WSUD in a changing climate

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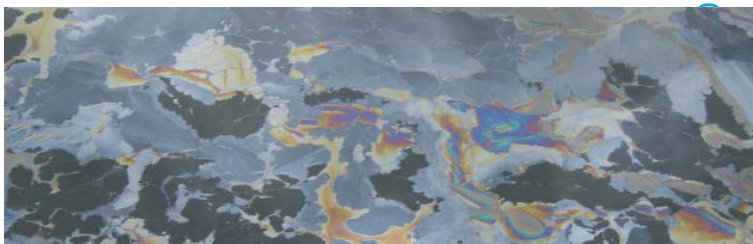
Climate risk for water systems in urban areas

Flooding

Population Growth and Liveability

Water Stress

Urban Heat



River Quality

Are today's solutions a valid response for tomorrow's climate

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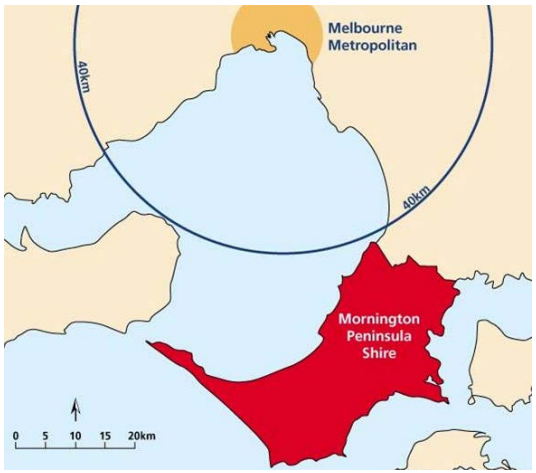
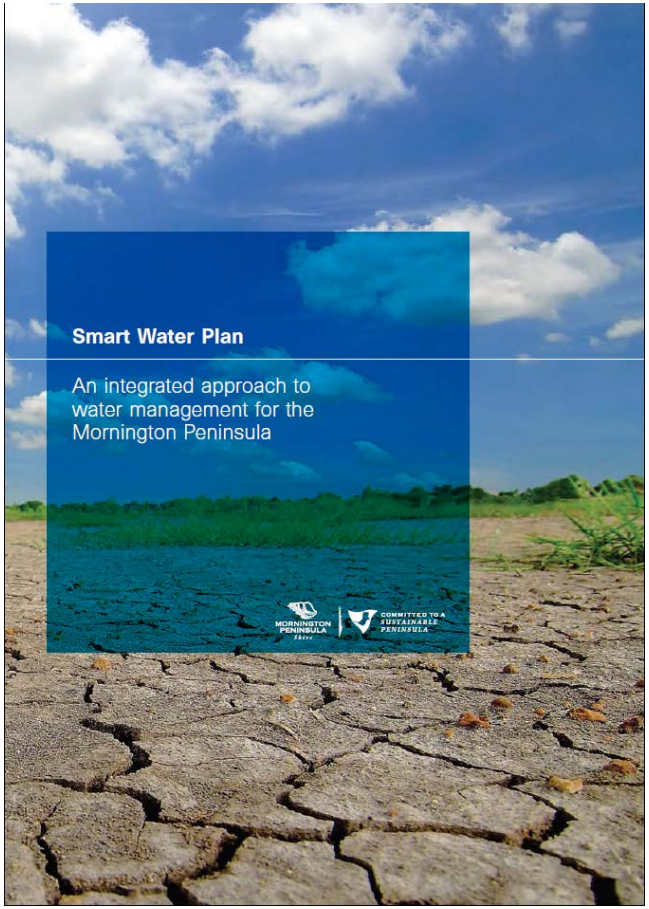
Mornington Peninsula Shire – Integrated Water Management





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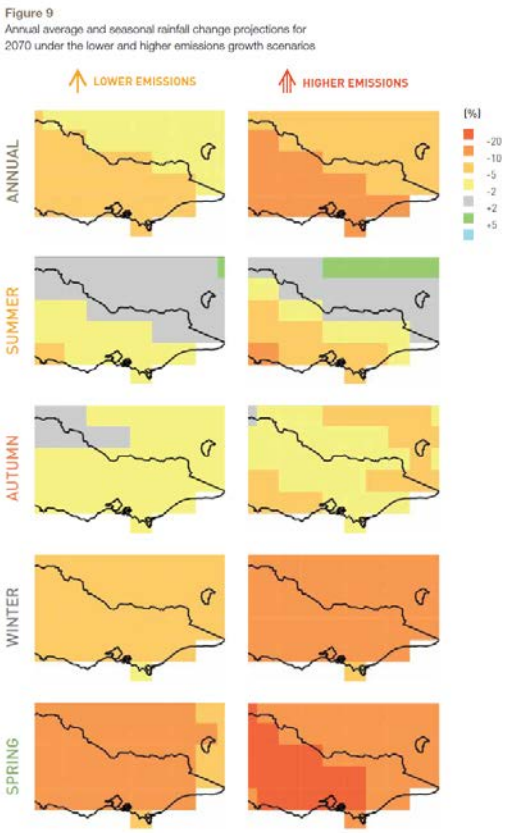
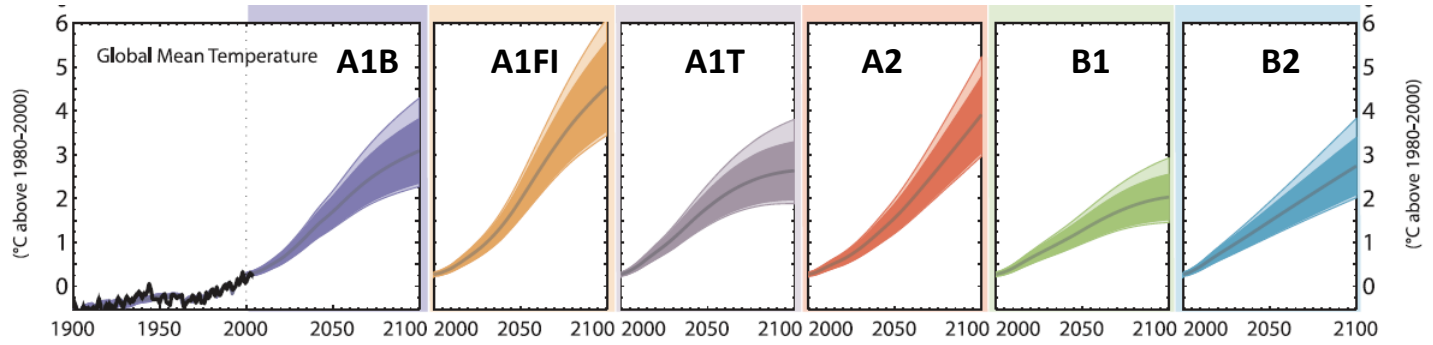
Climate change

- For southern Victoria, including Westernport:
  - Reduction in mean annual rainfall
  - Reduction in number of rain days
  - Increase in rainfall intensity
  - Increase in evaporation





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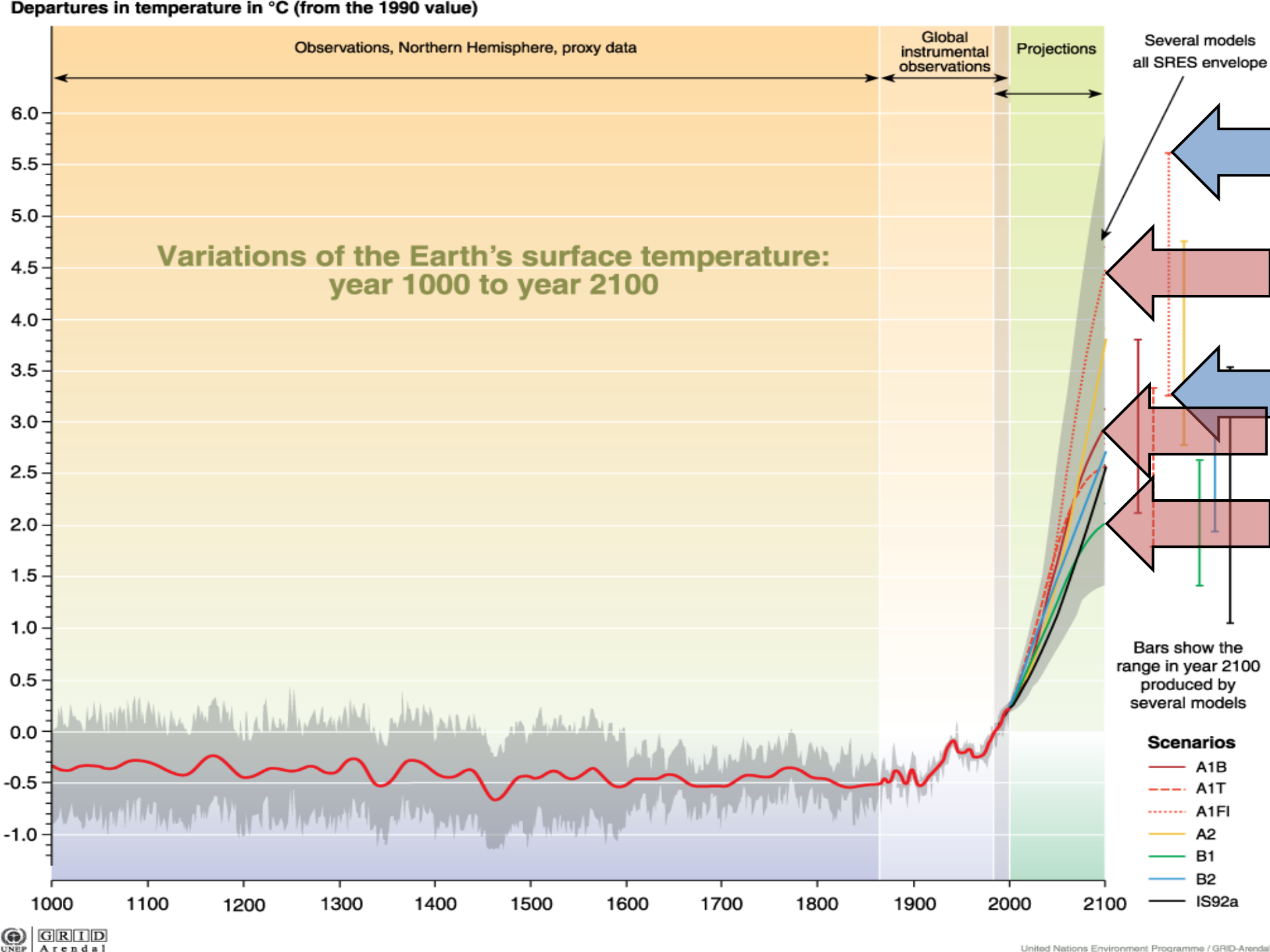

Departures in temperature in °C (from the 1990 value)
Observations, Northern Hemisphere, proxy data
Global instrumental observations
Projections
Several models all SRES envelope
Variations of the Earth's surface temperature: year 1000 to year 2100
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
Bars show the range in year 2100 produced by several models
Scenarios
A1B
A1T
A1FI
A2
B1
B2
IS92a
UNEP GRID Arendal
United Nations Environment Programme / GRID-Arendal

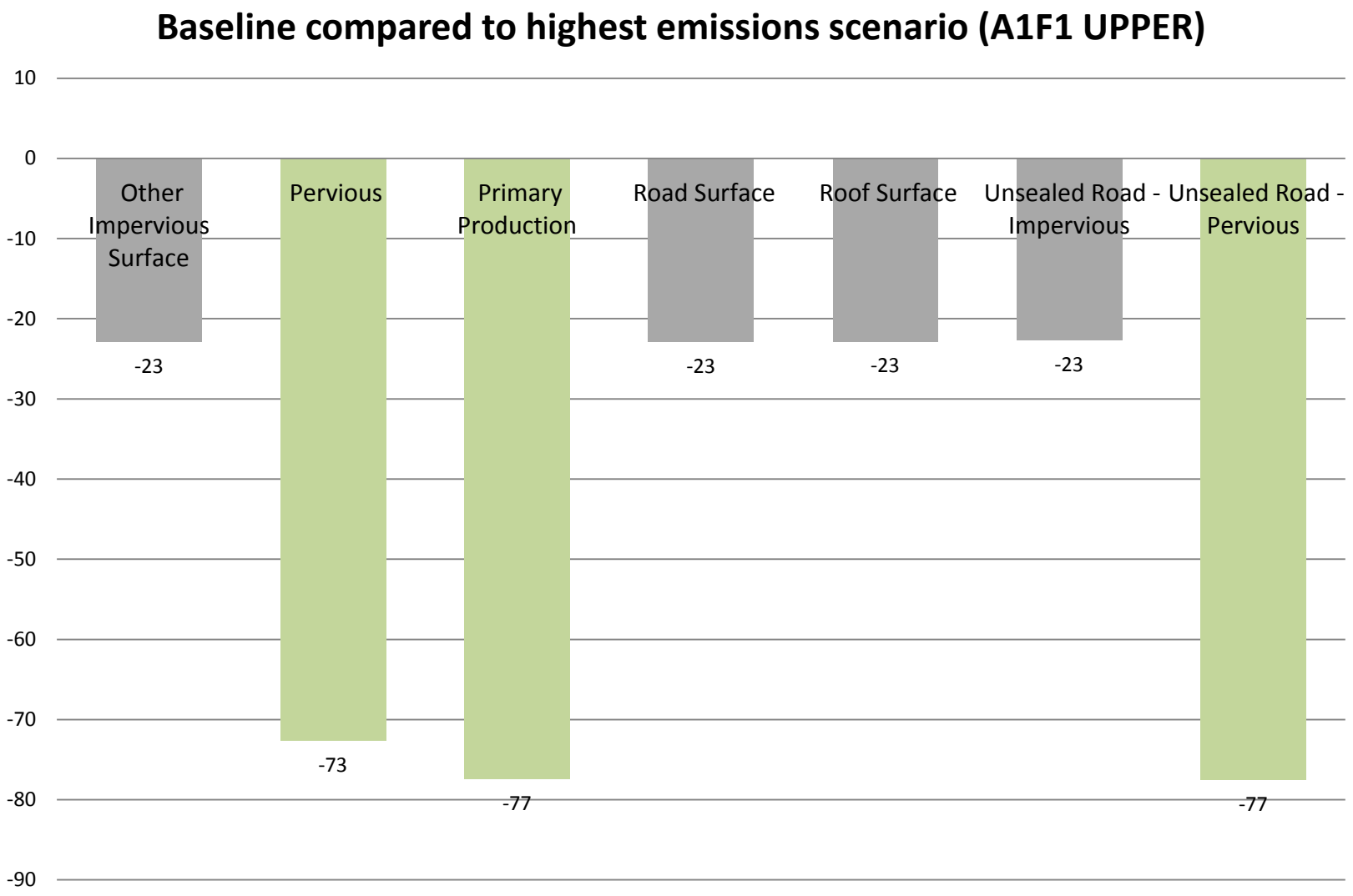
Methodology

- Adjusted rainfall data to match predicted changes in
  - Rainfall volumes
  - Rainfall intensities
  - Evapotranspiration
- Season-specific stochastically generated percentage changes to each day of rainfall
- 3 climate change projections
  - 6 scenarios

Three questions…

1. What comes from the catchments (pollutants, flows)?
2. What is the future performance?
   - Reliability of supply of stormwater for harvesting schemes, and
   - Pollutant removal performance for raingardens and wetlands
3. What are the impacts for vegetation?

Runoff volume



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Stormwater harvesting – reliability of supply

	Stormwater Harvesting A	Stormwater Harvesting B	Rainwater Tank A (outdoor irrigation only)	Rainwater Tank B (indoor & outdoor use)	Rainwater Tank C (primary source)
1990 Baseline (% reliability)	80	80	80	76	90
2030 Medium Emissions LOWER	0	0	0	0	0
2030 Medium Emissions UPPER	-3	-2	-1	-2	-4
Low Emissions B1 2070 LOWER	0	0	-1	-1	-1
Low Emissions B1 2070 UPPER	-6	-4	-2	-3	-7
High Emissions A1F1 2070 LOWER	-1	0	-1	-1	0
High Emissions A1F1 2070 UPPER	-11	-8	-4	-7	-15

Generally less than 5% change in supply volume

Harshest climate scenario

- up to 15% reduction in volume supplied

- 50 to 100% tank size increase

- coincide with extreme impacts on potable water supply

WSUD treatment performance – water quality

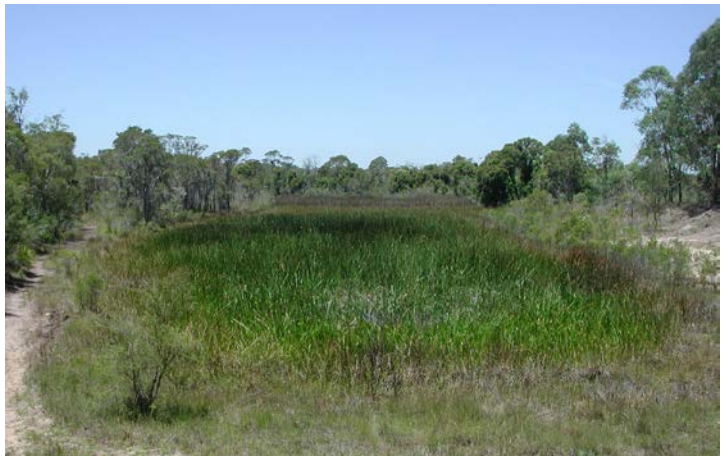
TN removal

	Raingarden	Swale	Treepit	Wetland
1990 Baseline load removal kg/yr (%)	51	46	47	47
Medium Emissions A1B 2030 Lower	-1	0	-1	0
Medium Emissions A1B 2030 Upper	-3	1	-1	0
Low Emissions B1 2070 Lower	0	-1	-1	0
Low Emissions B1 2070 Upper	-4	0	-1	1
High Emissions A1F1 2070 Lower	-1	-1	-2	-1
High Emissions A1F1 2070 Upper	-7	0	-1	2

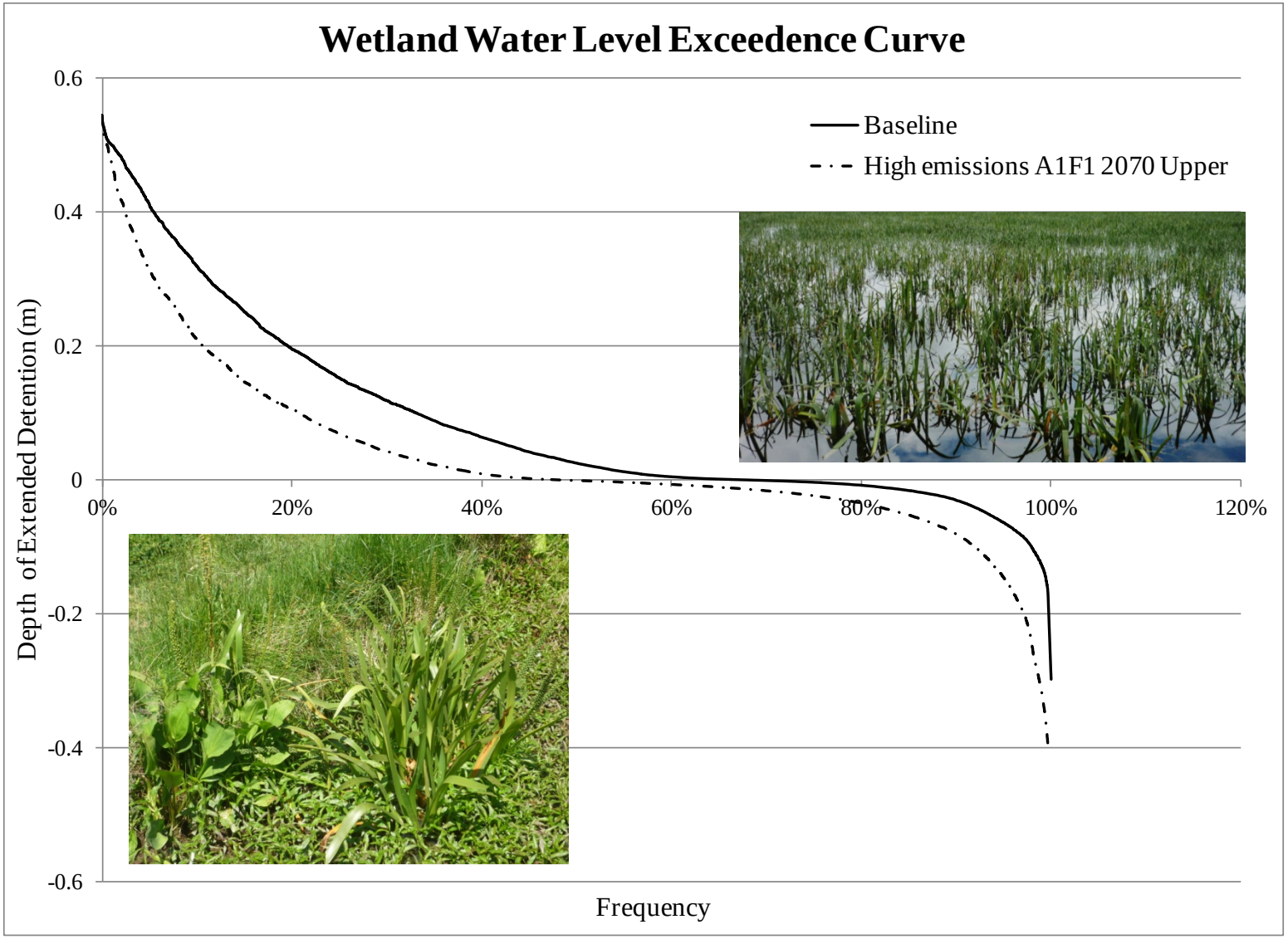
One scenario where performance differs >5% of the original design performance

Likely acceptable divergence given these are extremes of climate change scenarios

Wetlands increase performance



Wetland inundation and vegetation health



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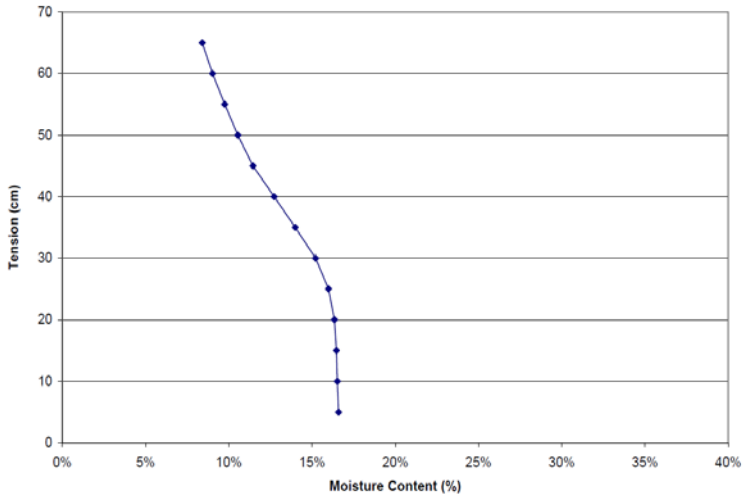
Raingarden soil moisture

- Only small changes to soil moisture holding capacity under the harshest climate change scenario
- Filter media being installed now has lower soil moisture holding capacity than is assumed in modelling



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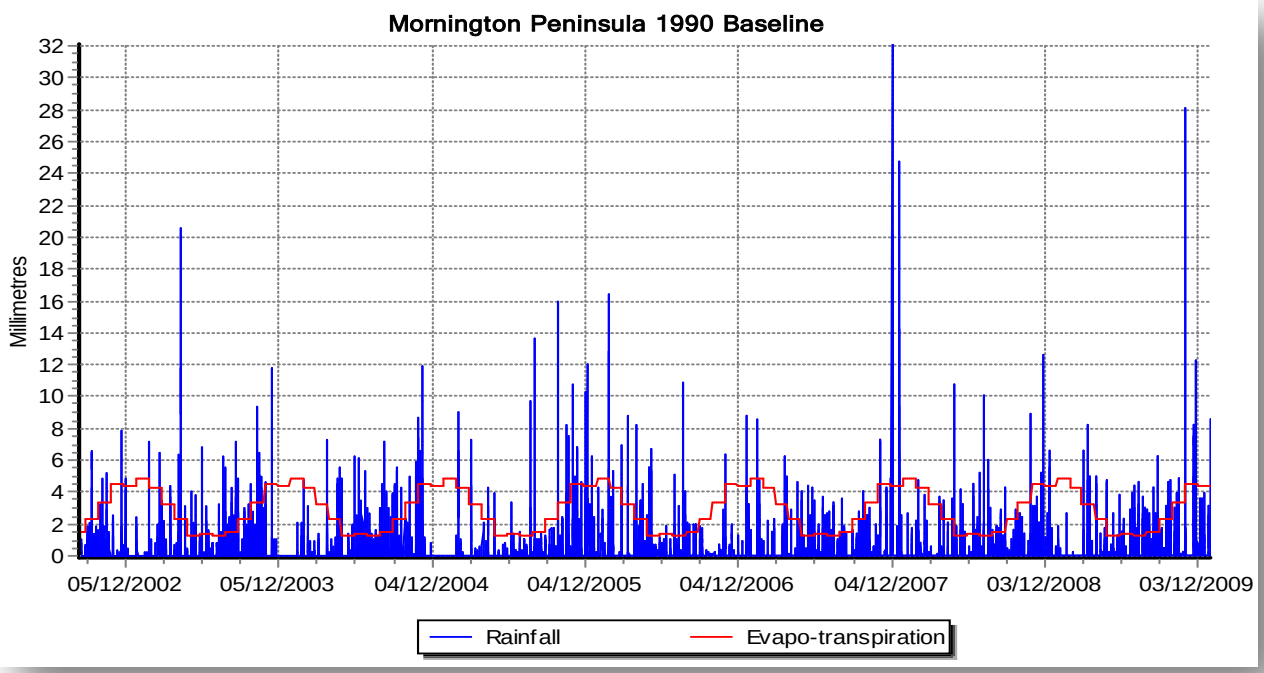
Southern Australian climate variability

- Southern Australia
- - low annual rainfall
- - high inter-annual rainfall variability
- Climate change scenarios are within the inter-annual rainfall variability
- Importance of long rainfall records for modelling



WSUD assets and climate change

- They are appropriate design solutions into the future
- Good design and construction will provide resilient assets
- Can be part of solutions to provide resilience to other urban landscapes and other benefits

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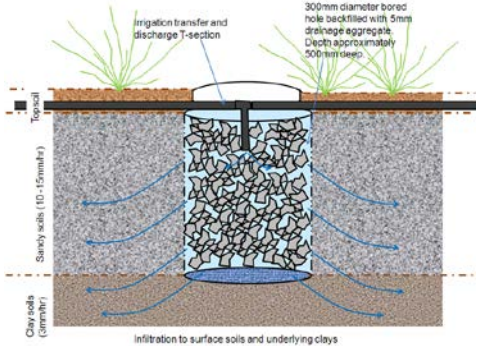
Napier Park – Moonee Valley City Council



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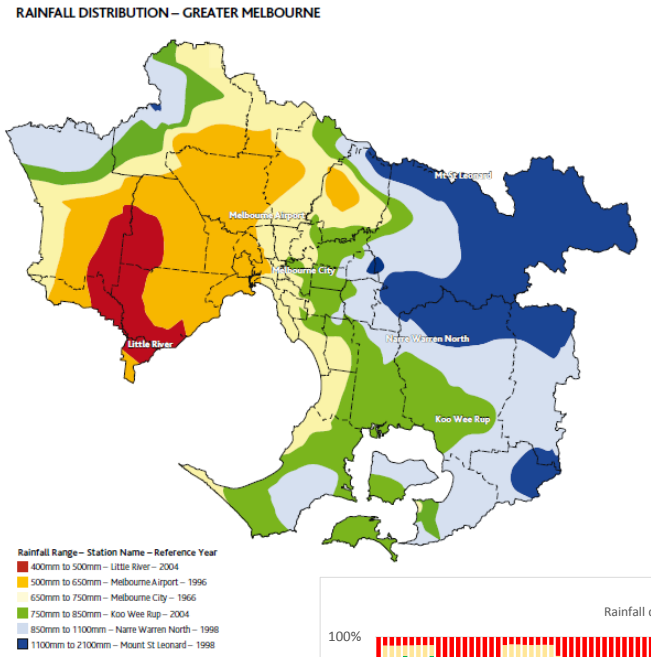
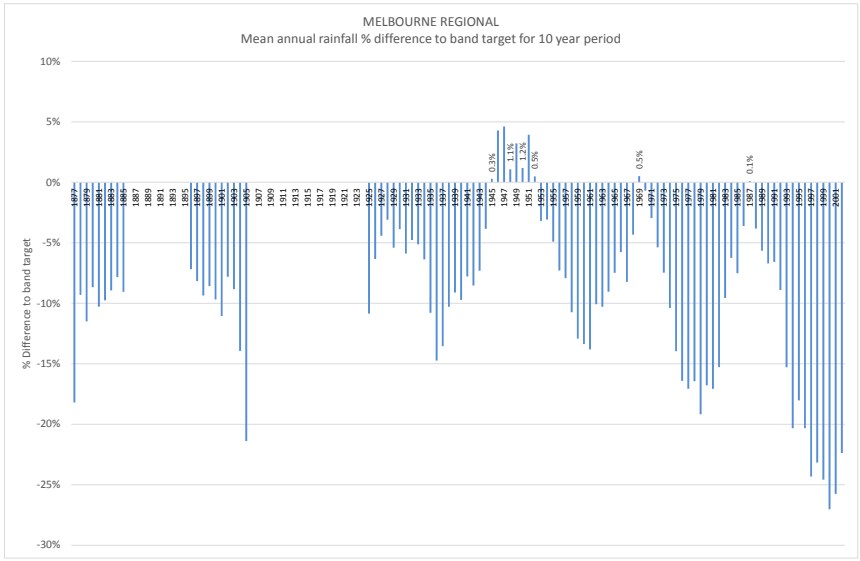
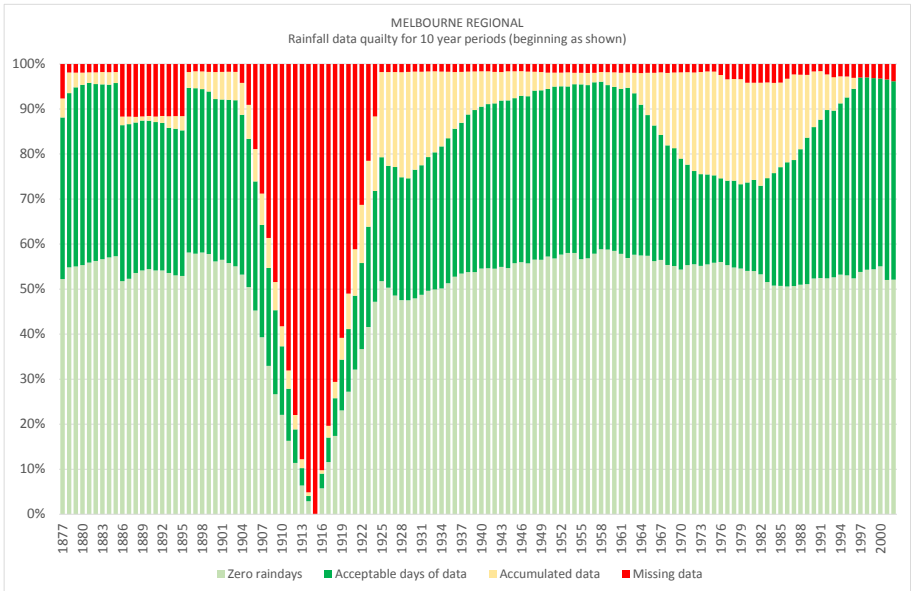
Melbourne Water MUSIC Guidelines
10 year rainfall templates







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Climate risk for water systems in urban areas

- Flooding
- Population Growth and Liveability
- Water Stress
- Urban Heat
- River Quality