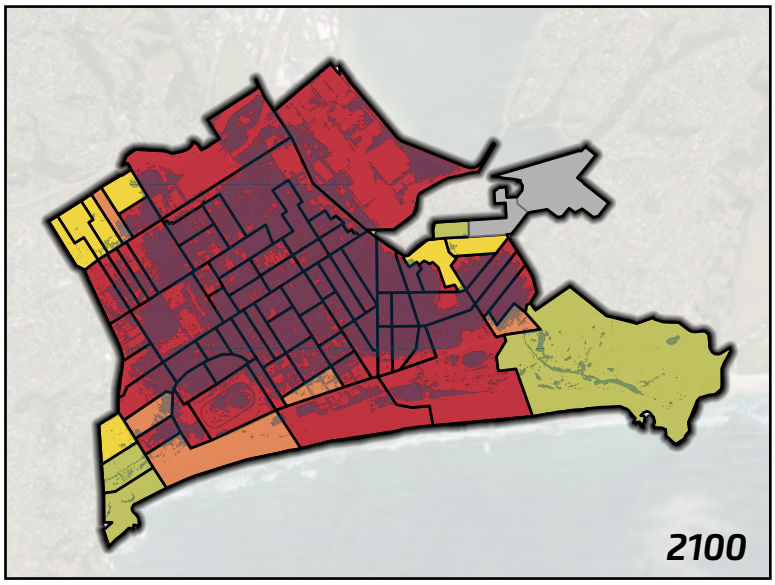
SSP2-4.5



SSP5-8.5

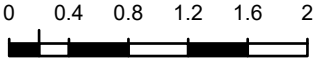






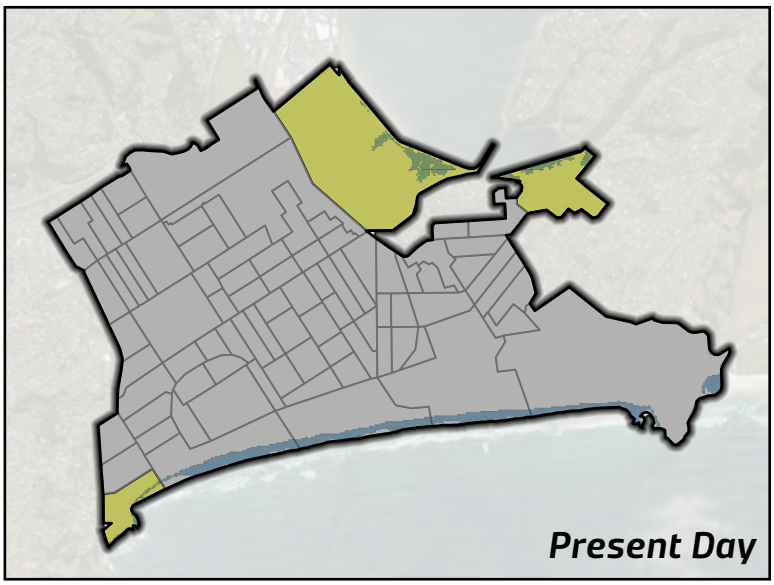
South Dunedin Future Boundary

1% AEP pluvial flood extent



Building (SA1 Boundary) Risk					
Risk Description	Very High	High	Moderate	Low	Not Exposed
Percentage of buildings in SA1 area rated high or medium risk for flooding above floor level in 10% AEP event (high) and 10-1% AEP event (medium)	≥ 50%	21% - 49%	11% - 20%	1% - 10%	< 1%

Figure 5.8 Building risk due to coastal inundation aggregated to SA1 units



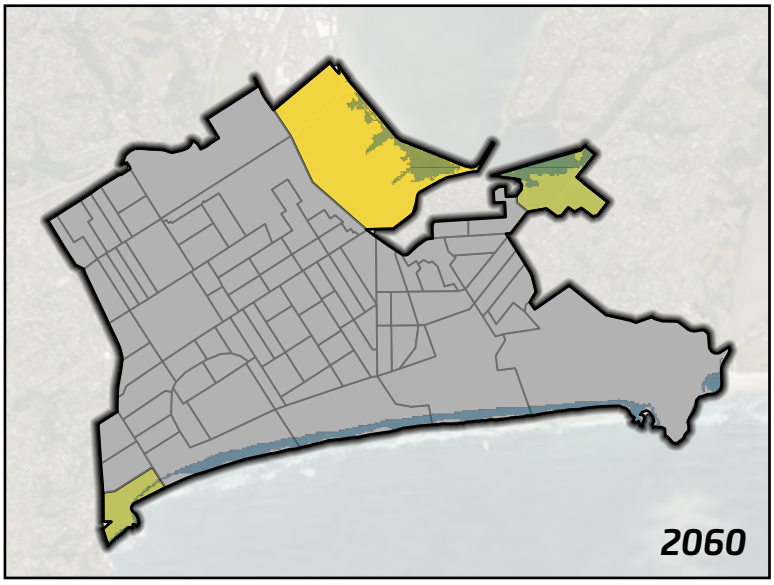
Explainer: These maps show the risk to buildings due to coastal inundation (blue shading), where risk ratings for individual buildings have been aggregated up to SA1 area level, to reflect available information and confidence levels. The maps illustrate a small area of low coastal inundation risk near the Portsmouth Drive and St Clair coastal edge at present day, with risk around Portsmouth Drive increasing to moderate and high at mid-century. At late century, coastal inundation rises to very high across the majority of South Dunedin due to potential overtopping at Portsmouth Drive flowing into The Flat. Flooding by salt water can result in significant damage to affected buildings, rendering them temporarily uninhabitable and in need of extensive and costly repairs. Flood damage can negatively impact building quality, value, and insurability, among other impacts (as outlined in Figure 6.1).

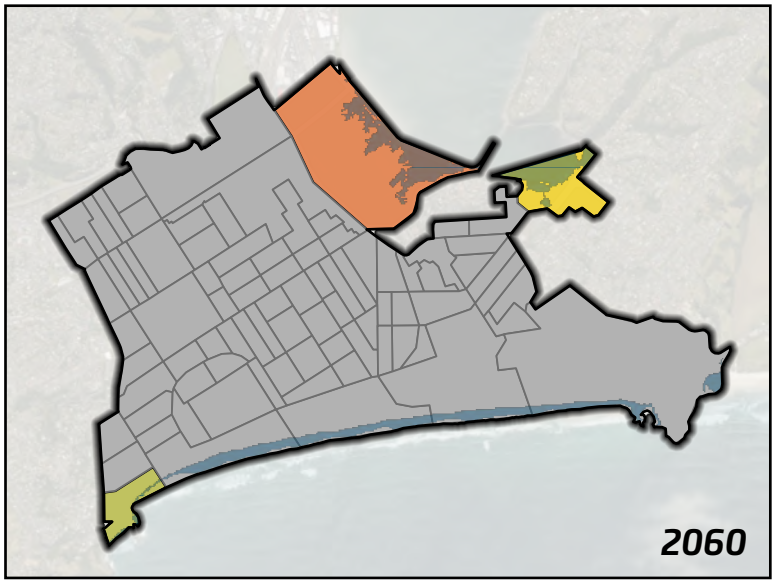
Disclaimer: The aggregation of site specific building risk to SA1 areas supports the purposes of the South Dunedin Risk Assessment, including by enabling adaptation planning at a suburb-level. However, it is not intended to assess risk at an individual building level – which requires consideration of a range of building-specific factors (e.g. floor level, construction material, building age, etc).

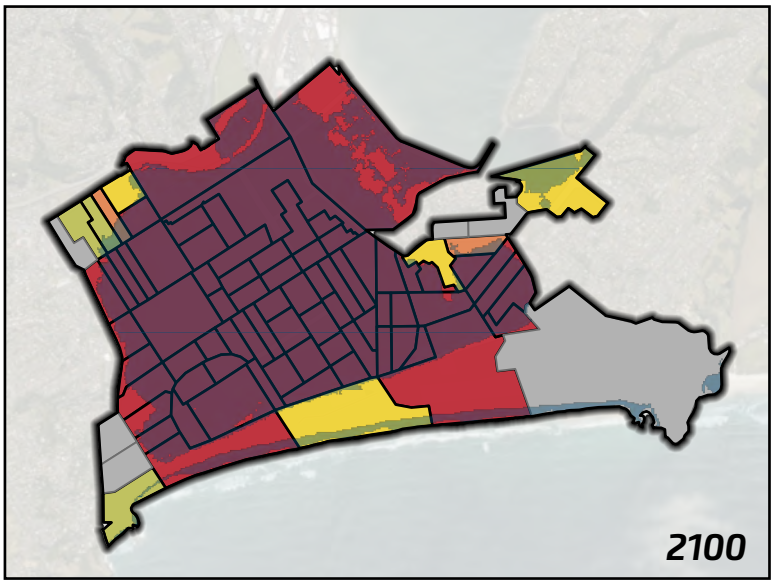
Hazard data **source:** Paulik, et al., 2023

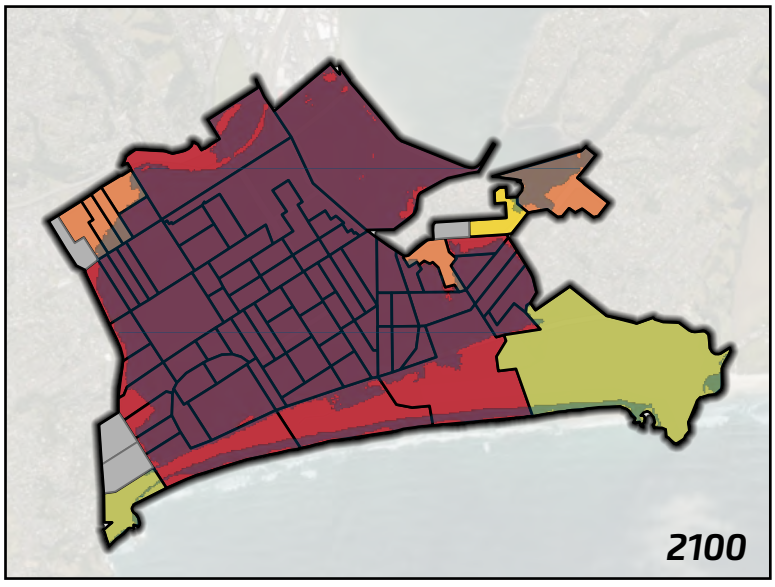
SSP2-4.5

SSP5-8.5



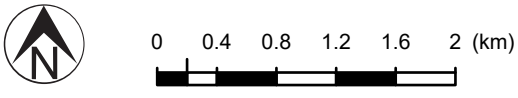






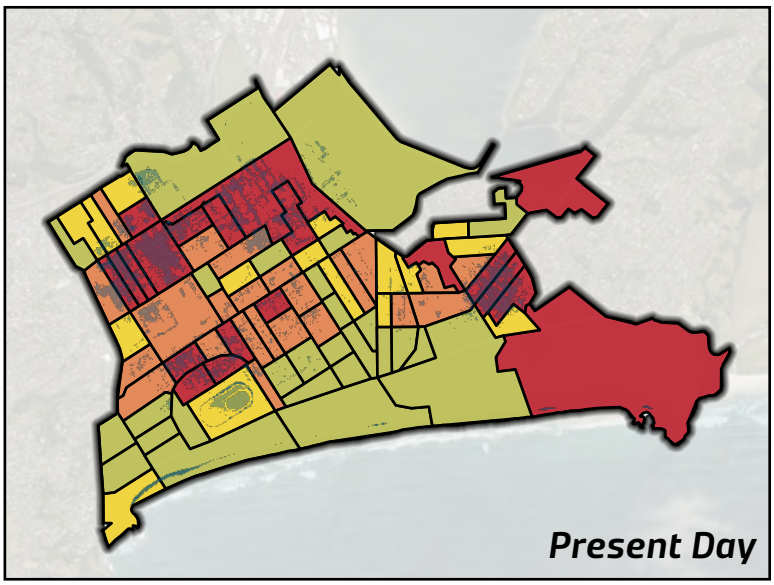
South Dunedin Future Boundary

1% AEP coastal inundation extent



Building (SA1 Boundary) Risk					
Risk Description	Very High	High	Moderate	Low	Not Exposed
Percentage of buildings in SA1 area rated high or medium risk for flooding above floor level in 10% AEP event (high) and 10-1% AEP event (medium)	≥ 50%	21% - 49%	11% - 20%	1% - 10%	< 1%

Figure 5.9 Building risk due to groundwater aggregated to SA1 units

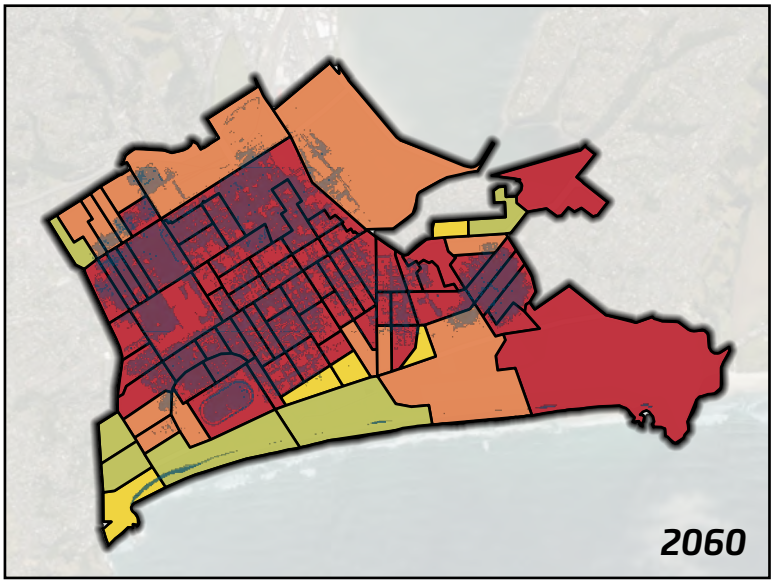


Explainer: These maps show the risk to buildings due to groundwater hazard (blue shading), where risk ratings for individual buildings have been aggregated up to SA1 area level, to reflect available information and confidence levels. The maps illustrate groundwater risk is already medium or high for many SA1 areas in South Dunedin, expanding to nearly all SA1 areas by 2100, particularly on The Flat. High risk to buildings is driven by exposure to emergent groundwater (dark blue shading), which can cause instability in building foundations, lead to issues of dampness and mould in housing, and may cause various environmental problems such as pollution and salinity stress in properties. Where groundwater is high but not yet emergent (light blue shading), groundwater is unlikely to damage building condition, but will impact the liveability of homes. These issues can negatively impact building quality, value, and insurability, among other impacts (as outlined in Figure 6.1).

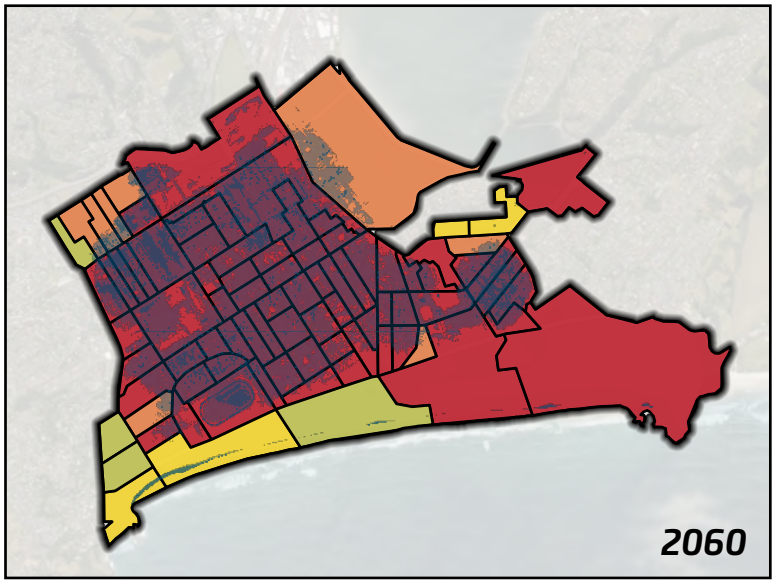
Disclaimer: The aggregation of site specific building risk to SA1 areas supports the purposes of the South Dunedin Risk Assessment, including by enabling adaptation planning at a suburb-level. However, it is not intended to assess risk at an individual building level – which requires consideration of a range of building-specific factors (e.g. floor level, moisture barriers, etc).

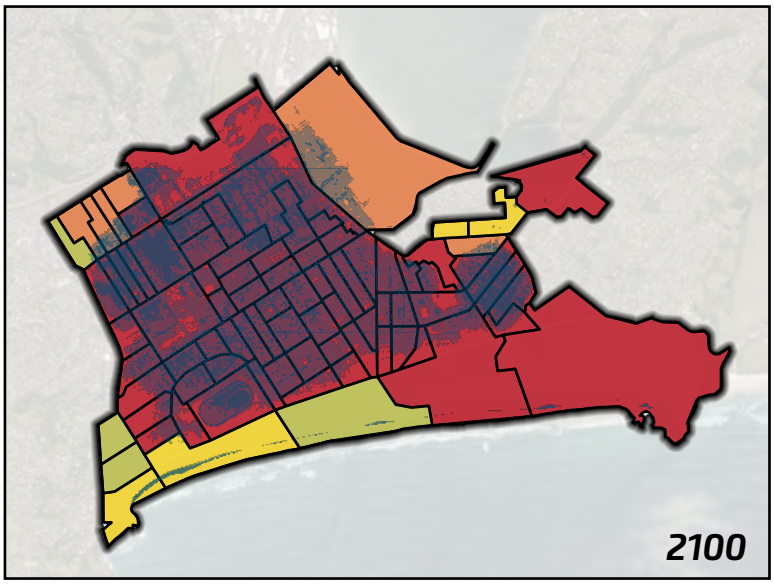
Hazard data source: Cox, et al., 2023

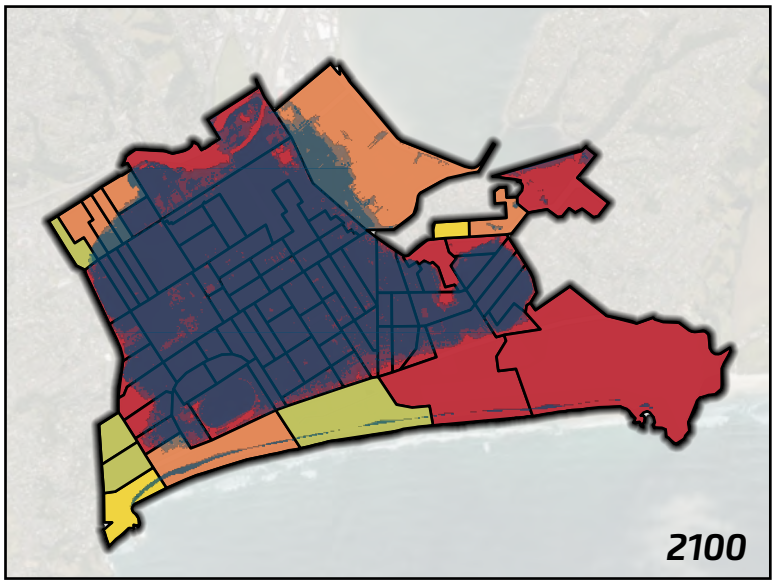
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

Emergent groundwater (median)

Median groundwater level (at 0.5 m below ground level)

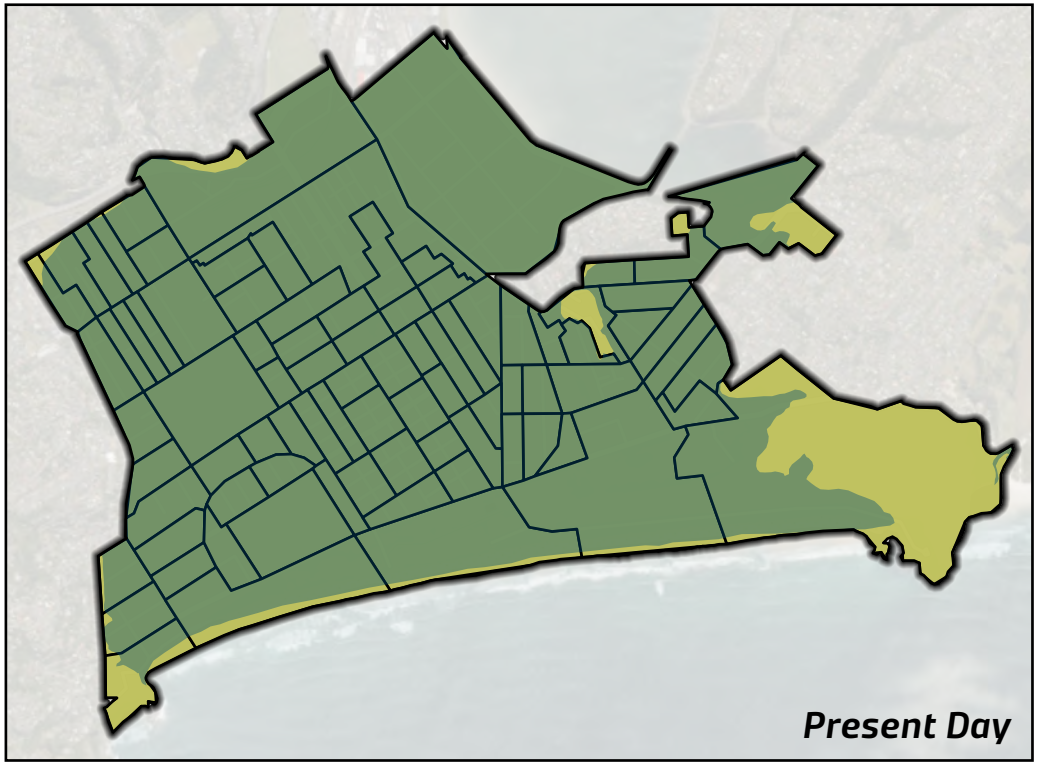
N

0 0.4 0.8 1.2 1.6 2 (km)

Building (SA1 Boundary) Risk					
Risk Description	Very High	High	Moderate	Low	Not Exposed
Percentage of buildings in SA1 area rated high or medium risk for emergent groundwater (high), groundwater within 0.5 m of surface (medium).	≥ 50%	21% - 49%	11% - 20%	1% - 10%	< 1%

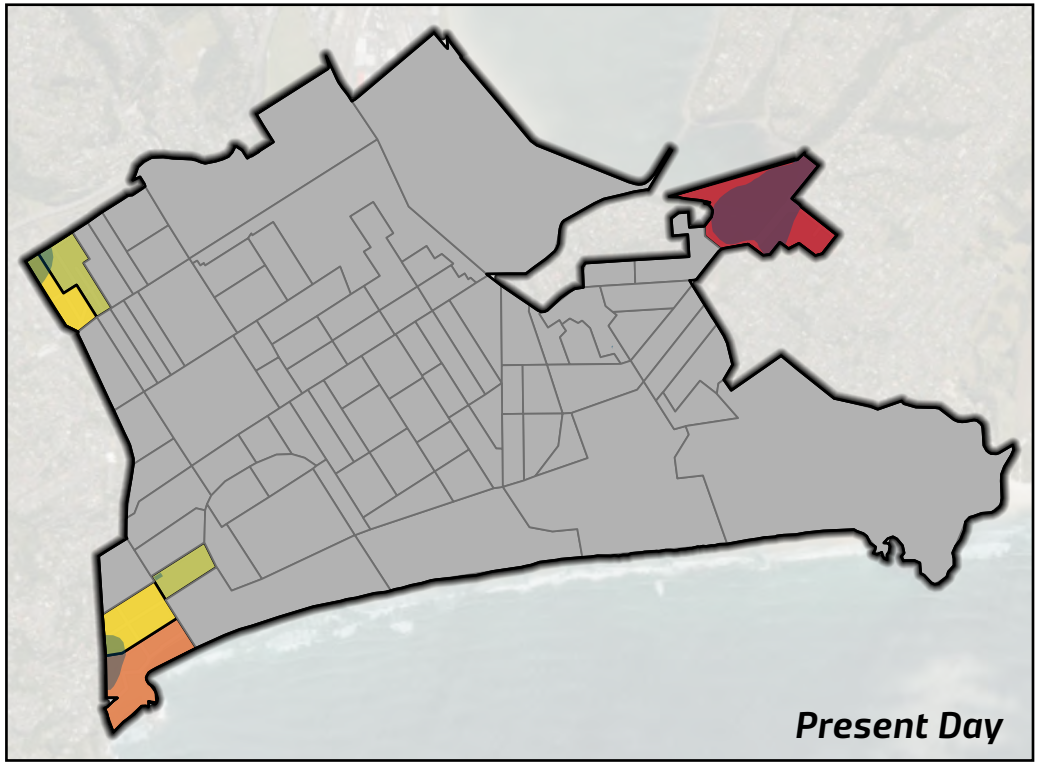
Figure 5.10 Building risk due to landslide and liquefaction aggregated to SA1 units

Liquefaction



Explainer: These maps show the risk to buildings due to liquefaction (blue shading), where risk ratings for individual buildings have been aggregated up to SA1 area level, to reflect available information and confidence levels. The maps illustrate liquefaction risk is low across South Dunedin at the present day. Liquefaction risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of sea level rise on liquefaction potential. If it were to occur, liquefaction can cause differential settlement and lateral spreading that distorts structures, reduces foundation-bearing capacity, and damages pile supports and service connections. Liquefaction damage can negatively impact building quality, value, and insurability, among other impacts (as outlined in Figure 6.1).
Disclaimer: The aggregation of site specific building risk to SA1 areas supports the purposes of the South Dunedin Risk Assessment, including by enabling adaptation planning at a suburb-level. However, it is not intended to assess risk at an individual building level – which requires consideration of a range of building-specific factors (e.g. foundation design, construction material, building age, etc). Liquefaction hazard information is based on a high level desktop review, where subsequent site specific assessment (Hornblow, 2020) has found that liquefaction potential is highly variable across sites analysed.
Hazard data source: Hornblow, 2020

Landslide



Explainer: These maps show the risk to buildings due to landslide, where risk ratings for individual buildings have been aggregated up to SA1 area level, to reflect available information and confidence levels. The maps illustrate that this type of landslide risk is confined to areas around the South Dunedin boundary. Landslides can severely damage buildings resulting in sudden collapse or failure and posing a potential risk to life. Landslide damage can negatively impact building quality, value, and insurability, among other impacts (as outlined in Figure 6.1). Landslide risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of climate change (groundwater level rising or increased rainfall intensity) on landslide.
Disclaimer: The aggregation of site specific building risk to SA1 areas supports the purposes of the South Dunedin Risk Assessment, including by enabling adaptation planning at a suburb-level. However, it is not intended to assess risk at an individual building level – which requires consideration of a range of building-specific factors (e.g. foundation design, construction material, building age, etc). The landslide extent is based on known landslide areas and does not account for other potential sources of landslide nor represent the extent of the area of deposition/runout.
Hazard data source: DCC Hazard database data provided for South Dunedin Future programme

South Dunedin Future Boundary

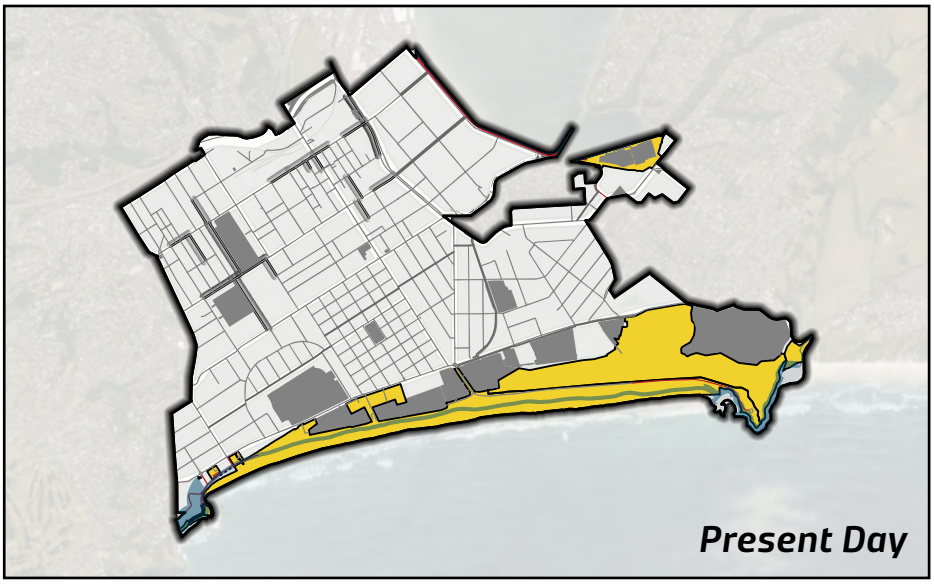
Land instability

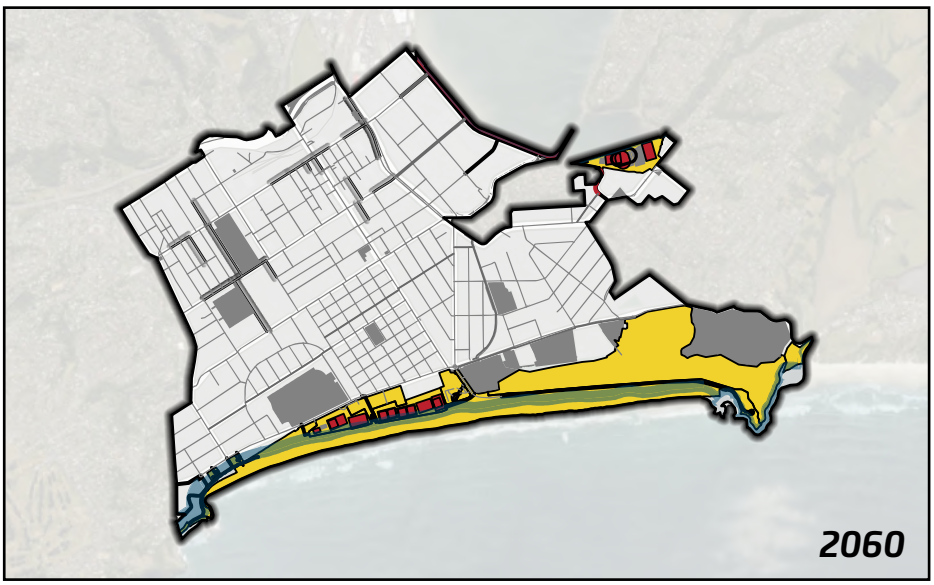
Liquefaction (Domain C: moderate liquefaction potential)

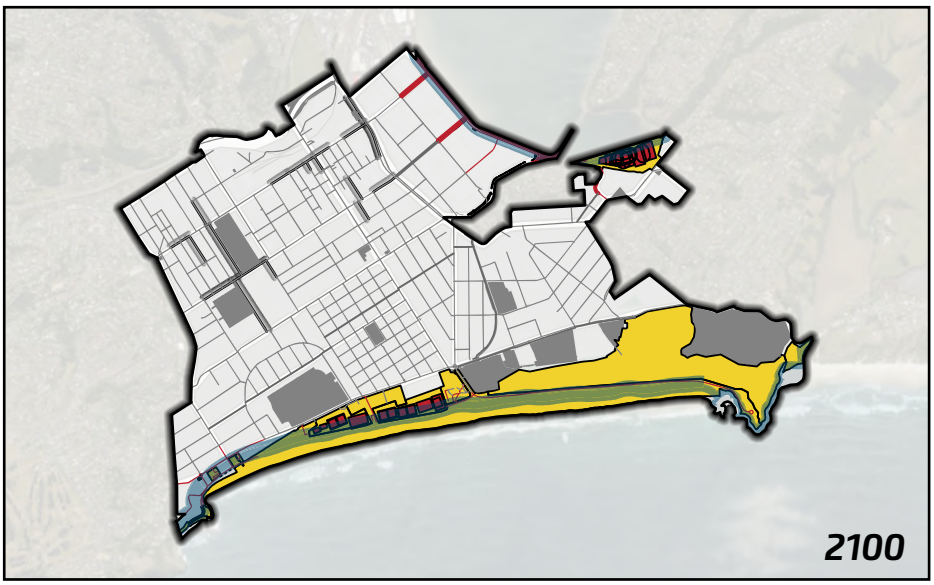
0 0.4 0.8 1.2 1.6 2 (km)

Building (SA1 Boundary) Risk					
Risk Description	Very High	High	Moderate	Low	Not Exposed
Percentage of buildings in SA1 area rated high or medium risk for landslide and liquefaction	**≥ 50%**	**21% - 49%**	**11% - 20%**	**1% - 10%**	**< 1%**

Figure 5.19 Open spaces and roads risk due to coastal erosion







Explainer: These maps show the risk to transport and open spaces due to coastal erosion, noting that there is a high level of uncertainty regarding coastal erosion risk due to data limitations at present (e.g. scale of screening study and accounting for impact of engineered structures). The maps indicate that coastal erosion risk to transport and open spaces is identified at the Otago Harbour coastal edge and the St Clair-St Kilda coastline at present day and mid-century, with high risk to some playing fields emerging at mid century.
Disclaimer: These maps are not intended to assess coastal erosion risk to specific assets, which requires more detailed hazard data and consideration of a range of building specific factors (e.g. foundation type). More detailed coastal hazard assessments are underway as part of the St Clair-St Kilda Coastal Plan, these will be completed in late-2025, after which coastal erosion risk ratings will be reviewed.
Hazard data source: WSP, 2024

South Dunedin Future Boundary

Coastal erosion*

Roads (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

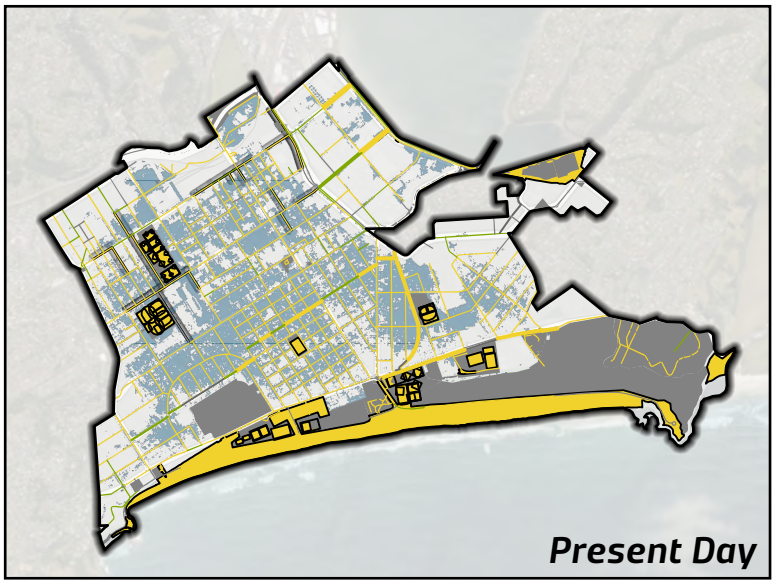
Open Spaces (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Major criticality route

N

0 0.4 0.8 1.2 1.6 2 (km)

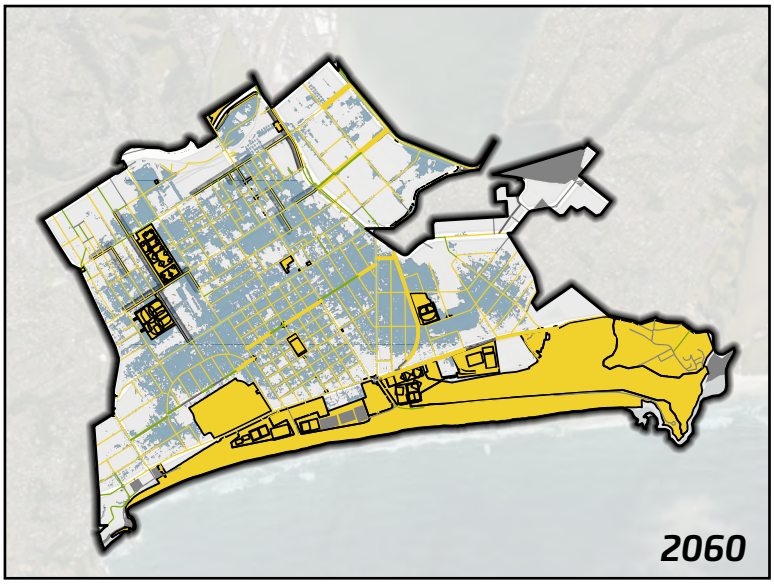
Figure 5.20 Open spaces and roads risk due to pluvial flooding

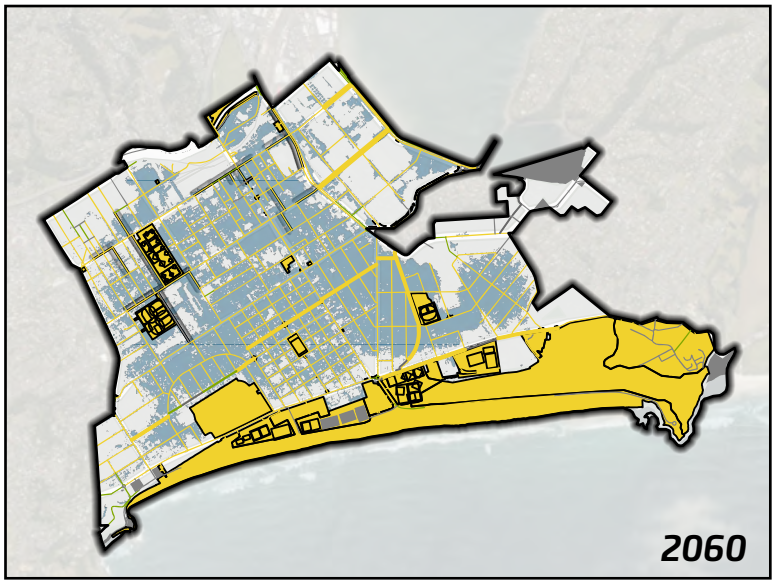


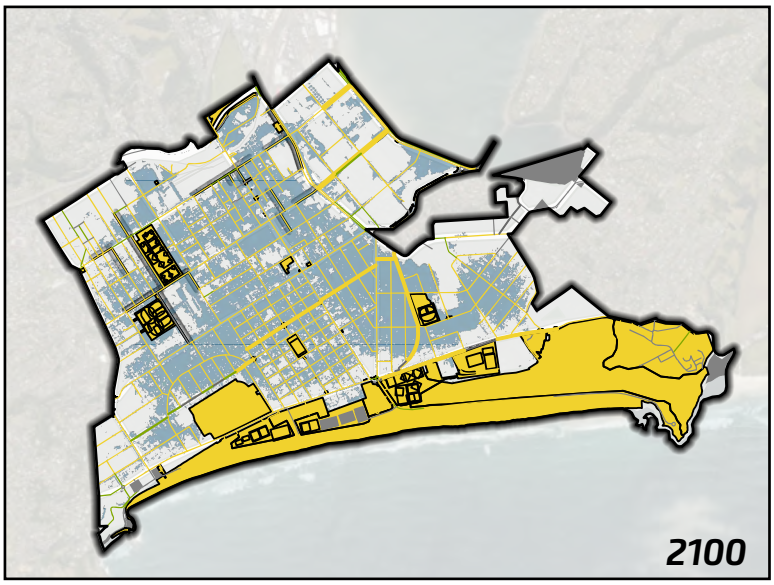
Explainer: These maps show the risk to roads and open spaces due to pluvial flooding (blue shading). Risk ratings for individual roads and open spaces are based on exposure of each asset to modelled pluvial flood plains, combined with the vulnerability of the park or road to flooding. Many roads and open spaces are extremely e posed, due to relatively frequent severe flooding (>10 % AEP). However, roads are rated to have low vulnerability to pluvial flooding as they tend to sustain minor damage that can be repaired through regular maintenance, as a result, they are typically rated medium risk. Parks are rated to have moderate vulnerability to periodic flooding, and are typically rated medium risk. Playing fields have higher vulnerability to increased seasonality (i.e. wetter winters), however this hazard is not assessed. The maps illustrate present day pluvial flood risk is medium for most roads and many open spaces within South Dunedin, expanding to nearly all roads and open spaces by 2100, particularly on The Flat. Flooding of roads may disrupt 'major criticality' transport routes (grey shadow on road) which may impact essential services or have wider social or economic impacts (as outlined in Figure 6.1).
Disclaimer: These maps are not intended to assess pluvial flooding risk at individual asset level, which requires consideration a range of site and asset specific factors.
Hazard data source: DCC ICMP Flood Model (Beca, WSP, 2024)

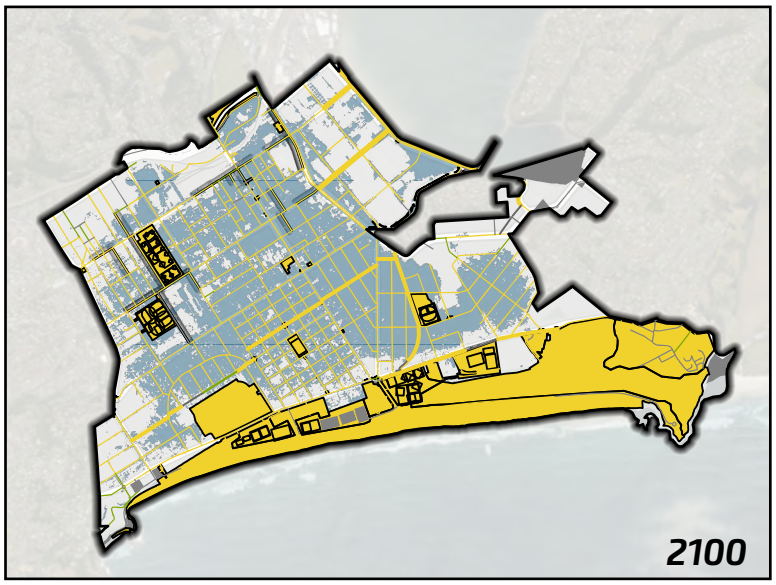
SSP2-4.5

SSP5-8.5









South Dunedin Future Boundary

1% AEP pluvial flood extent

Roads (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

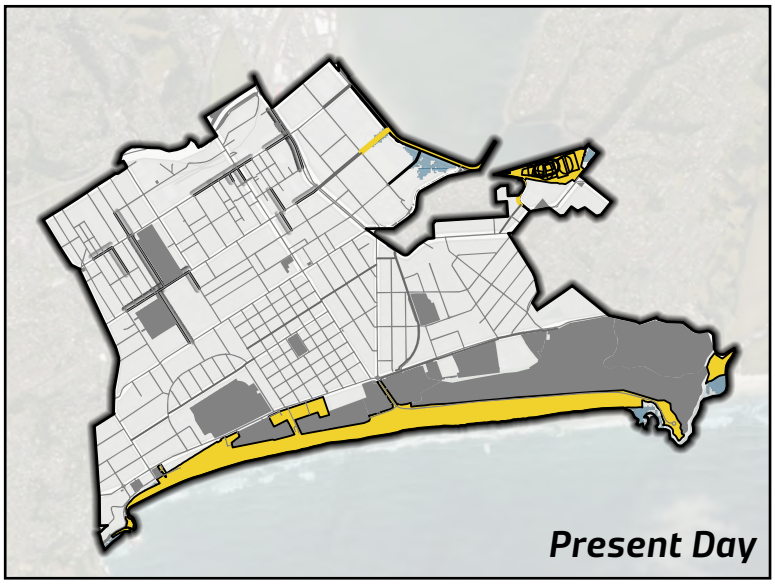
Open Spaces (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Major criticality route

N

0 0.4 0.8 1.2 1.6 2 (km)

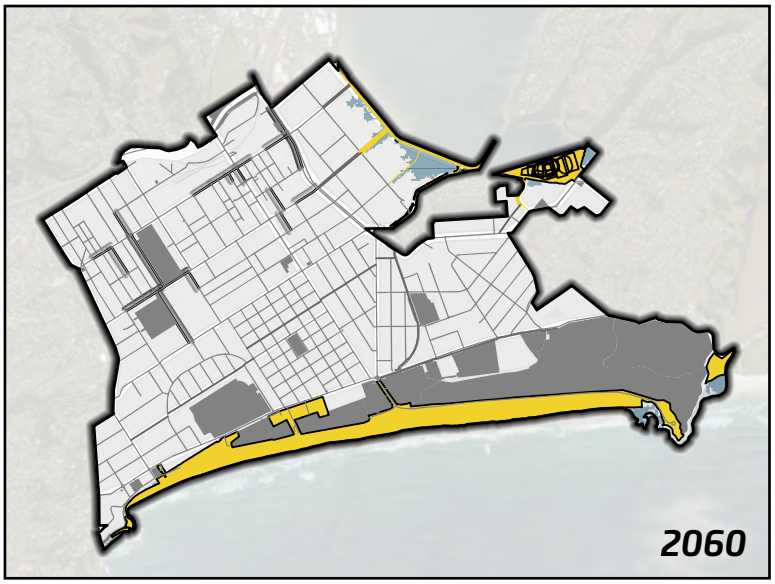
Figure 5.21 Open spaces and roads risk due to coastal inundation

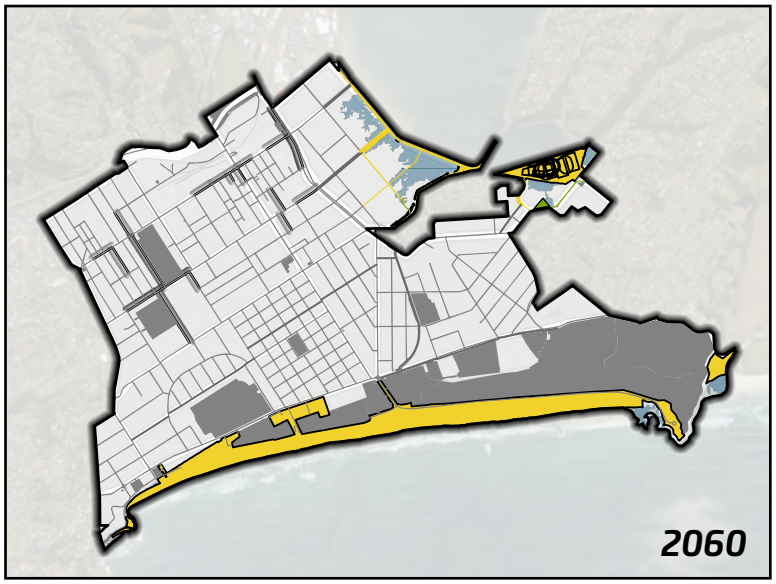


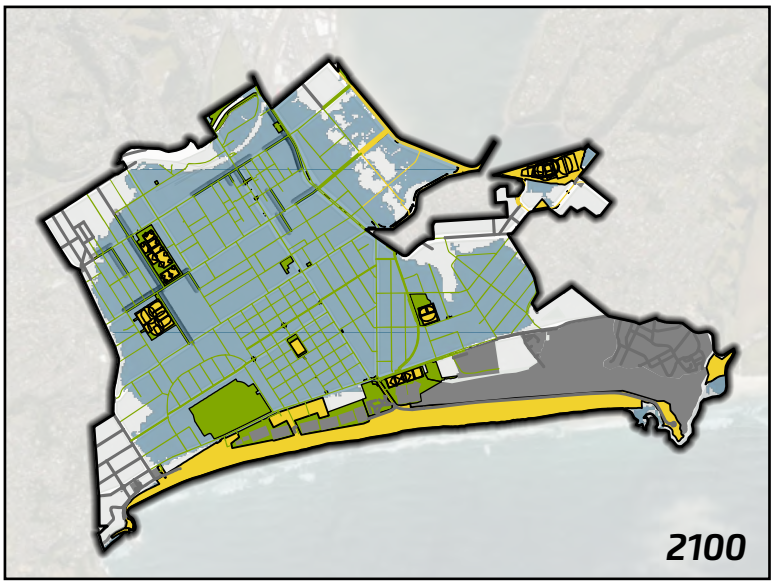
Explainer: These maps show the risk to roads and open spaces due to coastal inundation (blue shading). Risk ratings for individual roads and open spaces are based on exposure of each asset to modelled inundation at a range of return intervals, combined with the vulnerability of roads, parks and playing fields to inundation. While many roads and open spaces are extremely exposed, due to relatively frequent severe flooding (>10% AEP), road assets are rated to have low vulnerability to inundation as they tend to sustain minor damage that can be repaired through regular maintenance. Playing fields are rated to have moderate vulnerability to coastal inundation as they are likely to sustain damage, but can recover between events. The maps illustrate very little coastal inundation risk for most roads and many parks and playing fields until late century, at which time nearly all roads and open spaces are rated to have medium risk by 2100, particularly on The Flat. Inundation of roads may disrupt 'major criticality' transport routes (grey shadow on road) which may impact essential services or have wider social or economic impacts (as outlined in Figure 6.1).
Disclaimer: These maps are not intended to assess coastal inundation risk at the individual asset level, which requires consideration of site specific flooding risk as well as a range of other factors.
Hazard data source: Paulik, et al., 2023

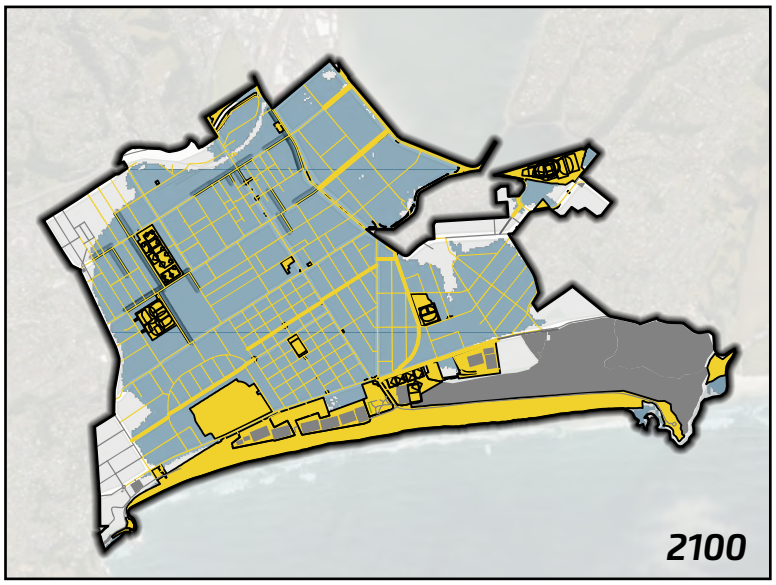
SSP2-4.5

SSP5-8.5









South Dunedin Future Boundary

1% AEP coastal inundation extent

Roads (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Open Spaces (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Major criticality route

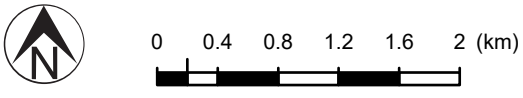
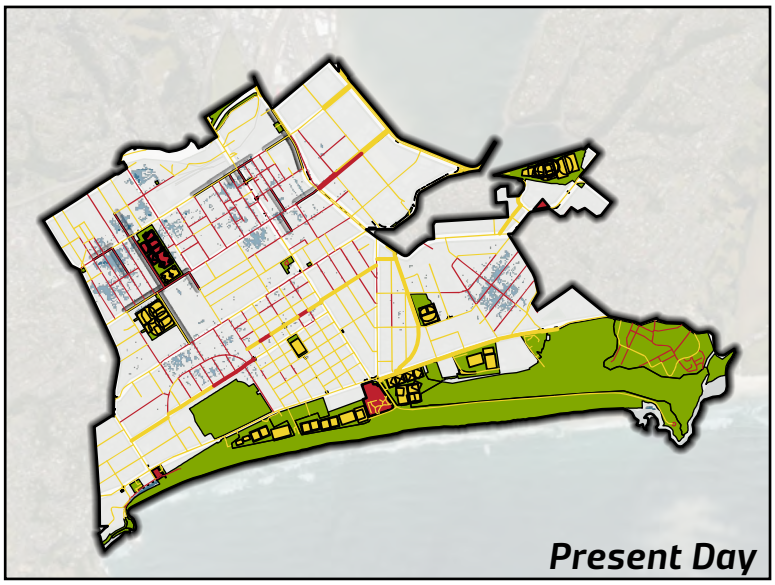


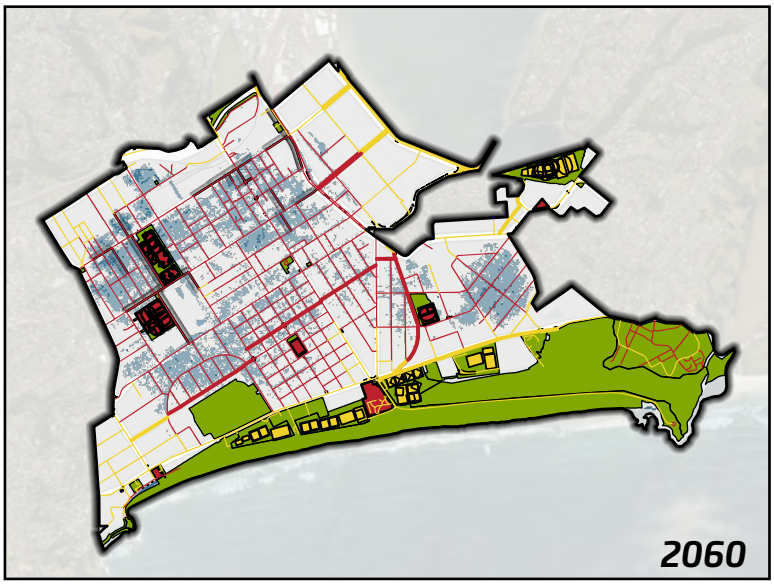
Figure 5.22 Open spaces and roads risk due to groundwater

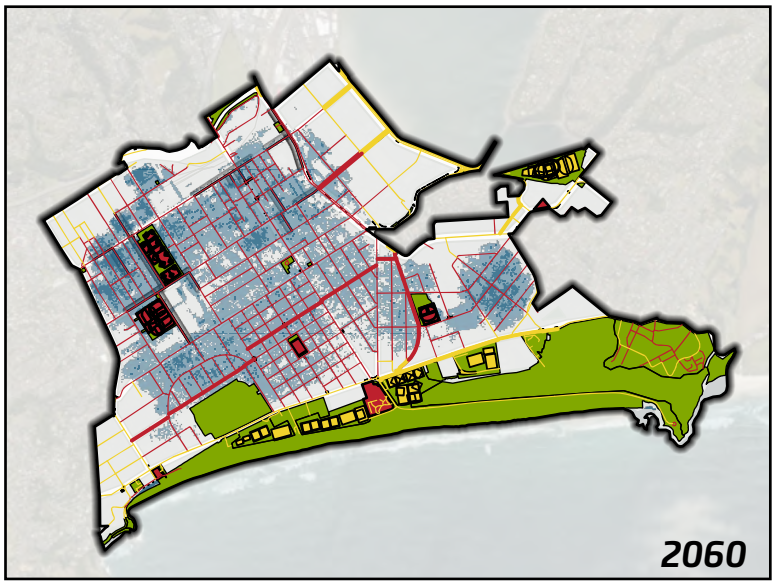


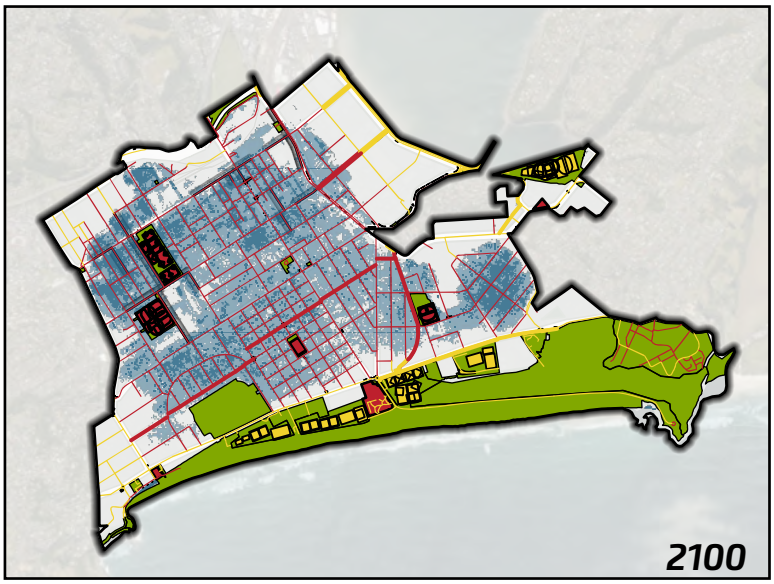
Explainer: These maps show the risk to roads and open spaces due to groundwater hazard. Risk ratings for road sections and open spaces are based on exposure of each asset to the modelled median groundwater level (blue shading), where roads are assessed to be highly vulnerable if groundwater rises to within 0.4 to 0.6 m of the ground surface (light blue shading). Playing fields and playgrounds are extremely vulnerable if groundwater rises to within 0.3 m of the ground surface, though all other parkland is less vulnerable due to greater adaptive capacity. The maps illustrate some roads, parks and playing fields are already at high risk, and by late century the majority of roads and many playing fields are at high risk. High groundwater may cause deterioration of the road basecourse and loss of function of playing fields. This may disrupt 'major criticality' transport routes (grey shadow on road) which may impact essential services or have wider social or economic impacts. As approximately 45 % of Dunedin's playing fields are located within South Dunedin, loss of these would place pressure on facilities across the wider city, as well as impacting social and community networks within South Dunedin (as outlined in Figure 6.1).
Disclaimer: These maps are not intended to assess groundwater risk at individual asset level, which requires consideration of site specific groundwater risk as well as a range of other factors.
Hazard data source: Cox, et al., 2023

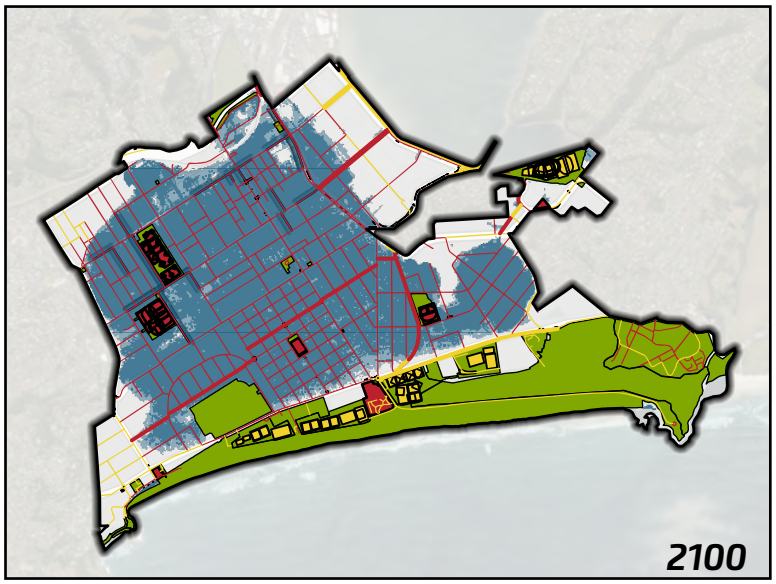
SSP2-4.5

SSP5-8.5









South Dunedin Future Boundary

Median groundwater level (at 0.4 m below ground level)

Emergent groundwater (median)

Roads (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Open Spaces (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

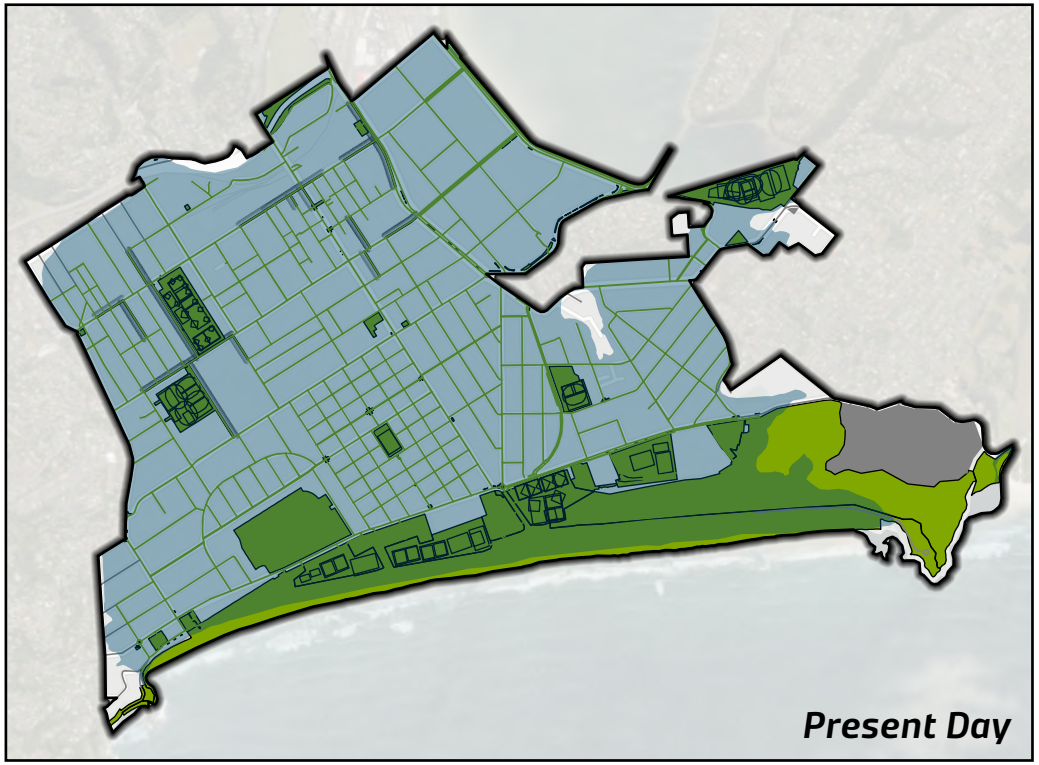
Major criticality route

N

0 0.4 0.8 1.2 1.6 2 (km)

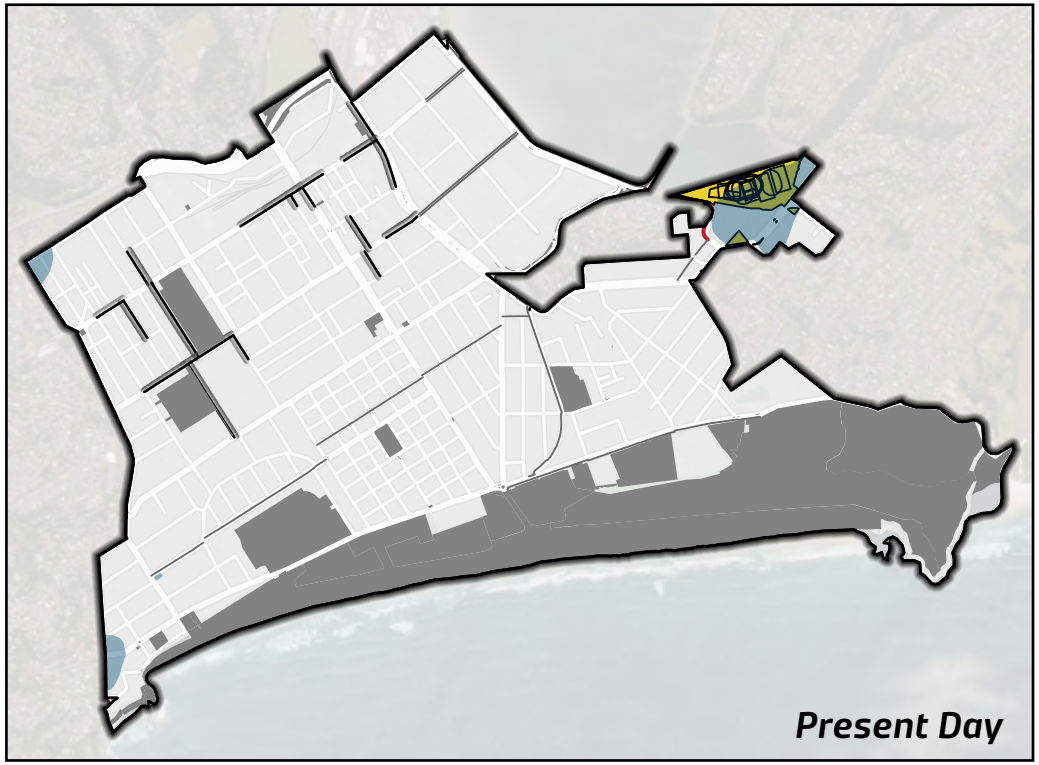
Figure 5.23 Open spaces and roads risk due to landslide and liquefaction

Liquefaction



Explainer: These maps show the risk to roads and open spaces due to liquefaction. Risk ratings for individual roads and open spaces are based on exposure of each asset to liquefaction potential, combined with their vulnerability rating (high). The maps illustrate liquefaction risk is low across South Dunedin at the present day. Liquefaction risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of sea level rise on liquefaction potential. If it were to occur, liquefaction may induce ground settlement and undulation of roads, resulting in uneven surfaces. Sand boils can occur, posing hazards and necessitating cleanup, while lateral spreading near free faces may lead to ground cracking. Liquefaction may induce ground settlement and undulation in parks and sports fields, resulting in uneven surfaces. Sand boils can occur, posing hazards and necessitating cleanup, while lateral spreading near free faces may lead to ground cracking.
Disclaimer: These maps are not intended to assess liquefaction risk at individual asset level, which requires consideration of site specific liquefaction risk as well as more detailed asset information. Liquefaction hazard information is based on a high level desktop review, where subsequent site specific assessment (Hornblow, 2020) has found that liquefaction potential is highly variable across sites analysed.
Hazard data source: Barrell, 2014

Landslide



Explainer: These maps show the risk to roads and open spaces due to landslide. Risk ratings for individual roads and open spaces are based on exposure of each asset to landslides, combined with their vulnerability rating (roads – extreme, open spaces - high). The maps illustrate that this type of landslide risk is confined to areas around the South Dunedin boundary. Landslide risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of climate change (groundwater level rising or increased rainfall intensity) on landslide. Landslides can severely damage transport and open spaces resulting in sudden collapse or failure and posing a potential risk to life. Landslide damage to parks can cause loss of field function, with potentially prohibitively high repair costs.
Disclaimer: These maps are not intended to assess landslide risk at individual asset level, which requires consideration of a site specific landslide risk as well as more detailed asset information. The landslide extent is based on known landslide areas and does not account for other potential sources of landslide nor represent the extent of the area of deposition/runout.
Hazard data source: DCC Hazard database data provided for South Dunedin Future programme

South Dunedin Future Boundary

Land instability

Liquefaction (Domain C: moderate liquefaction potential)

Roads (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

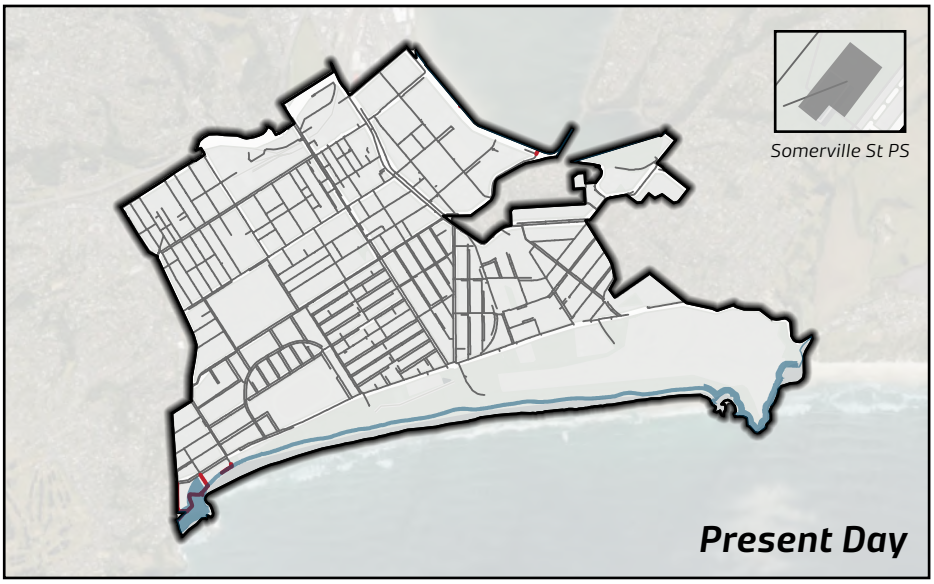
Open Spaces (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Major criticality route

N

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.28 Water supply infrastructure risk due to coastal erosion



Explainer: These maps show the risk to water supply due to coastal erosion (blue shading), noting that there is a high level of uncertainty regarding coastal erosion risk due to data limitations at present (e.g. scale of screening study and accounting for impact of engineered structures). The maps illustrate that coastal erosion risk to water supply is largely confined to the St Clair-St Kilda coastline at present day with risk to some pipe sections arising from the Otago Harbour at late-century.

Disclaimer: These maps are not intended to assess coastal erosion risk to specific assets, which requires more detailed hazard data and consideration of a range of building specific factors (e.g. foundation type). More detailed coastal hazard assessments are underway as part of the St Clair-St Kilda Coastal Plan, these will be completed in late-2025, after which coastal erosion risk ratings will be reviewed.

Hazard data source: WSP, 2024

South Dunedin Future Boundary

Coastal erosion

Water Pipe (Risk)

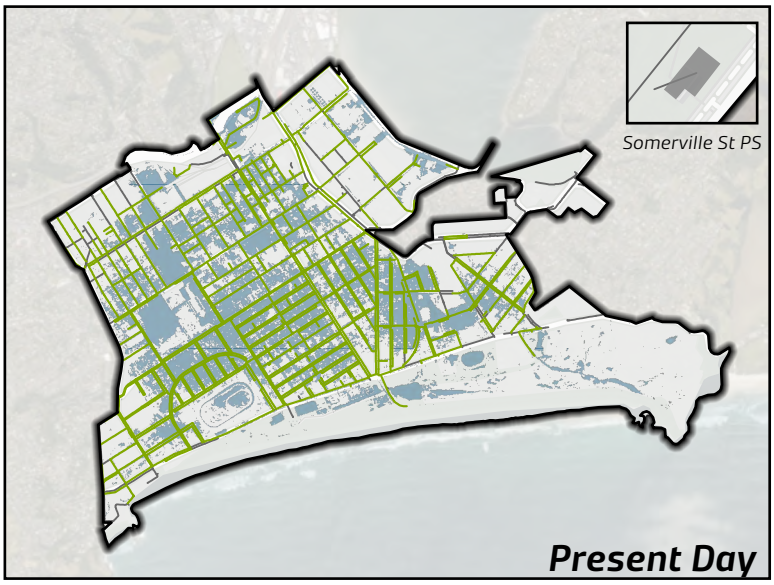
- High
- Medium
- Low
- Not exposed to scenarios assessed

Water Pump Station (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.29 Water supply infrastructure risk due to pluvial flooding

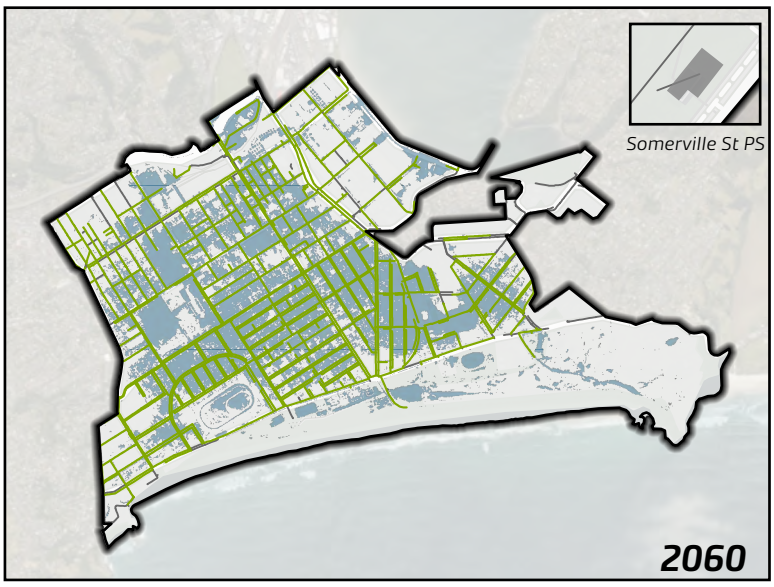


Explainer: These maps show the risk to water supply infrastructure due to pluvial flooding (blue shading). Risk ratings for individual water supply pipe sections are based on exposure of each asset to modelled pluvial flooding combined with the asset's vulnerability to flooding. Although many water supply pipes and the associated above ground infrastructure (pump stations, valves etc) are extremely exposed to frequent, severe, flooding (>10% AEP), they are rated as having very low vulnerability to pluvial flooding as they typically do not sustain damage during such events. The maps illustrate pluvial flood risk is low for all water supply pipes within South Dunedin under the assessed timeframes.

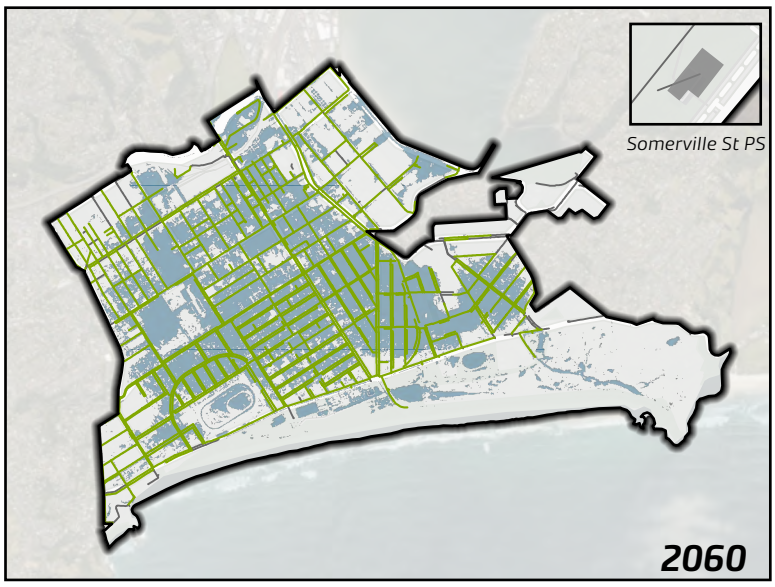
Disclaimer: Note these maps are not intended to assess pluvial flooding risk at individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.

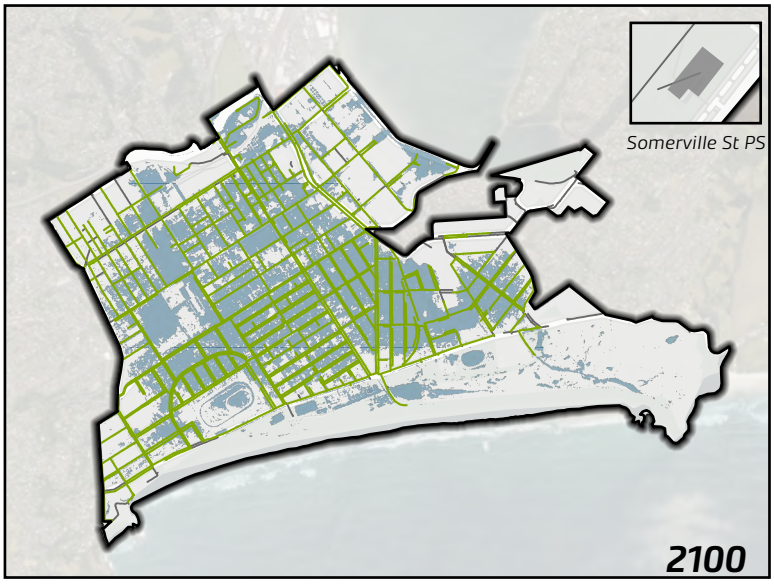
Hazard data source: DCC ICMP Flood Model (Beca, WSP, 2024)

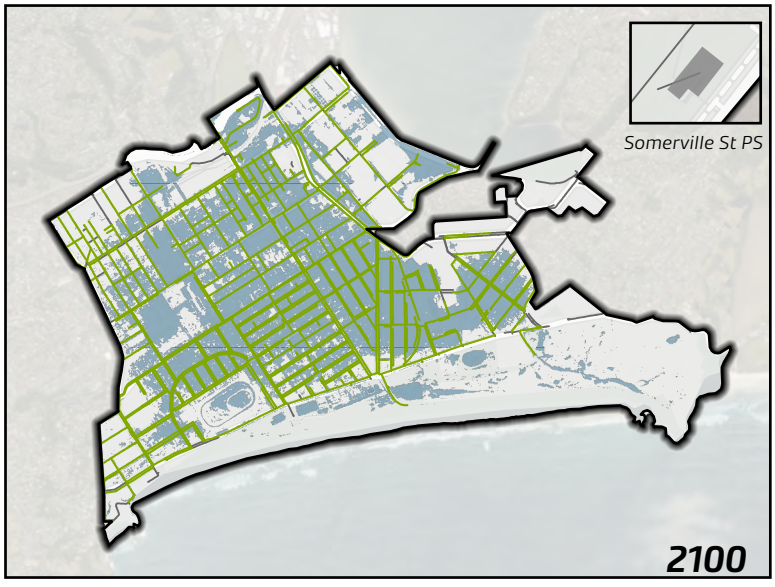
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

1% AEP pluvial flood extent

Water Pipe (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

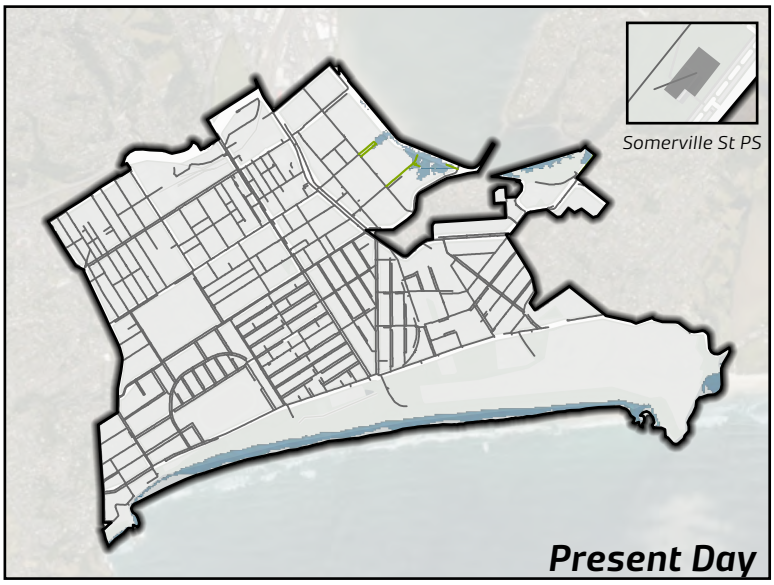
Water Pump Station (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

N

Figure 5.30 Water supply infrastructure risk due to coastal inundation

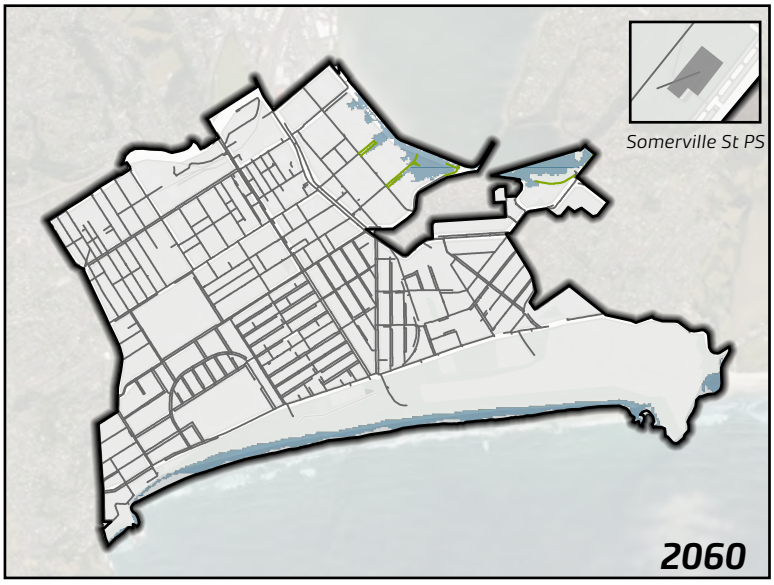


Explainer: These maps show the risk to water supply infrastructure due to coastal inundation (blue shading). Risk ratings for individual water supply pipe sections are based on exposure of each asset to modelled coastal inundation extents, combined with the vulnerability of the asset to inundation. Although many water supply pipes and the associated above ground infrastructure (pump stations, valves etc) are extremely exposed to frequent, severe, flooding (>10 % AEP) at late century, they are rated as having very low vulnerability coastal inundation as they do not tend to sustain damage during such events. The maps illustrate coastal inundation risk is low for most water supply pipes within South Dunedin under the assessed timeframes.

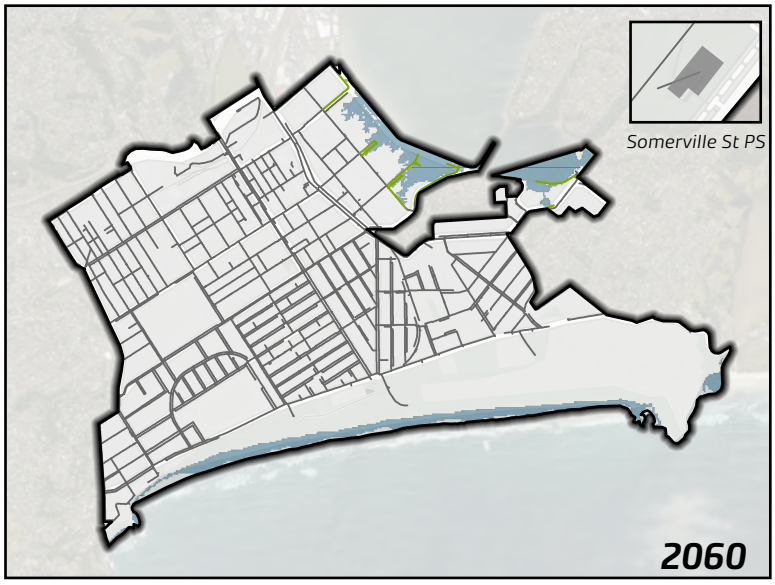
Disclaimer: These maps are not intended to assess coastal inundation risk at individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.

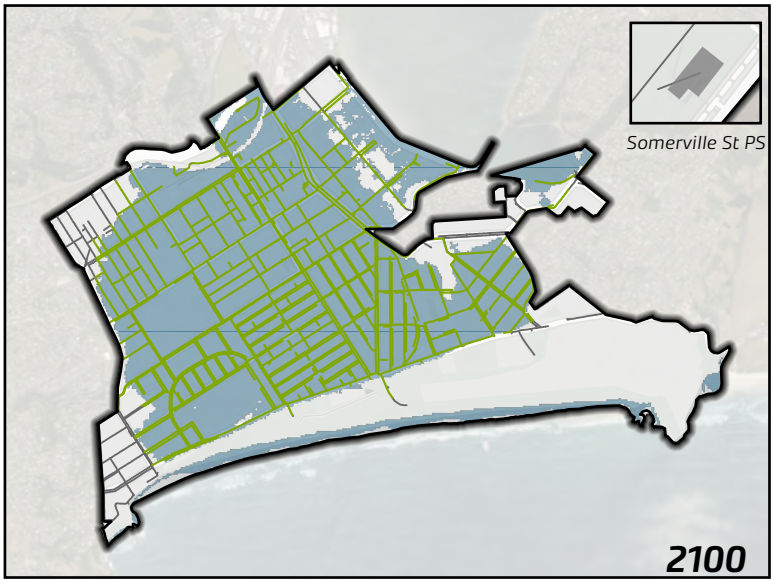
Hazard data source: Paulik, et al., 2023

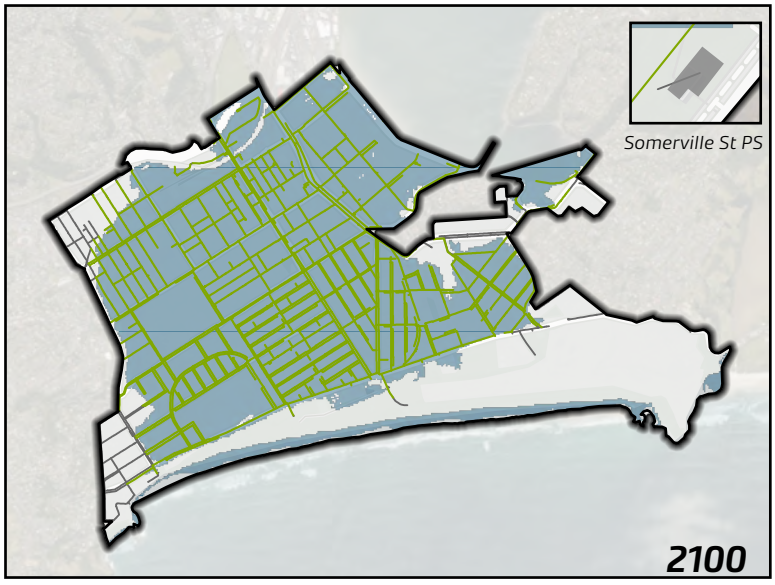
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

1% AEP coastal inundation extent

Water Pipe (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

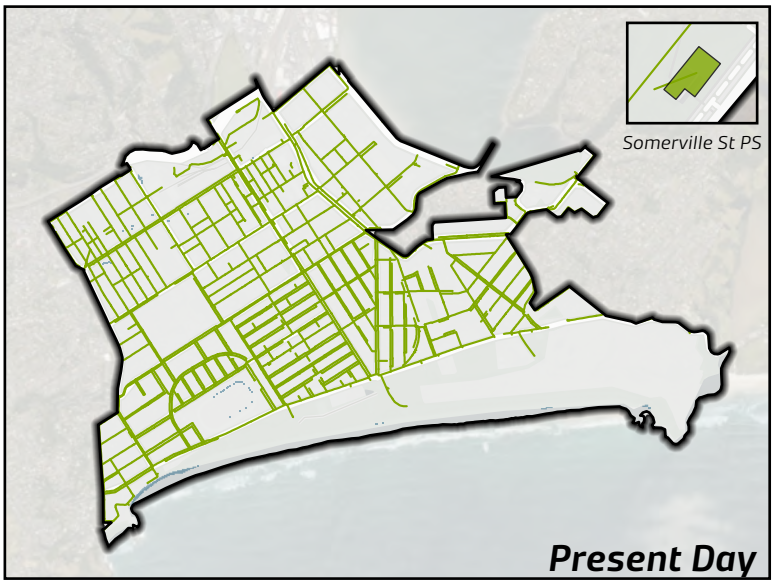
Water Pump Station (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

N

Figure 5.31 Water supply infrastructure risk due to groundwater

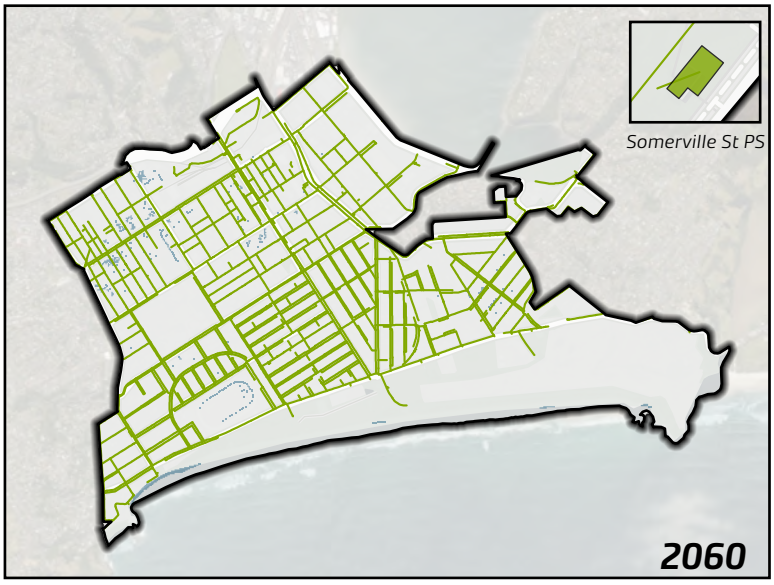


Explainer: These maps show the risk to water supply infrastructure due to groundwater (blue shading). Risk ratings for individual water supply pipe sections are based on exposure of each asset to the modelled median groundwater level (using the pipe invert level to test whether the pipe is exposed). While many water supply pipes are extremely exposed as they are below the groundwater level, water supply pipes are rated to have very low vulnerability to groundwater as they do not tend to sustain damage from groundwater exposure. The maps illustrate groundwater risk is low for most water supply pipes within South Dunedin under the assessed timeframes.

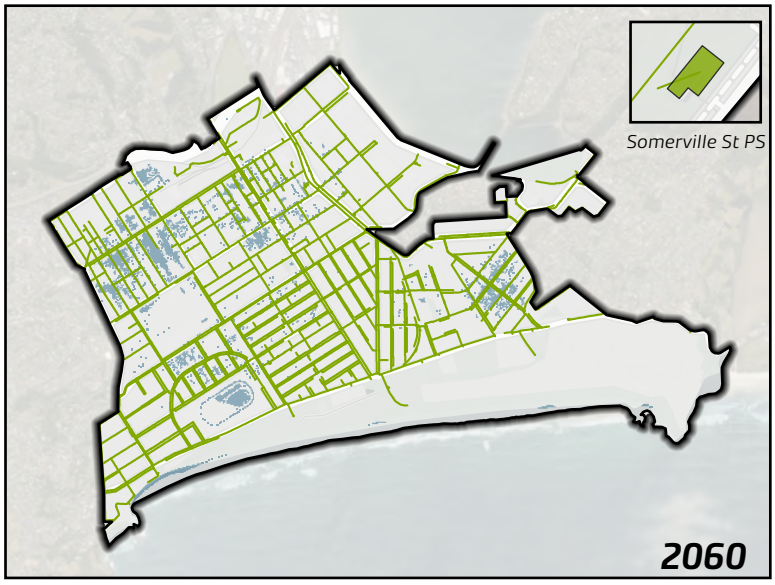
Disclaimer: These maps are not intended to assess ground water risk at individual asset level, which requires consideration of site specific groundwater risk as well as more detailed asset information.

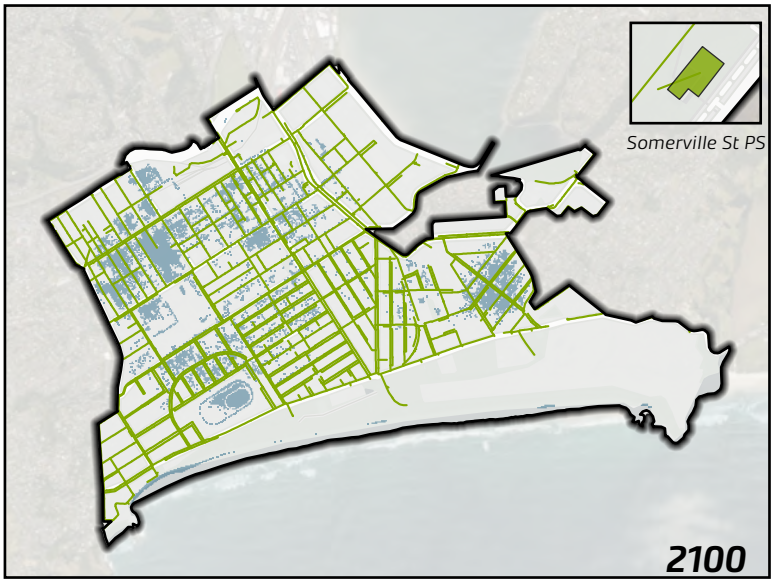
Hazard data source: Cox, et al., 2023

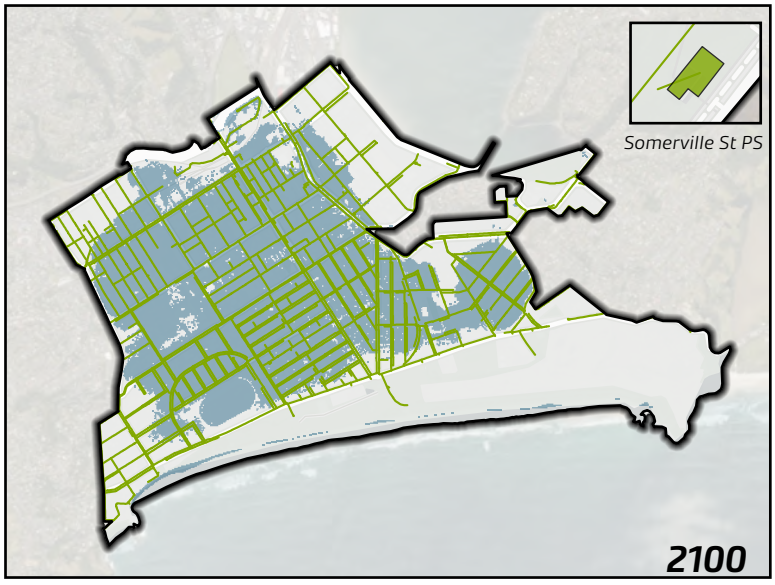
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

Emergent groundwater (median)

Water Pipe (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

Water Pump Station (Risk)

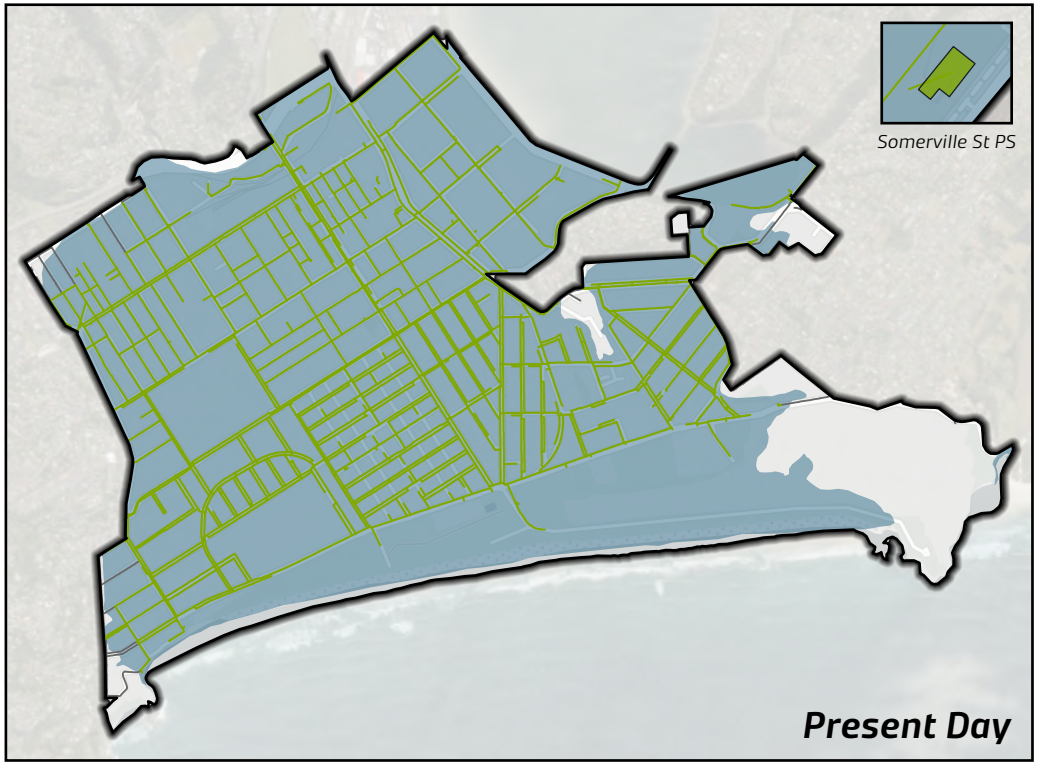
- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

N

Figure 5.32 Water supply infrastructure risk due to landslide and liquefaction

Liquefaction



Explainer: These maps show the risk to water supply due to liquefaction. Risk ratings for individual pipe lengths are based on exposure of each asset to liquefaction potential, combined with their vulnerability rating (high). The maps illustrate liquefaction risk is low across South Dunedin at the present day. Liquefaction risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of sea level rise on liquefaction potential. If it were to occur, liquefaction can impact water infrastructure by deforming the pipe network. Ground settlement or stretching may damage or disconnect pipes and chambers and subsequent inflow of sediment can cause blockages. Buoyancy can cause uplift of buried structures, and disrupt drainage systems, while sediment discharge can reduce water quality and affect aquatic habitats.
Disclaimer: These maps are not intended to assess liquefaction risk at individual asset level, which requires consideration of site specific liquefaction risk as well as more detailed asset information. Liquefaction hazard information is based on a high level desktop review, where subsequent site specific assessment (Hornblow, 2020) has found that liquefaction potential is highly variable across sites analysed.
Hazard data source: Barrell, 2014

Landslide

Explainer: These maps show the risk to water supply due to landslide, where some pipes at the South Dunedin boundary are rated medium risk. Risk ratings for individual water supply pipes are based on exposure of each asset to landslides, combined with their vulnerability rating. Landslides can severely damage water supply resulting in sudden collapse or failure. The maps illustrate that landslide risk is confined to areas around the South Dunedin boundary. Landslide risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of climate change (groundwater level rising or increased rainfall intensity) on landslide.
Disclaimer: These maps are not intended to assess landslide risk at individual asset level, which requires consideration of a site specific landslide risk as well as more detailed asset information. The landslide extent is based on known landslide areas and does not account for other potential sources of landslide nor represent the extent of the area of deposition/runout.
Hazard data source: DCC Hazard database data provided for South Dunedin Future programme

South Dunedin Future Boundary

Land instability

Liquefaction (Domain C: moderate liquefaction potential)

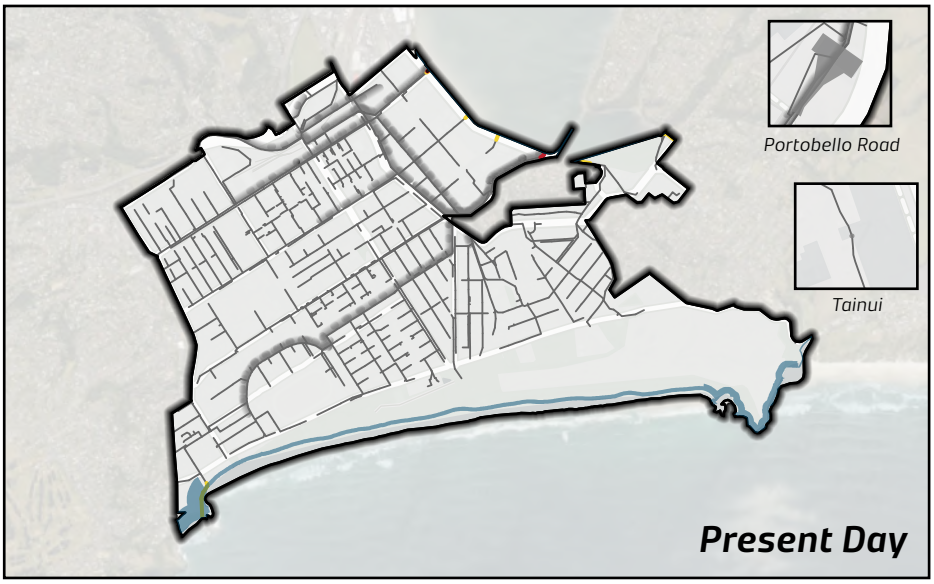
Water Pipe (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Water Pump Station (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

N

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.34 Stormwater infrastructure risk due to coastal erosion



Explainer: These maps show the risk to stormwater infrastructure due to coastal erosion, noting that there is a high level of uncertainty regarding coastal erosion risk due to data limitations at present (e.g. scale of screening study and accounting for impact of engineered structures). The maps indicate that coastal erosion risk to stormwater is confined to the Otago Harbour coastline at present day, and increases to a small number of pipes along the St Clair-St Kilda Coastline at mid-century, with higher risk of erosion at the St Clair end of the beach.

Disclaimer: These maps are not intended to assess coastal erosion risk to specific assets, which requires more detailed hazard data and consideration of a range of building specific factors (e.g. foundation type). More detailed coastal hazard assessments are underway as part of the St Clair-St Kilda Coastal Plan, these will be completed in late-2025, after which coastal erosion risk ratings will be reviewed.

Hazard data source: WSP, 2024

South Dunedin Future Boundary

Coastal erosion

Major criticality

Stormwater Pipe (Risk)

High

Medium

Low

Not exposed to scenarios assessed

Stormwater Pump Station (Risk)

High

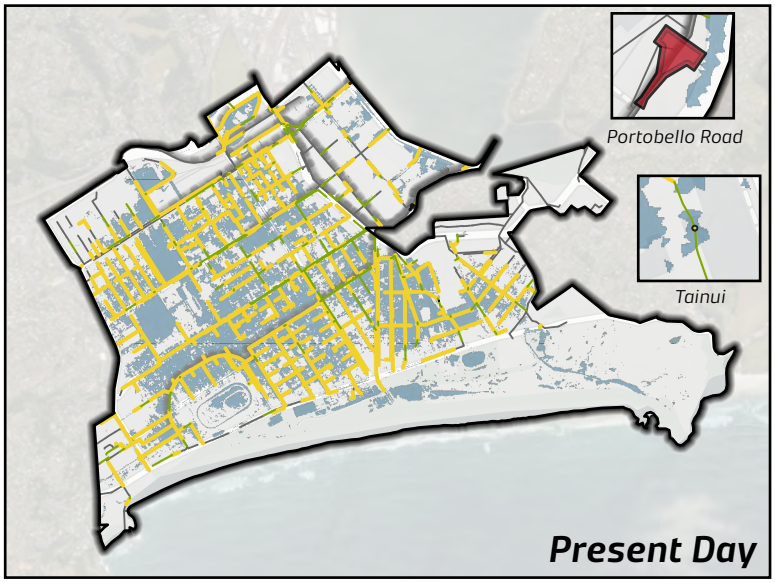
Medium

Low

Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

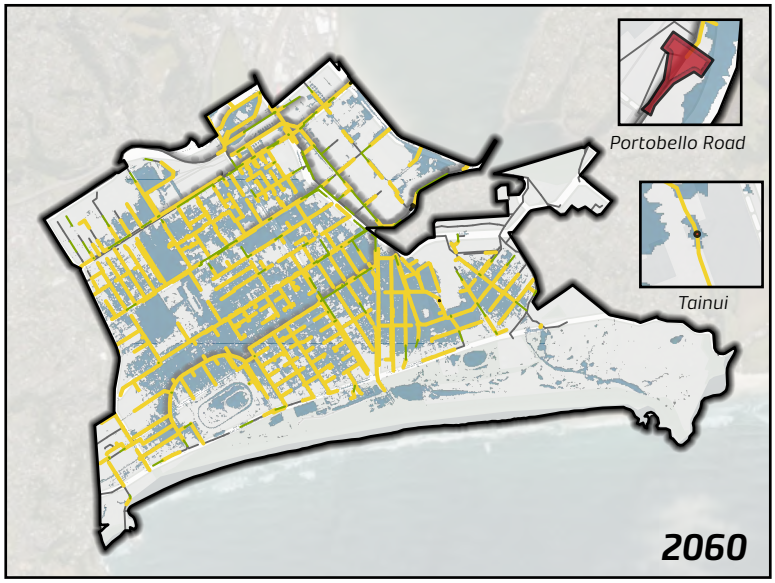
Figure 5.35 Stormwater infrastructure risk due to pluvial flooding



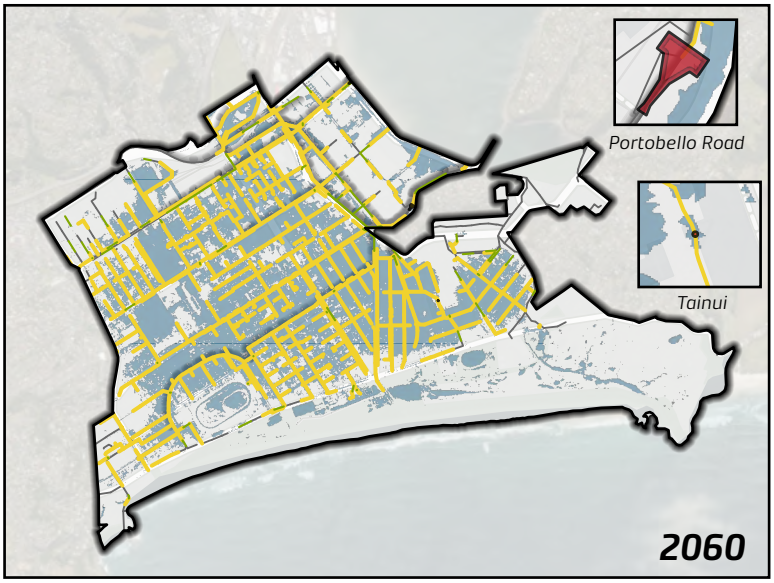
Explainer: These maps show the risk to stormwater infrastructure due to pluvial flooding (blue shading). Risk ratings for individual stormwater pipe sections are based on exposure of each asset to modelled pluvial flooding, combined with the vulnerability of the asset to flooding. While many stormwater pipes are extremely exposed to frequent severe flooding (>10% AEP), stormwater pipes are rated to have very low vulnerability to pluvial flooding as they do not tend to sustain damage during flooding. However, stormwater pump stations are highly vulnerable to flooding. The maps illustrate widespread medium risk at present day, which increases slightly in extent over time. Risk to pump stations is rated high under all timeframes.
Disclaimer: These maps are not intended to assess pluvial flooding risk at individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.

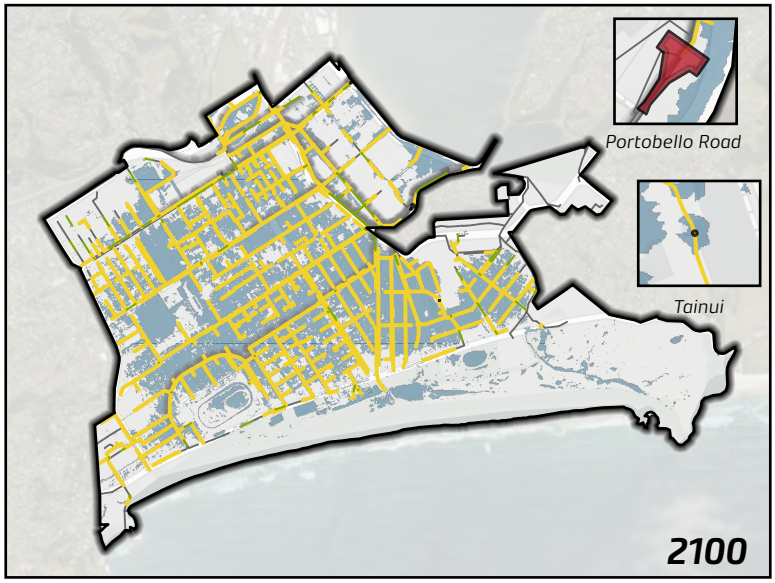
Hazard data source: DCC ICMP Flood Model (Beca, WSP, 2024)

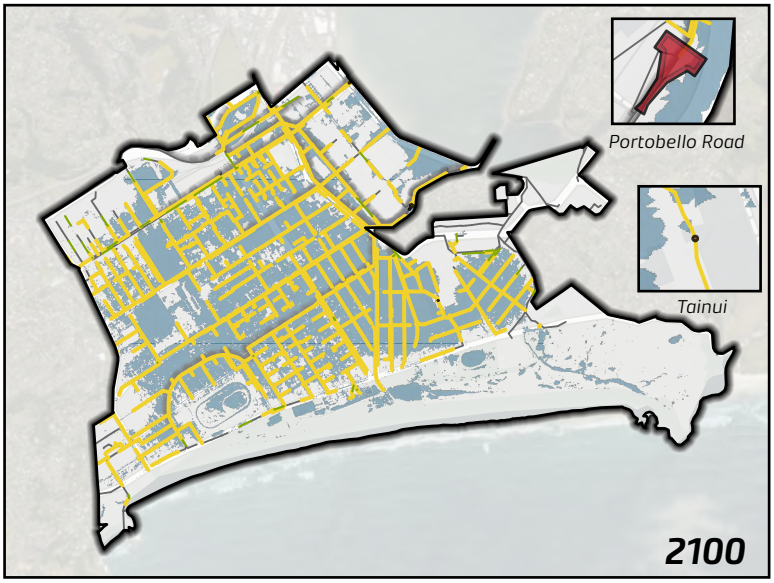
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

1% AEP pluvial flood extent

Major criticality

Stormwater Pipe (Risk)

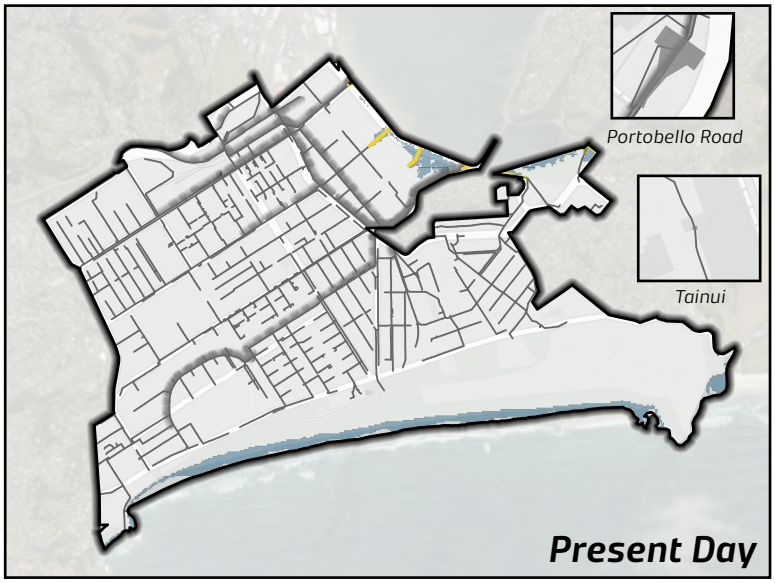
- High
- Medium
- Low
- Not exposed to scenarios assessed

Stormwater Pump Station (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

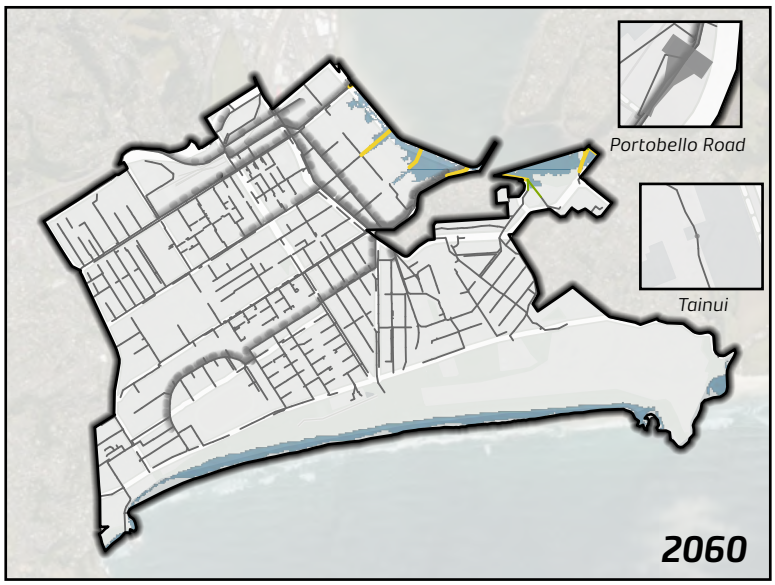
0 0.4 0.8 1.2 1.6 2 (km)

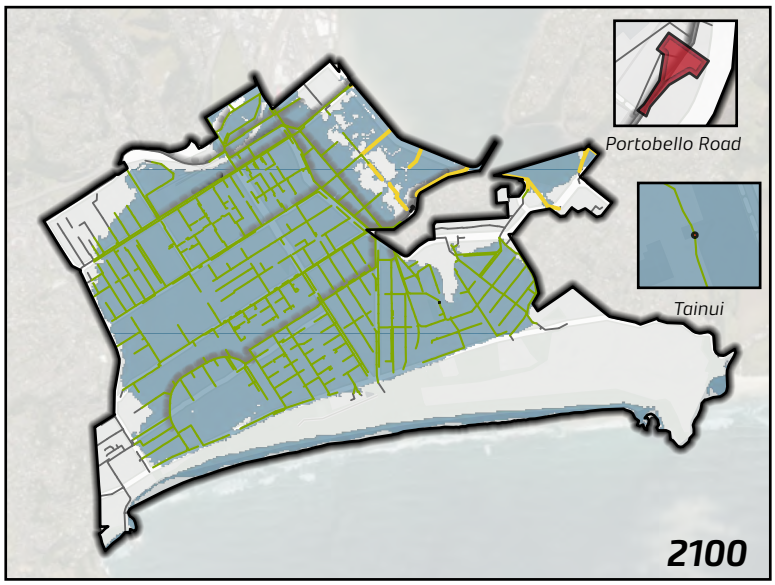
Figure 5.36 Stormwater infrastructure risk due to coastal inundation



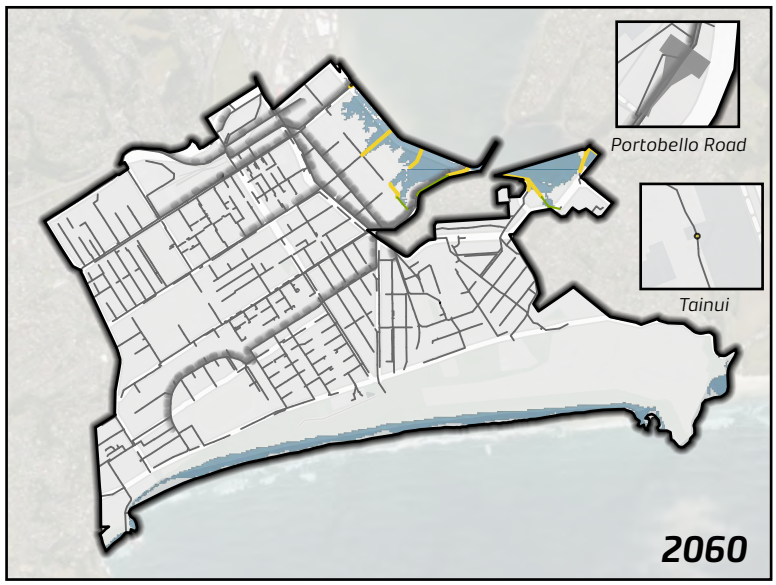
Explainer: These maps show the risk to stormwater infrastructure due to coastal inundation (blue shading). Risk ratings for individual stormwater pipe sections are based on exposure of each asset to modelled coastal inundation, combined with the vulnerability of the asset. While many stormwater pipes are extremely exposed at late century, due to relatively frequent severe flooding (>10% AEP), stormwater pipes are rated to have low vulnerability to coastal inundation as they do not tend to sustain damage during such events. The maps illustrate that at late century widespread low risk arises under a mid-range climate scenario, which increases to medium risk under a high end climate scenario. Risk to pump stations is rated high at late century.
Disclaimer: These maps are not intended to assess coastal inundation risk at individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.
Hazard data source: Paulik, et al., 2023

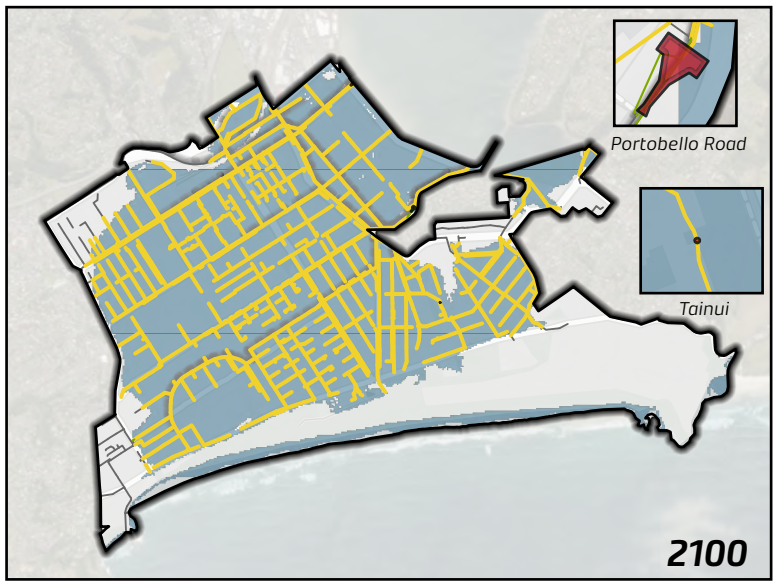
SSP2-4.5





SSP5-8.5





South Dunedin Future Boundary

1% AEP coastal inundation extent

Major criticality

Stormwater Pipe (Risk)

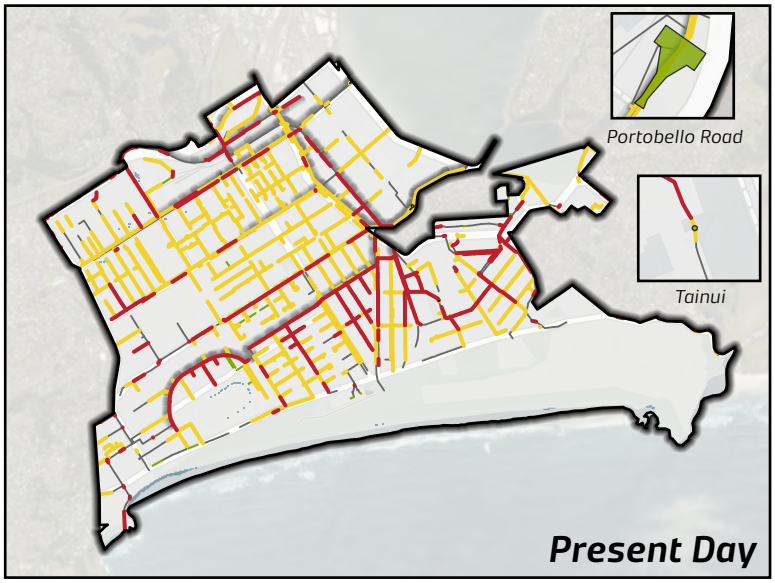
- High
- Medium
- Low
- Not exposed to scenarios assessed

Stormwater Pump Station (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

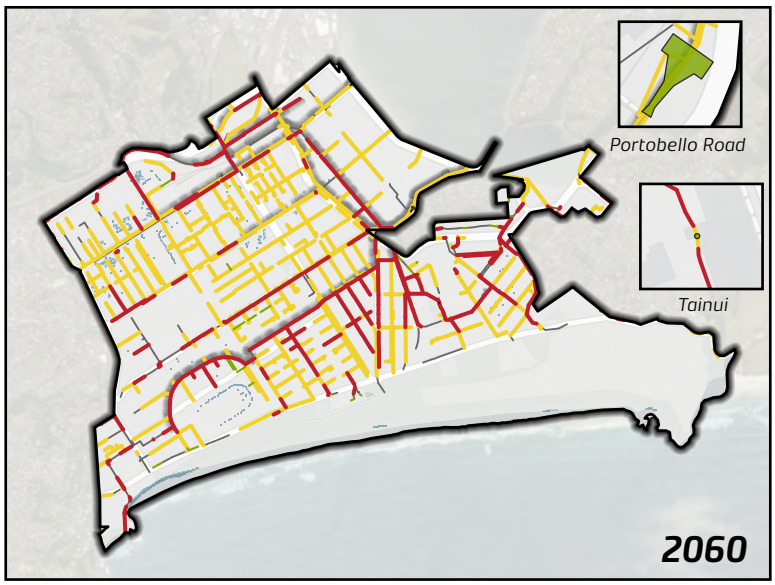
0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.37 Stormwater infrastructure risk due to groundwater

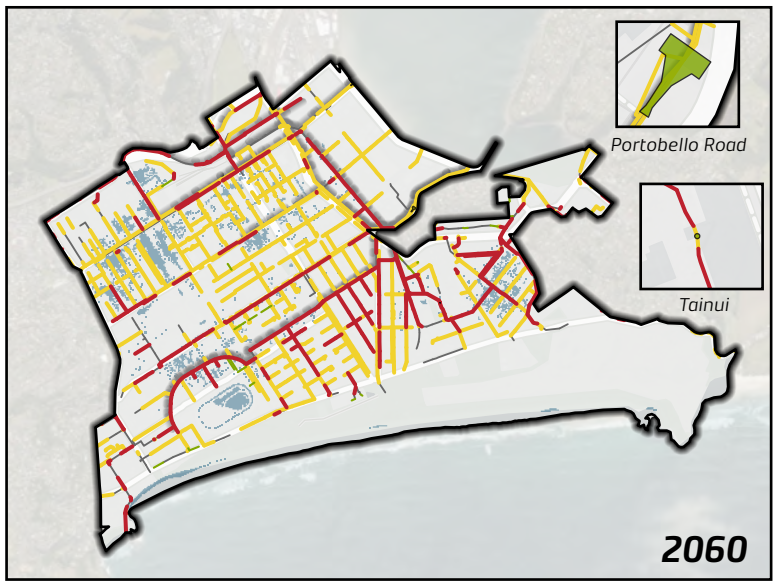


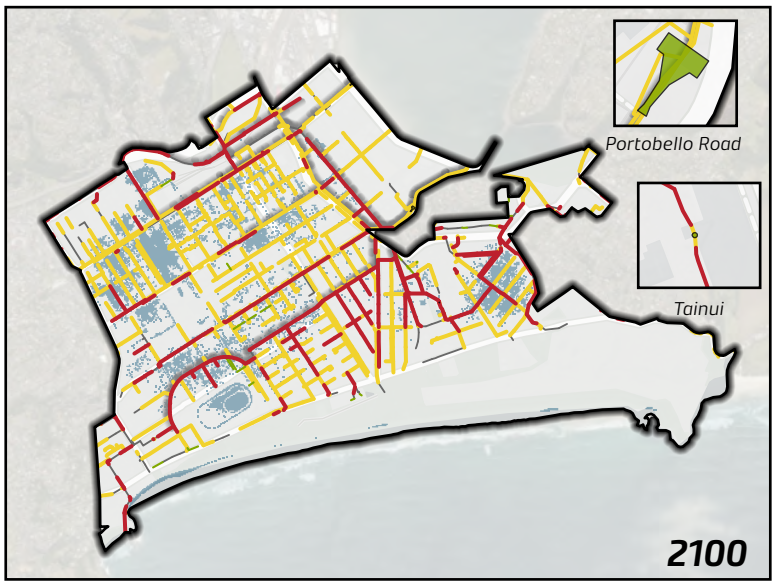
Explainer: These maps show the risk to stormwater infrastructure due to groundwater hazard (blue shading). Risk ratings for stormwater pipe sections are based on exposure of each pipe to the modelled median groundwater level (using pipe invert level to test whether the pipe is exposed). Pipe vulnerability to groundwater is a function of the pipe material or age, where cracked pipes or leaky joints mean that groundwater will flow into the system and reduce the pipe capacity, ultimately causing a reduction in level of service. The maps illustrate groundwater risk is medium or high for most stormwater pipes within South Dunedin under the assessed scenarios. A number of high criticality pipes (grey shadow on pipe) are rated at high risk. The impact of groundwater infiltration at a network scale is under investigation.
Disclaimer: These maps are not intended to assess groundwater risk at individual asset level, which requires consideration of site specific groundwater risk as well as more detailed asset information.
Hazard data source: Cox, et al., 2023

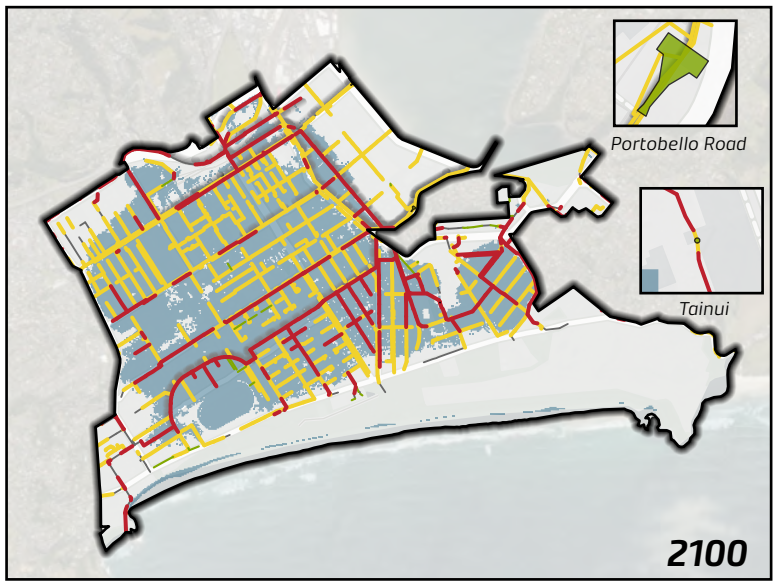
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

Emergent groundwater (median)

Major criticality

Stormwater Pipe (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

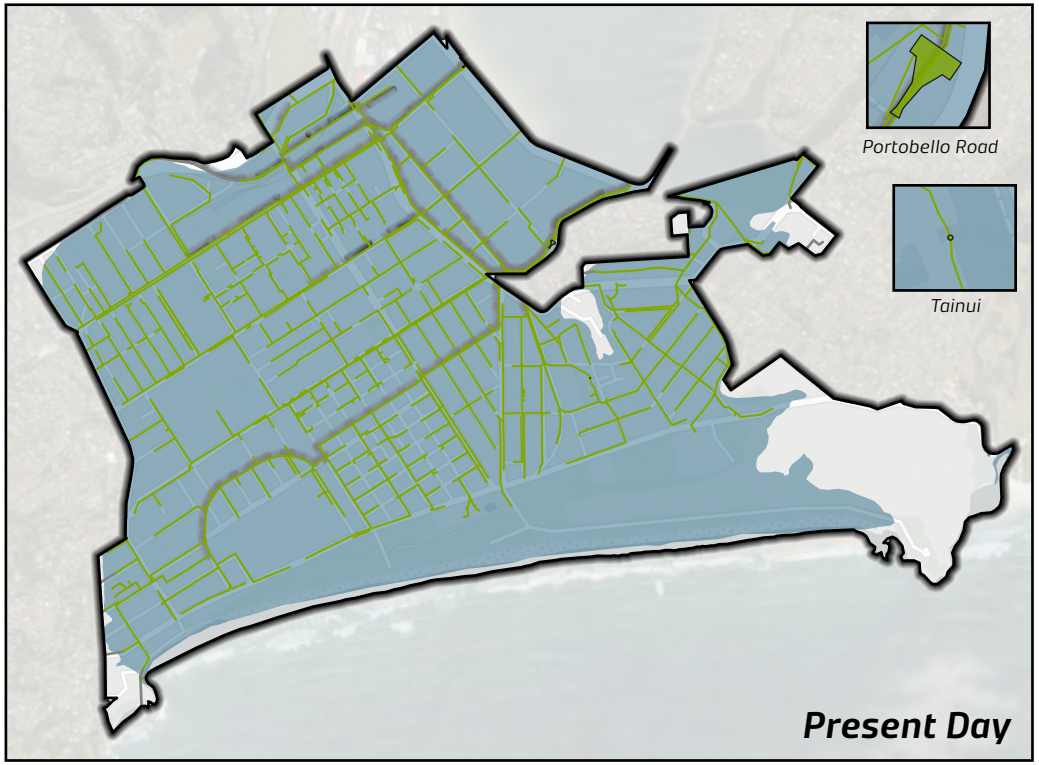
Stormwater Pump Station (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.38 Stormwater infrastructure risk due to landslide and liquefaction

Liquefaction



Explainer: These maps show the risk to stormwater infrastructure due to liquefaction. Risk ratings for individual pipe lengths are based on exposure of each asset to liquefaction potential, combined with their vulnerability rating which is based on pipe material and age. The maps illustrate liquefaction risk is low across South Dunedin at the present day. Liquefaction risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of sea level rise on liquefaction potential. If it were to occur, liquefaction can impact water infrastructure by deforming the pipe network. Ground settlement or stretching may damage or disconnect pipes and chambers and subsequent inflow of sediment can cause blockages. Buoyancy can cause uplift of buried structures, and disrupt drainage systems, while sediment discharge can reduce water quality and affect aquatic habitats.
Disclaimer: These maps are not intended to assess liquefaction risk at individual asset level, which requires consideration of site specific liquefaction risk as well as more detailed asset information. Liquefaction hazard information is based on a high level desktop review, where subsequent site specific assessment (Hornblow, 2020) has found that liquefaction potential is highly variable across sites analysed.
Hazard data source: Barrell, 2014

Landslide

Explainer: These maps show the risk to stormwater infrastructure due to landslide, where some pipes at the South Dunedin boundary are rated medium risk. Risk ratings for individual stormwater pipes are based on exposure of each asset to landslides, combined with their vulnerability rating and adjusted for pipe criticality (grey shadow on pipe). Landslides can severely damage stormwater resulting in major repairs and reduction in level of service. The maps illustrate that landslide risk is confined to areas around the South Dunedin boundary. Landslide risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of climate change (groundwater level rising or increased rainfall intensity) on landslide.
Disclaimer: These maps are not intended to assess landslide risk at individual asset level, which requires consideration of a site specific landslide risk as well as more detailed asset information. The landslide extent is based on known landslide areas and does not account for other potential sources of landslide nor represent the extent of the area of deposition/runout.
Hazard data source: DCC Hazard database data provided for South Dunedin Future programme

South Dunedin Future Boundary

Land instability

Liquefaction (Domain C: moderate liquefaction potential)

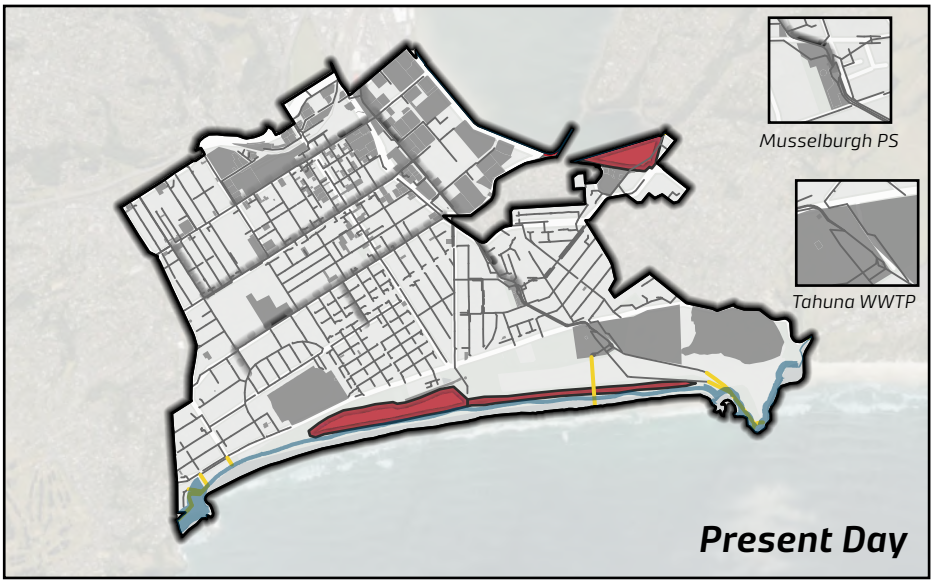
Major criticality

Stormwater Pipe (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Stormwater Pump Station (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.40 Wastewater infrastructure and contaminated land (HAIL sites) risk due to coastal erosion



Explainer: These maps show the risk to wastewater and HAIL sites due to coastal erosion (blue shading), noting that there is a high level of uncertainty regarding coastal erosion risk due to data limitations at present (e.g. scale of screening study and accounting for impact of engineered structures). The maps illustrate that coastal erosion risk to wastewater is confined to the St Clair-St Kilda coastline at all timeframes. The maps illustrate a high risk to HAIL sites located along the St Clair-St Kilda and Harbour coastlines at all timeframes.

Disclaimer: These maps are not intended to assess coastal erosion risk to specific assets, which requires more detailed hazard data and consideration of a range of building specific factors (e.g. foundation type). More detailed coastal hazard assessments are underway as part of the St Clair-St Kilda Coastal Plan, these will be completed in late-2025, after which coastal erosion risk ratings will be reviewed.

Hazard data source: WSP, 2024

South Dunedin Future Boundary

Coastal erosion

Major criticality

Wastewater Pipe (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

Structures (Risk)

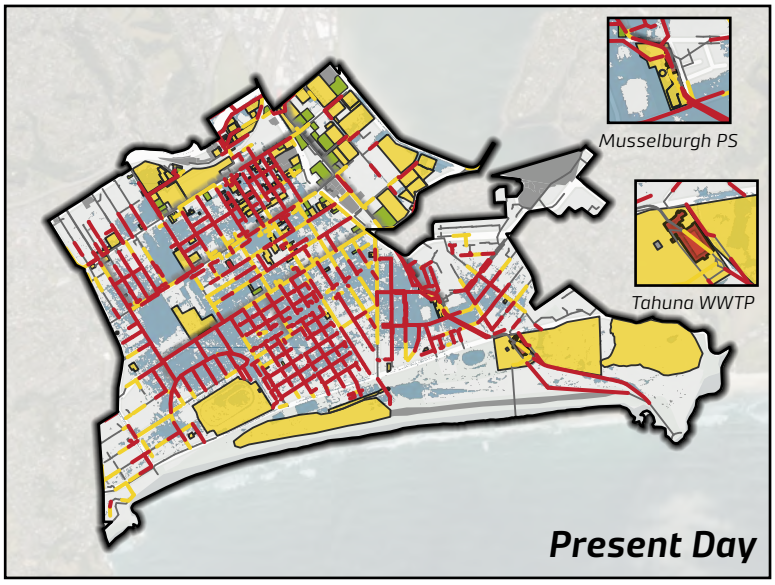
- High
- Medium
- Low
- Not exposed to scenarios assessed

HAIL Site (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.41 Wastewater infrastructure and contaminated land (HAIL sites) risk due to pluvial flooding

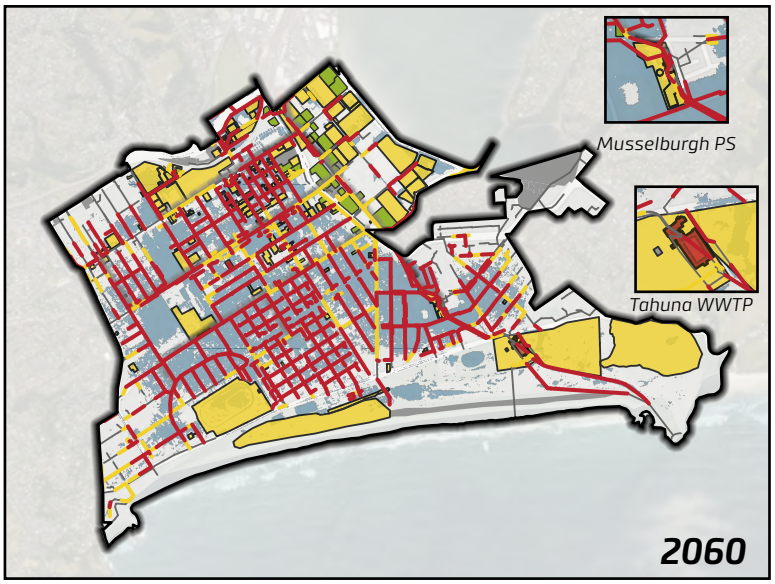


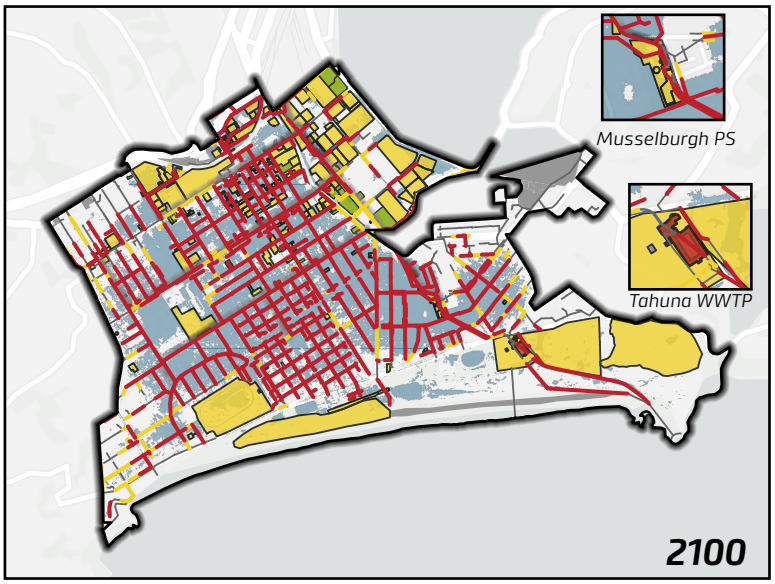
Explainer: These maps show the risk to wastewater infrastructure and HAIL sites due to pluvial flooding (blue shading). Risk ratings for individual wastewater pipe sections and HAIL sites are based on exposure of each asset or site to modelled pluvial flooding, combined with the vulnerability of the asset to flooding. Many wastewater pipes and HAIL sites are extremely exposed, due to frequent severe flooding (>10% AEP). Wastewater pipes are rated to have high vulnerability to pluvial flooding due to the potential for a reduction in level of service, which results in environmental contamination and associated breaches of consent conditions. Wastewater pump stations are extremely vulnerable to flooding. HAIL sites are rated to have low vulnerability to pluvial flooding. The maps illustrate pluvial flood risk is medium or high across most of the pipe network at present day, with the extent of high risk increasing in future timeframes. Risk to Musselburgh Pump Station is rated medium and Tahuna Wastewater Treatment Plant is rated high under all timeframes. Risk to many HAIL sites is medium at all timeframes.

Disclaimer: These maps are not intended to assess pluvial flooding risk at individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.

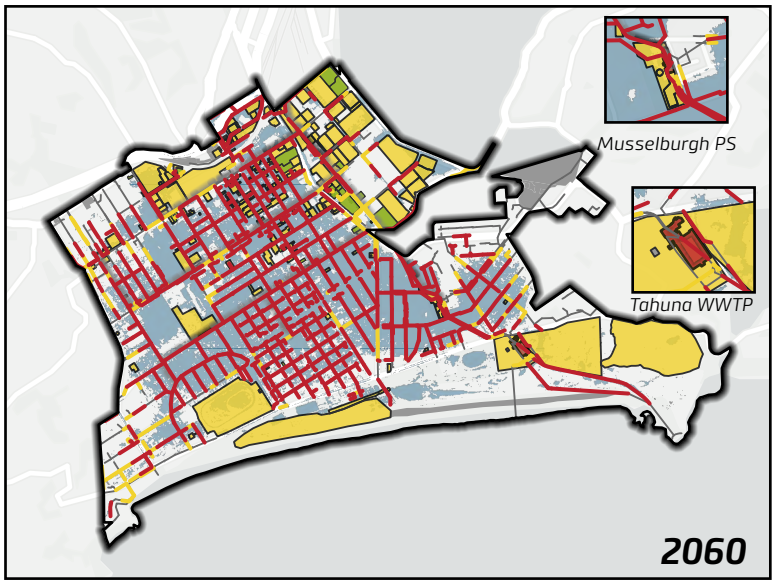
Hazard data source: DCC ICMP Flood Model (Beca, WSP, 2024)

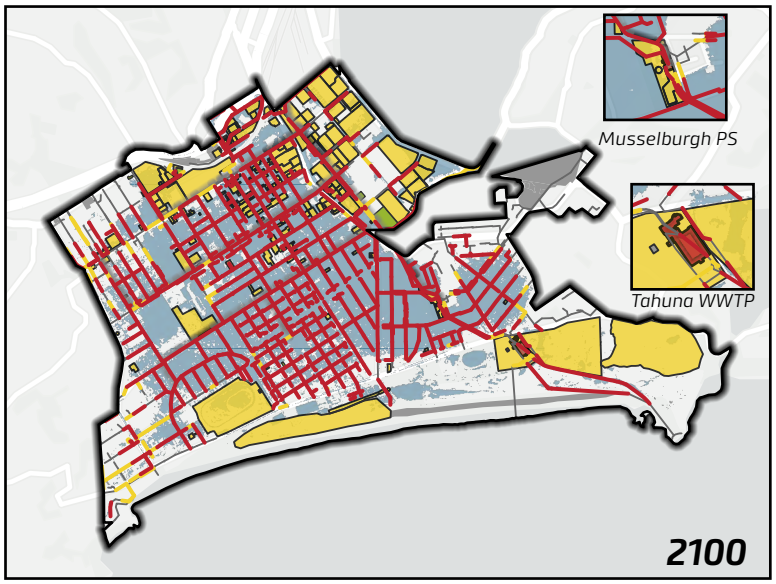
SSP2-4.5





SSP5-8.5





South Dunedin Future Boundary

1% AEP pluvial flood extent

Major criticality

Wastewater Pipe
- High
- Medium
- Low
- Not exposed to scenarios assessed

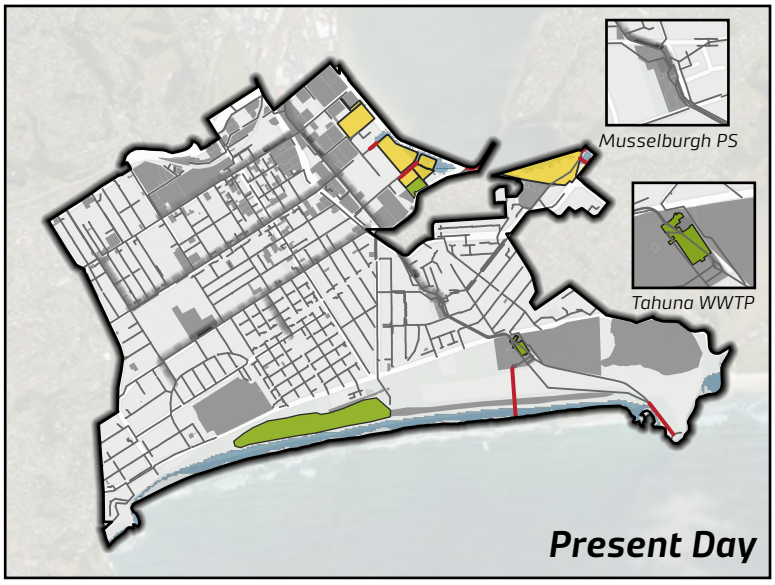
Structures
- High
- Medium
- Low
- Not exposed to scenarios assessed

HAIL Site
- High
- Medium
- Low
- Not exposed to scenarios assessed

N

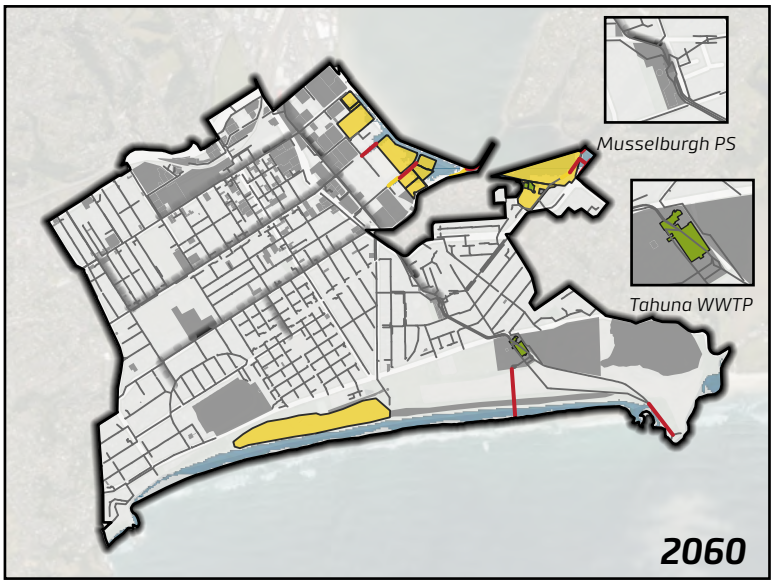
0 0.4 0.8 1.2 1.6 2 (km)

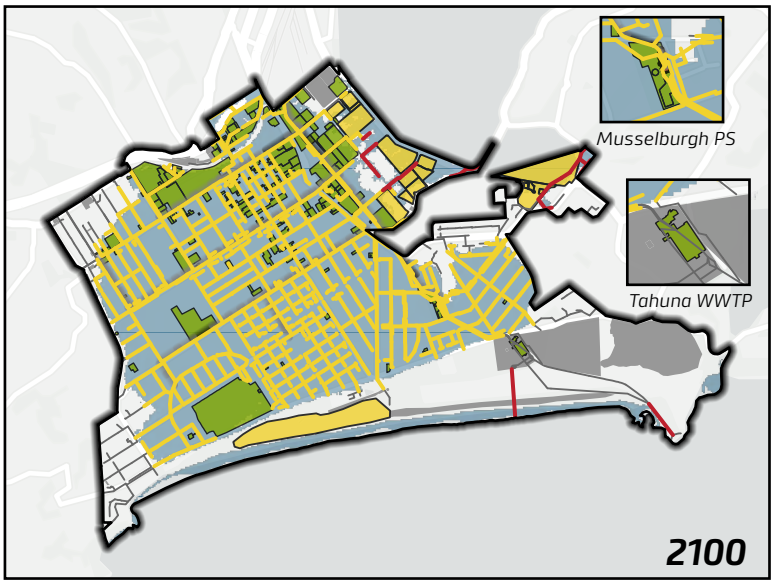
Figure 5.42 Wastewater infrastructure and contaminated land (HAIL sites) risk due to coastal inundation



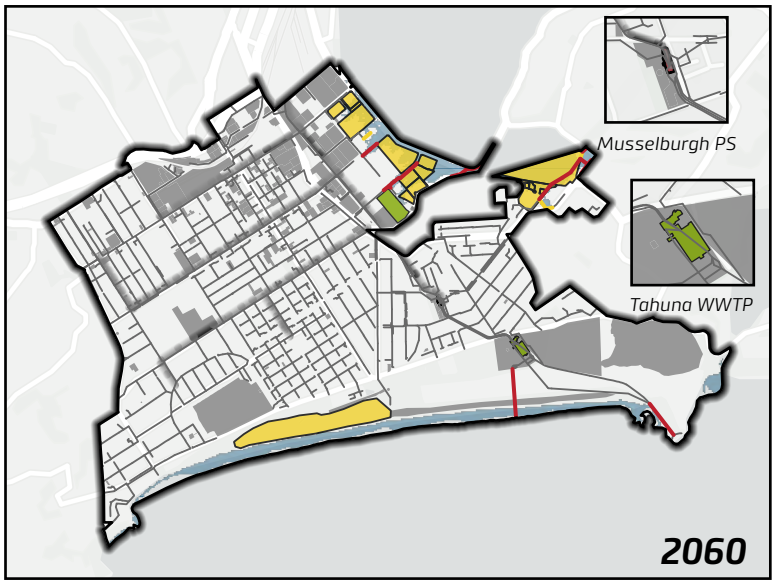
Explainer: These maps show the risk to wastewater infrastructure and HAIL sites due to coastal inundation (blue shading). Risk ratings for individual wastewater pipe sections and HAIL sites are based on exposure of each asset to modelled coastal inundation, combined with the vulnerability of the asset to inundation. While many wastewater pipes and HAIL sites are extremely exposed to frequent severe flooding (>10% AEP), HAIL sites are rated to have low vulnerability to coastal inundation as they do not tend to sustain damage during such events. Wastewater pipes are rated to have high vulnerability to coastal inundation due to the potential reduction in level of service, which results in environmental contamination and associated breaches of consent conditions. The maps illustrate that at late century coastal inundation risk becomes medium under a mid-range climate scenario, and high under a high end climate scenario for most wastewater pipes within South Dunedin. Risk to pump stations is rated low at mid century , and increases to medium at late century.
Disclaimer: These maps are not intended to assess coastal inundation risk at individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.
Hazard data source: Paulik, et al., 2023

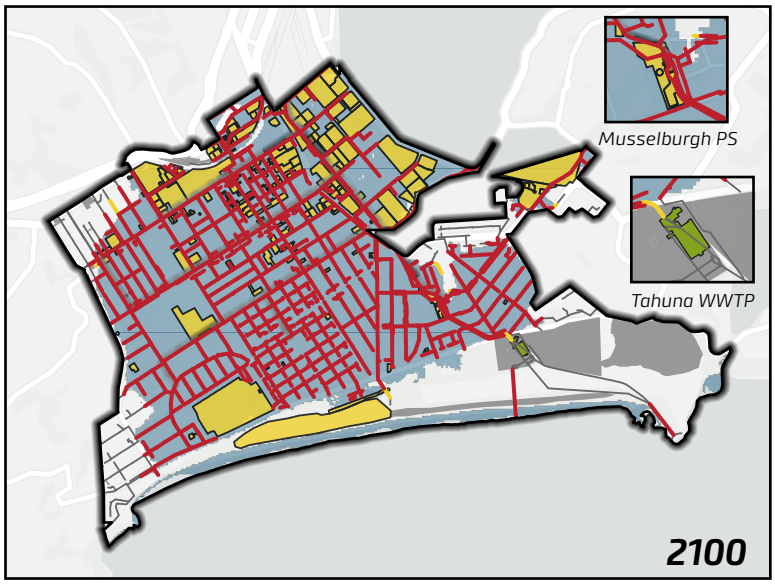
SSP2-4.5





SSP5-8.5





South Dunedin Future Boundary

1% AEP coastal inundation extent

Major criticality

Wastewater Pipe
- High
- Medium
- Low
- Not exposed to scenarios assessed

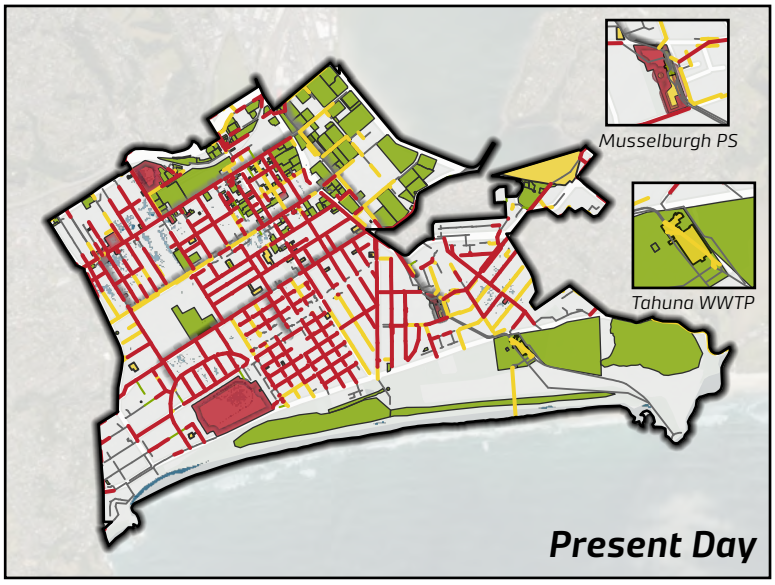
Structures
- High
- Medium
- Low
- Not exposed to scenarios assessed

HAIL Site
- High
- Medium
- Low
- Not exposed to scenarios assessed

N

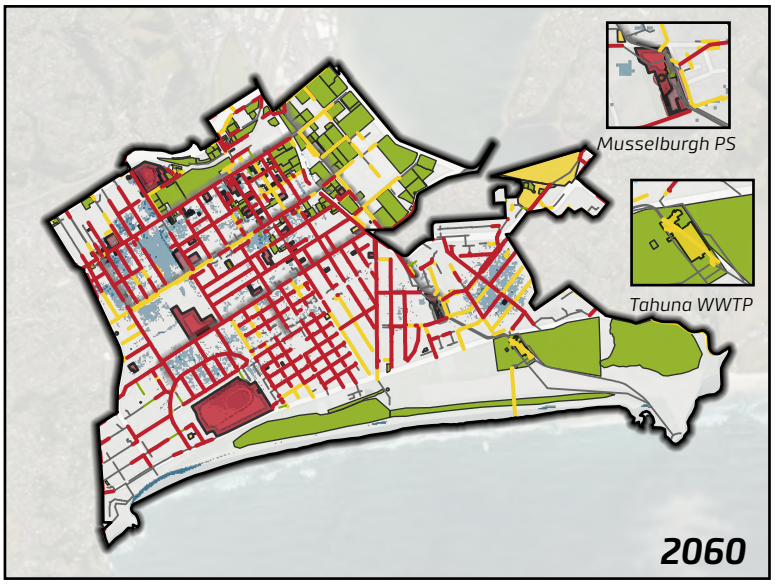
0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.43 Wastewater infrastructure and contaminated land (HAIL sites) risk due to groundwater

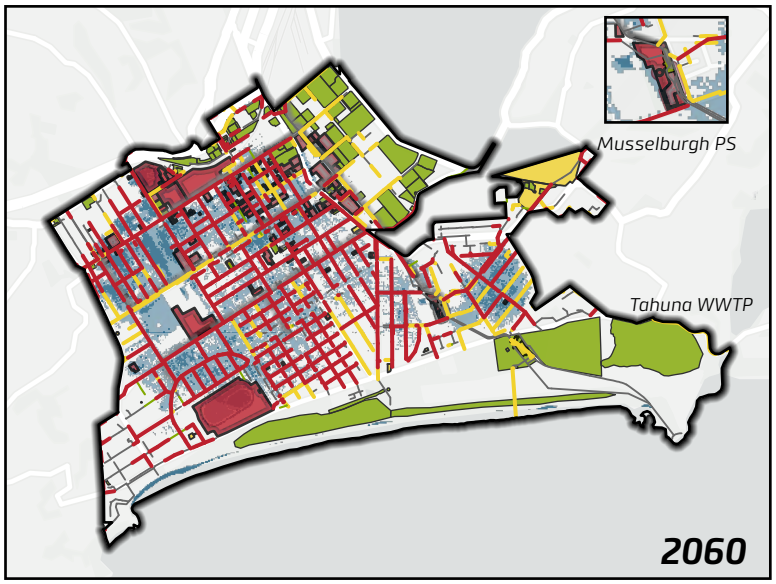


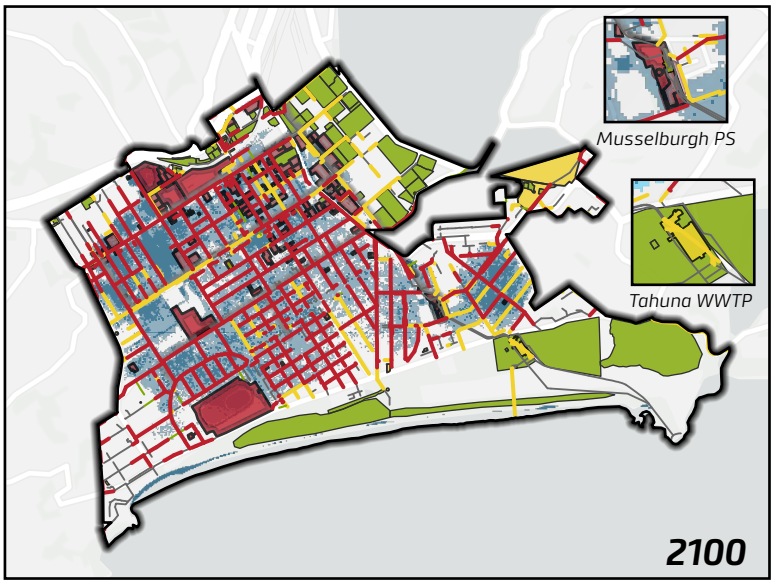
Explainer: These maps show the risk to wastewater infrastructure and HAIL sites due to groundwater (blue shading). Risk ratings for individual wastewater pipe sections are based on exposure of each asset to the modelled median groundwater level (using pipe invert level to test whether the pipe is exposed). Pipe vulnerability to groundwater is a function of the pipe material or age, where cracked pipes or leaky joints mean that groundwater will flow into the system and reduce the pipe capacity, ultimately causing a reduction in level of service. The maps illustrate groundwater risk is medium or high for most wastewater pipes within South Dunedin under the assessed timeframes. A number of high criticality pipes (grey shading) are rated at high risk. The impact of groundwater infiltration at a network scale is under investigation. Risk ratings for HAIL sites are based on exposure of each asset to the modelled median groundwater level, where residential sites are assessed to be highly vulnerable to groundwater if the median groundwater level rises to within 0.3 m of the ground surface (light blue shading) and industrial sites are highly vulnerable if the median groundwater level is emergent (dark blue shading).
Disclaimer: These maps are not intended to assess groundwater risk at individual asset level, which requires consideration of site specific groundwater risk as well as more detailed asset information.
Hazard data source: Cox, et al., 2023

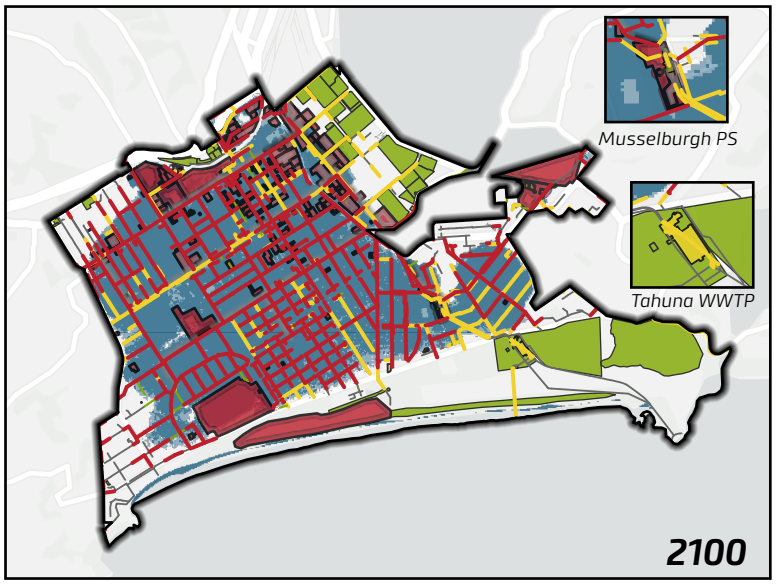
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

Major criticality

Median groundwater level (at 0.3 m below ground level)

Emergent groundwater (median)

Wastewater Pipe
- High
- Medium
- Low
- Not exposed to scenarios assessed

Structures
- High
- Medium
- Low
- Not exposed to scenarios assessed

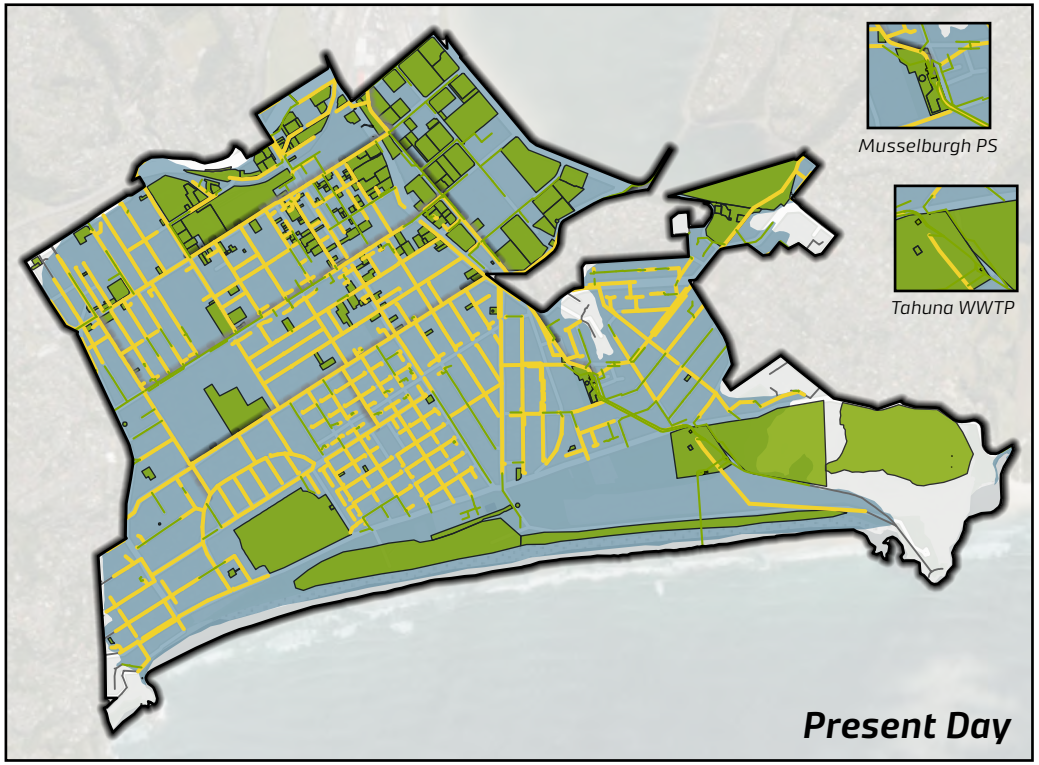
HAIL Site
- High
- Medium
- Low
- Not exposed to scenarios assessed

N

0 0.4 0.8 1.2 1.6 2 (km)

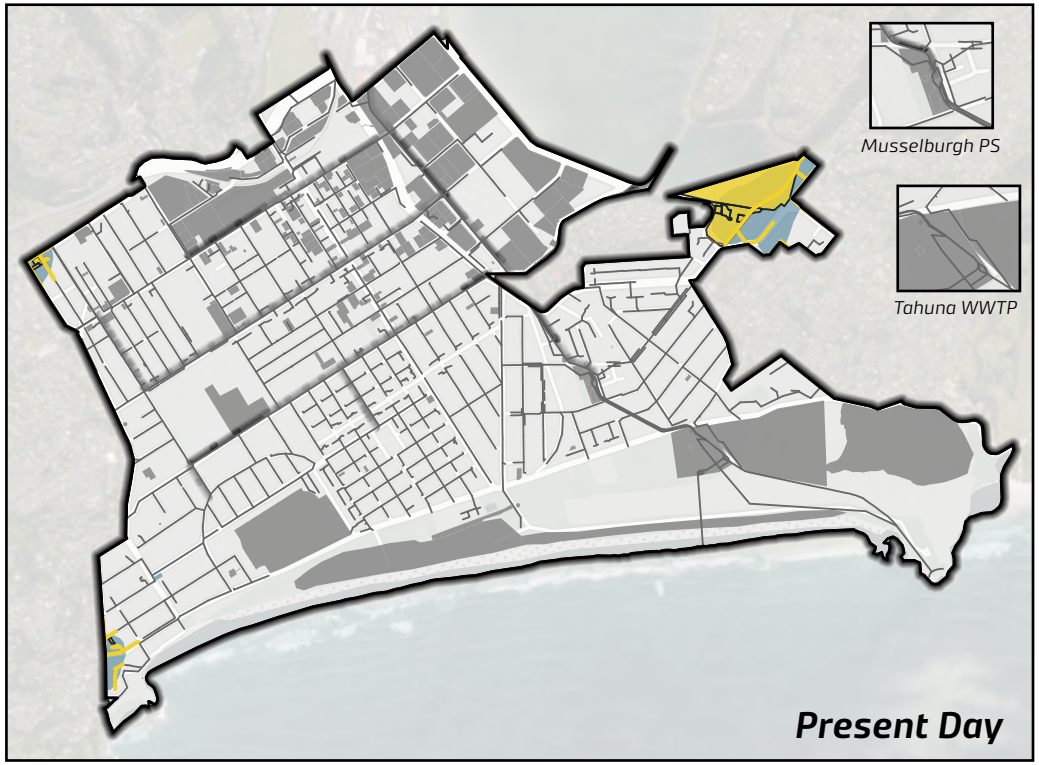
Figure 5.44 Wastewater infrastructure and contaminated land (HAIL sites) risk due to landslide and liquefaction

Liquefaction



Explainer: These maps show the risk to wastewater infrastructure and HAIL sites due to liquefaction. Risk ratings are based on exposure of each asset or site to liquefaction potential, combined with their vulnerability rating. The maps illustrate liquefaction risk is low across South Dunedin at the present day. Liquefaction risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of sea level rise on liquefaction potential. If it were to occur, liquefaction can impact water infrastructure by deforming the pipe network. ground settlement or stretching may damage or disconnect pipes and chambers and subsequent inflow of sediment can cause blockages. Buoyancy can cause uplift of buried structures, and disrupt drainage systems, while sediment discharge can reduce water quality and affect aquatic habitats.
Disclaimer: These maps are not intended to assess liquefaction risk at individual asset level, which requires consideration of site specific liquefaction risk as well as more detailed asset information. Liquefaction hazard information is based on a high level desktop review, where subsequent site specific assessment (Hornblow, 2020) has found that liquefaction potential is highly variable across sites analysed.
Hazard data source: Barrell, 2014

Landslide



Explainer: These maps show the risk to wastewater infrastructure and HAIL sites due to landslide. Risk ratings for individual wastewater pipes are based on exposure of each asset to landslides, combined with their vulnerability rating and adjusted for pipe criticality (grey shadow on pipe). Landslides can severely damage wastewater resulting in sudden collapse or failure and posing a potential risk to life in critical assets. The maps illustrate that some pipes and HAIL sites at the South Dunedin boundary are rated medium risk. Landslide risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of climate change (groundwater level rising or increased rainfall intensity) on landslide.
Disclaimer: These maps are not intended to assess landslide risk at individual asset level, which requires consideration of a site specific landslide risk as well as more detailed asset information. The landslide extent is based on known landslide areas and does not account for other potential sources of landslide nor represent the extent of the area of deposition/runout.
Hazard data source: DCC Hazard database data provided for South Dunedin Future programme

South Dunedin Future Boundary

Land instability

Liquefaction (Domain C: moderate liquefaction potential)

Major criticality

Wastewater Pipe (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

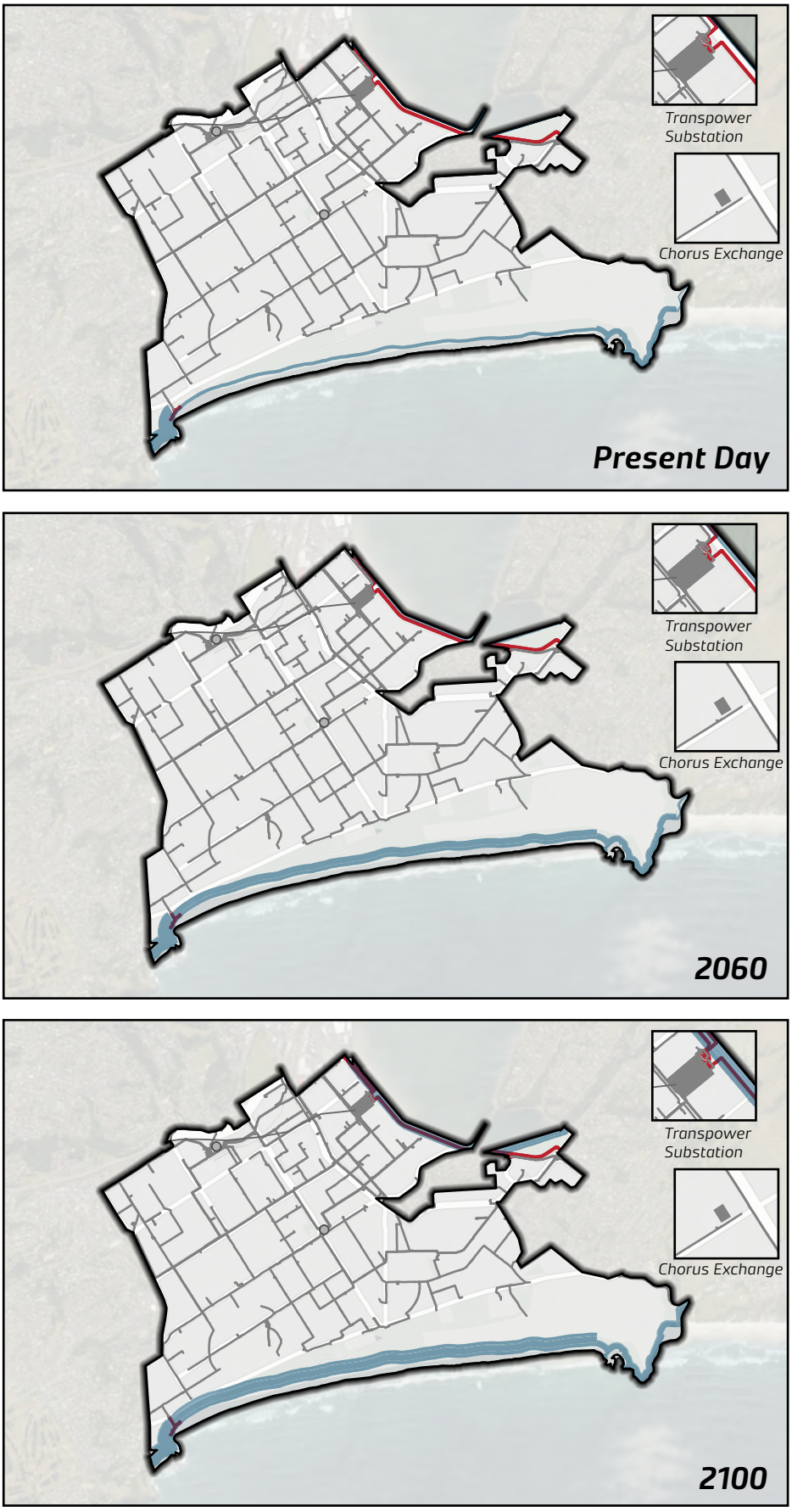
Structures (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

HAIL Site (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

N

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.48 Energy and telecommunications infrastructure risk due to coastal erosion

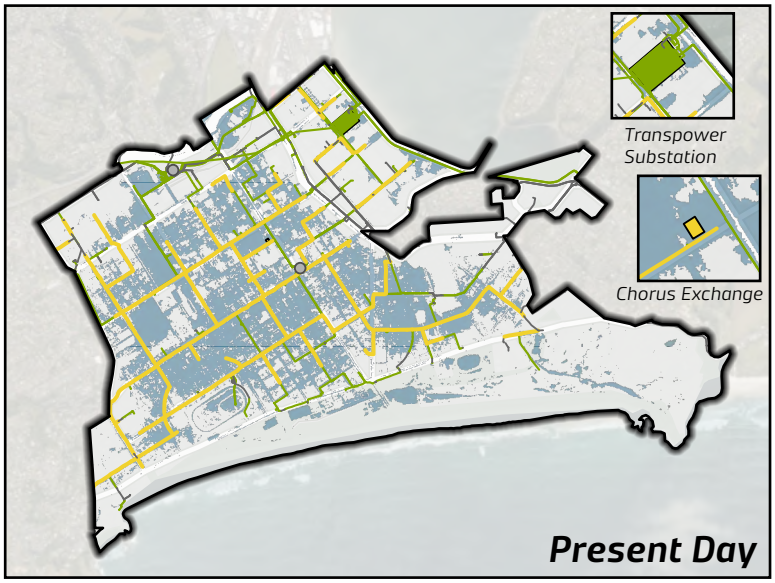


Explainer: These maps show the risk to energy and telecommunications infrastructure due to coastal erosion (blue shading), noting that there is a high level of uncertainty regarding coastal erosion risk due to data limitations at present (e.g. scale of screening study and accounting for impact of engineered structures). The maps indicate that coastal erosion risk to telecommunications lines is confined to areas directly adjacent to the Otago Harbour, and a small number of lines along the St Clair-St Kilda coastline at the St Clair end of the beach. More detailed coastal hazard assessments are underway as part of the St Clair-St Kilda Coastal Plan, these will be completed in late-2025, after which coastal erosion risk ratings will be reviewed.

Disclaimer: These maps are not intended to assess coastal erosion risk to specific assets, which requires more detailed hazard data and consideration of a range of building specific factors (e.g. foundation type).

Hazard data source: WSP, 2024

Figure 5.49 Energy and telecommunications infrastructure risk due to pluvial flooding

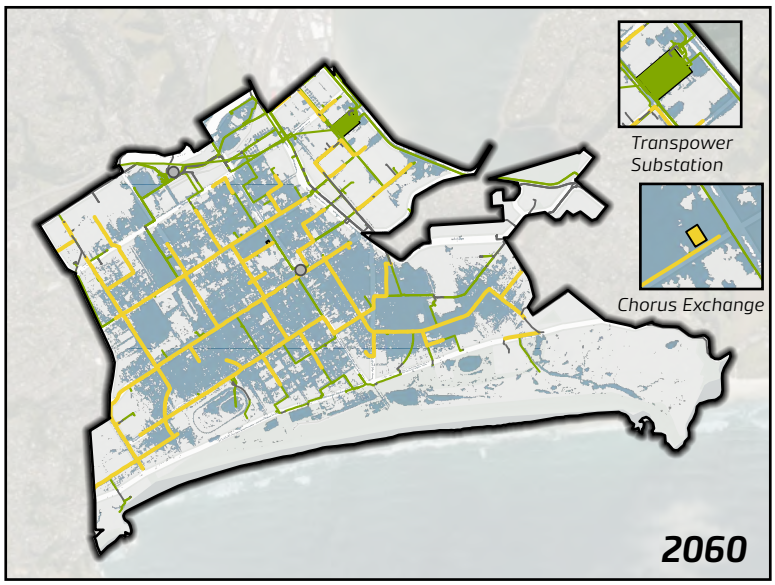


Explainer: These maps show the risk to energy and telecommunications infrastructure due to pluvial flooding (blue shading). Risk ratings for individual lines, substations and exchange sites are based on exposure of each asset or site to modelled pluvial flood at a range of return intervals, combined with the vulnerability of the asset to flooding. The maps illustrate pluvial flood risk is medium across the transmission line network across all timeframes and scenarios assessed. Risk to the Transpower substation is low across all scenarios and timeframes assessed, while the Chorus exchange site is at medium risk across all timeframes and scenarios.

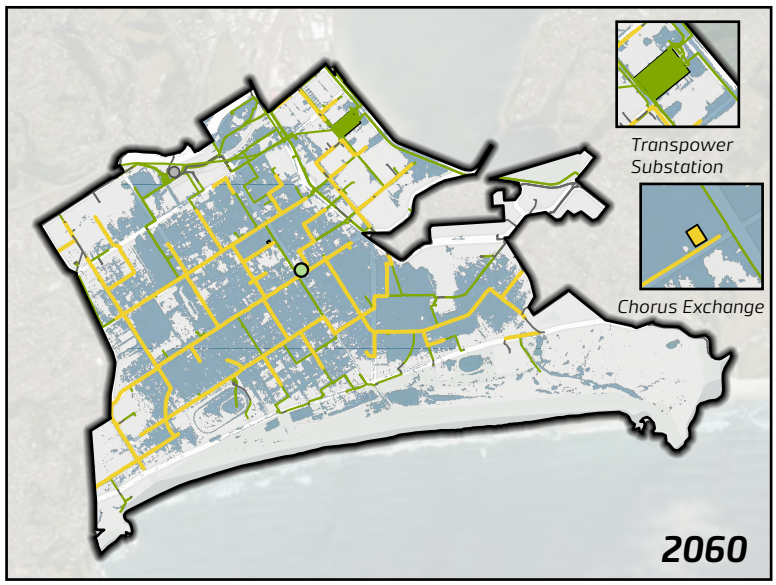
Disclaimer: These maps are not intended to assess pluvial flood risk at the individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.

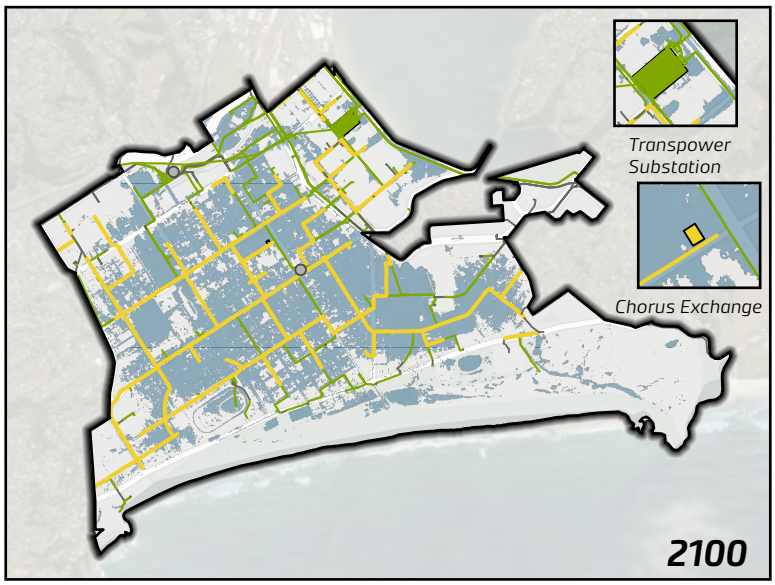
Hazard data source: DCC ICMP Flood Model (Beca, WSP, 2024)

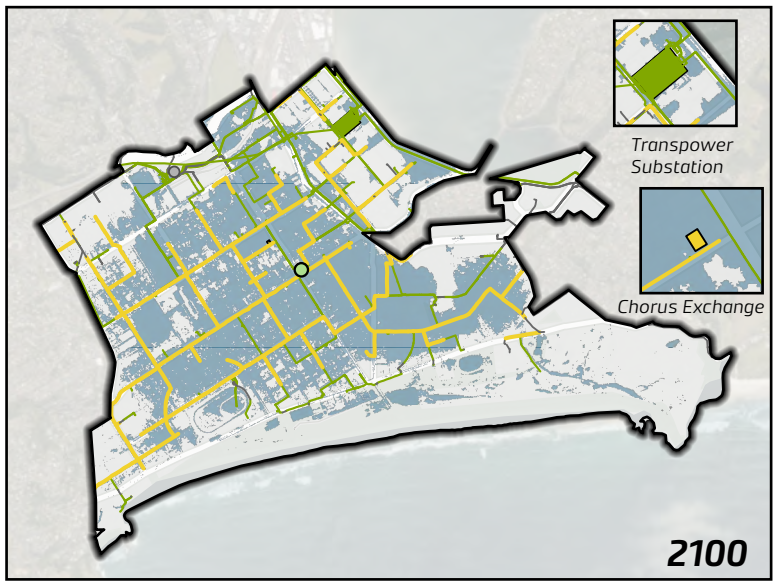
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

1% AEP pluvial flood extent

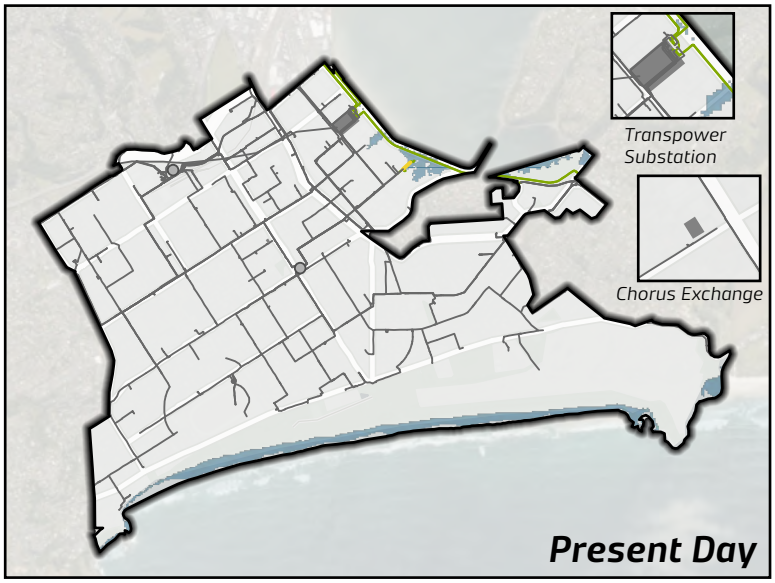
Aurora Substation (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Transmission Lines & Distribution Cables
- High
- Medium
- Low
- Not exposed to scenarios assessed

Transpower Substation & Chorus Exchange
- High
- Medium
- Low
- Not exposed to scenarios assessed

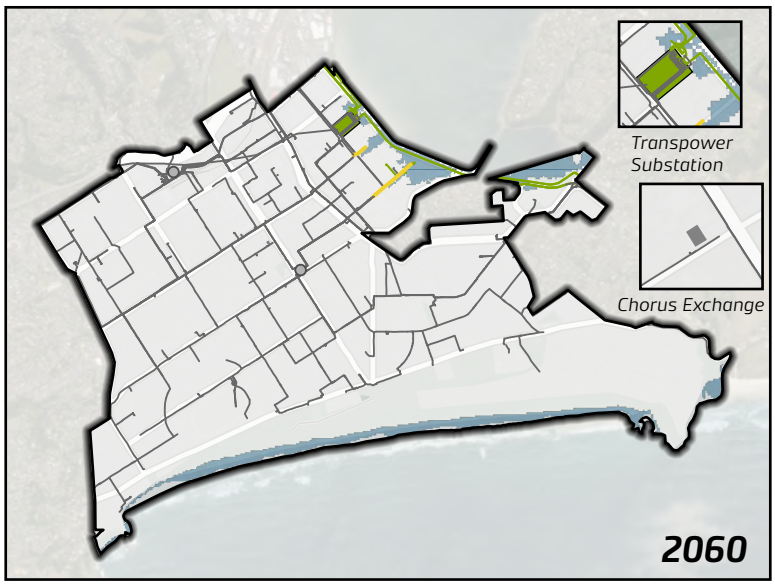
0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.50 Energy and telecommunications infrastructure risk due to coastal inundation

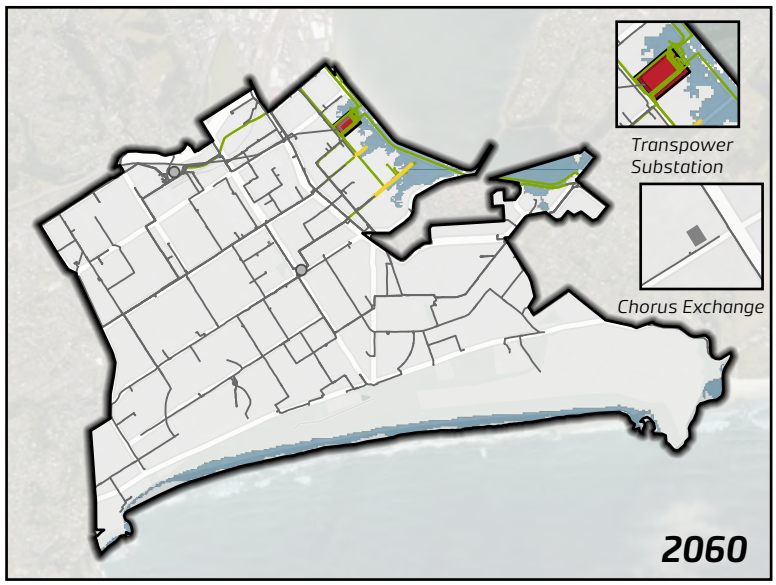


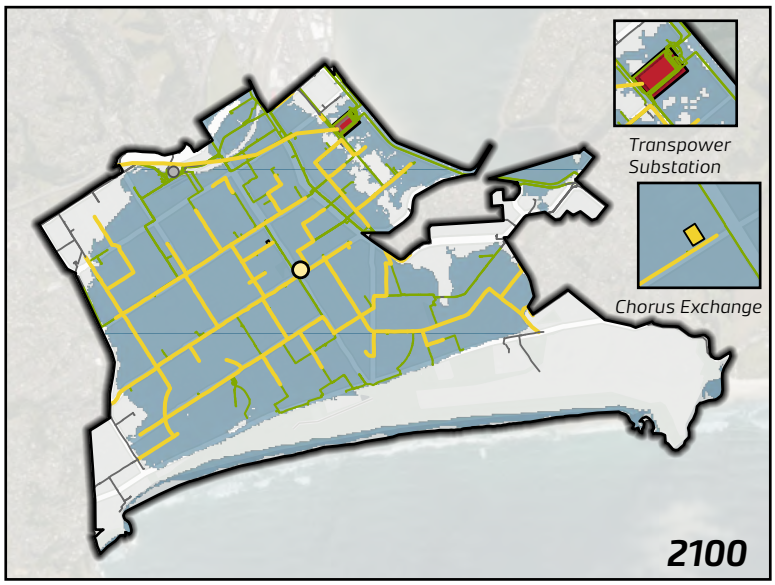
Explainer: These maps show the risk to energy and telecommunications infrastructure due to coastal inundation (blue shading). Risk ratings for individual lines, substations and exchange sites are based on exposure of each asset to modelled coastal inundation at a range of return intervals, combined with the vulnerability of the asset to inundation. Underground cables are rated to have very low vulnerability to pluvial flooding due to their location, while substations are rated high vulnerability where flood depths are greater than 0.2 m. Site specific review of Transpower South Dunedin substation found that sensitive transmission assets are located in minimally affected areas of the site, resulting in a very low service vulnerability for the scenarios assessed. The maps illustrate very little coastal inundation risk for most lines and substations until late century. Under a high end climate scenario, both the Transpower South Dunedin substation and the Chorus exchange are at high risk at late century. Risk to underground cables is low across all timeframes, while overhead cables and associated poles have a medium risk at late century.
Disclaimer: These maps are not intended to assess coastal inundation risk at the individual asset level, which requires consideration of site specific flooding risk as well as more detailed asset information.
Hazard data source: Paulik, et al., 2023

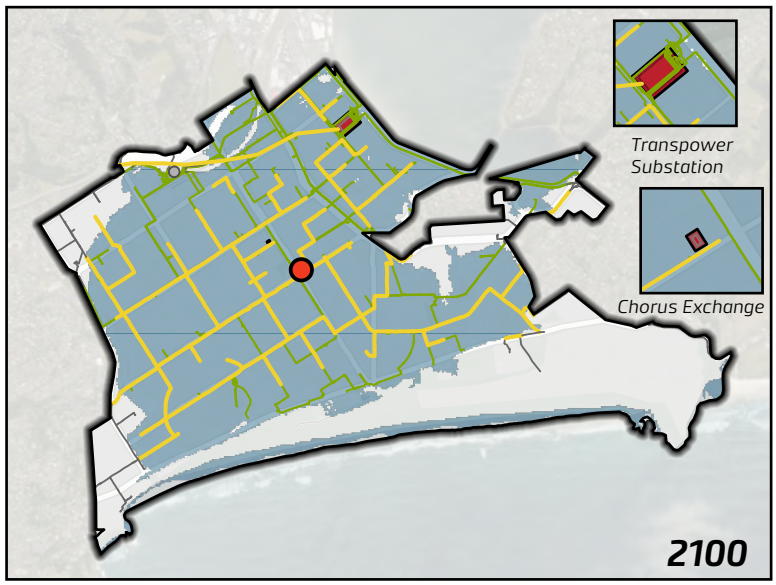
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

1% AEP coastal inundation extent

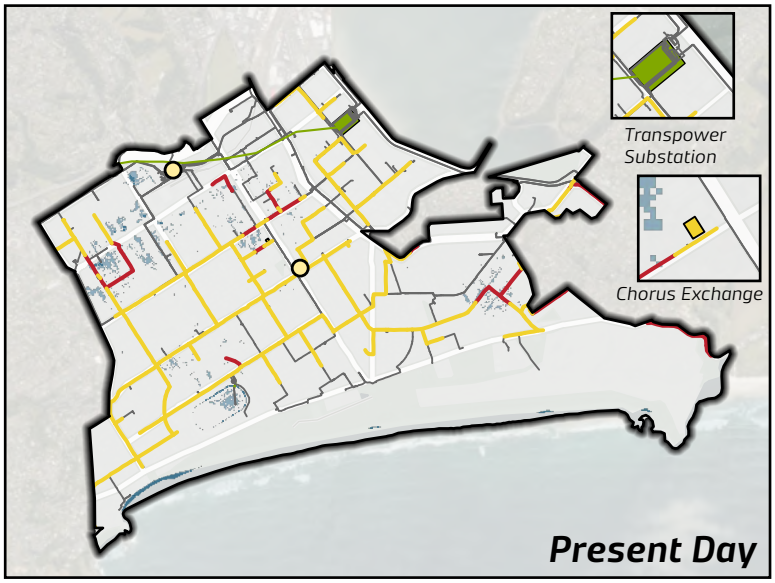
Aurora Substation (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Transmission Lines & Distribution Cables
- High
- Medium
- Low
- Not exposed to scenarios assessed

Transpower Substation & Chorus Exchange
- High
- Medium
- Low
- Not exposed to scenarios assessed

0 0.4 0.8 1.2 1.6 2 (km)

Figure 5.51 Energy and telecommunications infrastructure risk due to groundwater

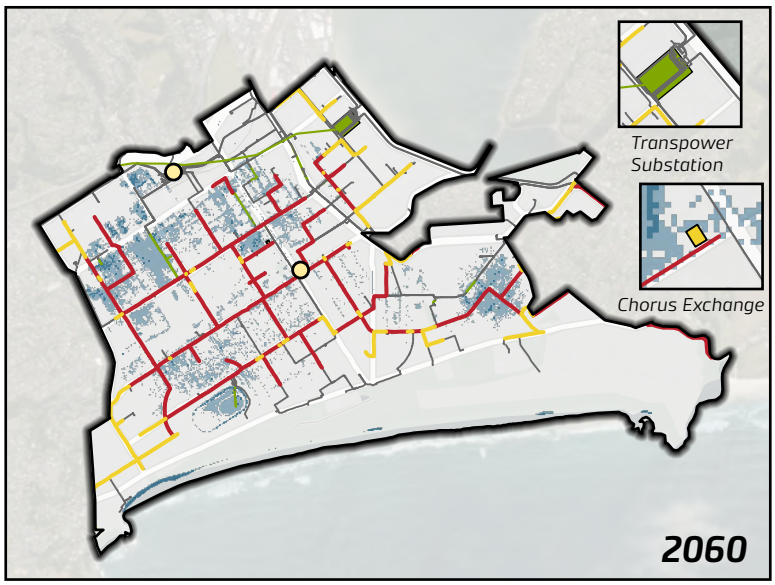


Explainer: These maps show the risk to energy and telecommunications infrastructure due to groundwater (blue shading). Risk ratings for individual lines, substations and exchanges are based on exposure of each asset to the modelled median groundwater level. Distribution lines and associated poles are vulnerable to a groundwater level that is within 0.3 m of the ground surface (light blue shading), however transmission infrastructure and substations have a lower vulnerability. The maps illustrate groundwater risk is medium across the distribution line network in the present day which increases to high for most of the network at mid-century. Risk to the Transpower South Dunedin substation is low across all scenarios and timeframes assessed, while the Chorus exchange site is at medium risk in the present day, which increases to high in future timeframes.

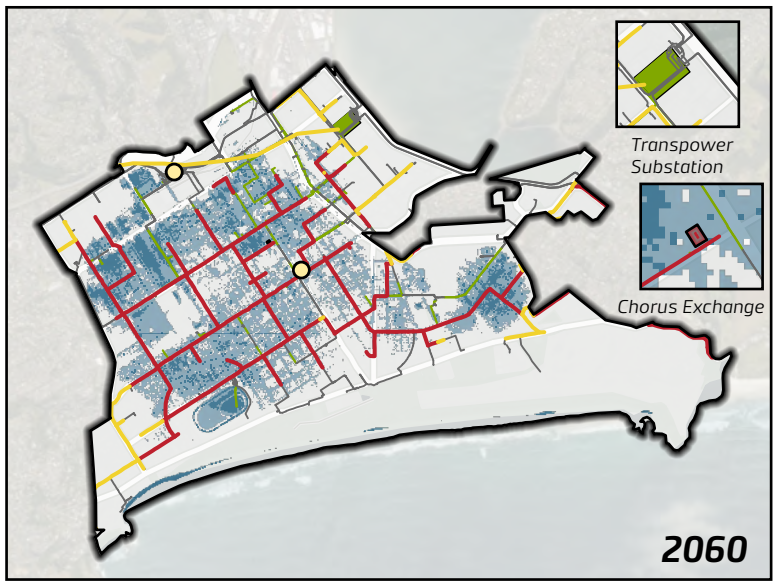
Disclaimer: These maps are not intended to assess groundwater risk at the individual asset level, which requires consideration of site specific groundwater risk as well as more detailed asset information.

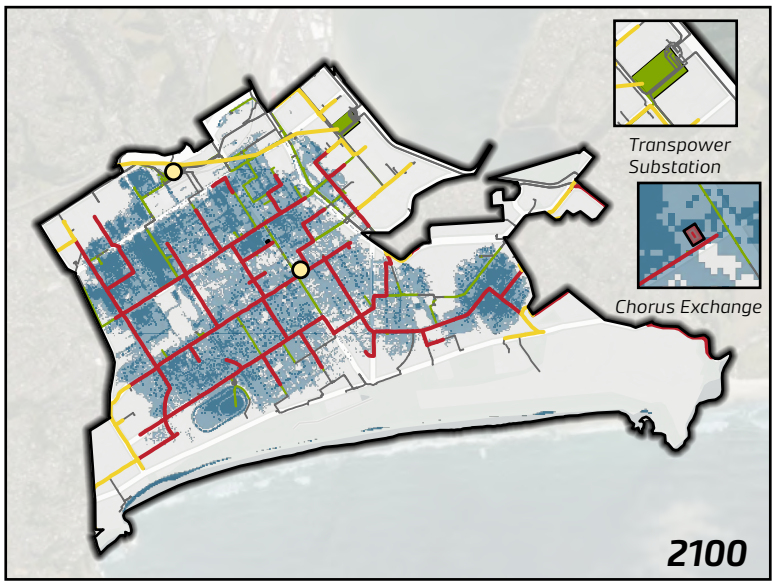
Hazard data source: Cox, et al., 2023

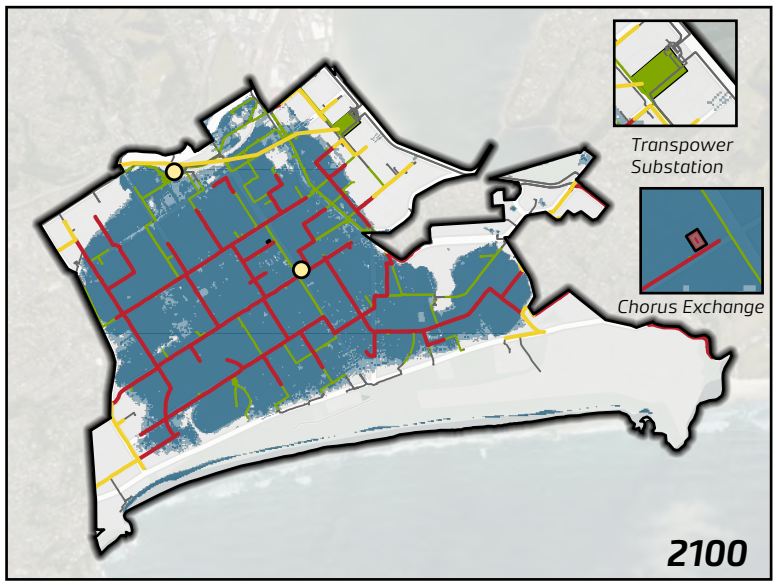
SSP2-4.5



SSP5-8.5







South Dunedin Future Boundary

Emergent groundwater (median)

Median groundwater level (at 0.3 m below ground level)

0 0.4 0.8 1.2 1.6 2 (km)

Aurora Substation (Risk)

- High
- Medium
- Low
- Not exposed to scenarios assessed

Transmission Lines & Distribution Cables

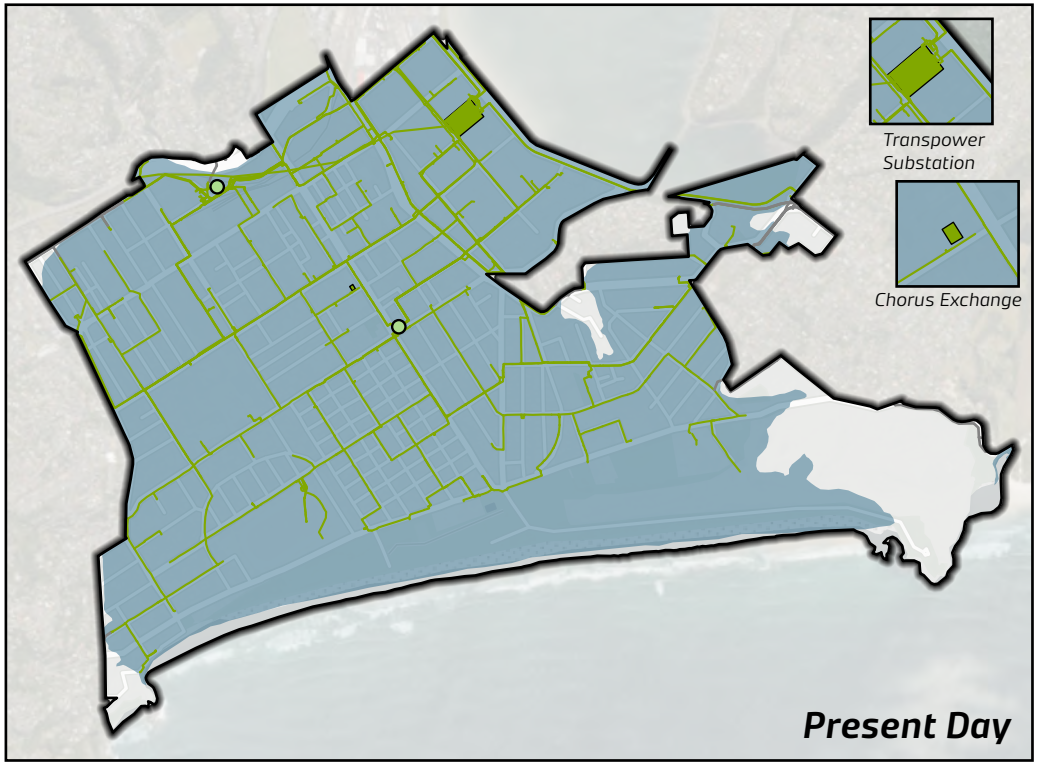
- High
- Medium
- Low
- Not exposed to scenarios assessed

Transpower Substation & Chorus Exchange

- High
- Medium
- Low
- Not exposed to scenarios assessed

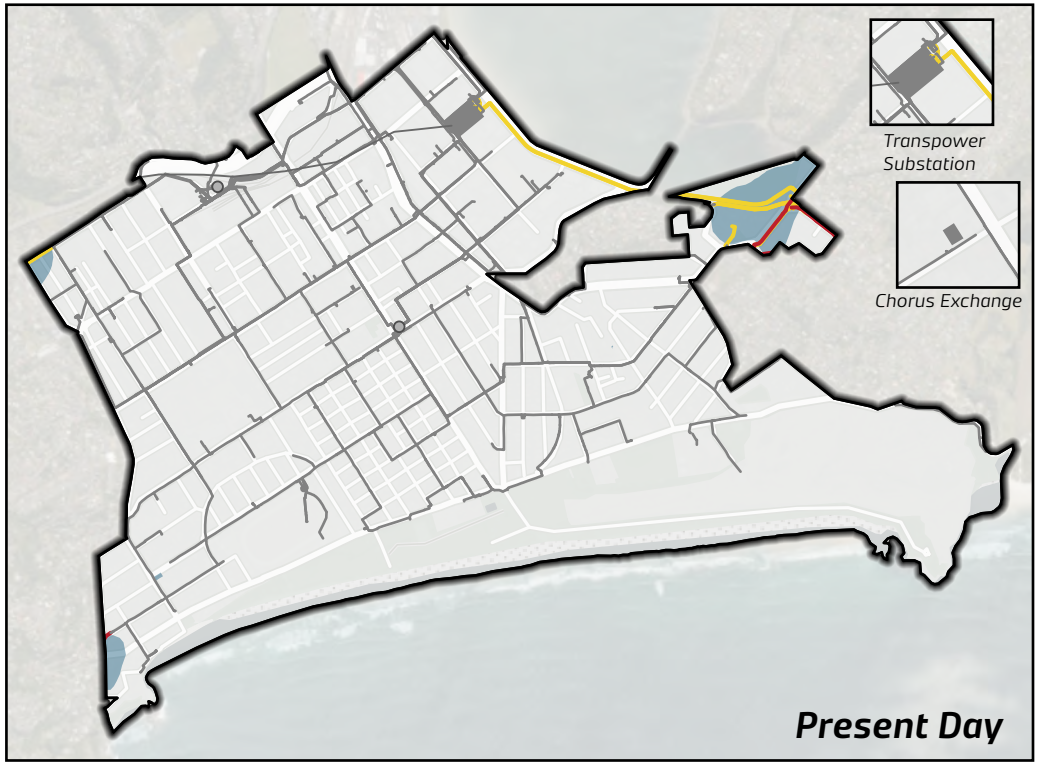
Figure 5.52 Energy and telecommunications infrastructure risk due to landslide and liquefaction

Liquefaction



Explainer: These maps show the risk to energy and telecommunications infrastructure due to liquefaction. Risk ratings for individual lines, substations and exchanges are based on exposure of each asset or site to liquefaction potential, combined with their vulnerability rating. Distribution and transmission poles have a moderate vulnerability rating, while underground cables are have high vulnerability rating. The maps illustrate liquefaction risk is low across South Dunedin at the present day. Liquefaction risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of sea level rise on liquefaction potential. If it were to occur, liquefaction can cause differential settlement and lateral spreading that distorts structures, reduces foundation-bearing capacity, and damages pile supports and service connections.
Disclaimer: These maps are not intended to assess liquefaction risk at individual asset level, which requires consideration of site specific liquefaction risk as well as more detailed asset information. Liquefaction hazard information is based on a high level desktop review, where subsequent site specific assessment (Hornblow, 2020) has found that liquefaction potential is highly variable across sites analysed.
Hazard data source: Barrell, 2014

Landslide



Explainer: These maps show the risk to energy and telecommunications infrastructure due to landslide (blue shading). Risk ratings for individual lines, substations and exchanges are based on exposure of each asset to landslides, combined with their vulnerability rating. Landslides can severely damage infrastructure through sudden collapse or failure. The maps illustrate some cables at the South Dunedin boundary are rated medium and high risk, with very little other exposure across South Dunedin. Landslide risk is not assessed at future timeframes due to the absence of spatial data that incorporates the influence of climate change (groundwater level rising or increased rainfall intensity) on landslide.
Disclaimer: These maps are not intended to assess landslide risk at individual asset level, which requires consideration of a site specific landslide risk as well as more detailed asset information. The landslide extent is based on known landslide areas and does not account for other potential sources of landslide nor represent the extent of the area of deposition/runout.
Hazard data source: DCC Hazard database data provided for South Dunedin Future programme

South Dunedin Future Boundary

Land instability

Liquefaction (Domain C: moderate liquefaction potential)

0 0.4 0.8 1.2 1.6 2 (km)

Aurora Substation (Risk)
- High
- Medium
- Low
- Not exposed to scenarios assessed

Transmission Lines & Distribution Cables
- High
- Medium
- Low
- Not exposed to scenarios assessed

Transpower Substation & Chorus Exchange
- High
- Medium
- Low
- Not exposed to scenarios assessed