Environmental Scan Report

North West Metro Region

VICTORIA State Government | Justice and Community Safety

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1. Introduction

Planning by agencies has traditionally focused on each hazard type e.g. fire, flood or storm, using risk-based decision-making processes to inform preparedness, response, relief and recovery activities. Victorian emergency management arrangements also support agencies and relevant stakeholders to work together across all hazard types. This includes creating opportunities to identify and manage priorities to effectively manage risks, together with communities and organisations from within and outside the emergency management sector.

In 2020, the *Emergency Management Act 2013* was updated by the *Emergency Management Legislation Amendment Act 2018*. In response to this, new State, Regional and Municipal plans are required to comply with the new legislation. Some of the key inclusions are information on regional context, and mitigation, response and recovery strategies, along with supporting roles and responsibilities for regional collaboration. The new arrangements also require the establishment of regional emergency management planning committees (REMPCs) and the preparation of regional emergency management plans (REMPs).

Emergency Management Victoria (EMV) is providing guidance to the REMPCs for each of the eight emergency management regions in Victoria to assist with the development of updated regional plans.

2. Purpose

The aim of this is to produce a document containing consistent, accurate contextual data and information for each REMPCs to use as a resource when preparing the context section of the REMPs.

The outputs from this analysis will link directly to the context section of the regional emergency management plans. The standard headings from the State plan reference natural, built, economic and social environments for consideration. While the relative importance of each of these will vary between regions, they will still provide a good overview of the key regional context.

3. Structure of document

The structure of this document first summarises the process used to investigate the environment under which each region operates. This environmental scanning process was undertaken using a PESTEL analysis (Political, Economic, Social, Technological, Environmental and Legal). The content of the document then explores the data and information found, grouped under the standard headings from the State Emergency Management Plan, Natural, Built, Social and Economic environments. Each of these has sub-headings relevant to the region. Finally, a data source section shows the data and information attribution and summarises the metadata for each source used in the document. This gives context to the data and information as well as an assessment of reliability, credibility and currency of the data.

4. Environmental scan process

The format for this analysis is a PESTEL analysis (Political, Economic, Social, Technological, Environmental and Legal). These categories are often used for business analysis to cover all aspects of context for a project or business proposal to expand the thinking outside of the standard considerations. This will broaden the scope of the emergency management sector to cover all emergencies and all communities. Further detail for each key area is in the image below.

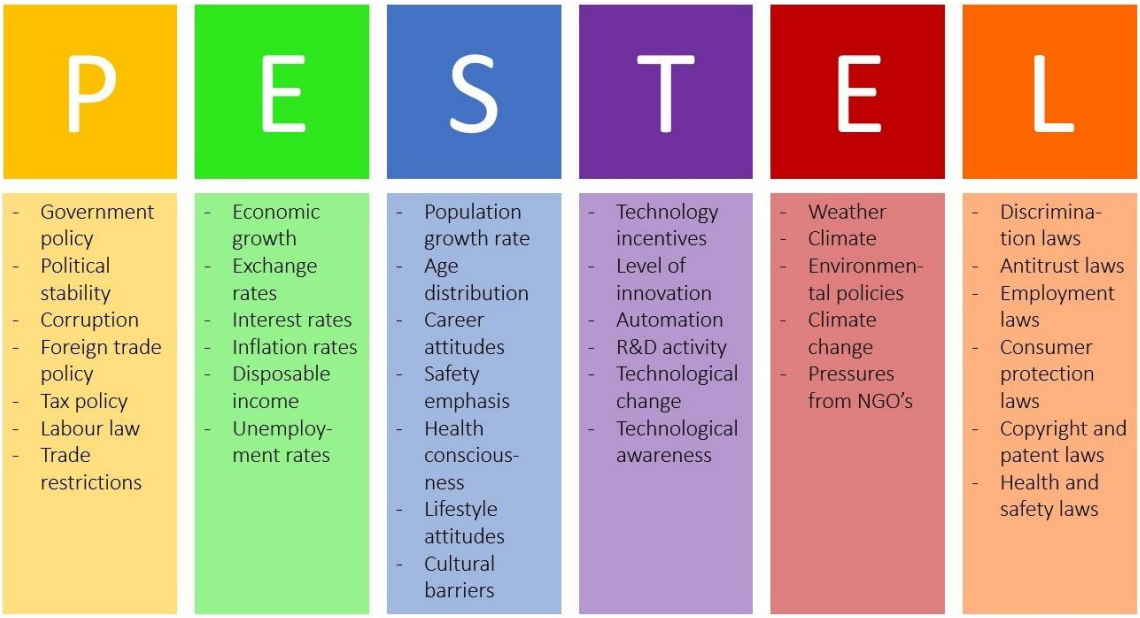


Figure 1. PESTEL analysis[1]

The broad environmental scanning process ensured that all impacts on the region were considered, including those influences outside of the regional boundaries.

5. Regional Context

North West Metro Region (NWMR) is the traditional home of the Boon Wurrung, Wurundjeri and Wathaurong peoples of the Kulin nation, and one of eight regions for emergency management in Victoria, declared under Section 63 of the *Emergency Management Act 2013*.

1 B2U (2020): https://www.business-to-you.com/scanning-the-environment-pestel-analysis/

Figure 2. Victorian Emergency Management Regions

NWMR shares boundaries with all but one of the other seven regions, covers 2,981 square kilometres and includes 228 suburbs or townships across 14 local government areas (LGAs). The profiles of these LGAs are diverse, covering both Melbourne's inner-city suburbs, including the central business district, and environs on the urban fringe.

Figure 3. North West Metro Region Map including LGA boundaries[2]

The LGAs located within NWMR are:

- Banyule City
- Brimbank City
- Darebin City
- Hobsons Bay City
- Hume City
- Maribyrnong City
- Melbourne City
- Melton Shire
- Moonee Valley City
- Moreland City
- Nillumbik Shire
- Whittlesea City
- Wyndham City
- Yarra City

The five LGAs that occupy NWMR's outer suburbs – Hume, Melton, Nillumbik, Whittlesea and Wyndham – categorise themselves as 'interface councils.' That is, "municipalities that form a ring around metropolitan Melbourne [and believe their] communities face exceptional liveability challenges as a result of increasingly rapid population growth, changing demographics and the impact of historic underfunding."[3]

While this environmental scan for NWMR considers all 14 LGAs as a whole in many of its analyses it should be noted that on occasion the profiles of the metropolitan LGAs will be quite different to those of the interface councils. Emergency management planning in this context therefore needs to be mindful of, and account for, the different circumstances encountered across LGAs within NWMR.

2 Victorian Multicultural Commission (2020): https://www.multiculturalcommission.vic.gov.au/vmc-regional-advisory-councils
3 Interface Councils of Victoria (2019): https://www.interfacecouncils.com.au/about

6. Natural Environment

The natural environment of North West Metro Region is diverse, encompassing both grassy plains to the south, north and west, and hilly, bushy terrain to the north-east. The region is bounded by an urban-rural interface with significant expanses of woodlands and grasslands.[4] In metropolitan areas, NWMR is home to plentiful parks, gardens and open spaces. The City of Melbourne has commenced work on its Urban Forest strategy, aiming to increase canopy cover to 40% by 2040.[5]

6.1 Climate

6.1.1 Average Temperatures

According to the Bureau of Meteorology (BOM)[6], NWMR falls within a temperate climate zone with no dry season and a warm summer. The region is susceptible to extended periods of hot and dry weather.

- February is typically the hottest month of the year with July the coldest.
- In Melbourne, 11 days per year, on average, currently reach temperatures greater than 35°C. This is predicted to increase to 16 days per year, on average, by 2050.[7] [8]

Like the rest of Victoria, peri-urban areas of NWMR are prone to bushfires, particularly whenever grassland vegetation and forest litter become very dry.

- The Fire Danger Period (FDP) in Victoria has become longer over time, indicating a trend towards extended fire seasons. Seasonal fire restriction dates are set by municipality and depend on amounts of rain, grassland curing and other local conditions. In 2019-2020, fire restriction dates for Victoria extended from as early as 23 September 2019 to 23 March 2020.[9]
- Melbourne's 'fire days' are projected to increase by 42% per year by 2050.[10]

Smoke from fires, including from planned burns, can also be a hazard within NWMR. Those most at risk from smoke exposure include young children, adults over 65 years of age, people with asthma or existing heart or lung conditions, pregnant women, outdoor workers and smokers.[11]

4 EMV (2015): Regional Emergency Risk and Resilience Profile – Northern and Western Metropolitan Region
5 City of Melbourne (2014): https://www.melbourne.vic.gov.au/SiteCollectionDocuments/UFPP_North_and_West_Melb_Precinct.pdf
6 BOM (2020): http://www.weather-climate.com/victoria.html
7 City of Melbourne (2020): https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx
8 DELWP (2019): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0029/442964/Victorias-Climate-Science-Report-2019.pdf.
9 FFMV (2020): https://www.ffm.vic.gov.au/permits-and-regulations/fire-restriction-dates
10 CSIRO (2019): https://www.climatechangeinaustralia.gov.au/media/ccia/2.1.6/cms_page_media/508/Vic%20Climate%20Projections%202019%20Regional%20Report%20-%20Greater%20Melbourne.pdf
11 DHHS (2020): https://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/bushfires-and-public-health/smoke-from-fires-and-public-health

- In January 2020, smoke from bushfires across Victoria (and from New South Wales) rendered Melbourne's air quality the worst in the world[12] with the smoke haze estimated to cost the cities of Melbourne, Sydney and Canberra over $500 million.[13]

Average maximum (max) and minimum (low) temperatures from a 30-year climate period from (1961-1990) are outlined below**:**

Table 1. Seasonal average temperatures for NWMR[14]

		Temperature (°C)			
		Summer		Winter	
	LGA	Max	Low	Max	Low
	Banyule	25.6	13.6	13.9	6.5
	Brimbank	25.4	13.6	14.0	5.6
	Darebin	25.4	13.7	13.9	6.5
	Hobsons Bay	25.3	14.0	14.4	6.0
	Hume	25.1	12.7	12.8	5.0
	Maribyrnong	25.4	13.9	14.3	6.2
	Melbourne	25.4	14.1	14.4	6.7
	Melton	25.2	12.9	13.3	4.8
	Moonee Valley	25.5	13.8	14.2	6.3
	Moreland	25.5	13.8	14.1	6.4
	Nillumbik	25.3	12.8	12.7	5.5
	Whittlesea	25.0	12.7	12.4	5.2
	Wyndham	25.1	13.5	14.2	5.4
	Yarra	25.4	13.9	14.2	6.8
Average	**Metro**	25.4	13.8	14.2	6.3
	Interface	25.1	12.9	13.1	5.2
	NWMR	**25.3**	**13.5**	**13.8**	**5.9**

6.1.2 Rainfall

The main rain source for inland Victoria is from eastward moving frontal systems crossing the Southern Ocean. Localised flash flooding may occur in any part of the region, while the north-west of the State can experience bad dust storms during dry years.[15]

12 The Guardian (2020): https://www.theguardian.com/australia-news/2020/jan/14/melbourne-choked-by-hazardous-smoke-as-bushfires-continue-to-burn-across-victoria
13 City of Melbourne (2020): https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx
14 BOM (2020): http://www.bom.gov.au/climate/averages/maps.shtml
15 BOM (2020): http://www.weather-climate.com/victoria.html

- Melbourne is expected to experience a drop in rainfall during spring of approximately 20% by 2050.[16] This will likely have flow-on effects for summer bushfire seasons.
- On average, the Melbourne region experiences 15 days of thunderstorms per year, most likely in the late spring and early summer months.
- In 2018, Melbourne experienced a 1 in 1,000 year rainfall event: 50mm of rain fell within 15 minutes, resulting in flash flooding, the suspension of train lines and power outages across the city.
- In 2019, Melbourne recorded 374mm of rainfall compared to its average of 630mm.[17]
- Victoria's winter rainfall has decreased by an average of approximately 100mm since 1990.[18]

Average rainfall for each season and annual average rainfall from a 30-year climate period from (1961-1990) are outlined below**:**

Table 2. Annual and seasonal average rainfalls for NWMR[19]

		Mean Rainfall (mm)				
	LGA	**Annual**	**Summer**	**Autumn**	**Winter**	**Spring**
	Banyule	694.5	156.6	177.1	169.6	191.3
	Brimbank	570.3	138.0	140.2	129.9	162.2
	Darebin	683.2	155.5	172.9	164.0	190.9
	Hobsons Bay	572.7	136.5	141.5	134.2	160.4
	Hume	611.5	139.5	150.4	147.0	174.6
	Maribyrnong	593.2	141.5	147.1	138.2	166.3
	Melbourne	620.3	145.8	155.2	147.2	172.1
	Melton	542.2	130.4	132.2	122.2	157.4
	Moonee Valley	592.6	142.1	146.6	136.6	167.3
	Moreland	631.0	148.1	157.2	147.9	177.9
	Nillumbik	843.5	172.5	210.9	226.1	234.0
	Whittlesea	759.3	156.9	188.2	204.8	209.4
	Wyndham	529.1	126.2	128.3	123.6	151.0
	Yarra	647.7	150.3	163.5	155.6	178.3
Average	**Metro**	622.8	146.0	155.7	147.0	174.1
	Interface	657.1	145.1	162.0	164.7	185.3
	NWMR	**635.1**	**145.7**	**158.0**	**153.4**	**178.1**

16 City of Melbourne (2020): https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx
17 City of Melbourne (2020): https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx
18 Environment Victoria (2019): https://environmentvictoria.org.au/our-campaigns/safe-climate/victoria-heatwaves-climate-change/#:~:text=In%20Victoria%2C%20the%20two%20worst,continued%20to%20tumble%20since%20then.andtext=In%20January%202018%20Bendigo%20experienced,days%2C%20set%20in%202014).
19 BOM (2020): http://www.bom.gov.au/climate/averages/maps.shtml

Figure 4 shows the significant variability in the annual rainfall timeseries for Victoria.

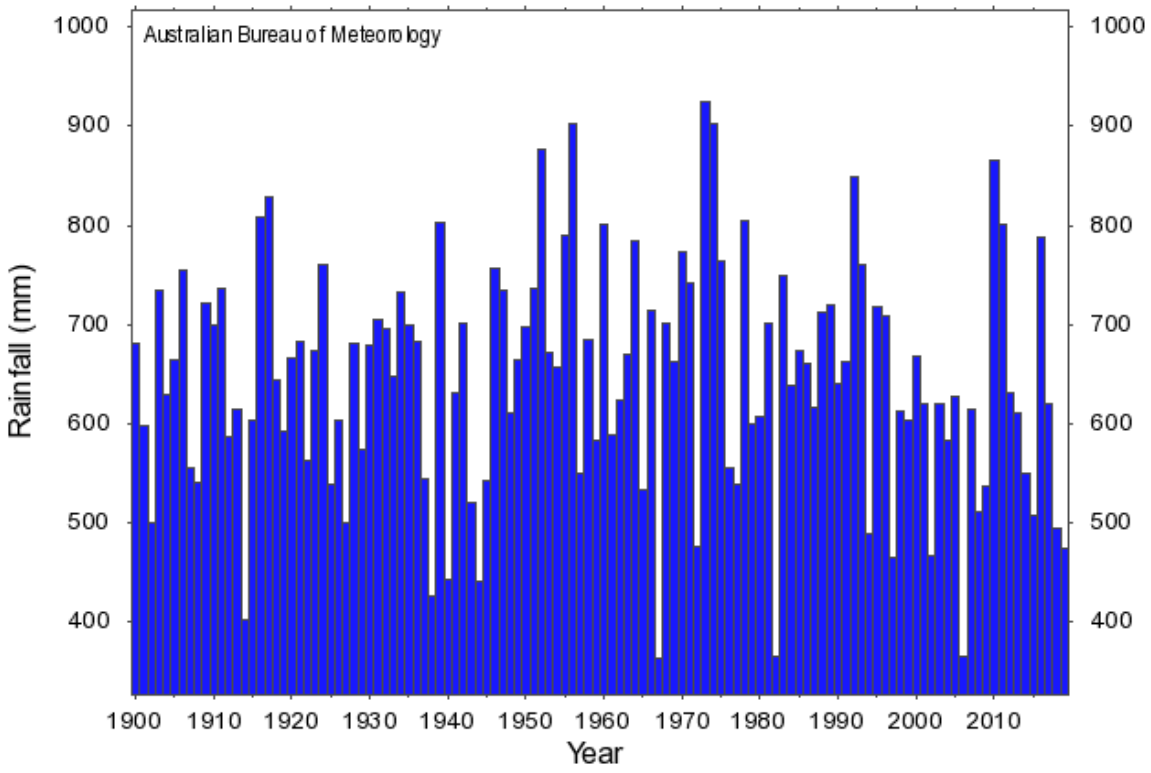


Figure 4. Annual rainfall Victoria (1900 to 2019) [20]

Intensity–Frequency–Duration (IFD) design rainfall intensities (mm/h) or design rainfall depths (mm) corresponding to selected standard probabilities, are based on the statistical analysis of historical rainfall. Design rainfall are used in the design of infrastructure including gutters, roofs, culverts, stormwater drains, flood mitigation levees, retarding basins and dams. They can also be used to assess the severity of observed rainfall events.

The following tables summarise the design rainfalls that could be of interest for critical infrastructure planning. They give an indication of heavy rainfall probability across the region and can be used as potential triggers for response based on observed or forecast rainfall. [21]

20 http://www.bom.gov.au/climate/change/index.shtml#tabs=Trackerandtracker=timeseriesandtQ=graph%3Drain%26area%3Dvic%26season%3D0112%26ave_yr%3D0

21 Further values can be obtained from: http://www.bom.gov.au/water/designRainfalls/revised-ifd/

Table 3. Design Rainfalls by LGA – 5 min[22]

	Design Rainfalls (mm)[23]							
	5 min 10% AEP				5 min 1% AEP			
LGA	Mean	Minimum	Maximum	Range	Mean	Minimum	Maximum	Range
Banyule	9.2	9.2	9.3	0.1	16.3	15.9	16.5	0.7
Brimbank	9.1	8.8	9.2	0.4	15.4	14.8	15.7	0.8
Darebin	9.2	9.2	9.3	0.0	16.4	16.0	16.7	0.7
Hobsons Bay	9.2	9.1	9.2	0.2	15.3	15.3	15.4	0.1
Hume	8.8	8.4	9.2	0.7	14.9	13.8	16.1	2.3
Maribyrnong	9.2	9.2	9.2	0.0	15.5	15.4	15.6	0.2
Melbourne	9.3	9.2	9.3	0.0	15.6	15.4	15.7	0.3
Melton	8.2	7.6	8.9	1.3	13.6	12.4	15.2	2.8
Moonee Valley	9.2	9.1	9.2	0.1	15.6	15.5	15.8	0.3
Moreland	9.2	9.2	9.2	0.1	15.9	15.8	16.1	0.4
Nillumbik	9.1	8.8	9.4	0.6	14.9	13.7	16.3	2.6
Whittlesea	9.2	8.9	9.6	0.7	15.9	15.6	16.6	0.9
Wyndham	8.3	7.4	9.1	1.7	13.9	12.3	15.4	3.1
Yarra	9.3	9.2	9.3	0.0	15.8	15.6	15.9	0.3

22 DJPR (2019): https://www.rdv.vic.gov.au/information-portal/table-and-chart
23 The standard probabilities shown here for reference are 10% annual exceedance probability (AEP) equivalent to 1 in 10 year average recurrence interval (ARI) and 1% AEP, equivalent to 1 in 100 year ARI

Table 4. Design Rainfalls by LGA – 1 hr[24]

	Design Rainfalls (mm)[25]							
	1 hr 10% AEP				1 hr 1% AEP			
LGA	Mean	Minimum	Maximum	Range	Mean	Minimum	Maximum	Range
Banyule	28.4	28.2	28.5	0.4	50.1	48.5	51.0	2.4
Brimbank	27.9	27.0	28.4	1.3	48.0	46.0	48.9	2.9
Darebin	28.5	28.4	28.6	0.1	50.7	49.6	51.5	1.9
Hobsons Bay	28.4	28.0	28.7	0.7	48.0	47.7	48.2	0.5
Hume	27.0	25.8	28.2	2.5	46.1	42.3	50.0	7.7
Maribyrnong	28.5	28.4	28.6	0.1	48.6	48.3	48.8	0.5
Melbourne	28.7	28.6	28.7	0.1	48.6	48.2	49.0	0.8
Melton	25.1	23.1	27.3	4.2	41.9	38.0	47.4	9.3
Moonee Valley	28.4	28.2	28.6	0.4	48.8	48.3	49.2	0.9
Moreland	28.4	28.3	28.6	0.3	49.6	49.0	50.2	1.1
Nillumbik	27.7	27.0	28.9	1.9	45.1	41.2	49.8	8.7
Whittlesea	28.1	27.5	29.6	2.1	48.7	47.2	51.0	3.9
Wyndham	25.4	22.6	28.3	5.7	42.7	37.4	48.0	10.6
Yarra	28.7	28.6	28.7	0.1	49.0	48.6	49.3	0.7

24 DJPR (2019): https://www.rdv.vic.gov.au/information-portal/table-and-chart
25 The standard probabilities shown here for reference are 10% annual exceedance probability (AEP) equivalent to 1 in 10 year average recurrence interval (ARI) and 1% AEP, equivalent to 1 in 100 year ARI

Table 5. Design Rainfalls by LGA – 1 day[26]

	Design Rainfalls (mm)[27]							
	1 day 10% AEP				1 day 1% AEP			
LGA	Mean	Minimum	Maximum	Range	Mean	Minimum	Maximum	Range
Banyule	82.2	80.9	83.6	2.7	132.7	130.2	135.9	5.7
Brimbank	83.3	80.3	86.4	6.2	138.7	133.2	143.9	10.7
Darebin	84.7	83.4	85.9	2.5	137.3	133.6	140.5	7.0
Hobsons Bay	79.4	76.5	81.4	4.9	129.8	126.5	132.3	5.8
Hume	89.2	84.8	97.5	12.7	148.7	141.7	159.7	18.0
Maribyrnong	82.6	81.9	83.3	1.4	134.7	133.0	136.7	3.7
Melbourne	82.2	81.2	83.9	2.7	131.2	129.9	134.2	4.3
Melton	81.7	74.2	96.0	21.8	134.5	120.9	157.6	36.7
Moonee Valley	84.7	82.3	87.7	5.4	138.7	132.1	145.7	13.6
Moreland	85.8	84.6	87.0	2.4	140.2	136.3	143.7	7.4
Nillumbik	87.3	80.3	104.9	24.6	141.4	129.1	167.2	38.1
Whittlesea	89.1	82.6	114.8	32.2	145.5	134.7	181.2	46.5
Wyndham	74.2	70.1	79.5	9.4	121.8	113.7	132.2	18.5
Yarra	81.7	81.0	82.7	1.7	129.1	127.9	131.4	3.5

For NWMR, the data shows there is little variation in the shorter duration events which are generally driven by convective activity. Statistical analysis shows that that patterns of heavy rainfall from these storm events are similar across the region. This is shown by similar mean design rainfall values across all LGAs and low ranges between maximums and minimums for the selected probabilities.

The largest difference is observed in the longer duration events, where orographic enhancement from larger synoptic systems generally leads to higher rainfall about elevated areas based on the prevailing wind direction, in this case, the larger interface LGAs that lead out of the Melbourne basin.

It is expected that the impact of climate change will be fewer days with rain, but higher intensity rain events when those do happen. This is because a warmer atmosphere can hold more moisture. Australia's heavy rainfall patterns have a high natural variability and some sites are witnessing a larger increase in heavy rainfall for shorter duration events that may increase the risk of flash flooding.[28]

This calculation is based on the standard 30-year reference climate period (1961–1990). This threshold was chosen as 5mm is the threshold to exceed canopy and interception losses in the Keetch-Byram Drought

26 DJPR (2019): https://www.rdv.vic.gov.au/information-portal/table-and-chart
27 The standard probabilities shown here for reference are 10% annual exceedance probability (AEP) equivalent to 1 in 10 year average recurrence interval (ARI) and 1% AEP, equivalent to 1 in 100 year ARI
28 BOM (2020): http://www.bom.gov.au/state-of-the-climate/australias-changing-climate.shtml

Index, which is used to estimate soil moisture as a surrogate for heavy fuel availability in fires. It is expected that the impact of climate change will be less days with rain, but higher intensity rain events when these do happen.

Table 6. Rain Days >5 mm by LGA[29] [30]

		Rain Days >5 mm (days)			
	LGA	**Mean**	**Minimum**	**Maximum**	**Range**
	Banyule	43.9	41	46	5
	Brimbank	33.0	33	33	0
	Darebin	41.9	41	44	3
	Hobsons Bay	34.9	33	38	5
	Hume	38.5	35	42	7
	Maribyrnong	36.8	33	37	4
	Melbourne	38.7	37	43	6
	Melton	31.5	28	37	9
	Moonee Valley	37.5	33	38	5
	Moreland	39.8	37	42	5
	Nillumbik	52.0	48	55	7
	Whittlesea	47.2	43	57	14
	Wyndham	29.3	27	34	7
	Yarra	41.0	41	41	0
Average	**Metro**	38.6	36.6	40.2	3.7
	Interface	39.7	36.2	45.0	8.8
	NWMR	**39.0**	**36.4**	**41.9**	**5.5**

6.1.3 Climate Change

Climate change is a global challenge: it is estimated that by 2030 the world will be 1.5°C warmer than pre-industrial times, with some suggesting this could rise to 4.0°C or more by 2100[31]. The United Nations has warned that any temperature rise above 1.5°C will lead to irreversible damage to our ecosystems.[32] Increased droughts in southern Australia with wildfires, storms and biodiversity loss are likely to become more common and more severe.[33]

Figure 5 shows the anomaly for the average Victorian summer maximum temperature and the average Victorian winter minimum temperature compared to the standard climate baseline period 1961 – 1990. From

29 This calculation is based on the standard 30-year reference climate period (1961 – 1990). The threshold chosen as 5mm is the threshold to exceed canopy and interception losses in the Keetch-Byram Drought Index, which is used to estimate soil moisture as a surrogate for heavy fuel availability in fires.
30 BOM (2016): http://www.bom.gov.au/jsp/ncc/climate_averages/raindays/index.jsp?period=anandproduct=5mm#maps
31 CSIRO (2019): https://www.csiro.au/en/Showcase/ANO
32 United Nations (2020): https://www.un.org/en/sections/issues-depth/climate-change/
33 Commissioner for Environmental Sustainability Victoria (2012): https://www.ces.vic.gov.au/sites/default/files/publication-documents/1-62.pdf

here the warming trend can be seen above the natural climate variability with warmer than average summer temperatures and fewer below average winter overnight temperatures. These general trends are indicative of the broad scale warming across Victoria.

Summer Maximum Temperature Anomaly **Winter Minimum Temperature Anomaly**

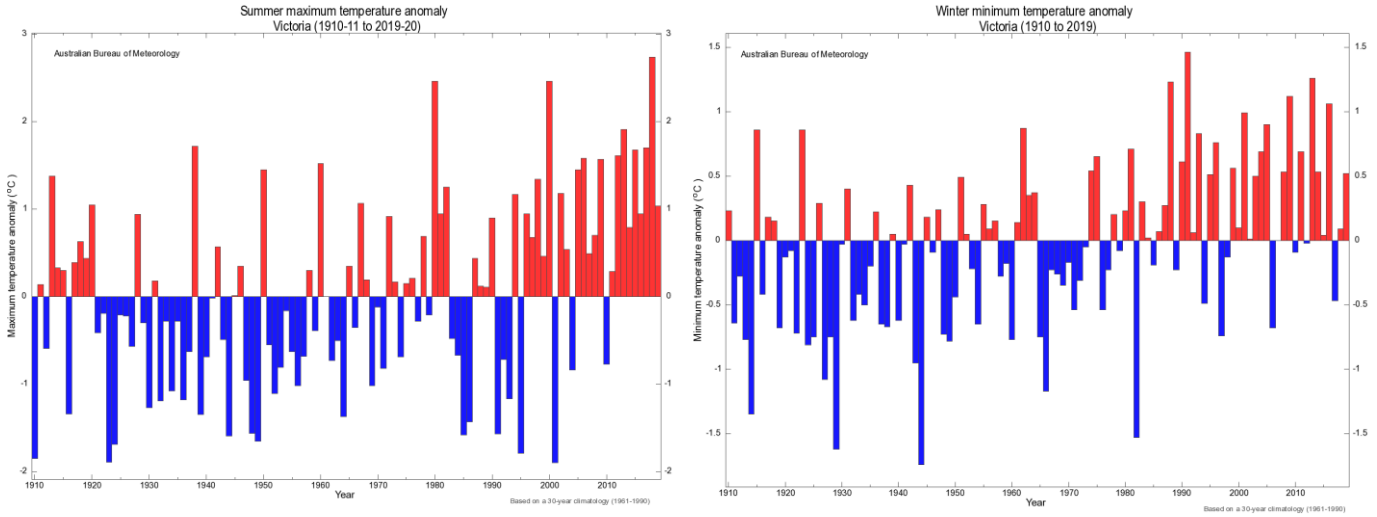


Figure 5. Summer (Max) and Winter (Min) Temperature Anomalies (1900 to 2019) [34]

In Victoria, the climate has already warmed by 1.0°C.[35] This means hotter summers and longer and more frequent heatwaves.

- Victoria's worst heatwaves have occurred in the last decade – January/February 2009 and January 2014.

Extreme heat is a very serious health risk to the Victorian population: heatwaves are responsible for more deaths per year than any other type of natural disaster and our emergency and health services can become strained by cases of heat stroke, exhaustion, dehydration, cardiac conditions and respiratory illnesses.[36]

- In the summer of 2009, Ambulance Victoria emergency callouts in Melbourne increased by 46% and emergency department presentations increased by 12% during a week of extremely hot weather where maximum temperature were 12-15 degrees above average. A total of 374 excess deaths were recorded – an increase of 62% on the previous year.[37]

34 http://www.bom.gov.au/climate/change/index.shtml#tabs=Trackerandtracker=timeseriesandtQ=graph%3Drain%26area%3Dvic%26season%3D0112%26ave_yr%3D0
35 DELWP (2019): https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0029/442964/Victorias-Climate-Science-Report-2019.pdf
36 Environment Victoria (2019): https://environmentvictoria.org.au/our-campaigns/safe-climate/victoria-heatwaves-climate-change/#:~:text=In%20Victoria%2C%20the%20two%20worst,continued%20to%20tumble%20since%20then.andtext=In%20January%202018%20Bendigo%20experienced,days%2C%20set%20in%202014).
37 Climate Council (2016): https://www.climatecouncil.org.au/uploads/b6cd8665c633434e8d02910eee3ca87c.pdf

Climate change is also having an impact on critical infrastructure, including energy, water and transport. Power outages are more likely during a heatwave, for example, as energy consumption due to air-conditioner use increases. Smaller health service providers, such as nursing homes and medical centres, may not be equipped with backup energy and water supplies. Disruptions to public transport can impede the ability for people to travel to hospitals or cooler places.[38]

6.2 Land Use

When considered as a whole, land in NWMR is predominantly used for residential (40.7%), primary production (17.1%) and parkland (15.5%) purposes. However, land use across NWMR varies considerably by LGA, and significant differences are evident according to whether an area is classified as a metropolitan or an interface LGA.

In 2016 (refer Figure 6), for example:

- Commercial land use was concentrated in the City of Melbourne (37.3%) and the City of Yarra (13.7%).
- Only 2.4% of land in NWMR was dedicated to educational purposes – most of this was located within the City of Darebin (7.9%).
    - The City of Darebin is home to La Trobe University and Melbourne Polytechnic, in addition to more than 60 schools and pre-schools.
- The City of Melbourne had the most land dedicated to hospitals and/or medical purposes (1.5%), while in Interface LGAs this was negligible (0.0%).
    - The City of Melbourne is home to 26 hospitals, including The Alfred, Epworth, Peter Maccallum Cancer Institute, Royal Children's Hospital, Royal Dental Hospital, Royal Melbourne Hospital, Royal Victorian Eye and Ear Hospital, Royal Women's Hospital and St Vincent's Private Hospital.
- Industrial land use was concentrated in Hobsons Bay (31.1%), Brimbank (22.1%) and Maribyrnong (17.9%).
    - The strongest industry sectors within NWMR include transport, postal, warehousing, construction and retail, particularly in the western parts of the region.[39]

38 Climate Council (2016): https://www.climatecouncil.org.au/uploads/b6cd8665c633434e8d02910eee3ca87c.pdf
39 Infrastructure Victoria (2019): https://www.infrastructurevictoria.com.au/wp-content/uploads/2019/04/SGS-Economic-social-and-environmental-profile-Western-Metro-Region-April-2019.pdf

- In 2017, Plan Melbourne identified five significant industrial precincts across Victoria, intended, "to provide strategically located land for major industrial development linked to the Principal Freight Network and transport gateways."[40] Two of these – Northern and Western – fall predominantly within NWMR.
- The Western State Significant Industrial Precinct (SSIP) is the largest (with 10.4 million square metres) and most active in Victoria, supporting traditional industrial uses such as manufacturing, transport and wholesaling. However, the vacant land supply could be exhausted by the early to mid-2030s without further zone allocation of proposed industrial land.
- The Northern SSIP is the second largest in Victoria. It boasts a greater share of transport and warehousing and fewer manufacturing workplaces. The vacant land supply is predicted to become exhausted sometime in the 2040s or 2050s. Refer Figure 4.

- More than half (50.5%) of Nillumbik's land use was categorised as 'other'.
  - Part of this allocation is likely due to the Nillumbik Green Wedge,[41] of which 80% is privately owned and 43% is identified as having environmental value.[42]
- Parkland features in all LGAs but is more apparent in Hobsons Bay (23.7%), Melbourne (22.9%) and Yarra (21.9%).
- Victoria's forestry and wood products industry is one of Australia's largest. In Victoria, it accounts for 9 million cubic metres or 27.5% of Australia's log harvest volume.[43] It accounts for approximately $7.3 billion or 31% of Australia's forest product manufacturing sales and service income.[44] [45] NWMR is home to over 1,569 businesses in the agriculture, forestry and fishing industries, creating an approximate total of 3,813 jobs for the region.[46]
- Almost half of the land in interface LGAs was used for primary production (48.0%). For three LGAs, primary production utilised more than half of their land - Melton (69.3%), Hume (53.7%) and Wyndham (52.3%). No land was dedicated to primary production in metropolitan LGAs (0.0%).

40 DELWP (2017): https://www.planning.vic.gov.au/__data/assets/pdf_file/0023/115187/Final_2017_Industrial_UDP_Report.pdf
41 Green wedge land is defined as, "non-urban areas of metropolitan Melbourne that lie outside the urban growth boundary." State Government of Victoria (2020): https://www.planning.vic.gov.au/policy-and-strategy/green-wedges#:~:text=What%20are%20green%20wedges%3F,green%20wedge%20area%20is%20unique.
42 Nilllumbik Shire (2020): https://participate.nillumbik.vic.gov.au/gwmp/background
43 DJPR (2020) https://djpr.vic.gov.au/forestry
44 DJPR (2020) https://djpr.vic.gov.au/__data/assets/pdf_file/0008/1924811/DJPR-Inclusion-Forestry-Plan-1.pdf
45 DJPR (2020) https://djpr.vic.gov.au/forestry
46 DJPR (2020): https://www.rdv.vic.gov.au/information-portal/table-and-chart

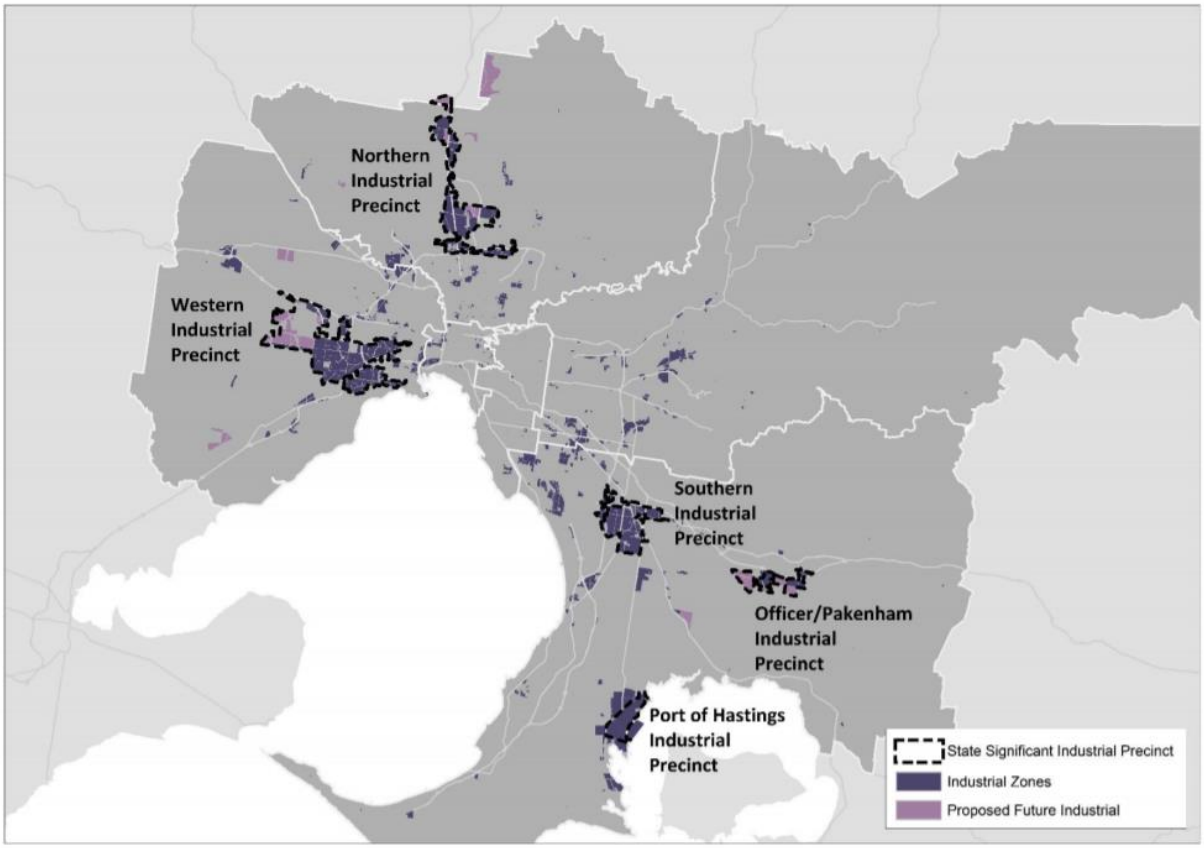
  - Land used for primary production included farming of dairy, beef, lamb and crops, and was interspersed with the small-scale growing of fruit, vegetables and flowers.

- More than half of NWMR's metropolitan LGA land was devoted to residential use (54.6%), far more than interface LGAs (15.7%).
- The City of Moonee Valley dedicated more land to transport use (9.3%) than any other LGA within NWMR (where the average for the region was 1.7%).
- Water was not a major feature of land use across NWMR. However, both metropolitan and interface LGAs dedicated the same amount of land on average (0.6%).

Table 7. NWMR Land use by LGA (2017) [47]

			Land Use Type (%)										
	LGA	Area (km²)	Commercial	Education	Hospital/Medical	Industrial	Other	Parkland	Primary Production	Residential	Transport	Water	Total %
	Banyule	63	1.6%	2.7%	0.6%	2.2%	0.0%	16.3%	0.0%	**76.3%**	0.2%	0.0%	**100.0%**
	Brimbank	123	2.7%	2.4%	0.2%	**22.1%**	5.3%	18.8%	0.0%	**46.8%**	1.7%	0.0%	**100.0%**
	Darebin	54	2.9%	**7.9%**	0.1%	7.0%	0.0%	13.1%	0.0%	**68.0%**	0.9%	0.2%	**100.0%**
	Hobsons Bay	64	1.4%	2.0%	0.0%	**31.1%**	0.0%	**23.7%**	0.0%	**38.0%**	2.0%	1.8%	**100.0%**
	Hume	504	6.8%	0.7%	0.0%	4.8%	10.2%	5.4%	**53.7%**	18.0%	0.2%	0.3%	**100.0%**
	Maribyrnong	31	7.9%	2.4%	0.3%	**17.9%**	4.4%	12.6%	0.0%	**51.5%**	3.0%	0.0%	**100.0%**
	Melbourne	37	**37.3%**	3.1%	**1.5%**	12.3%	0.0%	**22.9%**	0.0%	18.1%	1.6%	**3.2%**	**100.0%**
	Melton	528	0.4%	0.4%	0.0%	2.7%	8.8%	4.1%	**69.3%**	13.9%	0.2%	0.3%	**100.0%**
	Moonee Valley	43	3.7%	3.2%	0.3%	1.6%	0.0%	13.4%	0.0%	**68.6%**	**9.3%**	0.0%	**100.0%**
	Moreland	51	3.4%	2.6%	0.2%	5.5%	0.0%	15.4%	0.0%	**72.2%**	0.7%	0.2%	**100.0%**
	Nillumbik	432	0.1%	0.2%	0.0%	0.1%	**50.5%**	12.9%	24.9%	10.3%	0.1%	1.0%	**100.0%**
	Whittlesea	490	0.9%	0.6%	0.1%	3.6%	16.8%	19.8%	**39.9%**	17.0%	0.3%	1.0%	**100.0%**
	Wyndham	542	0.9%	1.1%	0.0%	4.5%	5.6%	16.1%	**52.3%**	19.5%	0.0%	0.2%	**100.0%**
	Yarra	20	**13.7%**	3.9%	0.8%	4.5%	0.0%	**21.9%**	0.0%	**51.8%**	3.4%	0.0%	**100.0%**
Avg.	**Metro**	486	8.3%	3.3%	0.4%	11.6%	1.1%	17.6%	**0.0%**	**54.6%**	2.5%	0.6%	**100.0%**
	Interface	2,496	1.8%	0.6%	**0.0%**	3.1%	18.4%	11.7%	**48.0%**	15.7%	0.1%	0.6%	**100.0%**
	NWMR	**2,982**	**6.0%**	**2.4%**	**0.3%**	**8.6%**	**7.3%**	**15.5%**	**17.1%**	**40.7%**	**1.7%**	**0.6%**	**100.0%**

47 DJPR (2019): https://www.rdv.vic.gov.au/information-portal/table-and-chart



Sources: Department of Environment, Land, Water and Planning, Plan Melbourne – 2017 to 2050.

Figure 6. Victoria's Significant Industrial Precincts[48]

6.2.1 Bushfire Risk

Bushfire prone areas are designated areas which are subject to or likely to be subject to bushfires, and to which specific bushfire construction standards apply.[49] Six LGA's within the North West Metropolitan region are not located within bushfire prone areas, however they do sometimes attract large grassfires with the potential to heavily impact built urban developments[50]. Of those LGA's that are within a bushfire prone area, it is the metropolitan interface areas that see the highest percentage of area covered. The metropolitan interface areas are at a particularly high risk for bushfire given large populations and total percentage within a bushfire prone area[51].

Table 2 highlights the large areas of bushland and urban interface zone in the interface LGAs Hume, Melton, Nillumbik, Whittlesea and Wyndham. The predominantly urban LGAs have little to no bushfire risk showing up in this assessment.

48 DELWP (2017): https://www.planning.vic.gov.au/__data/assets/pdf_file/0023/115187/Final_2017_Industrial_UDP_Report.pdf
49 DELWP (2020): https://www.planning.vic.gov.au/policy-and-strategy/bushfire-protection/building-in-bushfire-prone-areas
50 Deakin University https://this.deakin.edu.au/society/is-melbournes-urban-sprawl-creating-more-bushfire-risk
51 DELWP (2018) https://www.planning.vic.gov.au/__data/assets/pdf_file/0035/97685/Demographics-for-Bushfire-Risk-Analysis-web.pdf

Table 8. Bushfire Risk by LGA[52]

	Bushfire Risk			
LGA	BPA Area (km²)	Total Area (km²)	%	Plan Number
Banyule	8.8	63	*14.0%*	LEGL./18-399
Brimbank	21.0	123	*17.1%*	LEGL./20-101
Darebin	-	-	-	-
Hobsons Bay	5.9	64	*9.2%*	LEGL./17-388
Hume	378.4	504	*75.1%*	LEGL./20-107
Maribyrnong	-	-	-	-
Melbourne	-	-	-	-
Melton	445.9	528	*84.5%*	LEGL./20-110
Moonee Valley	-	-	-	-
Moreland	-	-	-	-
Nillumbik	421.1	432	*97.5%*	LEGL./14-557
Whittlesea	391.1	490	*79.8%*	LEGL./20-113
Wyndham	343.4	542	*63.3%*	LEGL./20-114
Yarra	-	-	-	-

6.3 Waterways

Natural waterways local to NWMR include:

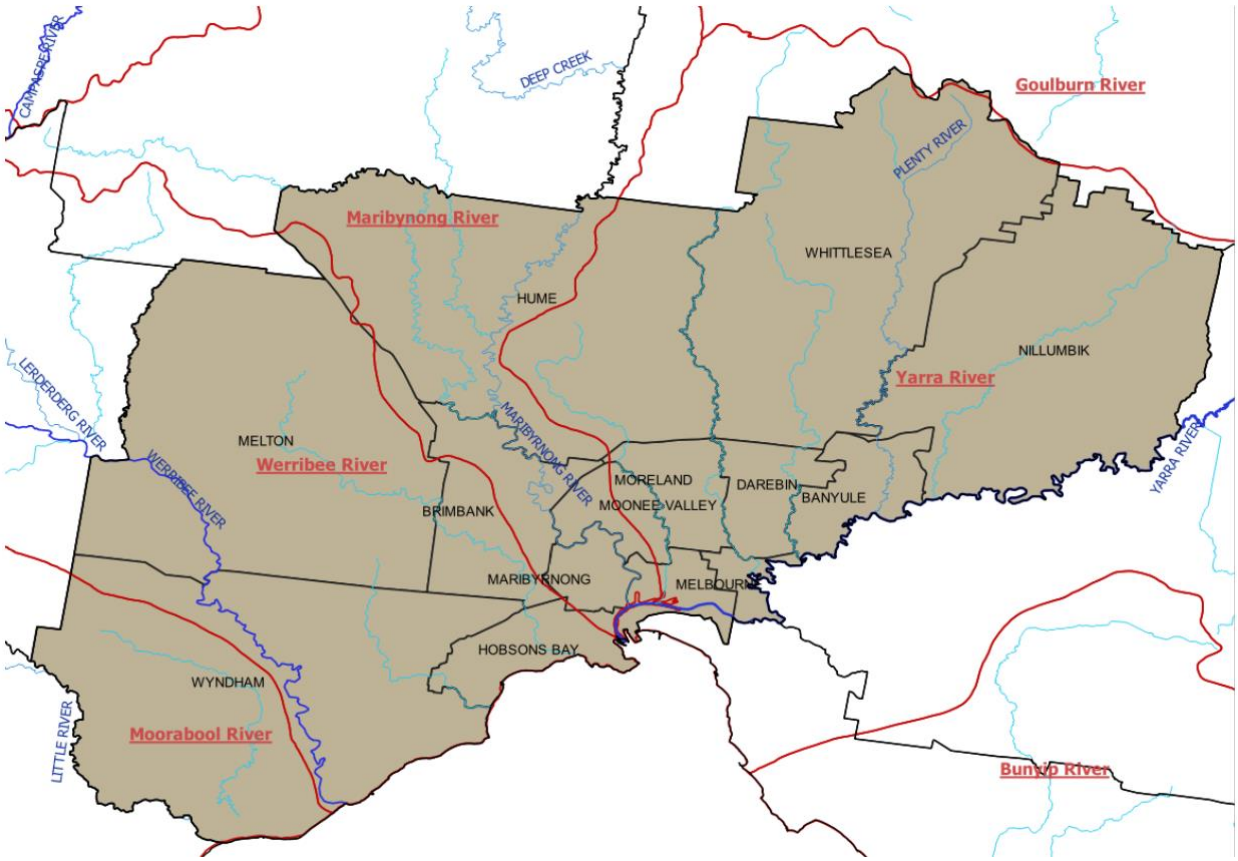
- The Mid- and Lower-Yarra catchments which feed into Sugarloaf Reservoir and include the Yarra River and Plenty River.
- The Maribyrnong catchment, including the Maribyrnong River.
- The Werribee catchment, including the Werribee, Little and Lerderderg Rivers.
- The Port Phillip catchment, including the Plenty River.

There are also numerous wetlands throughout the region, including Banyule Swamp (Viewbank), Truganina Swamp and Cheetham Wetlands (Altona North), as well as lakes, which are important tourism assets. They include:

- Cherry Lake (Altona)
- Taylors Lake (Keilor)[53]

53 Melbourne Water (2020): https://www.melbournewater.com.au/water/health-and-monitoring/river-health-and-monitoring/werribee-catchment

A map of NWMR catchments is provided in Figure 7.



Red lines – catchment boundaries Dark Blue lines – main rivers Light blue lines – main tributaries

Figure 7. Natural waterways overlayed with NWMR boundaries[54] [55]

Key waterways in NWMR are managed by Melbourne Water while EPA also have a monitoring role.

Victoria also has 10 catchment and land protection regions, each responsible for planning and managing the land, water and biodiversity within their region. NWMR's 14 LGAs fall within the remit of the Port Phillip and Westernport Catchment Management Agency. [56]

Declared water supply catchments and reservoirs located within NWMR include:

- The Maribyrnong catchment, including the Maribyrnong River.
- The Werribee catchment, including the Werribee, Little and Lerderderg Rivers.

54 Data Vic (2020): https://discover.data.vic.gov.au/dataset/vicmap-lite

55 https://discover.data.vic.gov.au/dataset/awrc-major-river-basins-of-victoria

56 DELWP (2020): https://www.water.vic.gov.au/waterways-and-catchments/our-catchments/catchment-management-framework

- Sugarloaf Reservoir (dam, catchment and adjacent area) – an off-stream reservoir located in Christmas Hills that can hold approximately 96 billion litres of water and supplies the northern, western and central suburbs of Melbourne.
- Greenvale Reservoir – an off-stream reservoir located in Greenvale that can hold approximately 27,000 megalitres of water and supplies the north-western and western suburbs of Melbourne.
- Upper Yarra Reservoir – a reservoir located near Reefton that can hold approximately 200,000 megalitres of water and supplies water to Silvan Reservoir in the Shire of Yarra Ranges, which distributes water throughout metropolitan Melbourne. Upper Yarra Dam is currently undergoing maintenance works due to be completed in mid-2021. [57]

Although they are not located in NWMR, some of Victoria's other reservoirs supply water to communities within NWMR, such as:

- Rosslyne Reservoir, located in Gisborne (Macedon Ranges Shire), which supplies water to residents in Melton Shire.
- Thomson Reservoir, located in Thomson (West Gippsland Shire), which may be utilised in times of drought to supply residents across Melbourne with water.

6.3.1 Floods

Floods cause more damage – including loss of life and livelihoods and damage to property and infrastructure – than any other type of natural disaster in Australia.[58] Victoria is prone to riverine flooding, which occurs in low-lying areas near rivers and streams, and flash flooding, which can happen anywhere in the event of intense rainfall. Flash flooding can be unpredictable, overwhelming drainage systems and causing localised threats.

- In December 2018, the City of Melbourne was subjected to over 37 mm of rain within 15 minutes, causing flash flooding across inner Melbourne. The SES received 515 calls for help, including 22 calls from stranded motorist trapped in their cars in floodwaters near Altona and South Melbourne. The EPA also warned Melburnians against swimming at bayside beaches following an inundation of litter, animal waste and chemicals flushed by heavy rains into Port Phillip Bay.[59]

57 Melbourne Water (2020): https://www.melbournewater.com.au/community-and-education/about-our-water/water-storage-reservoirs/sugarloaf
58 Flood Victoria (2020): https://www.floodvictoria.vic.gov.au/
59 ABC News (2018): https://web.archive.org/web/20190428031008/https://www.abc.net.au/news/2018-12-14/victorian-forecasters-predicting-more-rain/10617864

- December 2011 – there were thunderstorms on Christmas Day with 92mm of rain within 24hrs. Over a 7-hour period, 5 super cell thunderstorms moved eastward across the Northern suburbs with two embedded tornadoes reported. 6800 RFA's were received with costs in the vicinity of $750 million[60].

Flood management guidelines, including prevention, response and recovery activities, are provided in the *State Emergency Response Plan Flood Sub-Plan*, published in 2016.[61] The Victorian Government also issued a Victorian Floodplain Management Strategy in 2016 designed to assist communities to better prepare for future floods. This strategy relies on the combined efforts of various agencies including local government, SES, Catchment Management Authorities and community partnerships.[62]

The Bureau of Meteorology is responsible for providing a flood warning service for riverine flooding resulting from heavy rainfall in Victoria in cooperation with other government, water and emergency management agencies[63]. For Metro regions around Melbourne, Melbourne Water owns and operates the flood warning system and provides warnings for the Bureau to disseminate[64]. The coverage of this flood warning service is shown in Figure 8 with both the Flood Watch and Flood Warning catchment shown. The products from the Service Level Specification that cover the catchments in North West Metro are listed in Table 9 [65].

60 https://www.ses.vic.gov.au/documents/112015/0/Central+Region+Flood+Response+Plan-pdf.pdf/0ffcd489-e087-51aa-6d52-da24e4be660b

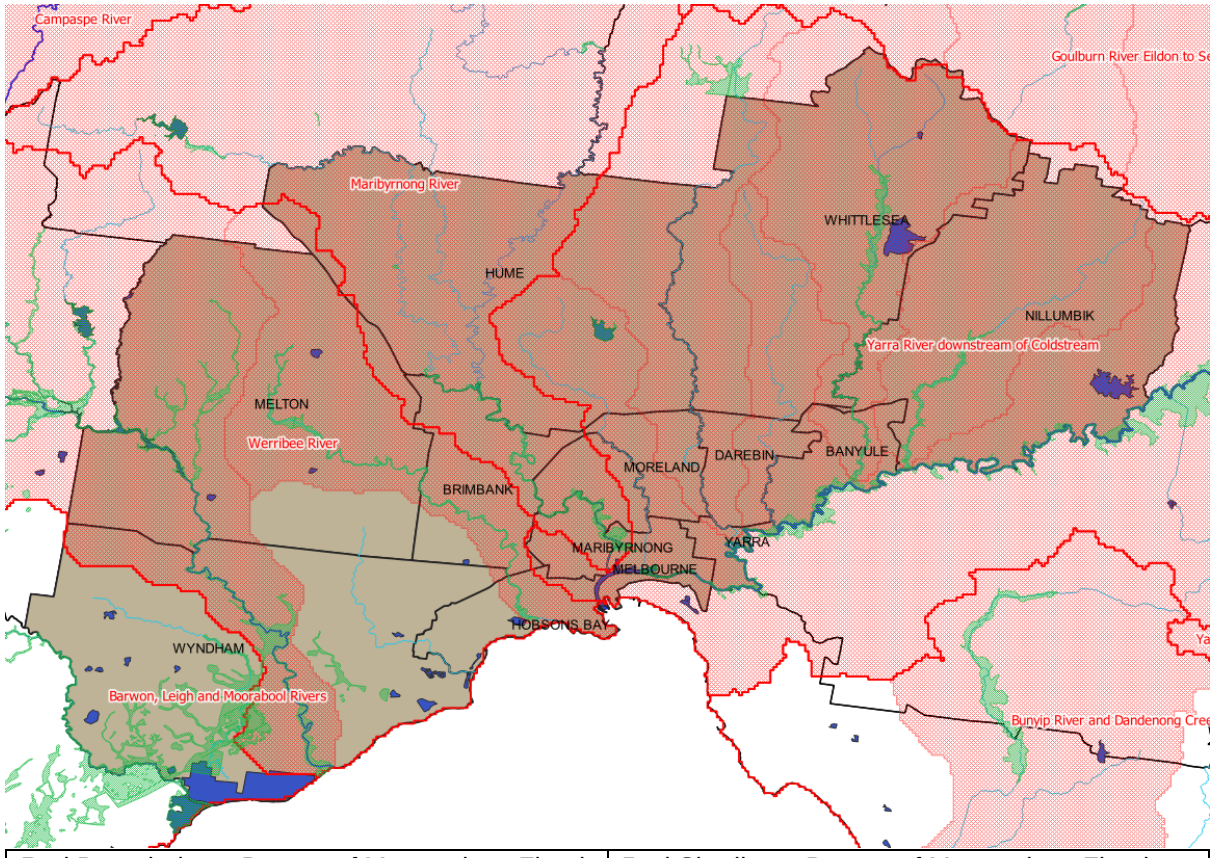
61 EMV (2016): https://www.ses.vic.gov.au/documents/112015/2504320/State+Emergency+Response+Plan+-+Flood+Sub-Plan+-+Edition+1.pdf/e4d997fa-080b-39fd-366b-42b5cb23443f

62 DELWP (2016): https://www.water.vic.gov.au/managing-floodplains/new-victorian-floodplain-management-strategy

63 http://www.bom.gov.au/water/floods/document/National_Arrangements_V4.pdf

64 http://www.bom.gov.au/vic/flood/brochures/VIC_SLS_current.pdf

65 http://www.bom.gov.au/vic/flood/brochures/VIC_SLS_current.pdf



Red Boundaries – Bureau of Meteorology Flood Watch areas	Red Shading – Bureau of Meteorology Flood Warning Catchments
Dark Blue areas – Lakes and dams	Blue lines – rivers and streams
Green areas – 1:100 year ARI modelled inundation area	Triangles – River observations sites

Figure 8. Flood warning and 1:100 year ARI inundation [66] [67] [68] [69] [70] [71]

66 http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900441?template=full
67 http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900561?template=full
68 http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900563?template=full
69 http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900564?template=full
70 https://discover.data.vic.gov.au/dataset/1-in-100-year-flood-extent
71 Data Vic (2020): https://discover.data.vic.gov.au/dataset/vicmap-lite

Table 9. Flood Warning products [72]

Product	Warning Area	Responsible Agency
IDV36300	Flood Warning for the Maribyrnong River and Jacksons Creek	Melbourne Water
IDV36310	Flood Warning for the Yarra River Flood Warning for the Watts River	Melbourne Water
IDV36340	Flood Warning for the Diamond Creek	Melbourne Water
IDV36350	Flood Warning for the Merri Creek	Melbourne Water
IDV36360	Flood Warning for the Kororoit Creek	Melbourne Water
IDV36370	Flood Warning for the Plenty River	Melbourne Water
IDV36390	Flood Warning for the Werribee River	Melbourne Water

The flood risk and area impacted by flooding varies around the region. Table 10 shows the percentage of each LGA which is impacted by flooding at the 1:100-year average recurrence interval (ARI). This is shown in Green in Figure 8. There is a one percent chance (1% annual exceedance probability (AEP)) of these areas experiencing flooding of this level in any given year[73] based on flood modelling results from flood studies. The localities listed have some defined built up area in or near the flood impact area defined by the 1:100-year ARI. This list may not be exhaustive, and some areas may experience impacts from flash flooding due to heavy rainfall that are not shown here.

Table 10. Areas potentially impacted by flooding inundation [74]

LGA	Percent Included In 1:100 Ari Area	Main Localities with Affected Built Up Areas
Banyule	8.20%	Alphington, Briar Hill, Bundoora, Diamond Creek, Eaglemont, Eltham, Eltham North, Greensborough, Heidelberg, Ivanhoe, Ivanhoe East, Kew East, Lower Plenty, Montmorency, Templestowe, Viewbank, Yallambie
Brimbank	2.94%	Albanvale, Albion, Ardeer, Braybrook, Brooklyn, Burnside, Burnside Heights, Cairnlea,Deer Park, Keilor, Kings Park, Laverton North, Sunshine, Sunshine West
Darebin	0.00%	Alphington, Bundoora, Fairfield, Ivanhoe
Hobsons Bay	1.62%	Altona, Altona North, Brooklyn, Laverton North, Point Cook, Williamstown
Hume	0.59%	Sunbury
Maribyrnong	5.91%	Aberfeldie, Altona North, Ascot Vale, Avondale Heights, Braybrook, Brooklyn, Essendon West, Flemington, Footscray, Kensington, Maidstone, Maribyrnong, Moonee Ponds, Sunshine, West Melbourne
Melbourne	6.85%	Abbotsford, Ascot Vale, Cremorne, Docklands, Flemington, Footscray, Kensington, Melbourne, Richmond, South Wharf, South Yarra, Southbank, West Melbourne

72 http://www.bom.gov.au/vic/flood/brochures/VIC_SLS_current.pdf

73 http://arr.ga.gov.au/arr-guideline

74 https://discover.data.vic.gov.au/dataset/1-in-100-year-flood-extent

Melton	2.11%	Albanvale, Brookfield, Burnside, Burnside Heights, Caroline Springs, Cobblebank, Deanside, Deer Park, Harkness, Kings Park, Kurunjang, Melton, Melton South, Melton West
Moonee Valley	3.54%	Aberfeldie, Ascot Vale, Avondale Heights, Braybrook, Essendon West, Flemington, Footscray, Kensington, Maidstone, Maribyrnong, Moonee Ponds
Moreland	0.00%	Ascot Vale, Moonee Ponds
Nillumbik	2.06%	Briar Hill, Bundoora, Cottles Bridge, Diamond Creek, Doreen, Eltham, Eltham North, Greensborough, Hurstbridge, Lower Plenty, Montmorency, North Warrandyte, Templestowe, Warrandyte, Wonga Park
Whittlesea	1.29%	Bundoora, Doreen, Greensborough, Mernda, Whittlesea
Wyndham	8.87%	Altona North, Brooklyn, Hoppers Crossing, Laverton North, Manor Lakes, Point Cook, Sunshine West, Tarneit, Werribee, Wyndham Vale
Yarra	11.23%	Abbotsford, Alphington, Burnley, Cremorne, Fairfield, Hawthorn, Ivanhoe, Kew, Melbourne, Richmond, South Yarra, Toorak

6.4 Geology

There are significant aspects of the Victorian environment that rely on natural workings underground. Victoria's geology contributes to a large cluster of volcanic plains, the frequency of weak to medium magnitude earthquakes and the versatility of groundwater.

There is an extensive area of volcanism in Victoria. Large basaltic formations (formed after the rapid cooling of lava) are present along the western coast of Victoria. The time of the last volcanic eruption in Victoria is contested by volcanologists, however common consensus is that it occurred approximately 7000 years ago at Mount Napier. In volcanology terms, this classifies the Western Victorian Volcanic Plains as an active volcanic region, with many volcanologists considering the area dormant rather than extinct.[75] The plains span approximately 2.3 million hectares or 10% of the state's land mass. The eastern side of Victoria experienced volcanic activity significantly earlier than in the west. [76] Older Volcanic Plains are scattered throughout eastern Victoria and as a whole experienced an estimated 400 eruptions that were sporadic, relatively low volume and widespread.[77]

75 http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/landform_geomorphological_framework_6.1

76 New 40Ar/39Ar ages for selected young (<1 Ma) basalt flows of the Newer Volcanic Province, Southeastern Australia (2011) https://www.sciencedirect.com/science/article/abs/pii/S1871101411000112

77 New 40Ar/39Ar ages for selected young (<1 Ma) basalt flows of the Newer Volcanic Province, Southeastern Australia (2011) https://www.sciencedirect.com/science/article/abs/pii/S1871101411000112

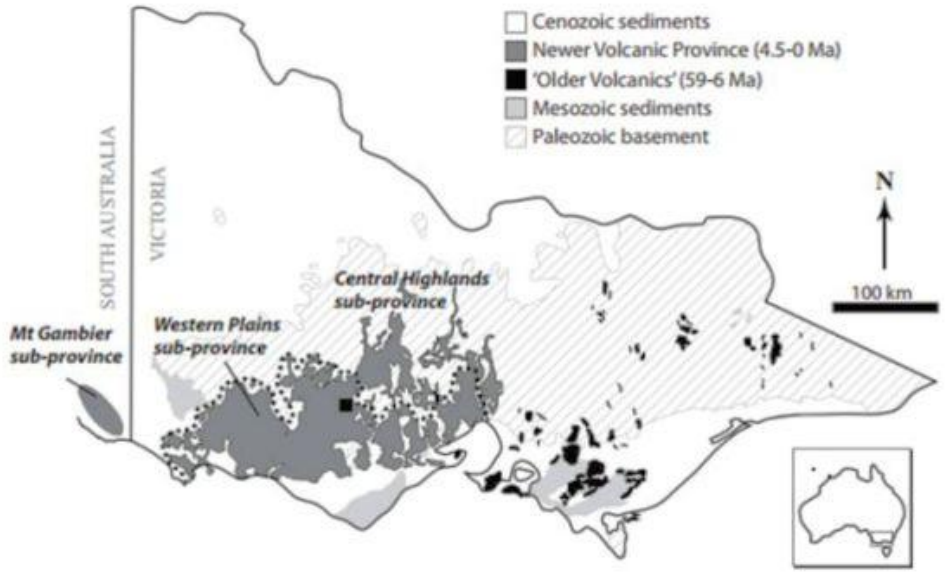


Figure 9 Map of Victoria with Volcanic overlay[78]

For metro Victoria, the key risk arising from a volcanic eruption in the Western Victoria Volcanic Plains includes the eruption of hazardous gases that could travel into the area.

On average, there are approximately 100 earthquakes in Australia per year that register above 3 magnitude.[79] As a nation, Australia experiences significantly less earthquakes than other parts of the world near tectonic boundaries, where large earthquakes occur more often. [80] However, the country experiences earthquakes due to a series of interlocking, interspersed fault lines that spread throughout the nation. In Victoria, several vault lines have been identified including the Strzelecki Ranges, The Mornington Peninsula and the Otway Ranges. However, the frequency of earthquakes in the state indicates that there are multiple minor fault lines that have not been formally identified. [81] Included below is a table that lists earthquakes in Victoria with a magnitude over 4.5 since records began with damage reported:

78 New 40Ar/39Ar ages for selected young (<1 Ma) basalt flows of the Newer Volcanic Province, Southeastern Australia (2011) https://www.sciencedirect.com/science/article/abs/pii/S1871101411000112

79 Geology Australia (2020) https://www.ga.gov.au/scientific-topics/community-safety/earthquake

80 Geology Australia (2020) https://www.ga.gov.au/scientific-topics/community-safety/earthquake

81 Geology Australia (2020) https://www.ga.gov.au/scientific-topics/community-safety/earthquake

Table 11. List of earthquakes above 4.5 magnitude in Victoria since records began [82] [83]

Location	Date	Magnitude	Damage Reported
Cape Liptrap	02 July 1885	5.7	Tied Victoria's largest earthquake – minor damage reported around epicentre
Warrnambool	14 July 1903	5.3	Minor damage over wide geographical area near epicentre
Alpine National Park	10 April 1904	5.0	No damage reported – epicentre in national park
Ocean Grove (offshore)	10 April 1922	5.7	Reports of minor item damage in Cranbourne, East Malvern, Pakenham and Portarlington – aftershock 4.7 magnitude
Mornington	03 September 1932	4.5	Minor damage
Bass Strait (offshore)	15 September 1946	6.2	Minor damage reported in Gippsland region and Tasmanian northern coast
Cape Otway	25 December 1950	5.3	No Damage Reported
Mt Hotham	5 May 1966	5.5	Windows broken in ski village
Boolarra	20 June 1969	5.3	5.0 magnitude aftershock, cracked walls and windows near epicentre
Western Port	7 July 1971	5.0	Damage reported in Cowes
Balliang	2 December 1979	4.7	Felt across south eastern suburbs, minor damage caused in Anakie area
Wonnangatta	21 November 1982	5.4	Felt across state, no damage reported
Mount Baw Baw	25 September	5.0	No damage reported
Boolarra	29 August 2000	5.0	Minor damage
Swan Hill	27 October 2001	4.8	Minor damage, power disruption
Wonthaggi	6 March 2011	4.5	No damage reported
Gippsland	19 June 2012	5.4	Minor damage

Groundwater is water found under the ground that flows through layers known as aquifers. Surface water from rainfall seeps into cracks or pores in the ground (aquifers), however aquifers can also be recharged from streams or indirectly from other aquifers.[84] Groundwater resources eventually flow into rivers, lakes or the ocean. Many surface environments known as 'groundwater dependent ecosystems' rely on groundwater including wetlands and river baseflows. Groundwater is also important as a water resource in semi-arid parts of Victoria where rainfall is infrequent or inadequate to reliably meet water needs.[85] In areas where

82 Seismology Research Centre (2020) https://www.src.com.au/earthquakes/older-quakes/

83 Earthquake Tracker (2020) https://earthquaketrack.com/p/australia/victoria/recent?mag_filter=4

84 Southern Rural Water – Groundwater Atlas (2012) http://www.srw.com.au/wp-content/uploads/2016/03/GGA_SmallSize-1.pdf

85 Geology Australia (2020) https://www.ga.gov.au/scientific-topics/water/groundwater/basics/what-is-groundwater

groundwater may be replenished on a regular basis (through rainfall), extraction can be managed on a renewable basis. However, in many areas in Australia the extraction greatly exceeds the rate at which groundwater is replenished - Australian Water Resources 2005 concluded that 30 per cent of groundwater extraction sites were approaching or beyond sustainable extraction limits.[86]

Peat consists of decayed vegetation or organic matter. Peat can pose a major fire hazard and a smouldering peat fire cannot be extinguished by light rain.[87] Peat fuelled fires can burn for extended periods of time and have also been observed as smouldering underground resulting in reignition if an oxygen source is present.[88] The minimum rainfall intensity required to extinguish a peat fire is roughly 4mm/h.[89] NWM does not have a significant peat deposit however some small sections are scattered throughout the west of the region. A full map of peat deposits can be found on EM-COP, below is a screenshot of the Southern Metro region with the peat hazard layer shown in yellow.

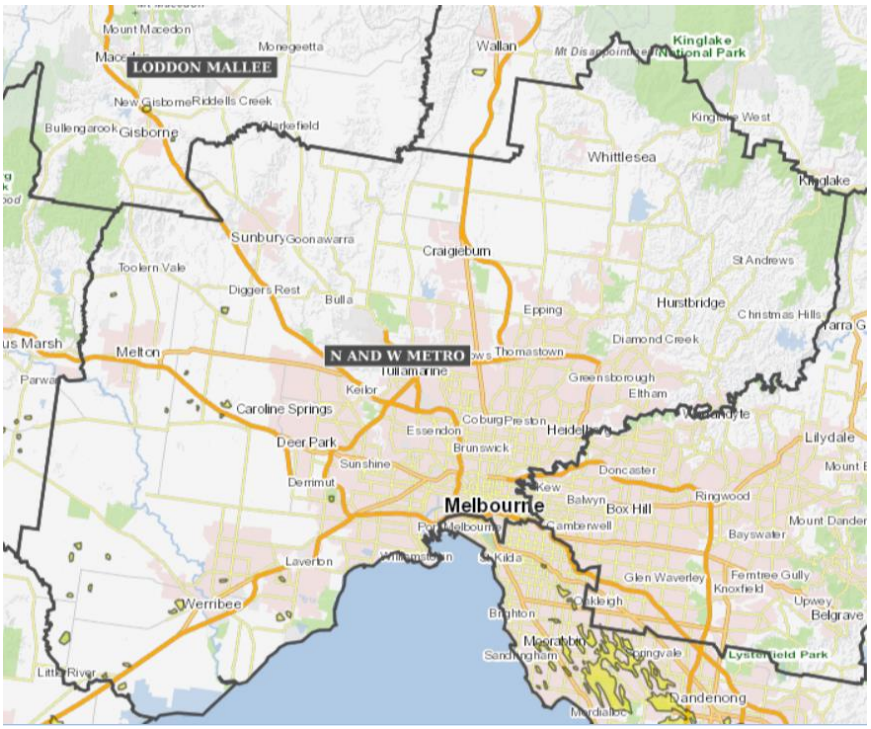


Figure 10 EM-COP layer depicting peat deposits in North West Metro

86 Geology Australia (2020) https://www.ga.gov.au/scientific-topics/water/groundwater/basics/what-is-groundwater
87 Lin and Huang (2020) https://www.sciencedirect.com/science/article/abs/pii/S0048969720319811
88 Lin and Huang (2020) https://www.sciencedirect.com/science/article/abs/pii/S0048969720319811
89 Lin and Huang (2020) https://www.sciencedirect.com/science/article/abs/pii/S0048969720319811

6.5 Marine

North West Metro area includes the Northern areas of Port Phillip Bay, Port of Melbourne and the Yarra and Maribyrnong Rivers. There tends to be significant patronage all year round. The ample access to water for a diverse range of waterway users results in increased risks. The area includes reefs, beaches and a large enclosed embayment. This region averages approximately 50 Volunteer MSAR responses annually. The City of Melbourne released a climate change impacts report that predicts that by 2050 sea levels will rise by 24cms on 1990 levels, increasing risks of extreme sea level events and coastal erosion.[90]

90 City of Melbourne (2020) https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx

7. Built Environment

For NWMR, the built environment includes the central business district of Melbourne, Australia's second-largest city and the State's largest hub for business, administration, cultural and recreational activities. NWMR is home to large numbers of high-rise residential buildings, social housing, the headquarters and branches of many agencies, companies, major transport and freight hubs. It is also host to significant industrial precincts and is experiencing significant urban growth. A diverse population and the confounding factors relevant to meeting the needs of a rural-urban interface makes the effective management of the built environment in NWMR very complex. Arrangements must include all levels of government in addition to private sector interests.

7.1 Information and telecommunications

The communications sector – incorporating internet, phone, radio, television, online transactions and business operations – is a foundation for economic and social development and stability within Victoria. These interconnected networks are owned by both national and international providers and are regulated by the Commonwealth.[91]

Key assets and infrastructure include:

- Networks – copper, hybrid fibre-coaxial, fibre-optic cable
- Towers – mobile telephone, wireless internet (e.g., 3G, 4G)
- Satellites
- Base stations
- Exchanges or points of interconnect
- Data centres
- Backhaul infrastructure (which transfers high data volumes to and from the core network)
- Cables – between onshore nodes and other countries

Key risks to the sector include:

- Natural disasters – fire, flood, storm, extreme weather
- Pandemic
- Security breaches

91 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf

- Technical issues (e.g., electricity disruption, asset failure)

7.1.1 Telephone exchanges

Within NWMR, telephone exchanges – which interconnect subscribers and are owned and operated by Telstra and Optus – are located in:

- Banyule (Heidelberg, Ivanhoe)
- Brimbank (Deer Park, Keilor, St Albans, Sunshine, Sydenham)
- Darebin (Bundoora, Northcote, Preston, Reservoir, Thornbury)
- Hobsons Bay (Altona, Newport, Point Cook, Williamstown)
- Hume (Broadmeadows, Bulla, Craigeburn, Greenvale, Kalkallo, Somerton, Sunbury, Tullamarine, Westmeadows)
- Maribyrnong (Brooklyn, Footscray, Maidstone)
- Melbourne (Batman, Carlton, City West, Exhibition, Russell, South Yarra)

7.1.2 Television and radio stations

Many television and radio broadcasting stations – national, community and commercial – transmit from studios within NWMR[92]. Several of these services could be of critical importance during an emergency, including the State's official emergency broadcasters, such as:[93]

- ABC Melbourne - AM 3LO 774
- ABC NewsRadio - AM 3PB 1026
- ABC Radio National - AM 3RN 621
- SBS Radio – AM 3EA 1224
- Vision Australia Radio - AM 3RPH 1179

Refer also Table 12.

92 https://en.wikipedia.org/wiki/List_of_radio_station_callsigns_in_Victoria
93 EMV (2016): https://www.emv.vic.gov.au/responsibilities/victorias-warning-system/emergency-broadcasters/official-emergency-broadcasters-in

Table 12. Communication services in NWMR

		Communication Services (No.)	
	LGA	**Television**	**Radio**
	Banyule	0	10
	Brimbank	0	2
	Darebin	0	0
	Hobsons Bay	0	0
	Hume	0	4
	Maribyrnong	0	1
	Melbourne	1	4
	Melton	0	2
	Moonee Valley	0	0
	Moreland	0	0
	Nillumbik	0	2
	Whittlesea	0	1
	Wyndham	0	4
	Yarra	0	0
Total	**Metro**	1	17
	Interface	0	13
	NWMR	**1**	**30**

7.2 Energy

Energy – including electricity, gas and liquid fuels – is one of eight critical infrastructure sectors identified for Victoria. All three of these sub-sectors are privately owned and operated, and form part of extensive national networks to import and export energy between Victoria and other States.[94]

Victoria's primary energy sources are electricity generated from brown coal in the La Trobe Valley, and natural gas sourced from the Gippsland Basin.[95]

NWMR is not home to many alternative renewable energy supplies such as wind or solar farms. However, a large investment has been made to build a 7.5 MV Airfield Solar Farm at Melbourne Airport.[96]

Energy distribution within NWMR is summarised by LGA in Table 13 and discussed further in the following sections.

94 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
95 DELWP (2020): https://www.energy.vic.gov.au/
96 Melbourne Airport (2020): https://my.melbourneairport.com/solar-farm

Table 13. Energy distribution (km) by LGA[97]

		Energy distribution (km)		
	LGA	Major Electricity Transmission	Oil Pipelines	Gas Pipelines
	Banyule	31.4	0.0	8.8
	Brimbank	105.3	0.0	29.1
	Darebin	19.8	0.0	5.5
	Hobsons Bay	30.4	45.2	24.2
	Hume	149.9	0.0	19.2
	Maribyrnong	**12.1**	0.0	26.7
	Melbourne	27.1	1.5	21.3
	Melton	119.4	0.0	**70.6**
	Moonee Valley	16.4	0.0	6.7
	Moreland	29.8	0.0	12.0
	Nillumbik	147.2	0.0	24.0
	Whittlesea	**223.2**	0.0	49.3
	Wyndham	157.5	**67.1**	62.4
	Yarra	24.7	0.0	**5.1**
Total	**Metro**	297.0	46.7	139.4
	Interface	797.2	67.1	225.5
	NWMR	**1,094.2**	**113.8**	**364.9**

For the energy sector overall, key risks include:

- Fire
- Severe weather
- Extreme temperatures
- Cyber-attack
- Earthquake
- Earthworks damaging underground infrastructure
- Loss of communication

97 EMV (2020): Potential Impact Reports (by LGA)

- Workforce issues (which could arise for any number of reasons but include industrial issues, heat stress, pandemic, an ageing workforce and lack of experience or specialist staff).[98]

Key dependencies for the energy sector include:

- Production infrastructure
- Supporting infrastructure (e.g., energy supplies for operations)
- Water and wastewater
- Transport infrastructure
- Human resources and management systems
- Information technology and communications[99]

7.2.1 Electricity

The key assets and infrastructure for the electricity sector include generators, high and low voltage transmission and distribution systems[100]. There are five electricity distributors in Victoria, who own and manage the power poles and wires delivering power across the State. Of these, Ausnet, Jemena, Citipower and Powercor service different geographical areas within NWMR with more than 1000 km of major transmission lines shown in Table 13.[101]

Most of Melbourne's electricity is generated by brown coal generators in the La Trobe Valley. While there are no major power facilities or generators located within NWMR, there are seven terminal stations and two zone substations.[102]

Terminal stations are key centres for receiving high voltage electricity from transmission lines and converting it to lower voltages for distribution to zone substations.[103] NWMR's terminal stations are located in:

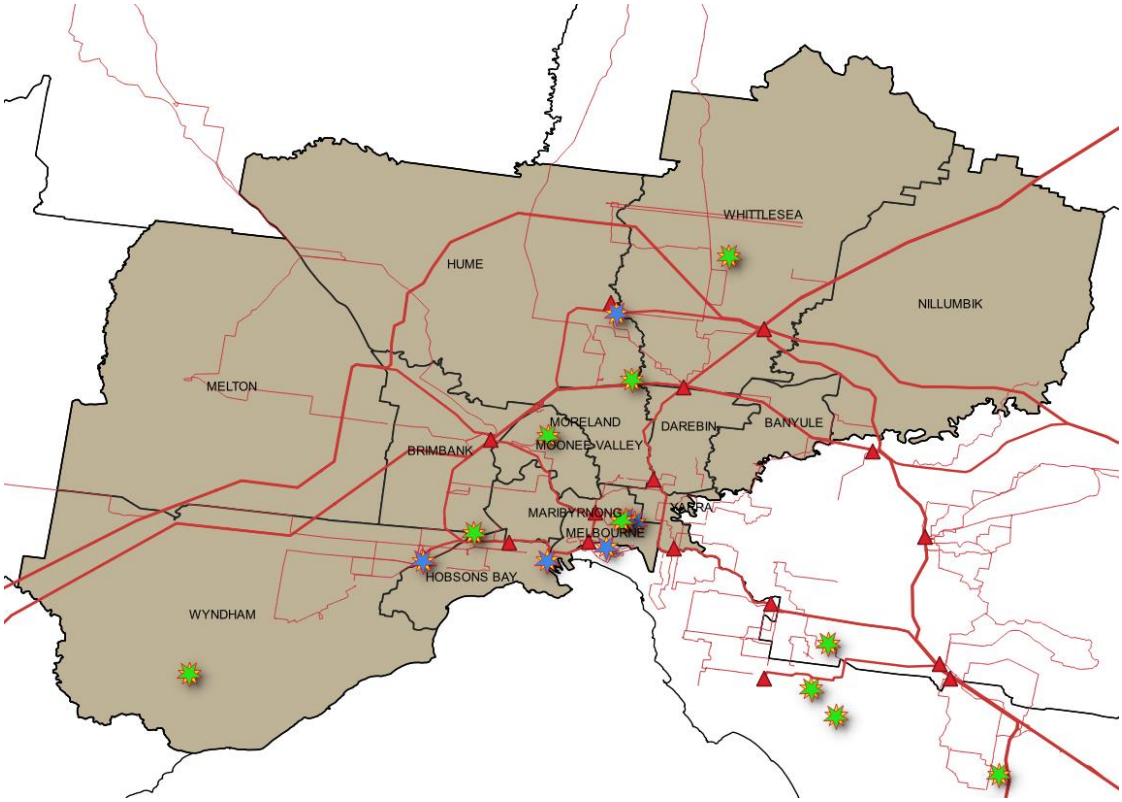
- Brooklyn (in the City of Hobsons Bay)
- Donnybrook (in the City of Whittlesea)
- Fishermans Bend (Switchyard) (in the City of Melbourne)
- Keilor (in the City of Brimbank)
- Newport (Switchyard) (in the City of Hobsons Bay)
- Somerton (in the City of Hume)
- West Melbourne (in the City of Melbourne)

98 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
99 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
100 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
101 DELWP (2020): https://www.energy.vic.gov.au/electricity/electricity-distributors
102 DELWP (2020): https://www.energy.vic.gov.au/electricity/about-the-electricity-sector
103 AusNet Services (2018): https://www.ausnetservices.com.au/-/media/Files/AusNet/About-Us/Determining-Revenues/Distribution-Network/Customer-Forum/Week-1/Networks-101-Customer-Forum.ashx?la=en

Zone substations receive electricity from bulk supply substations and transform the voltage to 11,000 volts for distribution to customers' homes and businesses along powerlines or cables.[104] NWMR's zone substations are located in:

- Kalkallo (in the City of Hume)
- Sunbury (in the City of Hume)
- Watsonia (in the city of Banyule)

A map of electrical infrastructure is provided in Figure 11 below:



Green star – renewable power generation	Blue star – non-renewable power generation
Red triangle – Electrical substation	Green triangle – Electrical switchyard
Yellow triangle – Electrical transmission	Blue triangle – Electrical zone
Black dot – Electrical terminal	Thick red line – Power transmission
Thin red line – Power sub-transmission	

Figure 11. Transmission lines within NWMR [105] [106] [107]

104 AusNet Services (2018): https://www.ausnetservices.com.au/-/media/Files/AusNet/About-Us/Determining-Revenues/Distribution-Network/Customer-Forum/Week-1/Networks-101-Customer-Forum.ashx?la=en

105 https://data.gov.au/dataset/ds-aurin-aurin%3Adatasource-AU_Govt_GA-UoM_AURIN_DB_national_major_power_stations_2016/details?q=Major%20Power%20Stations

106 https://data.gov.au/dataset/ds-aurin-aurin%3Adatasource-AU_Govt_GA-UoM_AURIN_DB_national_electricity_transmission_substations_2017/details?q=electricity%20transmission%20substations

107 https://discover.data.vic.gov.au/dataset/foi-line-vicmap-features-of-interest

7.2.2 Gas

The key assets and infrastructure for the gas sector include production, receiving, processing and storage facilities, and transmission and distribution systems.[108]

Victoria's natural gas supply is sourced from outside of NWMR, predominantly in the Gippsland Basin and processed in Longford. The Principal Transmission System, which covers Melbourne and central Victoria, is owned by GasNet and operated by the Australian Energy Market Operator (AEMO).[109]

Approximately 365 km of gas pipelines traverse NWMR (refer Table 13 and Figure 12) including:

- The Dandenong – West Melbourne Ring Main (crossing the Cities of Banyule, Brimbank, Darebin, Hume, Maribyrnong, Melbourne, Moonee Valley, Moreland and Whittlesea and Nillumbik Shire)
- Supply to Newport Power Station (City of Hobsons Bay)
- Somerton Transmission Pipeline (crossing the Cities of Hume and Whittlesea)
- BHP Petroleum in Laverton North (City of Wyndham)
- Supply to Snowy Hydro Power Pipeline (City of Wyndham)

Gas supplies may also originate from the Otway Basins, interstate and offshore from the Bass Coast.[110] For example, Nillumbik Shire hosts 24 km of the underground high-pressure transmission pipeline that carries natural gas from Bass Strait for distribution across the State. The pipeline is operated by the APA Group[111] and is patrolled daily by helicopter and car. Control valves are located off Yow Creek Road at St Andrews and on the eastern side of Yan Yean Road.[112]

108 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
109 DELWP (2017): https://www.energy.vic.gov.au/gas/about-the-gas-sector
110 DELWP (2017): https://www.energy.vic.gov.au/gas/about-the-gas-sector
111 The APA Group (APA) comprises of two trusts: Australian Pipeline Trust (APT) and APT Investment Trust (APTIT).
112 Nillumbik Shire Council (2020): https://www.nillumbik.vic.gov.au/Living-in/Fire-and-other-emergencies/Councils-role-in-an-emergency?BestBetMatch=emergency|d13b95b2-5146-4b00-9e3e-a80c73739a64|4f05f368-ecaa-4a93-b749-7ad6c4867c1f|en-AU

Figure 12. Natural gas pipelines within NWM Region[113]

7.2.3 Liquid fuels

The key assets and infrastructure for the liquid fuels sector include production and import facilities, fuel refineries, storage, distribution systems (including pipelines and transport) and retail outlets.[114]

The Altona Refinery is located within NWMR in the City of Hobsons Bay and plays a critical role in Victoria's fuel supply chain. The refinery processes crude oil into petroleum products, supplying approximately half of Victoria's needs for refined fuels. This includes the production of petrol, diesel and jet fuel. Approximately 100 storage tanks store the refined products before they are transported via pipelines to Mobil's Yarraville terminal (amongst others) and then distributed by road. Altona Refinery is registered as a Major Hazard Facility due to the large quantity of flammable products and contributes around $270 million every year to the Victorian economy. [115]

113 EM-COP – Gas Pipelines Overlay Layer
114 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
115 Exxon Mobil (2019): https://www.exxonmobil.com.au/Energy-and-environment/Energy-resources/Downstream-operations/Altona-Refinery

The major fuel tanks are at Melbourne Airport, situated in Hume. There are 34km of pipeline used for fuel at a daily rate of 6 million litres. The storage capacity is around 39.1 million litres[116].

The Australian Government has recently implemented a comprehensive fuel security package in recognition of, "ongoing financial pressures on the domestic refining sector, which have been exacerbated by the COVID-19 pandemic." More details are available from the Department of Industry, Science, Energy and Resources (DISER).[117]

7.3 Food, grocery and manufacturing

Victoria is the epicentre of manufacturing in Australia, home to more than 13,000 manufacturing firms employing over 280,000 people and generating $30 billion for the Victorian economy.[118]

Several large manufacturing businesses have their home bases in NWMR including:

- BOC Gases (Linde Group) (supplier of compressed and bulk gases, chemicals and equipment).[119]
- CSL Limited (biotechnology company involved in research, development and manufacturing of medical and laboratory products, such as blood plasma derivatives, vaccines, antivenom and cell culture reagents).[120]

Food and beverage manufacturing within NWMR, and concomitant supply logistics, is also an essential sector within Victoria which provides fresh, refrigerated and packaged food and groceries across the State. For example, the Melbourne Wholesale Fruit, Vegetable and Flower Market located in Epping (in the City of Whittlesea) is vital to Victoria's infrastructure, with an annual turnover in excess of $1 billion. The market involves approximately 3,000 small businesses – including growers, traders, transport and logistics companies and buyers – supplying produce to supermarkets, greengrocers, restaurants and food processors.[121]

Key assets and infrastructure may include:

- Warehousing and distribution centres
- Complex logistics networks
- Multiple modes of transport

116 NWMR REMPC feedback

117 DISER (2020): https://www.energy.gov.au/government-priorities/energy-security/australias-future-fuel-security-package
118 DJPR (2020): https://djpr.vic.gov.au/about-us/overview/strategies-and-initiatives/advancing-victorian-manufacturing
119 Linde (2020): https://www.boc-limited.com.au/en/about/about.html
120 CSL (2020): https://www.csl.com/contact
121 https://www.smh.com.au/business/small-business/fruit-and-vegetable-traders-put-bruising-melbourne-market-battles-behind-them-20160104-glyogd.html

7.3.1 Food supply chain

The safety, security and continuity of Australia's food supply is complicated. It is a nationally distributed system, generally owned and operated by the private sector, with oversight from the Department of Agriculture and Water Resources (DAWR) and other industry and government agencies. However, "States and territories have the lead responsibility for planning for and responding to emergency events within their jurisdictions."[122] Emergency situations that could give rise to supply chain disruptions, with downstream effects on consumers, include:

- Pandemic
- Biosecurity concern (e.g., foot and mouth disease)
- Drought
- Industrial action
- Natural disaster
- Severe weather event
- Terrorist attack
- Food or water contamination
- Power, water or communications outage

Figure 13 provides an overview of the food supply chain and its dependencies.

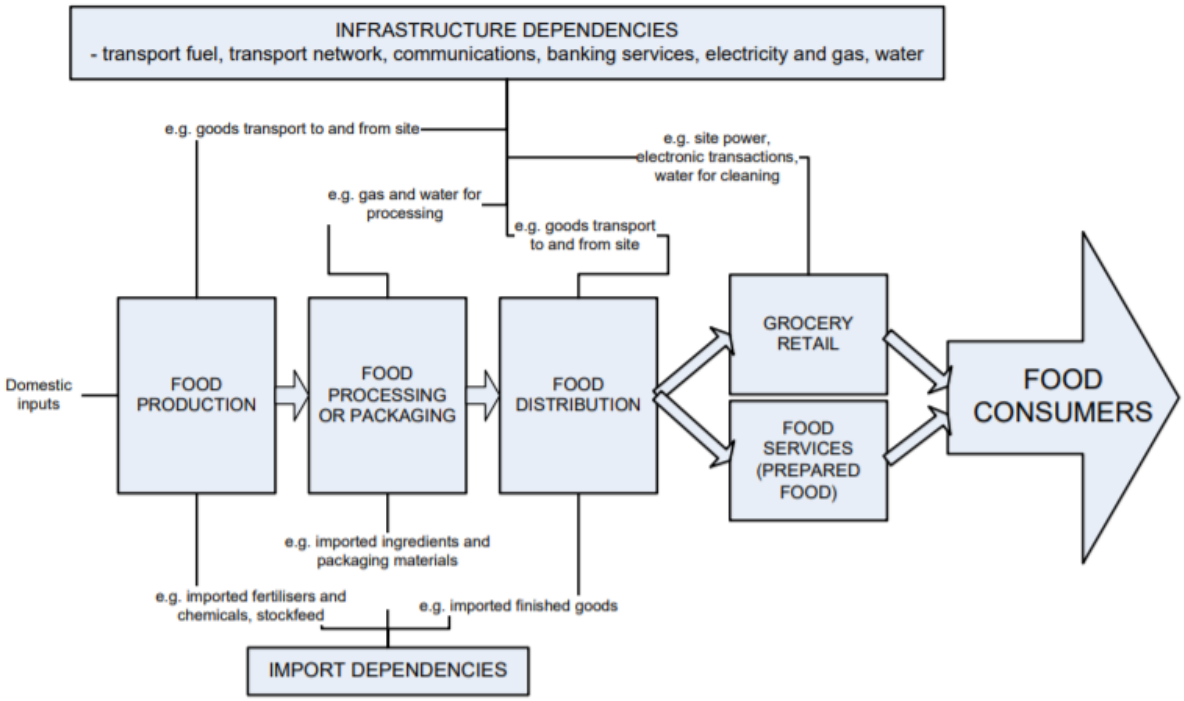


Figure 13. Overview of food supply chain and dependencies[123]

122 DAWR (2020): https://www.agriculture.gov.au/ag-farm-food/food/food-chain-resilience
123 DAFF (2012): https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/ag-food/food/national-food-plan/submissions-received/resilience-food-supply.pdf

7.4 Transport

NWMR plays a critical role as a transport gateway for Melbourne's growing economy.[124] It is home to several major transport hubs – such as Melbourne Airport, Essendon Airport, the Port of Melbourne and the intermodal freight terminal at Truganina – and has a high level of demand for travel by both private vehicle and public transport. Significant disruptions to any of these routes could have a major impact on NWMR residents, those who travel through NWMR and who need to travel for work, services or recreation.

Transport infrastructure within NWMR is summarised by LGA in Table 14 and discussed further by mode in the following sections.

Table 14. Transport infrastructure (km) by LGA[125]

		Transport infrastructure (km)			(%)
	LGA	Major Roads	Major Rail	Distance to Melbourne CBD	Population close to Public Transport
	Banyule	42.4	29.0	23.0	*90.4%*
	Brimbank	180.8	81.7	19.0	*84.1%*
	Darebin	38.4	27.5	14.0	*99.7%*
	Hobsons Bay	56.8	106.8	22.0	*87.7%*
	Hume	187.7	109.8	40.0	*75.3%*
	Maribyrnong	37.6	88.7	9.0	*96.9%*
	Melbourne	114.0	243.0	**2.0**	*99.2%*
	Melton	141.2	58.7	**43.0**	*71.4%*
	Moonee Valley	47.8	24.1	9.0	*95.7%*
	Moreland	53.8	33.5	8.0	*99.0%*
	Nillumbik	105.2	15.4	25.0	***50.3%***
	Whittlesea	167.8	72.9	28.0	*75.6%*
	Wyndham	145.3	127.4	27.0	*65.0%*
	Yarra	43.3	32.3	4.0	***100.0%***
Total	**Metro**	614.9	666.6	12.2	*94.7%*
	Interface	747.2	384.1	32.6	*67.5%*
	NWMR	**1,362.1**	**1050.7**	**19.5**	***85.0%***

124 https://www.suburbandevelopment.vic.gov.au/__data/assets/pdf_file/0026/59282/eBook-Northern.pdf
125 EMV (2020): Potential Impact Reports (by LGA)

7.4.1 Roads

More than 1,362 km of major roads traverse NWMR, including major highways, freeways, arterial roads, bridges and tunnels.

The road network is shown in Figure 14 and Figure 15, with darker red representing arterial roads, and lighter red municipal roads and tracks. This network includes:

- Bolte Bridge
- Burnley Tunnel
- Calder Highway
- CityLink
- Craigieburn Bypass
- Domain Tunnel
- Hume Highway
- Metropolitan Ring Road
- Princes Highway (links Melbourne to Geelong and then onto Adelaide)
- Tullamarine Freeway
- West Gate Bridge
- West Gate Freeway
- Western Highway
- Western Ring Road

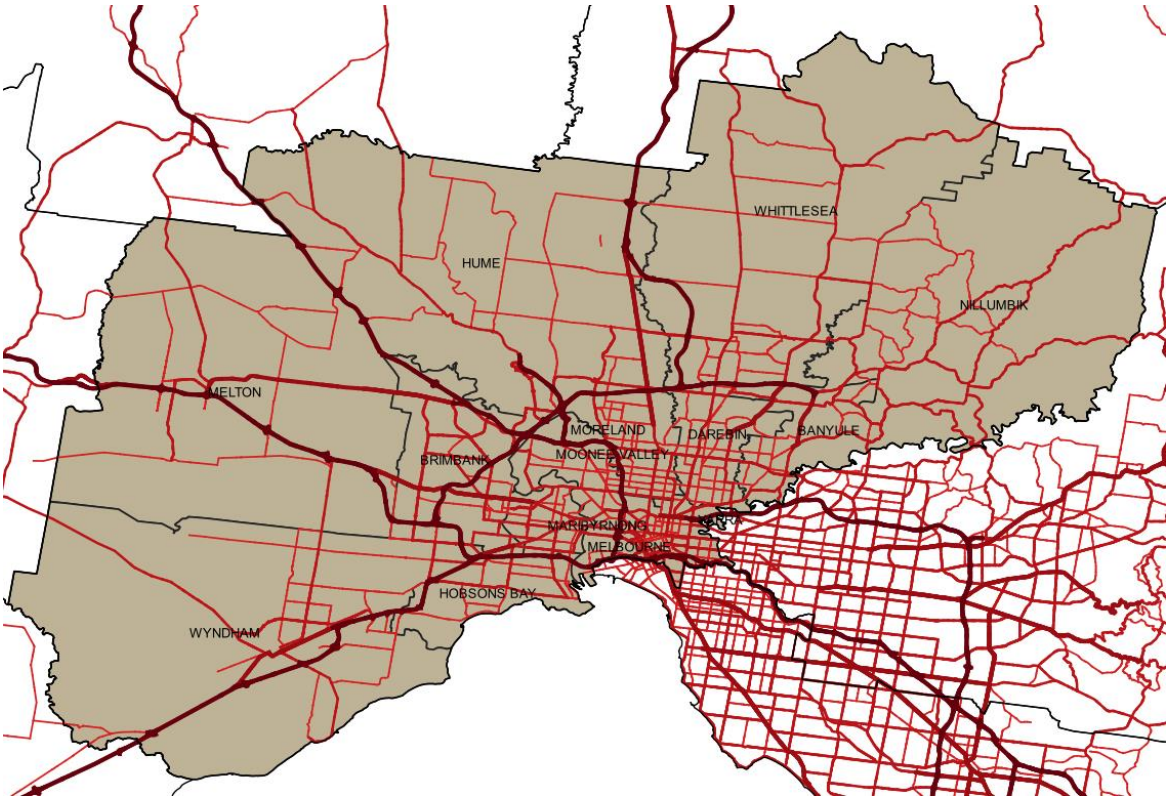


Figure 14. Major roads within NWMR[126]

126 Data Vic (2020): https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport

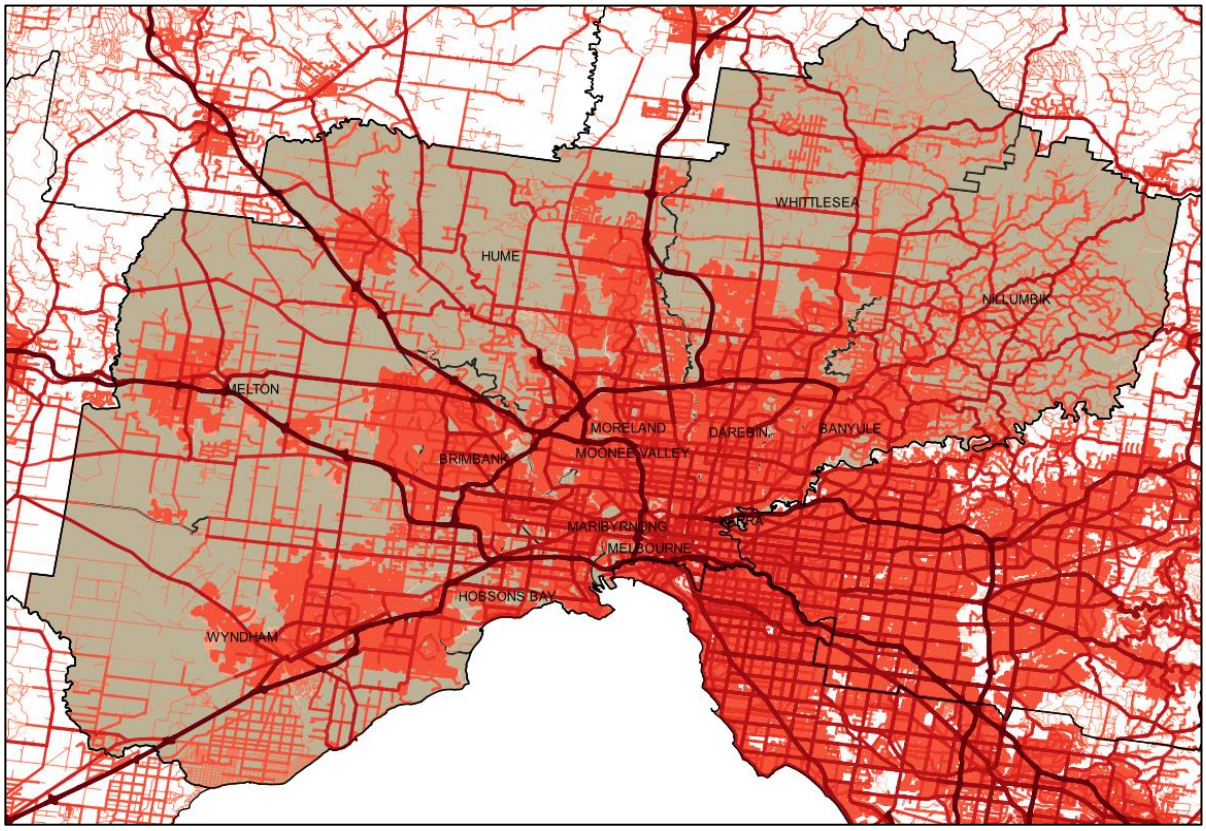


Figure 15. Density of road network within NWMR[127]

Density of network in the LGAs closer to Melbourne CBD is clear. The interface LGAs generally have a lower density, but longer total length of local roads given their larger size. The satellite development areas also stand out, linked by road and rail corridors.

Table 15 has calculated road lengths for each LGA based on Department of Transport standard categories. All road lengths in kilometres [128]. Note for evacuation planning, road capacity for a single lane can be estimated using a standard method supplied by Department of Transport. This can help to understand required lead time to evacuate areas with limited access.

127 Data Vic (2020): https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport

128 Data Vic (2020): https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport

Table 15. Road Lengths by LGA[129]

		Road Lengths (km)									
	LGA	Freeway	Highway	Arterial	Sub-Arterial	Collector	Local	2WD	4WD	Walking Track	Bike Path
	Banyule	3	8	35	27	61	489	14	-	49	35
	Brimbank	99	26	93	29	79	817	39	3	24	63
	Darebin	-	8	40	56	31	495	16	-	52	22
	Hobsons Bay	36	1	28	38	40	410	10	-	23	48
	Hume	80	24	82	132	110	1,253	379	11	56	57
	Maribyrnong	3	3	35	24	19	253	34	-	10	16
	Melbourne	50	0	57	45	35	222	15	-	63	47
	Melton	81	19	27	57	51	678	222	8	37	14
	Moonee Valley	31	-	11	45	33	402	4	-	11	33
	Moreland	23	6	25	55	35	473	8	-	23	26
	Nillumbik	3	0	96	51	56	321	347	38	16	29
	Whittlesea	54	2	100	89	50	1,116	341	102	110	40
	Wyndham	65	14	82	81	69	1,464	474	13	86	86
	Yarra	18	3	22	15	20	211	6	-	12	24
Total	**Metro**	262	56	347	334	353	3,772	146	3	268	313
	Interface	283	58	387	410	336	4,833	1,762	171	305	227
	NWMR	**545**	**114**	**734**	**744**	**689**	**8,605**	**1,908**	**174**	**572**	**540**

[129] Data Vic (2020): https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport

A listing of the major roads is also provided below:

Table 16. Major Roads by LGA[130]

LGA	Major Roads	
Banyule – 10.8km	Greensborough Highway Greensborough Road Lower Plenty Road	Metropolitan Ring Road Plenty Road
Brimbank – 94.7km	Airport Drive Ballarat Road Calder Freeway Geelong Road	Melton Highway Western Freeway Western Ring Road Westfield Drive
Darebin – 7.7km	Plenty Road	
Hobsons Bay – 26.4km	Geelong Road Princes Freeway	West Gate Freeway
Hume – 83km	Calder Freeway Hume Freeway Hume Highway Metropolitan Ring Road	Sydney Road Tullamarine Freeway Western Ring Road
Maribyrnong – 5.3km	Ballarat Road	West Gate Freeway
Melbourne – 25.4km	Boulton Parade Burnley Tunnel Citylink Domain Tunnel	Kings Way Princes Street West Gate Freeway
Melton – 85.0km	Calder Freeway Federation Drive High Street Melton Highway	Old Western Highway Western Freeway Western Highway
Moonee Valley – 19.6km	Calder Freeway Citylink	Tullamarine Freeway
Moreland – 21.6km	Citylink Metropolitan Ring Road Sydney Road	Tullamarine Freeway Western Ring Road
Nillumbik – 2.5km	Metropolitan Ring Road	Plenty Road
Whittlesea – 42.9km	Hume Freeway Metropolitan Ring Road	Plenty Road
Wyndham – 58.4km	Princes Freeway Princes Highway Synnot Street Werribee Street	Werribee Street S West Gate Freeway Western Ring Road
Yarra – 17.6km	Alexandra Parade Burnley Tunnel Citylink	Eastern Freeway Harcourt Parade Princes Street

130 Data Vic (2020): https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport

The number of bridges in NWMR are shown in Table 17 by LGA and road class. Bridges are often a weakness in the overall road network, acting as a potential bottleneck funnelling traffic over an obstacle such as a river or other transport route. They can become impassable in floods or blocked by traffic and there is not always a suitable alternative route available.

Table 17. Number of bridges by LGA[131]

		Number of bridges by LGA									
	LGA	Freeway	Highway	Arterial	Sub-Arterial	Collector	Local	2WD	4WD	Walking Track	Bike Path
	Banyule	2	2	22	6	3	7	-	-	25	14
	Brimbank	118	10	49	9	19	10	2	-	28	2
	Darebin	-	5	7	9	2	14	-	-	22	5
	Hobsons Bay	37	2	31	5	9	3	-	-	18	4
	Hume	47	13	38	45	18	52	19	1	17	16
	Maribyrnong	3	-	20	3	2	1	-	-	6	3
	Melbourne	205	-	80	38	5	12	-	-	19	15
	Melton	22	6	10	23	6	20	8	-	11	8
	Moonee Valley	76	-	9	40	11	1	-	-	28	3
	Moreland	60	-	20	23	-	7	-	-	11	16
	Nillumbik	2	-	21	4	7	8	6	-	3	13
	Whittlesea	37	-	17	41	5	32	19	5	22	10
	Wyndham	29	2	34	22	4	37	3	-	16	17
	Yarra	32	-	26	12	6	6	-	-	11	3
Total	**Metro**	533	19	264	145	57	61	2	-	168	65
	Interface	137	21	120	135	40	149	55	6	69	64
	NWMR	**670**	**40**	**384**	**280**	**97**	**210**	**57**	**6**	**237**	**129**

The following roads projects are also underway or soon to start:

- Northern Roads Upgrade – This project is expected to benefit growing communities in the northern suburbs of Melbourne. A contract is expected to be awarded mid-2020, with the project due for completion by 2025.[132]
- Western Roads Upgrade – This project is due for completion by 2021 and is expected to benefit growing communities in the western suburbs of Melbourne.[133]

[131] Data Vic (2020): https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport

132 https://roadprojects.vic.gov.au/projects/northern-roads-upgrade

133 https://roadprojects.vic.gov.au/projects/northern-roads-upgrade

- North East Link Project – This project is touted as, “the biggest road transport project in Victoria’s history. Up to 135,000 vehicles will use North East Link every day, reducing congestion. and slashing travel times between Melbourne’s north and south-east by up to 25 minutes.” Early works for this project have begun, with builders moving more than 100 above and below ground services – including power, water, gas, sewer and telecommunications lines – so major construction can start in 2021.[134]

7.4.2 Rail

Major rail crosses NWMR for 1050 km (refer Figure 16), including lines and hubs run by the following Rail Authorities:

- **Metro Trains (commuter rail):**
  - Broadmeadows Line
  - City Loop (incorporating Flagstaff, Melbourne Central and Parliament underground stations)
  - Epping Line
  - Flemington Racecourse Line
  - Flinders Street Station
  - Glen Waverley Line
  - Hurstbridge Line
  - Lilydale Line
  - Pakenham Line
  - Sunbury Line
  - Sydenham Line
  - Upfield Line
  - Werribee Line
  - Williamstown Line
- **V/Line (commuter rail):**
  - Bendigo Line (Echuca and Swan Hill lines continue at Bendigo)
  - Seymour Line (Shepparton line continues at Seymour)
  - Ballarat Line (Ararat line and Maryborough lines continue at Ballarat)
  - Geelong Line (Warrnambool line continues at Geelong)
- **NSW TrainLink Southern (ARTC Managed Track):**
  - Sydney-Melbourne XPT

134 North East Link Project (2020): https://northeastlink.vic.gov.au/works/early-works-program

- Albury/Wodonga Line (*ARTC Managed Track from Craigieburn*[135])

- **VicTrack (freight rail):**
  - Western Standard Gauge Line (part of the Melbourne-Adelaide rail corridor and principal rail link for freight between Victoria and the western States)

NWMR is also serviced by the Melbourne extensive tram network (Routes 1, 3/3a, 5, 6, 11, 12, 16, 19, 30, 35, 48, 57, 58, 59, 64, 67, 70, 72, 75, 82, 86, 96, 109). Refer Figure 16 where train lines are depicted in green and tram lines are red.

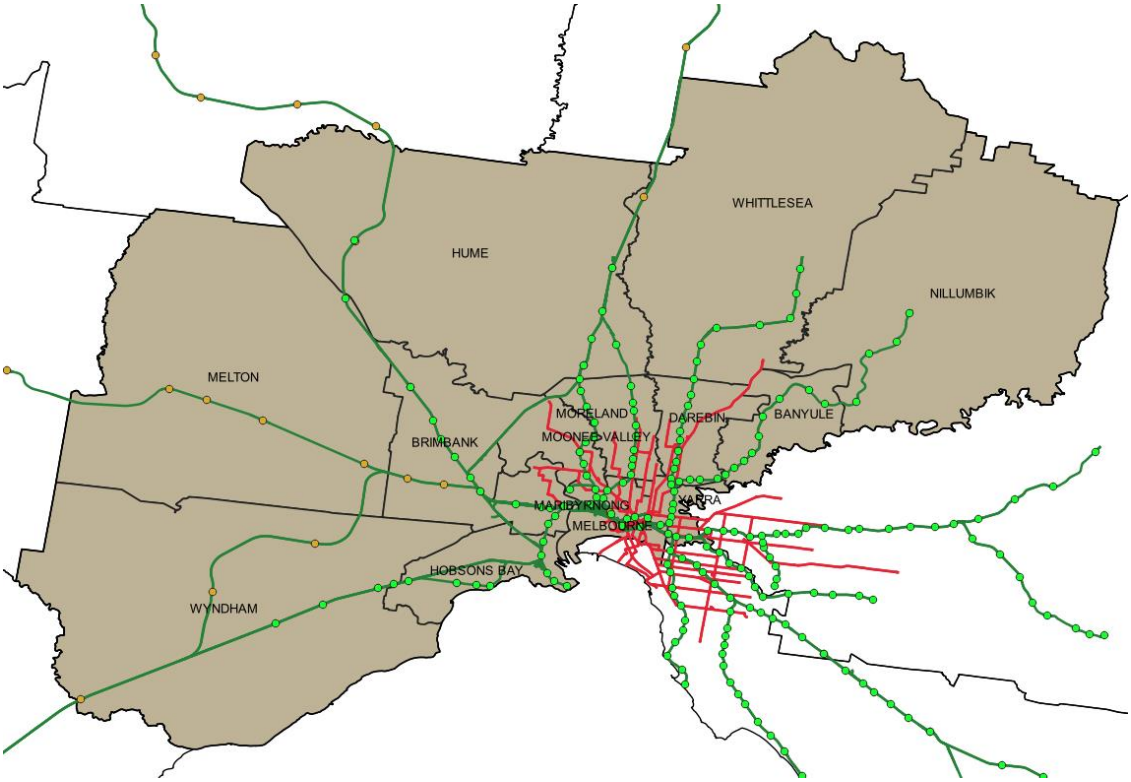


Figure 16. Map of major rail networks overlayed with NWMR boundaries

Several construction projects are underway to further improve rail networks that are located in or feed into NWMR:

- Suburban Rail Loop – a suburban rail loop with a 90 km route that will link major rail lines and has been designed to ease congestion and take pressure off Melbourne's entire transport network.[136]

135 https://www.artc.com.au/customers/operations/nib/sydney-craigieburn/
136 Suburban Rail Loop (2020): https://suburbanrailloop.vic.gov.au/en

- Metro Tunnel – An underground line currently under construction in Melbourne's CBD as part of the Public Transport Victoria (PTV) Network Development Plan which has been designed to unlock network capacity and improve efficiency, reliability and patronage.[137]
- Broadmeadows Station has been identified as the location for a regional super hub within the Suburban Rail Loop project, which aims to link every metropolitan train line from Cheltenham to Werribee, create a rail link to Melbourne Airport and connect regional passengers to the Suburban Rail Loop.[138]

- Upgrades to the Sunbury, Hurstbridge and Cranbourne Rail Lines
- Melbourne Airport Rail Link – This project is still in the planning stages but the Victorian Government has selected the Sunshine Route as its preferred option and the business case, due for completion in 2020, will assess station and procurement options. It is due to begin in 2022 and is likely to take nine years to build.[139]

7.4.3 Air

Within NWMR, there are two airports:

- Melbourne Airport (MEL) in Tullamarine
  - Operates international and domestic flights, across 24 hours, 7 days a week.
  - Located approximately 22 km from Melbourne CBD and in close proximity to major industrial areas.
  - Airservices Australia provides airport rescue and firefighting services.
  - Makes a significant contribution to the Victorian economy – approximately $7 billion from businesses within the airport precinct and $17.6 billion from the activities of the Airport itself in 2015-16.
  - Melbourne Airport employs approximately 150,000 Victorians; the movement of airfreight supports a further 28,000 jobs in Victoria.[140]
- Essendon Airport (MEB) in Essendon Fields
  - Operates international and domestic flights for general aviation and corporate jets.

137 Metro Tunnel (20920): https://metrotunnel.vic.gov.au/
138 https://www.suburbandevelopment.vic.gov.au/__data/assets/pdf_file/0026/59282/eBook-Northern.pdf
139 Major Transport Infrastructure Authority (2020): https://bigbuild.vic.gov.au/projects/melbourne-airport-rail
140 APAC (2018): https://my.melbourneairport.com/45980/widgets/243585/documents/105421

- Located approximately 10 kilometres from Melbourne CBD at the intersection of the Tullamarine and Calder Freeways, in close proximity to Melbourne's major hospitals.
- AirServices Australia estimates a third of total movements at Essendon Airport relate to emergency services, including more than 8,000 incidents per year attended by Air Ambulance and Police Air Wing.
- Air Ambulance operates three helicopters and four fixed-wing aircraft from Essendon Airport; also hosts Royal Flying Doctor Service, Erickson Air Crane and Coulson helicopters, Australian Maritime Safety Authority and Jet City Rescue.
- Two regional airlines – Sharp Airlines and Fly Corporate Air – fly to four destinations in NSW and two in the Bass Strait (King Island and Flinders Island).[141]

NWMR is also serviced by Avalon Airport (AVV) in Lara, located in the City of Greater Geelong.

7.4.4 Sea

Ports and their associated infrastructure are important gateways for the import and export of goods. Indeed, it is estimated that Australia conducts 98% of its trade through ports, which play a pivotal role in the national's supply chain.[142]

Key risks to the sector include:

- Disruptions to human resources.
- Disruptions to electricity supply or liquid fuel.
- Transport infrastructure emergencies.
- Disruptions to major non-transport infrastructure
- Security events.[143]

The Port of Melbourne, located in West Melbourne, is Victoria's largest container and general cargo port and operates 24 hours a day, 7 days a week. Swanston Dock handles more than a third of Australia's container trade while other, multipurpose terminals handle non-containerised packs, such as farm equipment, machinery, timber and steel. A variety of companies and service providers enable the movement of goods though the port, including stevedores, freight forwarders, transport companies, container parks and shipping lines. The Port of Melbourne Corporation estimates it contributes $6 billion to the Victorian

141 Essendon Fields (2020): https://ef.com.au/community/about/ef-airport/
142 Ports Australia (2020): https://www.portsaustralia.com.au/resources/trade-statistics
143 EMV (2019): https://www.emv.vic.gov.au/publications/victorias-critical-infrastructure-all-sectors-resilience-report-2018

economy each year.[144] However, Infrastructure Victoria estimate it will reach capacity by 2055 by which time a second major container port will need to be established. Bay West – located on the Port Phillip Bay coastline between Point Lillias and Point Cook (in the City of Greater Geelong) has been identified as the preferred location for this development.[145]

7.5 Water and wastewater

Treated water supplies and wastewater services are essential to human health, liveability and the environment. As the population grows and expands across Victoria the criticality of these services and their associated infrastructure will also increase.

7.5.1 Water

In their outlook for 2020, Melbourne Water noted that,

> *Melbourne's water supplies are currently secure for the coming year, however… challenges such as our increasing population and a warming, drying climate have contributed to Melbourne's storages decreasing by an annual average of 61 billion litres over the last five years.*[146]

A shortage of water is an increasing issue and forecasts suggest a potential 50% reduction in streamflow by 2065.[147]

Water security is heavily impacted by both long-term trends, such as increasing population growth, urbanisation and climate change, along with sudden events, including floods and oil spills. Different land uses in the region place varying levels of demand on water use, with some land uses posing potential threats to water quality and river health if note carefully managed.

Catchments in NWMR are at risk of threats to drinking water, including from:

- Bushfires – ash and sediment washed into reservoirs can contaminate water supplies for many months, while forests within catchment areas recover less water so reservoir supplies can become diminished.
- Contamination – from both human and animal sources.
- Erosion – which can cause sediment to enter the waterways that feed our reservoirs.[148]

144 Port of Melbourne (2020): https://www.portofmelbourne.com/about-us/
145 Infrastructure Victoria (20178): https://www.infrastructurevictoria.com.au/project/securing-victorias-ports-capacity/
146 Melbourne Water (2020): https://www.melbournewater.com.au/about/strategies-and-reports/water-outlook
147 Emergency Management in Victoria 2030: Drivers and Trends, 2019, p.3.
148 Melbourne Water (2020): https://www.melbournewater.com.au/water/water-facts-and-history/why-melbournes-water-tastes-great-tap/water-catchments

Some examples of the impacts such events could have include:

- Diminished agricultural production leading to a decline in gross domestic product.
- Health risks, such as blue-green algae outbreaks, which can be triggered by changes in nutrients and salinity, storage volumes, water flow and warmer weather. Large numbers of blue-green algae can produce toxins harmful to humans, animals, birds, livestock and the environment.[149]
- An increasing reliance on groundwater, which in Victoria is primarily used by dairy farms and other livestock, for irrigating crops, power generation and town water supplies.[150]

In a range of emergencies – including blue-green algae incidents, dam safety issues and the disruption to water services, DELWP is charged with responsibility for responding to and mitigating the impact of such events.[151]

Since 2006 the water sector has been identified as an essential service according to an Act of Parliament,[152] which requires Victoria's water organisations to have risk management plans in place which include provisions for terrorist acts. Water resources are also particularly susceptible to all hazard events, including bushfires, drought, floods, earthquakes, cyclones, contamination and epidemics. Individual disruptions to infrastructure in one area can have an impact on the response and recovery efforts in other areas because water is both dependent and interdependent on infrastructure networks across Victoria. For example, water supplies rely on electric power to operate distribution pumps, while electric power requires water for electricity generation. So too, the water sector relies on supply chains, including the transport sector, to provide chemicals for water treatment and disinfection and may share common service corridors.[153]

Several government departments and agencies share responsibility for managing and protecting Victoria's bays, rivers and ports, including:

- Parks Victoria
- Fisheries Victoria
- Agriculture Victoria
- Department of Environment, Land, Water and Planning (DELWP)
- Department of Transport

149 DELWP (2020): https://www.water.vic.gov.au/waterways-and-catchments/rivers-estuaries-and-waterways/blue-green-algae
150 DELWP (2020): https://www.water.vic.gov.au/groundwater/victorias-groundwater-resources
151 DELWP (2019): https://www.water.vic.gov.au/managing-dams-and-water-emergencies/emergency-management
152 The Terrorism (Community Protection) Act 2003.community protection
153 Global Terrorism Research Centre (2015): https://www.researchgate.net/publication/275658307_Plan_Prepare_and_Safeguard_Water_Critical_Infrastructure_Protection_in_Australia

- Environmental Protection Agency (EPA)
- Water Police[154]

Victoria's water grid connects dams, reservoirs, irrigation districts and the Wonthaggi desalination plant via rivers, pipes and pumps. In 2018, a Water Grid Partnership was established to oversee the grid's operation and address Victoria's water security challenges such as climate change and population growth. The use of desalinated water will increase over time and form part of Melbourne's regular water supplies.[155] Refer Figure 17.

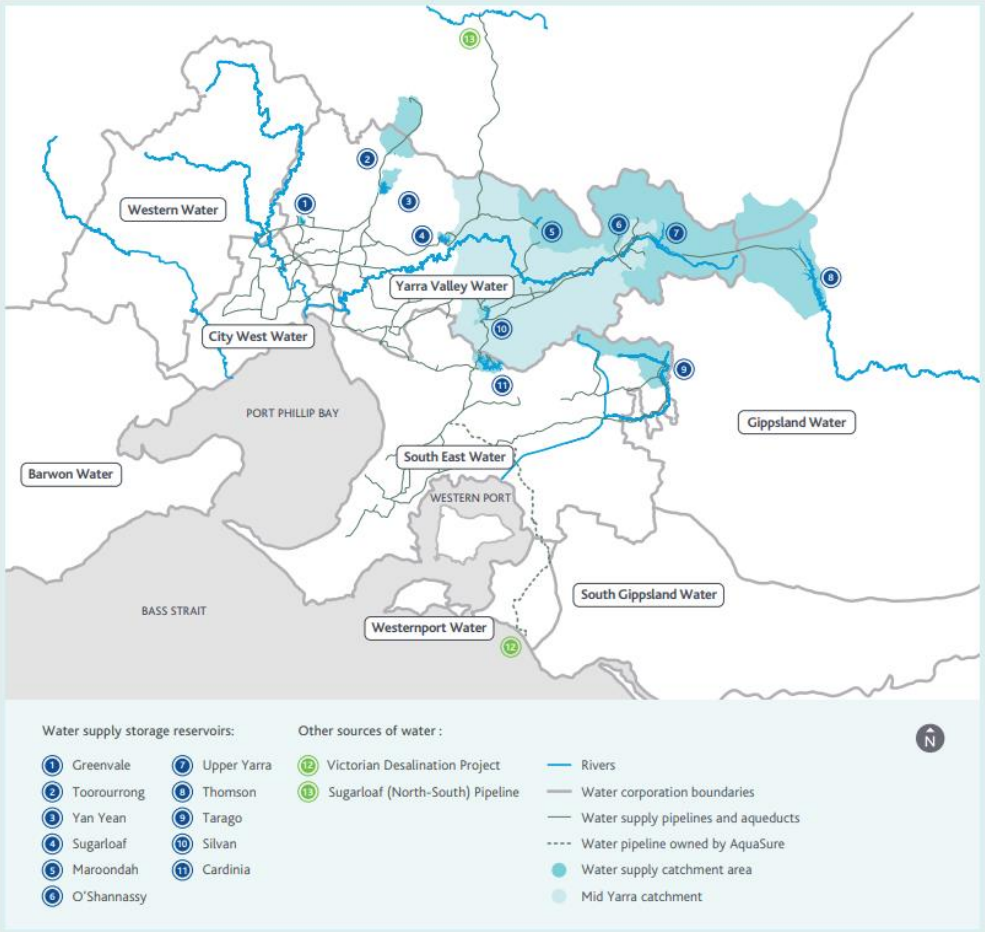


Figure 17. Melbourne's water supply system[156]

NWMR also incorporates 20 km of coastline around Port Phillip Bay (in the City of Hobsons Bay). Coastal hazards include storms, king tides, extreme weather, beach erosion and coastal inundations.

154 Parks Victoria (2020): https://www.parks.vic.gov.au/water-management
155 DELWP (2019): https://www.water.vic.gov.au/water-grid-and-markets/the-grid
156 Melbourne Water (2017): https://www.melbournewater.com.au/sites/default/files/2017-09/Melbourne-Water-System-Strategy_0.pdf

Small parts of NWMR are within the Melbourne Water catchment zone, supplying water to Melbourne. Economic, recreational or other activities in these areas risks contamination to the water supply, impacting on water quantity and quality, as do events linked to severe weather such as floods, fires and landslides. Table 18 lists these catchments.

Table 18. Water Supply Catchments for Melbourne Water[157]

Catchment	AREA_HA	Easting	Northing	Land use
Greenvale	364.1	314201	5833677	Melbourne Water owned
Yan Yean	2,573.1	337133	5843419	Melbourne Water owned
Sugarloaf	1,382.1	349090	5829469	Melbourne Water owned
Wallaby Creek	10,578.7	340151	5857336	National Park
Running Creek	1,396.1	344036	5846620	Reservoir is DEPI Asset

7.5.2 Emergency water supply points

Victoria has more than 300 emergency water supply points, overseen by DELWP and managed by various state agencies, for use during drought and bushfires. Some can be used to supply water to firefighting vehicles.[158]

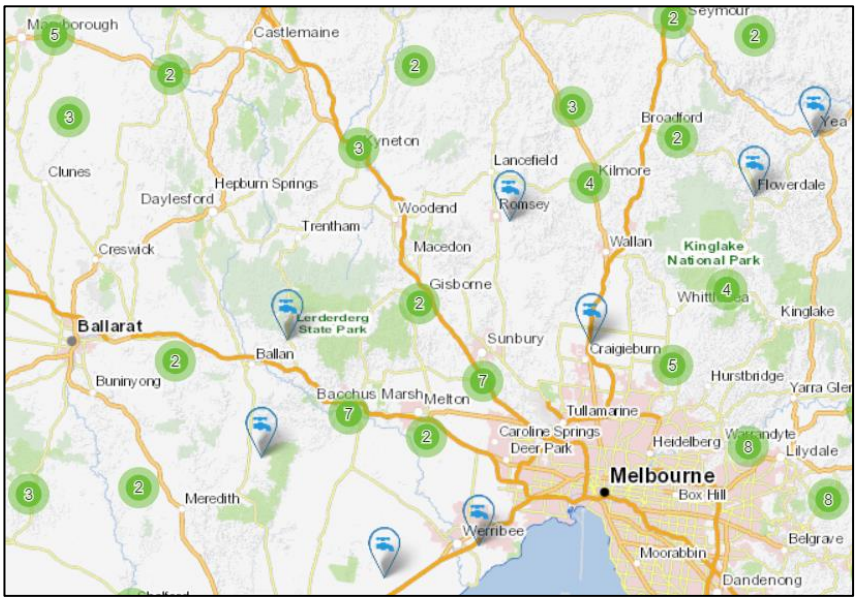


Figure 18. Emergency water supply points within NWMR[159]

157 https://discover.data.vic.gov.au/dataset/water-supply-catchments-for-melbourne-water
158 DELWP (2020): https://data.aurin.org.au/dataset/vic-govt-delwp-datavic-water-ewsp-na
159 DELWP (2019): https://www.water.vic.gov.au/groundwater/emergency-water-supply-points

7.5.3 Wastewater

There are several wastewater treatment plants across the region, regulated by the Victorian Environment Protection Authority (EPA). The Western Treatment Plant, located in Werribee, treats half of Melbourne's sewage and produces the largest amount of high-quality recycled water in Australia which can be used for non-drinking purposes.[160]

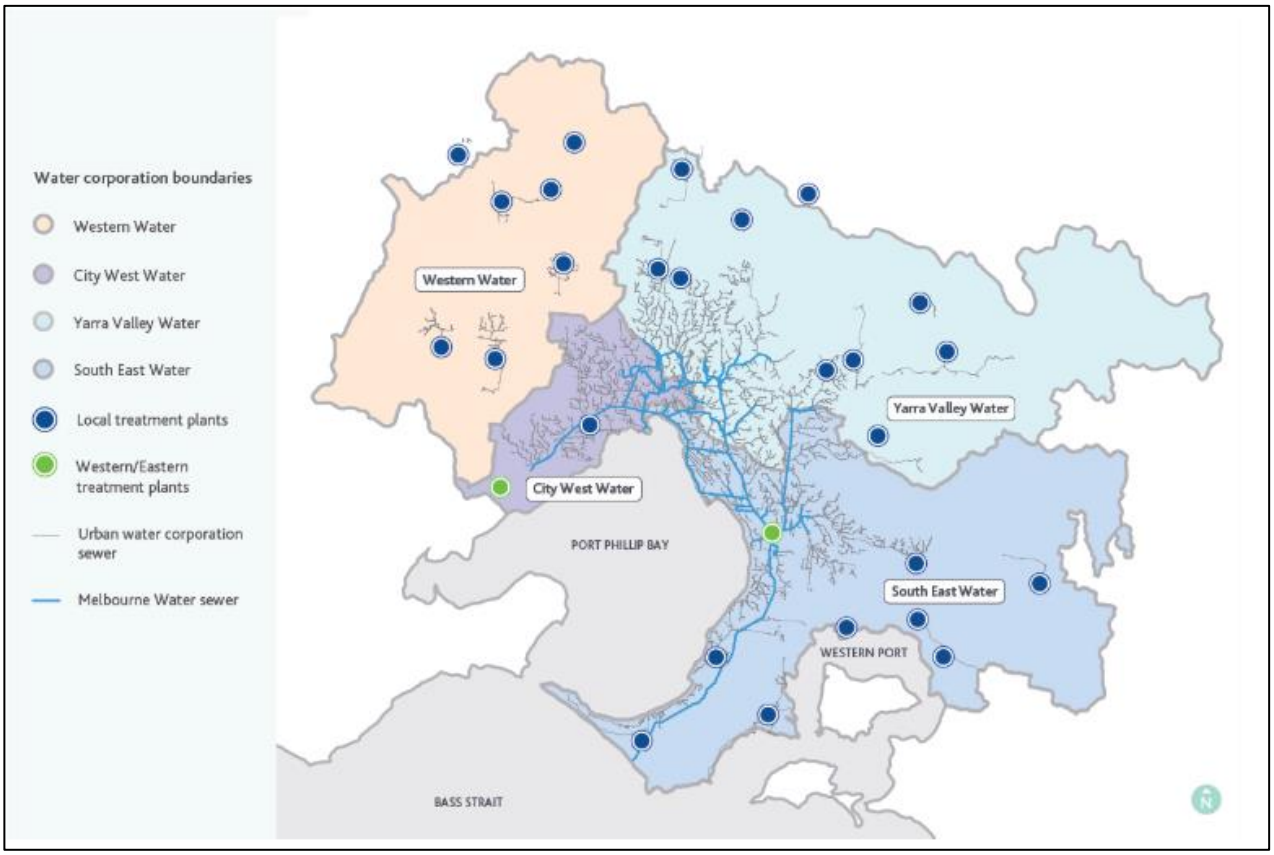


Figure 19. Melbourne's sewerage network[161]

7.6 Waste and recycling

7.6.1 Landfill

Landfill, the below ground disposal of waste materials that cannot be recycled continues to be a part of Victoria's waste management strategy. Many landfill sites are licensed to accept low-hazard (Category C) industrial waste. However, prescribed industrial waste can only be accepted at one hazardous (Category B) landfill in Victoria. This is located in Taylors Road in Dandenong South in the City of Greater Dandenong.[162]

EPA Victoria has identified several active environmental issues pertaining to landfill within NWMR, including:

160 Melbourne Water (2020): melbournewater.com.au/community-and-education/water-and-sewerage-treatment-plants/western-treatment-plant
161 Melbourne Water (2020): https://www.melbournewater.com.au/water/water-facts-and-history/importance-sewerage
162 EPA Victoria (2020): https://ref.epa.vic.gov.au/your-environment/waste/landfills

- Kealba landfill, owned by the Barro Group; has been identified to have underground hotspots due to excessive heat inside the landfill;
- Ravenhall landfill, owned by Cleanaway since 2015; currently being investigated by EPA following reports from residents of strong odours emanating from the site[163]

Closed landfills also pose environmental risks, including from:

- Leachate, a liquid formed by decomposing waste and rainwater, which can contaminate groundwater; and
- Landfill gas, from decomposing waste, which can migrate to the atmosphere.[164]

Closed landfills in NWMR are located in:

- Sunshine landfills, located near residential areas of Albion and St Albans, closed in 1990
- Tullamarine landfill. hazardous waste managed by Cleanaway, closed in 2008[165]

A study conducted by the Fire Services Commissioner in 2012 found that a series of significant fires in Victorian landfill sites, including two within NWMR (Brooklyn and Werribee) had been costly and resource intensive for fire services to suppress. The need to work more closely with operators of landfill sites was identified as a recommendation to improve operating practices and develop fire management plans.[166]

7.6.2 Recycling

Transfer stations and recycling depots in NWMR include:

- Banyule Waste Recovery Centre
- Brimbank City Council Detox Centre
- TPI Brooklyn Landfill And Waste Recycling (Brimbank)
- Darebin Resource Recovery Centre
- Campbellfield Recycling and Waste Transfer Station (At Landfill Site) (Hume)
- Melton Recycling Centre
- Moonee Valley Transfer Station
- Brunswick Waste Transfer Station (Moreland)
- Nillumbik Recycling and Recovery Centre (Nillumbik Shire Depot)
- Cooper St Resource Recovery Centre (At Landfill Site) (Whittlesea)

163 EPA Victoria (2020): https://www.epa.vic.gov.au/for-community/current-projects-issues/active-environmental-issues/western-metro/ravenhall-landfill
164 EPA Victoria (2020): https://ref.epa.vic.gov.au/your-environment/waste/landfills/closed-landfills.html
165 EPA Victoria (2020): https://www.epa.vic.gov.au/for-community/current-projects-issues/active-environmental-issues
166 EMV (2012): https://www.emv.vic.gov.au/how-we-help/reviews-and-lessons-management/operational-reviews/fire-management-at-landfill-sites

- Sunbury Recycling and Waste Transfer Station (At Landfill Site) (Hume)
- Citywide Waste And Recycling Centre (Melbourne)
- High Quality Group Recycling (Bulla)
- Hansons Wollert Landfill (Whittlesea)
- Wyndham Transfer Station (At Wests Road Refuse Disposal Facility)
- Bulla Tip and Quarry (Bulla)

There are also 150 stockpile sites – waste in storage for recycling or reuse – registered by EPA within NWMR. The majority of these are located in the Cities of Brimbank (38) and Hume (37). Refer Table 19.

Table 19. Transfer Stations, Recycling Depots and EPA Stockpile sites in NWMR by LGA[167]

	LGA	Transfer Stations and Recycling Depots	EPA Stockpile Sites
	Banyule	1	1
	Brimbank	2	38
	Darebin	1	5
	Hobsons Bay	0	15
	Hume	4	37
	Maribyrnong	0	15
	Melbourne	1	2
	Melton	1	5
	Moonee Valley	1	2
	Moreland	1	5
	Nillumbik	1	1
	Whittlesea	2	5
	Wyndham	1	16
	Yarra	0	3
Total	**Metro**	7	86
	Interface	9	64
	NWMR	**16**	**150**

7.7 Government services

Regional emergency management plans should consider how to ensure the continuation of government services to the community during an emergency – a time when they are likely to need vital support. The coronavirus pandemic of 2020 has already demonstrated the precarious nature of government workforces and the impact that absenteeism as a direct consequence of a disaster can have flow on effects (e.g., health care workers in an emergency department who are required to self-isolate for a period of 14 days following

167 EMV (2020): Potential Impact Reports (by LGA)

exposure to the virus can lead to the closure of wards or the cessation of elective surgeries which may lead to diversions for Ambulance Victoria and other care settings being required to pick up the slack).

Government services not already covered in this scan include prisons and community correctional services which can have their own unique issues in the face of an emergency.

NWMR is home to:

- Melbourne Assessment Prison (West Melbourne)
- Metropolitan Remand Centre (Ravenhall)
- Port Phillip Prison (Truganina)
- Dame Phyllis Frost Centre (Ravenhall)
- Judy Lazarus Transition Centre (West Melbourne)
- Ravenhall Correctional Centre
- Melbourne Youth Justice Centre (Parkville)
- MITA Detention Centre (Broadmeadows)

Victoria's primary courts and tribunals are also located in NWMR:

- Supreme Court of Victoria (Melbourne)
- County Court of Victoria (Melbourne)
- Magistrates' Court of Victoria (Melbourne)
- Coroners Court of Victoria (Southbank)
- Victorian Civil and Administrative Tribunal (VCAT) (Melbourne)
- Victims of Crime Assistance Tribunal (VOCAT) (Melbourne)
- Family Court of Australia (Melbourne)
- Federal Court of Australia (Melbourne)
- Federal Circuit Court of Australia (Melbourne)

Magistrates' Courts in NWMR include:

- Broadmeadows Magistrates' Court
- Heidelberg Magistrates' Court
- Melbourne Magistrates' Court
- Neighbourhood Justice Centre (Collingwood)
- Sunshine Magistrates' Court
- Werribee Magistrates' Court

Other significant infrastructure in NWMR includes:

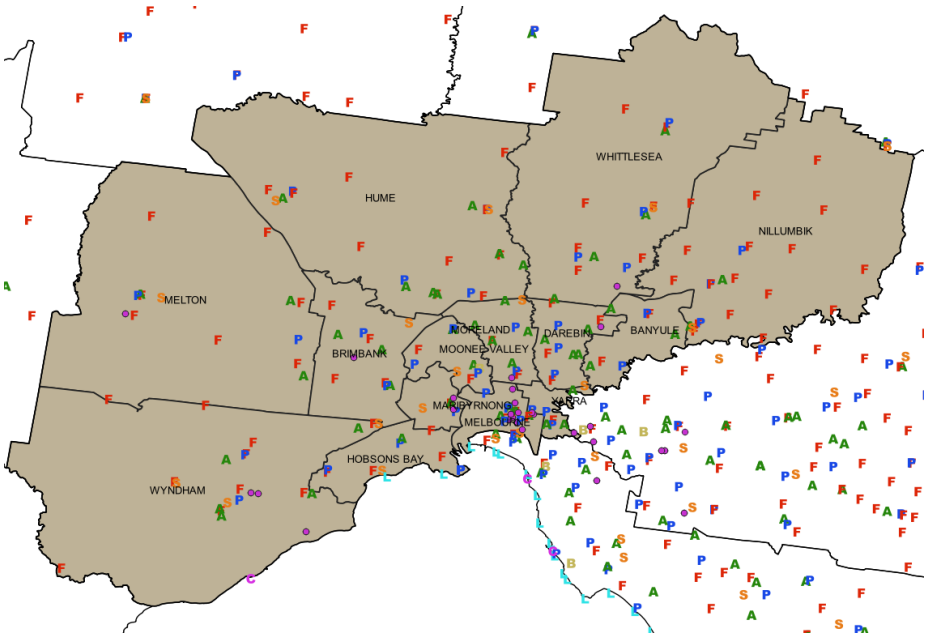
- Simpson Barracks (Yallambie)

7.8 Emergency services

NWMR is serviced by 39 police stations, 46 ambulance stations, 76 fire brigades, 15 SES units, two Life Saving Victoria (LSV) units and one Coast Guard flotilla. NWMR is also home to the headquarters for:

- Victoria Police (Docklands)
- SES (Southbank)
- Fire Rescue Victoria (East Melbourne)
- Life Saving Victoria (Port Melbourne)

Emergency services agencies are supported by the State Control Centre (SCC) in East Melbourne (the State's primary control centre for the management of Class 1 and some Class 2 emergencies), a Regional Control Centre (RCC) in Melton (a facility that enables the implementation of Command, Coordination and Control arrangements within a set regional boundary) and an Incident Control Centre (ICC) in Kangaroo Ground (where an Incident Controller and Incident Management Teams can manage response activities in an emergency).[168] These are shown in Table 20 and Figure 21. A map of emergency services in EMR is provided in Figure 20.



Red = Fire station (CFA and FRV) Green = Ambulance station Blue = Police station	Orange = SES Light Blue = Life saving Purple = Coast Guard

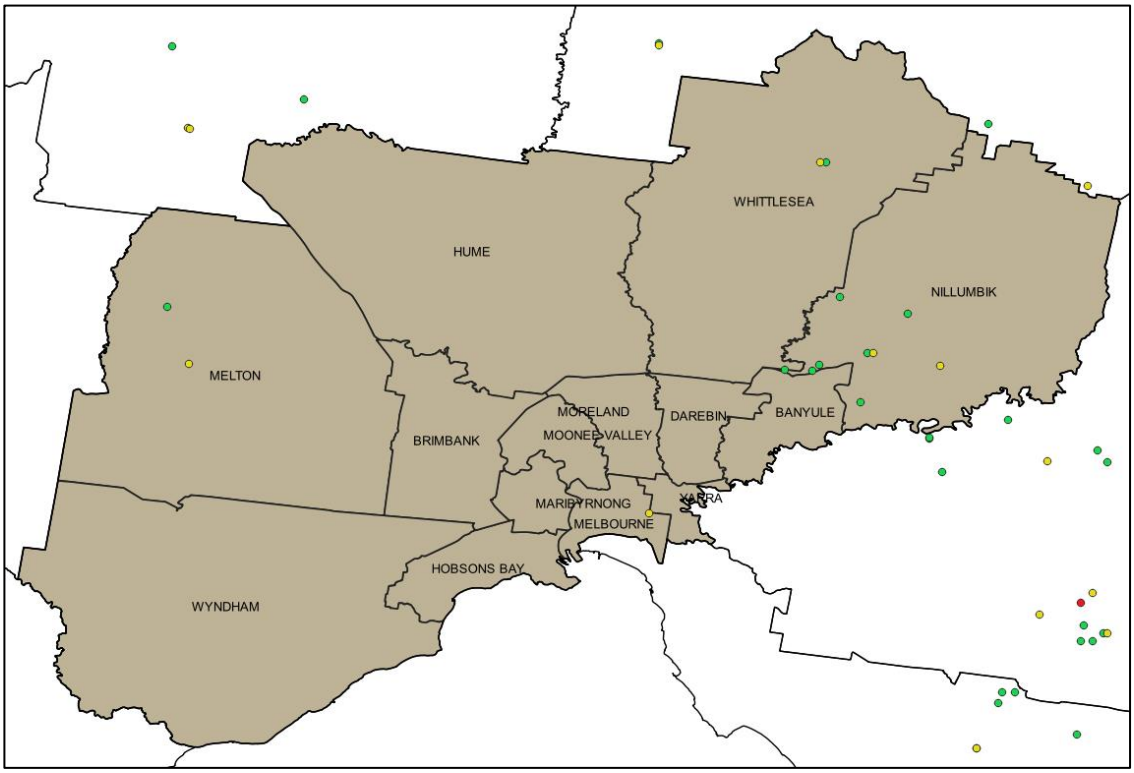
Figure 20. Emergency services in NWMR

168 EMV (2019): https://files-em.em.vic.gov.au/public/Doctrine/ManHand/VIC-EOpsHandbook.pdf

Table 20. Emergency services in NWMR by LGA[169]

		Ambulance			Fire		Police, SES and SLS			Emergency Coordination Facilities	
	LGA	Ambulance Stations[170]	Code 1 Response (% within 15 Mins)	Code 1 Response Time (Average Mins)	Fire Brigades	Fire Refuges and Neighbourhood Safer Places	Police Stations	SES Units	Surf Life Saving and Coast Guard	SCC and RCCs	ICCs
	Banyule	3	*91.3%*	10:15	2	0	2	0	0	0	0
	Brimbank	3	*89.7%*	10:22	5	0	2	2	0	0	0
	Darebin	4	*92.6%*	9:51	3	0	3	1	0	0	0
	Hobsons Bay	1	*85.6%*	10:50	3	0	4	1	2	0	0
	Hume	8	*85.9%*	11:05	10	0	4	3	0	0	0
	Maribyrnong	1	*90.9%*	10:09	2	0	1	1	0	0	0
	Melbourne	3	*93.2%*	8:48	4	0	3	1	0	1	0
	Melton	3	*81.6%*	11:32	9	1	2	1	0	1	0
	Moonee Valley	3	*87.5%*	11:16	2	0	4	1	0	0	0
	Moreland	4	*92.1%*	10:13	2	0	2	0	0	0	0
	Nillumbik	2	***67.7%***	13:41	17	7	3	1	0	0	1
	Whittlesea	3	*84.8%*	11:08	10	1	4	1	0	0	0
	Wyndham	5	*83.0%*	11:22	6	0	2	2	1	0	0
	Yarra	3	*92.3%*	9:04	1	0	3	0	0	0	0
Total	**Metro**	35	***90.6%***	10:05	24	0	24	7	2	1	0
	Interface	21	***82.6%***	11:45	52	9	15	8	1	1	1
	NWMR	**46**	***87.0%***	10.41	**76**	**9**	**39**	**15**	**3**	**2**	**1**

169 EMV (2020): Potential Impact Reports (by LGA)
170 Includes Air Ambulance Stations.



Yellow = Emergency Coordination Centres
Red = Community Refuge
Green = Neighbourhood Safer Places

Figure 21. Map of emergency coordination in NWMR

7.9 Other infrastructure assets and industries

7.9.1 Major Hazard Facilities

NWMR is home to a significant number of infrastructure assets and industries, including:

- Melbourne Water Corporation (Christmas Hills)
- Momentive Speciality Chemicals (Deer Park)
- Wesfarmers Kleenheat Gas (Deer Park)
- Australian Vinyls (Laverton North)
- Orica Australia (Laverton North)
- ALDI distribution Centre
- Americold (Laverton)
- Origin Energy LPG (Somerton)
- Shell Company of Australia (Spotswood)
- Shell Refining (Australia)
- Melbourne Airport fuel tanks (Hume)
- GHPL Coles Ambient Distribution Centre (Somerton)
- Hilton Food Meat Plant

- Coles Linfox Distribution Centre (Wyndham)
- Coles Chilled Distribution Centre (Laverton)
- Melbourne Liquor Distribution Centre
- Melbourne Market Authority

The following Major Hazard Facilities have been identified by WorkSafe Victoria [171].

- Terminals Pty Ltd (West Melbourne)
- Stolthaven Coode Island Pty Ltd (West Melbourne)
- FBT - Transwest Pty Ltd (Tottenham)
- Mobil Oil Australia Pty Ltd (Yarraville)
- Caltex Australia Petroleum Pty Ltd (Newport)
- Viva Energy Australia Ltd (Spotswood)
- Mobil Refining Australia Pty Ltd (Williamstown)
- Dow Chemical (Australia) Ltd (Altona)
- Mobil Refining Australia Pty Ltd (Altona)
- Mobil Refining Australia Pty Ltd (Altona)
- Qenos Pty Ltd (Altona)
- Hexion Pty Ltd (Deer Park)
- Elgas Limited (Deer Park)
- Nufarm Australia Ltd (Laverton North)
- Ixom Operations Pty Ltd (Laverton North)
- Ixom Operations Pty Ltd (Laverton North)
- Toll North Pty Ltd (Laverton North)
- Nufarm Australia Limited (Laverton North)
- Freight Specialists Pty Ltd (Truganina)
- Mobil Oil Australia Pty Ltd (Melbourne Airport)

Melbourne Airport is situated within the Municipality of Hume, the Airport is located in South of the municipality and is the second busiest airport in Australia. The Airport is a major passenger and freight gateway into Melbourne and sit on 2369 hectares. There are in excess of 35 million passengers per annum from either domestic or internal coming in and out of the airport. There are approximately 13,000 staff directly employed by freight operators.

171 https://content.api.worksafe.vic.gov.au/sites/default/files/2019-06/ISBN-Licensed-registered-major-hazard-facilities-2019-05.pdf

The Australia Post Entry facility for the state is located in Mickleham and situated on 144 hectares. The facility is used to quarantine plants, animal and insects.

7.9.2 Dependencies

The following infrastructure assets are key dependencies for this region:

- Gas pipeline: The Dandenong – West Melbourne Ring Main (crossing the Cities of Banyule, Brimbank, Darebin, Hume, Maribyrnong, Melbourne, Moonee Valley, Moreland and Whittlesea and Nillumbik Shire)
- Somerton Transmission Pipeline (crossing the Cities of Hume and Whittlesea)
- BHP Petroleum in Laverton North (City of Wyndham)
- Supply to Snowy Hydro Power Pipeline (City of Wyndham)
- Altona Oil refinery
- Melbourne Airport (MEL) in Tullamarine
- Essendon Airport (MEB) in Essendon Fields
- NSW TrainLink Southern (ARTC Managed Track): Sydney-Melbourne XPT
- Ballarat Line (Ararat line and Maryborough lines continue at Ballarat)
- Geelong Line (Warrnambool line continues at Geelong)
- Albury/Wodonga Line (*ARTC Managed Track from Craigieburn*[172])
- Western Standard Gauge Line (part of the Melbourne-Adelaide rail corridor and principal rail link for freight between Victoria and the western States)
- Roads/key connectors: Bolte Bridge, Burnley Tunnel, Princes Highway (links Melbourne to Geelong and then onto Adelaide), Calder Highway, CityLink, West Gate Bridge, West Gate Freeway

7.9.3 Tourism

One of NWMR's biggest claims to fame is its national and international sporting events, including:

- The Melbourne Cup and other racing events, held at Flemington Racecourse
- Australian Rules Football, held at the Melbourne Cricket Ground (MCG) (East Melbourne) and Marvel Stadium (Docklands)

172 https://www.artc.com.au/customers/operations/nib/sydney-craigieburn/

- The Australian Open Grand Slam tennis tournament, hosted at Melbourne Park and Olympic Park

Other popular tourist attractions include:

- Federation Square
- Royal Botanic Gardens
- The Arts Centre Melbourne and Southbank precinct
- National Gallery of Victoria
- Eureka Tower
- Queen Victoria Market
- Arcades, laneways and shopping precincts
- Melbourne Museum, Royal Exhibition Building and the Carlton Gardens
- Melbourne Zoo
- Werribee Open Range Zoo
- Shrine of Remembrance
- Queen Victoria Market
- Parliament House
- Immigration Museum
- Scienceworks
- Moonee Valley Racecourse
- Werribee Park Mansion
- State Rose Garden
- RAAF Museum

Major shopping centres and/or precincts include:

- The Bourke Street Mall and surrounds
- Emporium Melbourne
- The District Docklands
- Highpoint Shopping Centre (Maribyrnong)
- Watergardens Shopping Centre (Taylors Lake)
- Craigieburn Central (Craigieburn)
- Northland Shopping Centre
- Pacific Werribee
- Westfield Airport West
- Westfield Plenty Valley (Mill Park)
- Greensborough Plaza (Greensborough)
- Broadmeadows Central (Broadmeadows)

All of these locations attract large numbers of the population and tourists from all around the world and contribute significantly to the Victorian economy and reputation.

7.9.4 Cladding fire safety risk

The Victorian Building Authority (VBA) is in the process of conducting a State-wide audit of non-compliant building materials in Victoria, with a focus on reducing fire safety risks for buildings found to have combustible cladding.[173]

- On 25 November 2014, a fire in the 23-storey Lacrosse high-rise building in Docklands highlighted the fire safety risks of non-compliant external wall coverings. The fire, which spread vertically, directly affected approximately 500 residents who required immediate evacuation and accommodation.[174]

To date, more than 2,200 inspections have been undertaken and NWMR has been identified to have 657 privately owned buildings with cladding: 594 in the metro region and 63 in interface LGAs shown in Figure 22[175].

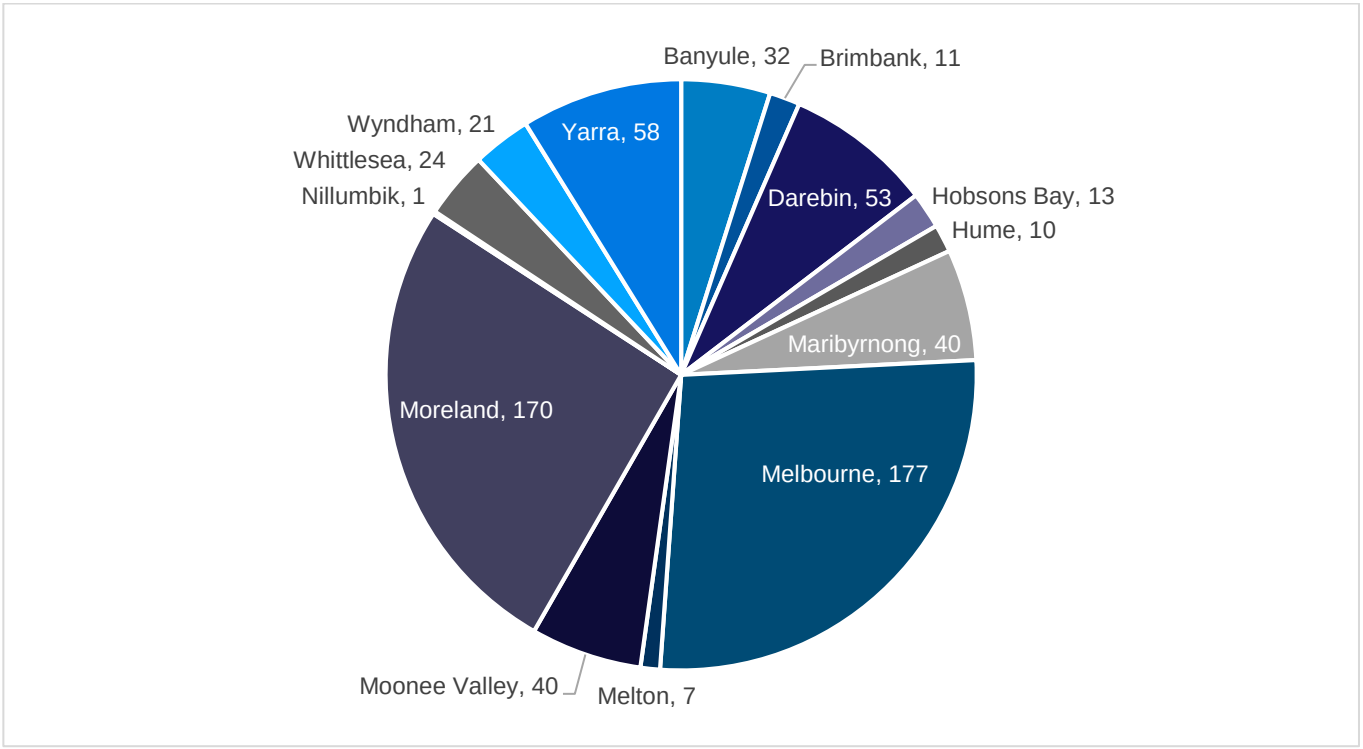


Figure 22: Number of privately owned buildings with cladding by LGA

[173] https://www.vba.vic.gov.au/cladding/audit

[174] https://www.melbourne.vic.gov.au/sitecollectiondocuments/mbs-report-lacrosse-fire.pdf

[175] https://www.vba.vic.gov.au/cladding/cladding-by-municipality

7.9.5 High Density Public Housing

North West metro has the most high density public housing than any other region with a total of 42 locations. They are located at the following addresses:

- 351 Barkly Street, Brunswick
- 478 Drummond Street, Drummond
- 522 Drummond Street, Drummond
- 20 Elgin Street, Carlton
- 38 Elgin Street, Carlton
- 480 Elgin Street, Carlton
- 510 Elgin Street, Carlton
- 530 Elgin Street, Carlton
- 141 Nicholson Street, Carlton
- 229 Hoddle Street, Collingwood
- 254 Hoddle Street, Collingwood
- 240 Wellington Street, Collingwood
- 140 Brunswick Street, Fitzroy
- 90 Brunswick Street, Fitzroy
- 125 Napier Street, Fitzroy
- 95 Napier Street, Fitzroy
- 29 Crown Street, Flemington
- 12 Holland Court, Flemington
- 120 Racecourse Road, Flemington
- 126 Racecourse Road, Flemington
- 130 Racecourse Road, Flemington
- 127 Gordon Street, Footscray
- 56 Derby Street, Kensington
- 94 Ormond Street, Kensington
- 33 Alfred Street, North Melbourne
- 76 Canning Street, North Melbourne
- 159 Melrose Street, North Melbourne
- 9 Pampas Street, North Melbourne
- 12 Sutton Street, North Melbourne
- 1 Holmes Street, Northcote
- 2 Cooke Court, Richmond
- 3 Cooke Court, Richmond
- 106 Elizabeth Street, Richmond
- 108 Elizabeth Street, Richmond
- 110 Elizabeth Street, Richmond
- 112 Elizabeth Street, Richmond
- 181 Elizabeth Street, Richmond
- 191 Elizabeth Street, Richmond
- 139 Highett Street, Richmond
- 63 Hanmer Street, Williamstown
- 235 Nelson Place, Williamstown

8. Social Environment

Social factors that influence the culture and institutions of NWMR include demographic characteristics and trends, and the values, norms and customs of the people who reside or work within or travel through the region.

8.1 Population

The following figures and tables show the current population statistics as at 2019 and the projected changes by 2036. Over two million people live in NWMR, making up approximately one third (34%) of the population of Victoria, but this proportion is likely to increase by 2036 (to 37.6%). In real terms, NWMR is projected to increase by more than a million people (to more than 3 million) with the majority taking up residence in interface councils (around 606,000 people). However, the rate of growth varies according to LGA: for example, Melton Shire is forecast to more than double in size (from approximately 150,000 to over 300,000 people) by 2036 while the Cities of Wyndham and Melbourne are forecast to grow by 69.8% and 63.5% respectively. Conversely, Nillumbik Shire is expected to grow by less than 8%.

Table 21. NWMR Population by LGA (2019)[176]

	LGA	Population [177]	Area (km^2)	Population Density (persons/km^2)
	Banyule	131,631	63	2,089
	Brimbank	209,523	123	1,703
	Darebin	164,184	54	3,040
	Hobsons Bay	97,751	64	1,527
	Hume	233,471	504	463
	Maribyrnong	93,448	31	3,014
	Melbourne	178,955	37	4,837
	Melton	164,895	528	312
	Moonee Valley	130,294	43	3,030
	Moreland	185,767	51	3,642
	Nillumbik	65,094	432	151
	Whittlesea	230,238	490	470
	Wyndham	270,487	542	499
	Yarra	101,495	20	5,075
Total	**Metro**	1,293,048	486	2,661
	Interface	964,185	2,496	386
	NWMR	**2,257,233**	**2,982**	757

176 ABS (2020): https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02018-19?OpenDocument
177 DJPR (2020): https://www.rdv.vic.gov.au/information-portal/table-and-chart

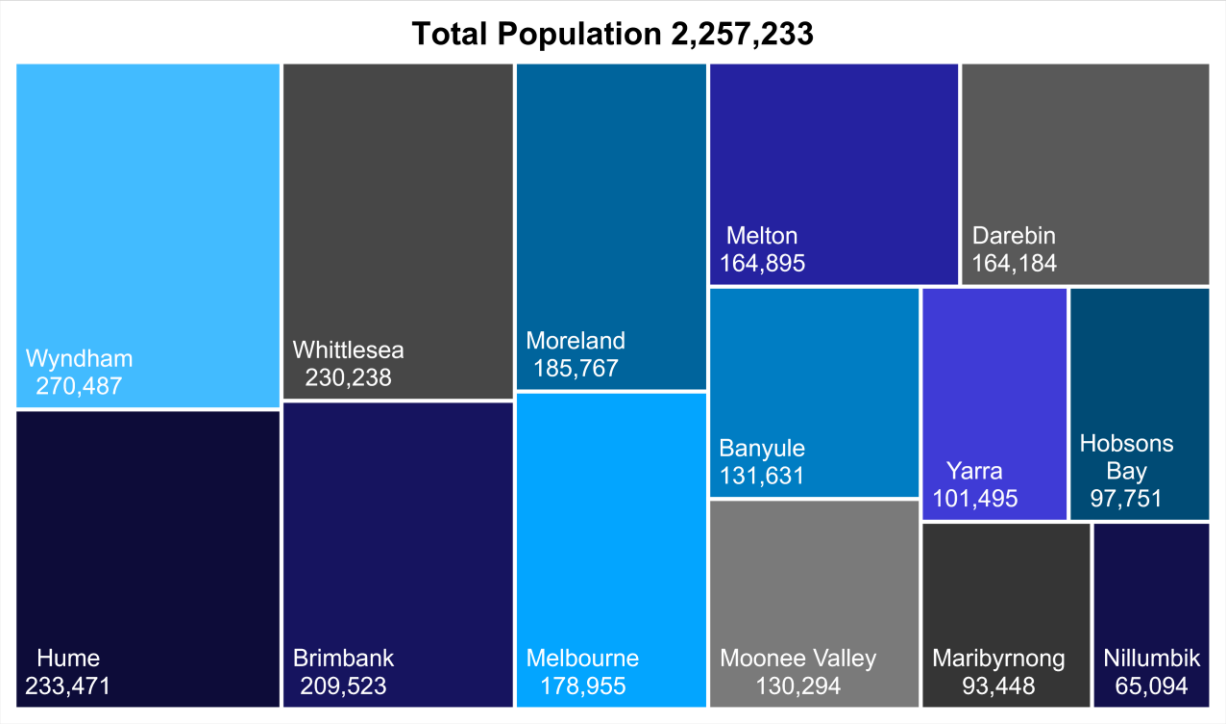


Figure 23. NWMR Population by LGA

Table 22. NWMR Estimated Population and Projections by LGA

		Estimated Population and Projections			
	LGA	**2019[178]**	**2036[179]**	**No. Increase**	**% Growth**
	Banyule	131,631	150,761	19,130	*14.5%*
	Brimbank	209,523	244,500	34,977	*16.7%*
	Darebin	164,184	210,649	46,465	*28.3%*
	Hobsons Bay	97,751	120,598	22,847	*23.4%*
	Hume	233,471	343,989	110,518	*47.3%*
	Maribyrnong	93,448	147,464	54,016	*57.8%*
	Melbourne	178,955	292,630	113,675	***63.5%***
	Melton	164,895	332,051	167,156	***101.4%***
	Moonee Valley	130,294	167,779	37,485	*28.8%*
	Moreland	185,767	241,544	55,777	*30.0%*
	Nillumbik	65,094	70,314	5,220	***8.0%***
	Whittlesea	230,238	364,453	134,215	*58.3%*
	Wyndham	270,487	459,216	188,729	***69.8%***
	Yarra	101,495	136,454	34,959	*34.4%*
Total	**Metro**	1,293,048	1,712,379	419,331	*32.4%*
	Interface	964,185	1,570,023	605,838	*62.8%*
	NWMR	**2,257,233**	**3,282,402**	**1,025,169**	**45.4%**
	VICTORIA	**6,596,039**	**8,722,766**	**2,126,727**	***32.2%***

178 ABS (2017): https://www.rdv.vic.gov.au/information-portal/table-and-chart
179 VIF2019 projections: https://www.planning.vic.gov.au/land-use-and-population-research/victoria-in-future/tab-pages/victoria-in-future-data-tables

8.2 Vulnerability indicators

In emergency management there are many population vulnerability indicators that have a geographical distribution and are relevant to natural hazard risk analysis. These include:

- The young, the elderly and those needing assistance, who may be dependent on others for care;
- Single parents, who may lack support for their dependent children;
- Income and public housing residency, which are indicators of socio-economic disadvantage and can have an impact on a household's ability to recover from a disaster;
- Education level and proficiency in English, which can limit understanding of warnings, risks and preparation advice;
- Car ownership, which may have an impact on a household's ability to evacuate;
- Unoccupied dwellings, which may reduce owners' engagement levels with the local community and reduce the likelihood that relevant preparations will be undertaken for their properties.[180]

Some of these indicators for NWMR are summarised in Table 23 and Figure 24

180 Inspector General for Emergency Management (2019): Review of emergency management for high-risk Victorian communities.

Table 23: Vulnerable Communities Indicators by LGA (2016) [181]

		Vulnerability Indicators (%)						
	LGA	Population aged 65+	Lone person households	People with a disability	People with poor English proficiency	Estimated homeless population	Population with no motor vehicles	Population with no internet connection at
	Banyule	*17.4*	*21.6*	*5.0*	*3.0*	*0.3*	*5.5*	*11.3*
	Brimbank	*13.6*	*15.6*	*6.4*	*13.4*	*0.8*	*6.4*	*16.6*
	Darebin	*14.2*	*24.6*	*6.0*	*7.3*	*0.7*	*11.3*	*16.0*
	Hobsons Bay	*14.8*	*22.2*	*5.6*	*4.9*	*0.4*	*6.7*	*15.1*
	Hume	*10.3*	*14.3*	*6.3*	*8.1*	*0.5*	*4.3*	*12.1*
	Maribyrnong	*9.7*	*23.0*	*4.7*	*9.2*	*0.9*	*12.0*	*12.9*
	Melbourne	*6.5*	*29.9*	*1.7*	*6.9*	*1.3*	*37.1*	*7.0*
	Melton	*8.4*	*14.0*	*4.9*	*3.9*	*0.2*	*2.9*	*10.4*
	Moonee Valley	*16.1*	*23.6*	*5.2*	*4.7*	*0.3*	*8.9*	*14.0*
	Moreland	*13.7*	*23.9*	*6.2*	*6.4*	*0.5*	*11.9*	*14.7*
	Nillumbik	*13.1*	*13.0*	*3.3*	*0.7*	*0.1*	*1.7*	*6.0*
	Whittlesea	*11.7*	*14.3*	*5.7*	*7.5*	*0.3*	*4.2*	*13.1*
	Wyndham	*7.5*	*12.9*	*3.9*	*5.7*	*0.3*	*3.2*	*8.8*
	Yarra	*10.5*	*28.1*	*3.5*	*5.1*	*1.0*	*17.4*	*9.0*
Total	**Metro**	*12.9*	*23.6*	*4.9*	*6.8*	*0.7*	*13.0*	*13.0*
	Interface	*10.2*	*13.7*	*4.8*	*5.2*	*0.3*	*3.3*	*10.1*
	NWMR	***12.0***	***20.1***	***4.9***	***6.2***	***0.5***	***9.5***	***11.9***

[181] https://blog.id.com.au/2020/population/demographic-trends/interactive-chart-is-your-community-demographically-vulnerable/#chart

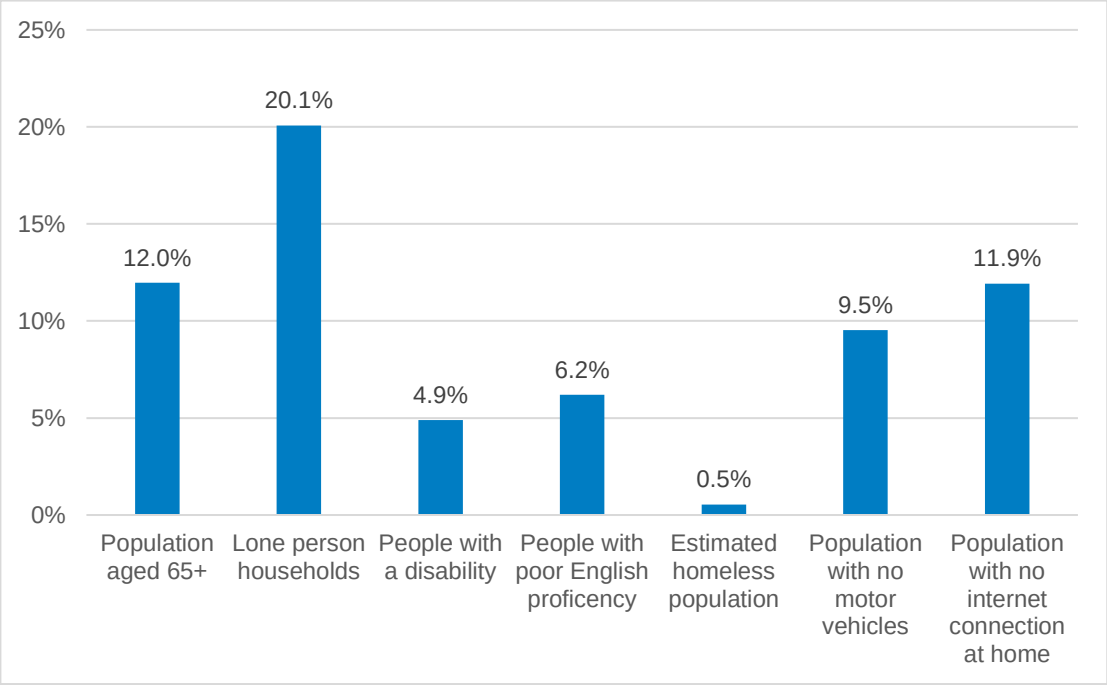


Figure 24: Vulnerable Communities Indicators for NWMR (2016)

8.2.1 The young, the elderly and those needing assistance

Within NWMR, 24.3% of the population was aged 19 years or younger in 2017, while 11.5% was aged 65 years or older. However, these vulnerable groups were not evenly distributed across the region: Wyndham had the highest number of people aged 0-19 years (74,427), while Yarra had the lowest (13,636); Brimbank had the highest number of people aged 65+ years (27,757), while Maribyrnong had the lowest (8,508). Although none of these proportions was wildly different to those for Victoria as a whole, there is a suggestion that those aged 20-44 years were slightly over-represented in NWMR, while those aged 45-85+ years were slightly under-represented. Refer Table 24.

Table 24. NWMR Population by age group (2017) [182]

		Age Group (Years)												
	LGA	**0-14**	**15-19**	***0-19 Subtotal***	**20-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**75-84**	**85+**	***65+ Subtotal***	**Total No.**
	Banyule	23,807	7,095	30,902	8,206	17,920	18,224	16,882	14,946	11,963	6,758	3,324	22,045	129,125
	Brimbank	38,481	12,534	51,015	16,806	34,952	27,463	25,927	23,089	16,598	8,180	2,979	27,757	**207,009**
	Darebin	25,366	7,196	32,562	12,978	32,026	24,453	20,151	14,766	10,036	7,851	3,922	21,809	158,745
	Hobsons Bay	17,811	4,791	22,602	5,775	14,484	14,182	13,176	10,944	7,322	4,443	2,150	13,915	95,078
	Hume	48,168	14,634	62,802	16,555	35,577	29,541	27,536	21,364	13,622	6,315	1,948	21,885	**215,260**
	Maribyrnong	14,300	3,657	17,957	8,114	21,292	15,046	10,515	7,929	4,505	2,611	1,392	8,508	89,361
	Melbourne	10,349	11,558	21,907	35,522	52,311	18,480	11,119	9,292	6,351	2,604	1,337	10,292	158,923
	Melton	36,766	9,651	46,417	10,005	23,391	24,529	18,326	13,341	8,515	3,189	931	12,635	148,644
	Moonee Valley	21,248	6,696	27,944	8,867	20,885	17,691	16,758	13,589	9,886	6,639	3,156	19,681	125,415
	Moreland	28,594	7,582	36,176	14,552	39,714	27,835	20,377	15,159	10,276	8,514	4,368	23,158	176,971
	Nillumbik	12,921	4,691	17,612	4,424	6,240	8,379	10,323	9,127	5,665	2,173	683	8,521	64,626
	Whittlesea	46,602	12,312	58,914	15,471	37,621	32,176	25,898	20,785	14,701	7,696	2,454	24,851	**215,716**
	Wyndham	60,497	13,930	74,427	15,340	45,561	40,927	27,276	19,529	11,728	4,854	1,458	18,040	**241,100**
	Yarra	10,755	2,881	13,636	8,099	29,917	15,142	10,603	8,589	5,886	3,014	1,095	9,995	95,981
Total	**Metro**	190,711	63,990	254,701	118,919	263,501	178,516	145,508	118,303	82,823	50,614	23,723	**157,160**	**1,236,608**
	%	*48.2%*	*53.7%*	*49.5%*	*65.8%*	*64.0%*	*56.8%*	*57.1%*	*58.4%*	*60.4%*	*67.6%*	*76.0%*	***64.7%***	***58.3%***
	Interface	204,954	55,218	260,172	61,795	148,390	135,552	109,359	84,146	54,231	24,227	7,474	**85,932**	**885,346**
	%	*51.8%*	*46.3%*	*50.5%*	*34.2%*	*36.0%*	*43.2%*	*42.9%*	*41.6%*	*39.6%*	*32.4%*	*24.0%*	***35.3%***	***41.7%***
	NWMR	**395,665**	**119,208**	**514,873**	**180,714**	**411,891**	**314,068**	**254,867**	**202,449**	**137,054**	**74,841**	**31,197**	**243,092**	**2,121,954**
	%	***18.6%***	***5.6%***	***24.3%***	***8.5%***	***19.4%***	***14.8%***	***12.0%***	***9.5%***	***6.5%***	***3.5%***	***1.5%***	***11.5%***	***100.0%***
	VICTORIA	**1,166,502**	**374,125**	**1,540,627**	**466,102**	**991,712**	**849,923**	**809,781**	**705,704**	**532,826**	**294,754**	**130,219**	**957,799**	**6,321,648**
	%	***18.5%***	***5.9%***	***24.4%***	***7.4%***	***15.7%***	***13.4%***	***12.8%***	***11.2%***	***8.4%***	***4.7%***	***2.1%***	***15.2%***	***100.0%***

182 ABS (2017): https://www.rdv.vic.gov.au/information-portal/table-and-chart

Table 25. NWMR Projected population by age group (2036) [183]

		Age Group (Years)												
	LGA	**0-14**	**15-19**	***0-19 Subtotal***	**20-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**75-84**	**85+**	***65+ Subtotal***	**Total No.**
	Banyule	25,125	9,268	34,393	10,422	18,943	19,420	19,910	17,223	13,948	10,890	5,612	55,288	150,761
	Brimbank	41,821	14,337	56,157	17,972	34,995	34,321	30,777	23,879	21,149	17,144	8,107	84,692	244,500
	Darebin	31,849	10,131	41,980	15,337	37,609	34,213	28,122	20,603	16,462	10,694	5,629	59,940	210,649
	Hobsons Bay	21,553	7,192	28,744	7,465	15,316	16,580	16,161	13,046	11,327	8,241	3,717	42,853	120,598
	Hume	69,601	24,661	94,262	23,927	42,794	47,959	47,070	33,392	28,051	19,004	7,532	101,641	343,989
	Maribyrnong	21,097	6,332	27,429	10,989	28,303	27,577	21,251	13,973	9,470	6,124	2,348	33,536	147,464
	Melbourne	27,480	14,050	41,530	34,302	79,942	69,040	36,760	14,011	7,673	5,656	3,715	30,374	292,630
	Melton	70,379	23,126	93,506	22,823	48,189	49,532	44,649	33,850	21,356	12,796	5,350	73,654	332,051
	Moonee Valley	26,451	8,968	35,419	11,261	25,449	24,966	23,136	17,671	14,541	10,217	5,118	54,634	167,779
	Moreland	37,737	11,142	48,878	16,843	44,498	42,141	34,753	22,127	16,109	10,647	5,547	59,060	241,544
	Nillumbik	11,859	4,484	16,342	4,075	6,473	9,213	9,647	7,823	7,517	6,547	2,677	30,805	70,314
	Whittlesea	75,188	25,313	100,501	25,531	47,893	53,869	51,727	33,943	24,286	17,711	8,993	92,986	364,453
	Wyndham	97,639	33,473	131,112	32,619	62,964	68,574	68,434	43,599	26,913	17,474	7,527	96,302	459,216
	Yarra	16,268	4,203	20,471	8,659	33,195	25,830	19,210	11,739	8,725	5,861	2,765	31,936	136,454
Total	**Metro**	249,380	85,623	335,002	133,251	318,250	294,088	230,081	154,273	119,404	85,474	42,558	452,313	1,712,380
	%	*43.4%*	*43.5%*	*43.5%*	*55.0%*	*60.4%*	*56.2%*	*50.9%*	*50.3%*	*52.5%*	*53.8%*	*57.0%*	*53.4%*	*52.2%*
	Interface	324,667	111,056	435,723	108,975	208,313	229,146	221,526	152,606	108,122	73,533	32,078	395,388	1,570,023
	%	*56.6%*	*56.5%*	*56.5%*	*45.0%*	*39.6%*	*43.8%*	*49.1%*	*49.7%*	*47.5%*	*46.2%*	*43.0%*	*46.6%*	*47.8%*
	NWMR	**574,047**	**196,679**	**770,726**	**242,226**	**526,563**	**523,234**	**451,607**	**306,879**	**227,526**	**159,007**	**74,636**	**847,701**	**3,282,403**
	%	***17.5%***	***6.0%***	***23.5%***	***7.4%***	***16.0%***	***15.9%***	***13.8%***	***9.3%***	***6.9%***	***4.8%***	***2.3%***	***25.8%***	***100.0%***
	VICTORIA	**1,484,771**	**511,324**	**1,996,095**	**585,796**	**1,232,559**	**1,266,034**	**1,146,896**	**886,495**	**771,700**	**568,029**	**269,162**	**2,948,620**	**8,722,766**
	%	***17.0%***	***5.9%***	***22.9%***	***6.7%***	***14.1%***	***14.5%***	***13.1%***	***10.2%***	***8.8%***	***6.5%***	***3.1%***	***33.8%***	***100.0%***

183 VIF2019 projections: https://www.planning.vic.gov.au/land-use-and-population-research/victoria-in-future/tab-pages/victoria-in-future-data-tables

Table 25 shows projections regarding population growth of particular age cohorts in NWMR and suggests that:

- The 65+ year old cohort will outnumber all other age groups, growing from 11.5% of NWMR's total population in 2017 to 25.8% in 2036. This represents an increase in NWMR from about a quarter of a million residents (243,092) to closer to a million (847,701) by 2036.
- The proportion of the NWMR population falling into the 0-19 year age group will remain roughly the same (24.3% in 2017 to 23.5% in 2036). However, in real numbers this cohort is likely to increase by more than a quarter of a million people (from 514,873 to 770,726 people).

When it comes to assistance with core activities, approximately five per cent of the population within NWMR have a need – in real terms that represents 98,449 people. However, the number of people in need varies according to LGA, from just 2.0% in Melbourne (2,372 people) in 2016 to 6.7% in Hume (12,429 people) and 6.9% in Brimbank (12,473 people). Refer Table 26 below.

Table 26. NWMR Population by need for assistance with core activities (2016) [184]

		Need for Assistance					
		Does not have a need		Has Need		Total	
	LGA	No.	%	No.	%	No.	%
	Banyule	109,269	*94.7%*	6,074	*5.3%*	115,343	*100.0%*
	Brimbank	168,546	*93.1%*	**12,473**	***6.9%***	181,019	*100.0%*
	Darebin	127,156	*93.5%*	8,772	*6.5%*	135,928	*100.0%*
	Hobsons Bay	78,398	*94.1%*	4,950	*5.9%*	83,348	*100.0%*
	Hume	172,151	*93.3%*	12,429	*6.7%*	184,580	*100.0%*
	Maribyrnong	72,148	*94.9%*	3,846	*5.1%*	75,994	*100.0%*
	Melbourne	117,145	*98.0%*	**2,372**	***2.0%***	119,517	*100.0%*
	Melton	119,076	*94.7%*	6,614	*5.3%*	125,690	*100.0%*
	Moonee Valley	103,017	*94.4%*	6,091	*5.6%*	109,108	*100.0%*
	Moreland	141,798	*93.4%*	10,070	*6.6%*	151,868	*100.0%*
	Nillumbik	56,445	*96.6%*	1,997	*3.4%*	58,442	*100.0%*
	Whittlesea	175,056	*94.0%*	11,264	*6.0%*	186,320	*100.0%*
	Wyndham	194,721	*95.8%*	8,457	*4.2%*	203,178	*100.0%*
	Yarra	75,298	*96.1%*	3,040	*3.9%*	78,338	*100.0%*
Total	**Metro**	992,775	*94.5%*	57,688	*5.5%*	1,050,463	*100.0%*
	Interface	717,449	*94.6%*	40,761	*5.4%*	758,210	*100.0%*
	NWMR	**1,710,224**	***94.6%***	**98,449**	***5.4%***	**1,808,673**	***100.0%***

184 ABS Census 2016: https://www.rdv.vic.gov.au/information-portal/table-and-chart

8.3 Diversity

8.3.1 Birthplaces and languages spoken

Ethnic and cultural indicators reflect a population's composition and can be useful indicators of socio-economic status. These characteristics can help inform decision-makers about a population's ability to access services and information and assist service providers determine the need to communicate in languages other than English.

The population of NWMR is culturally diverse with more than a third (38.7%) of the population born overseas. However, this varied according to LGA: for example, a greater proportion of the population of City of Brimbank was born overseas (51.6%) compared with Nillumbik Shire (16.3%). Refer Table 27.

In NWMR the most common countries of birth (other than Australia) were:

- India – which featured in the top three for all but two LGAs
- United Kingdom – which featured in 8 of the 14 LGAs
- Italy – which featured in 6 of the 14 LGAs

More than 40% of the population of NWMR speaks a language other than English at home. In some LGAs, the number of people who speak another language outnumber those who speak only English: for example, in Brimbank, approximately 62% of the population speak a language other than English at home. Similarly, other languages prevail over English in the City of Melbourne (54.3%). In contrast, Nillumbik Shire has the greatest proportion of English only speakers (90.4%). A breakdown by LGA is shown in Table 28.

In NWMR the most common languages spoken (other than English) were:

- Greek – which featured in the top three for 7 of the 14 LGAs
- Italian – which featured in 7 of the 14 LGAs
- Mandarin – which featured in 7 of the 14 LGAs

NWMR is also home to approximately one quarter (24.8%) of Victoria's Aboriginal and Torres Strait Islander peoples.[185] As a proportion of NWMR, however, Aboriginal and Torres Strait Islanders represent less than 1.0% of the total NWMR population (0.7%), ranging between 0.4% of the population in the Cities of Melbourne and, Moonee Valley and Nillumbik Shire, to 1.0% of the population in the Shire of Melton.

185 https://northwestpalliative.com.au/services_quickguide/nw-metro-regional-map/

Table 27. NWMR Population by Aboriginal and Torres Strait Islander (ATSI) status and birthplace and LGA (2016) [186]

		Birthplace										
		Australia				Elsewhere		Total		Top 3 Countries of Birth (other than Australia)[187]		
		ATSI[188]		All								
	LGA	No.	% NWMR	No.	%	No.	%	No.	%	1	2	3
	Banyule	706	*0.58%*	87,089	*75.3%*	28,611	***24.7%***	115,700	***100.0%***	**United Kingdom**	China	**Italy**
	Brimbank	816	*0.42%*	87,157	*48.4%*	92,992	***51.6%***	180,149	***100.0%***	Vietnam	**India**	Philippines
	Darebin	1,167	*0.79%*	86,911	*64.0%*	48,854	*36.0%*	135,765	***100.0%***	**Italy**	China	**India**
	Hobsons Bay	490	*0.55%*	56,177	*67.5%*	27,109	*32.5%*	83,286	***100.0%***	**United Kingdom**	**India**	New Zealand
	Hume	1,456	*0.74%*	113,841	*61.7%*	70,523	*38.3%*	184,364	***100.0%***	Iraq	**India**	Turkey
	Maribyrnong	431	*0.52%*	43,134	*56.7%*	32,969	*43.3%*	76,103	***100.0%***	Vietnam	**India**	China
	Melbourne	421	***0.35%***	44,439	*37.0%*	75,809	***63.0%***	120,248	***100.0%***	China	Malaysia	**India**
	Melton	1,288	***0.95%***	86,024	*67.9%*	40,601	*32.1%*	126,625	***100.0%***	**India**	Philippines	**United Kingdom**
	Moonee Valley	428	***0.37%***	76,902	*70.4%*	32,263	*29.6%*	109,165	***100.0%***	**Italy**	**India**	**United Kingdom**
	Moreland	813	*0.50%*	96,294	*63.5%*	55,234	*36.5%*	151,528	***100.0%***	**Italy**	**India**	**United Kingdom**
	Nillumbik	232	***0.39%***	48,958	*83.7%*	9,563	***16.3%***	58,521	***100.0%***	**United Kingdom**	**Italy**	New Zealand
	Whittlesea	1,635	*0.83%*	115,304	*62.2%*	70,128	*37.8%*	185,432	***100.0%***	**India**	**Italy**	North Macedonia
	Wyndham	1,732	*0.80%*	114,542	*55.9%*	90,214	*44.1%*	204,756	***100.0%***	**India**	New Zealand	**United Kingdom**
	Yarra	382	*0.44%*	53,057	*67.9%*	25,119	*32.1%*	78,176	***100.0%***	**United Kingdom**	New Zealand	Vietnam
Total	**Metro**	5,654	*0.5%*	631,160	*56.9%*	418,960	***59.9%***	1,050,120	***100.0%***			
	Interface	6,343	*0.8%*	478,669	*43.1%*	281,029	***40.1%***	759,698	***100.0%***			
	NWMR	**11,997**	***0.7%***	**1,109,829**	***61.3%***	**699,989**	***38.7%***	**1,809,818**	***100.0%***			

186 ABS Census 2016: https://www.rdv.vic.gov.au/information-portal/table-and-chart
187 .id (2020): profile.id.com.au
188 ABS Census 2016: https://www.rdv.vic.gov.au/information-portal/table-and-chart

Table 28. NWMR Population by language spoken at home (2016) [189]

		Language Spoken at Home								
		English Only		Other Language		Total		Top 3 Languages Spoken (other than English)[190]		
	LGA	No.	%	No.	%	No.	%	1	2	3
	Banyule	89,901	*77.3%*	26,431	*22.7%*	116,332	*100.0%*	**Mandarin**	**Italian**	**Greek**
	Brimbank	69,303	***37.9%***	113,454	***62.1%***	182,757	*100.0%*	Vietnamese	Punjabi	Filipino/Tagalog
	Darebin	82,620	*60.3%*	54,340	*39.7%*	136,960	*100.0%*	**Italian**	**Greek**	**Mandarin**
	Hobsons Bay	58,234	*69.3%*	25,757	*30.7%*	83,991	*100.0%*	Arabic	**Italian**	**Greek**
	Hume	97,598	*52.4%*	88,551	*47.6%*	186,149	*100.0%*	Arabic	Turkish	Assyrian/Aramaic
	Maribyrnong	42,044	*55.0%*	34,443	*45.0%*	76,487	*100.0%*	Vietnamese	**Mandarin**	Cantonese
	Melbourne	55,007	*45.7%*	65,452	*54.3%*	120,459	*100.0%*	**Mandarin**	Cantonese	Indonesian
	Melton	82,987	*65.6%*	43,582	*34.4%*	126,569	*100.0%*	Filipino/Tagalog	Vietnamese	Punjabi
	Moonee Valley	75,216	*68.4%*	34,718	*31.6%*	109,934	*100.0%*	**Italian**	**Greek**	Vietnamese
	Moreland	91,029	*59.5%*	62,047	*40.5%*	153,076	*100.0%*	**Italian**	Arabic	**Greek**
	Nillumbik	53,162	***90.4%***	5,635	***9.6%***	58,797	*100.0%*	**Italian**	**Greek**	**Mandarin**
	Whittlesea	100,995	*53.7%*	86,972	*46.3%*	187,967	*100.0%*	Macedonian	Arabic	**Italian**
	Wyndham	115,332	*56.4%*	89,168	*43.6%*	204,500	*100.0%*	Punjabi	Hindi	**Mandarin**
	Yarra	59,571	*75.5%*	19,316	*24.5%*	78,887	*100.0%*	Vietnamese	**Greek**	**Mandarin**
Total	**Metro**	622,925	*58.8%*	435,958	*41.2%*	1,058,883	*100.0%*			
	Interface	450,074	*58.9%*	313,908	*41.1%*	763,982	*100.0%*			
	NWMR	**1,072,999**	***58.9%***	**749,866**	***41.1%***	**1,822,865**	*100.0%*			

189 ABS (2016): https://www.rdv.vic.gov.au/information-portal/table-and-chart
190 .id (2020): profile.id.com.au

There are many Aboriginal languages. However, they do not have geographic boundaries. The most widespread in Victoria are the Kulin languages.[191] Figure 24 shows a map of Aboriginal languages around Victoria**.**

Figure 25: Map of Aboriginal languages of Victoria [192]

8.3.2 Income and housing

According to Socio-Economic Indexes for Areas (SEIFA), which measure the relative level of socio-economic advantage or disadvantage based on a range of Census characteristics (where higher scores indicate lower levels of disadvantage), NWMR overall (with a score of 1,009) is similar to Victoria overall (which has a score of 1,010). The metro and interface LGAs were also similar overall (1,009 and 1,008 respectively). When considered individually, Brimbank was the most disadvantaged (921) (and is ranked third most disadvantaged LGA in the State) and Nillumbik was the least disadvantaged (1,099) (and is ranked the least disadvantaged LGA in Victoria). Refer Table 20.

Other indicators of socio-economic status include income and housing. In NWMR in 2016:

- There were 777,999 private dwellings with an average of 2.7 people and 1.7 motor vehicles per dwelling.
- The City of Melbourne had the most private dwellings (75,516) while the City of Maribyrnong had the least (35,697).

[191] https://www.vcaa.vic.edu.au/Documents/alcv/History.pdf
[192] https://cv.vic.gov.au/stories/aboriginal-culture/our-story/vacl-language-map-of-victoria/

- The City of Melbourne had fewer average people per dwelling (2.0) compared to all other LGAs; The Cities of Hume and Wyndham had the most (3.1).
- On average, metro Councils had fewer people per dwelling (2.5) and fewer average motor vehicles per dwelling (1.5) than interface Councils (3.0 and 2.0 respectively).
- The average weekly income was $1,581 but varied greatly between LGAs, between $1,263 in the City of Brimbank to $2,098 in Nillumbik Shire.

These findings provide an indication of the number of properties that could be impacted in the event of an emergency and the relative ease with which people might be able to leave their dwellings by motor vehicle. However, those LGAs with higher average weekly incomes (e.g., Nillumbik and Yarra) did not necessarily correspond with the highest average number of motor vehicles, primarily because some are better serviced by public transport (e.g., Yarra – refer Table 29) than others.

Table 29. NWMR Household Statistics (2016) [193]

		Household Statistics				
	LGA	Private Dwellings (No.)	People per Dwelling (Avg. No.)	Motor Vehicles per Dwelling (Avg. No.)	Weekly Income ($)	SEIFA Index
	Banyule	50,153	2.6	1.8	$1,655	1,055
	Brimbank	69,223	3.0	1.9	**$1,263**	**921**
	Darebin	63,496	2.5	1.5	$1,423	1,004
	Hobsons Bay	37,146	2.6	1.7	$1,567	1,015
	Hume	67,360	**3.1**	2.0	$1,379	947
	Maribyrnong	**35,697**	2.5	1.4	$1,551	995
	Melbourne	**75,516**	**2.0**	0.7	$1,354	1,010
	Melton	46,691	3.0	2.0	$1,542	994
	Moonee Valley	50,119	2.5	1.6	$1,635	1,035
	Moreland	70,650	2.5	1.4	$1,503	1,014
	Nillumbik	21,741	3.0	2.3	**$2,098**	**1,099**
	Whittlesea	70,987	3.0	1.9	$1,444	991
	Wyndham	75,281	**3.1**	1.9	$1,620	1,009
	Yarra	43,939	2.1	1.1	**$1,958**	1,035
Total	**Metro**	**495,939**	**2.5**	**1.5**	$1,545	**1,009**
	Interface	**282,060**	**3.0**	**2.0**	$1,617	**1,008**
	NWMR	**777,999**	**2.7**	**1.7**	**$1,581**	**1,009**

193 ABS (2016): https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat

8.4 Education

Table 30 shows that approximately 1 in 4 persons (25.7%) of people over 15 years of age in the NWMR Region have a bachelor's degree or higher non-school qualification. Nearly 5% of people aged between 15-19 years old were not in some form of education or employment at the time of the 2016 census.

Table 30: Education level within NWMR (2016) [194]

Education level	Total	%
People over 15 with bachelor's degree or higher non-school qualification	430,839	*25.7%*
15-19 years old not in school or employment	5,608	*4.7%*

The number of children attending primary and secondary schools in NWMR is influenced by the age structure of the population and vice versa. In 2019 NWMR was home to a total of 554 Government, Catholic and Independent schools with 318,919 total enrolments. This represents approximately one quarter (24.6%) of all schools (2,254) and one third (32.3%) of all enrolments (988,436) within Victoria.[195]

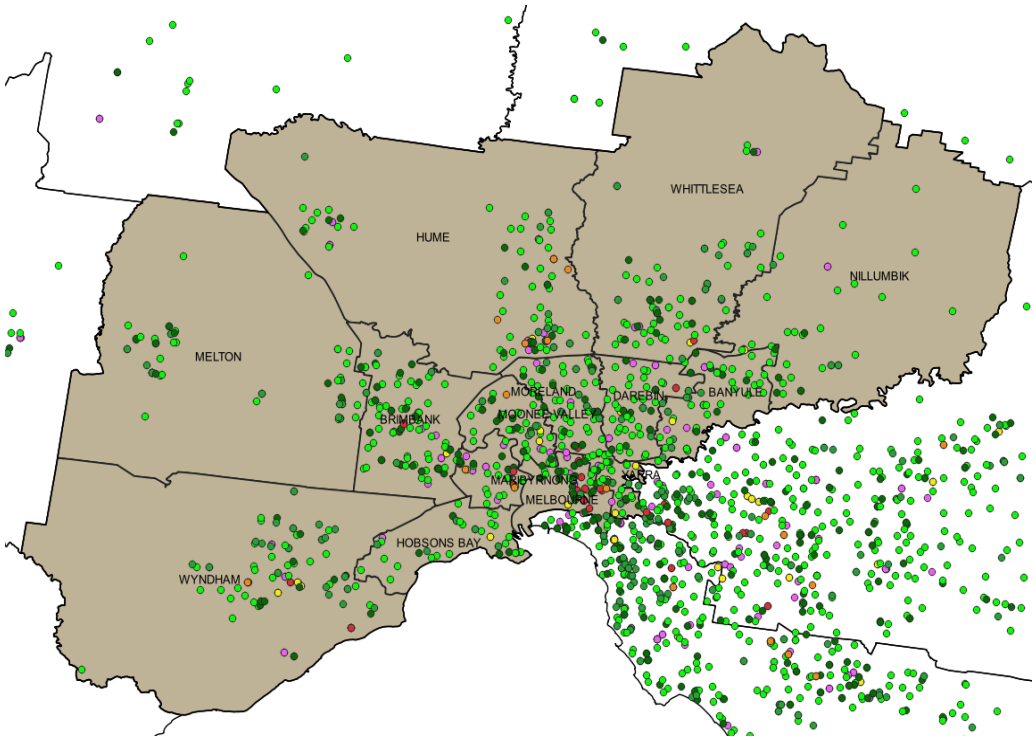
More schools were located in Metro LGAs of NWMR (328) compared to Interface LGAs (226). However, the total number of enrolments in each were similar (162,341 in Metro; 156,579 in Interface). Hume had the greatest number of schools (60), while Maribyrnong had the least (22). Wyndham had the highest number of enrolments (48,209) across all school sectors, while Nillumbik had the lowest (9,806). Refer Table 31. Figure 26 shows the location of educational facilities in the NWM Region.

194 DJPR (2020): https://www.rdv.vic.gov.au/information-portal/table-and-chart
195 DET (2020): https://www.education.vic.gov.au/about/department/Pages/factsandfigures.aspx

Table 31. NWMR Enrolments and Schools by LGA and type (2019) [196]

		School Sector							
		Government		Catholic		Independent		Total	
	LGA	Enrolments	No. Schools	Enrolments	No. Schools	Enrolments	No. Schools	Enrolments	No. Schools
	Banyule	14,176	28	6,715	11	2,303	3	**23,193**	**42**
	Brimbank	20,191	38	8,497	**19**	2,618	2	**31,306**	59
	Darebin	14,198	28	3,345	12	1,340	4	**18,883**	**44**
	Hobsons Bay	9,681	17	3,764	10	278	2	**13,723**	**29**
	Hume	24,416	**40**	7,671	14	6,829	6	**38,916**	**60**
	Maribyrnong	8,865	15	2,779	7	**28**	**0**	**11,672**	**22**
	Melbourne	**4,610**	**10**	**1,423**	5	4,463	**9**	**10,496**	**24**
	Melton	17,818	24	4,877	8	4,214	4	**26,909**	**36**
	Moonee Valley	11,068	20	7,813	14	3,540	2	**22,421**	**36**
	Moreland	11,117	27	5,109	14	3,178	3	**19,404**	**44**
	Nillumbik	7,023	20	1,497	**4**	1,286	3	**9,806**	**27**
	Whittlesea	22,222	35	8,386	14	2,132	3	**32,740**	**52**
	Wyndham	**31,264**	32	**9,564**	14	**7,380**	5	**48,209**	**51**
	Yarra	8,625	19	1,618	5	999	4	**11,242**	**28**
Total	**Metro**	102,530	202	41,063	97	18,747	29	**162,341**	**328**
	Interface	102,742	151	31,996	54	21,841	21	**156,579**	**226**
	NWMR	**205,272**	**353**	**73,059**	**151**	**40,589**	**50**	**318,919**	**554**

196 DET (2020): https://www.education.vic.gov.au/about/department/Pages/factsandfigures.aspx



Light Green = Primary school	Orange = Further education
Mid-green = Primary/secondary school	Yellow = Tertiary institution
Dark Green = Secondary school	Red = University
Pink = Special school	

Figure 26. Map of educational facilities within NWMR

Proximity to tertiary education can also have an influence over the age structure of the population and the degree to which educational opportunities are sought out, especially by young people in their late teens or early twenties.

Tertiary Institutions located within NWMR include:

- Australian Catholic University (Fitzroy)
- Gordon Institute of Tafe (Werribee)
- John Paul II Institute for Marriage and Family (East Melbourne)
- Kangan Batman Institute of TAFE (Broadmeadows; Docklands; Essendon; Moonee Ponds, Richmond)
- La Trobe University (Bundoora; Melbourne)
- Melbourne Polytechnic (Collingwood; Epping; Fairfield; Greensborough; Heidelberg; Preston)
- University of Melbourne (Burnley; Parkville; Southbank; Werribee)
- Monash University (Parkville)

- RMIT (Brunswick; Bundoora; Melbourne; Point Cook)
- Victoria University (Footscray; Melbourne; Melton; Newport; St Albans; Sunshine' Werribee East; Werribee West)
- William Angliss Institute of Tafe (Melbourne)

There are also approximately 1500 childcare facilities across the region (including childcare centres, pre-schools and kindergartens)

8.5 Health

The State Health Emergency Response Plan outlines arrangements for managing health emergencies (i.e., incidents requiring a significant and coordinated response from the health system, the Department of Health and Human Services and the emergency management sector, in partnership with the community) to ensure an effective response and ease adverse consequences.[197] Practitioners, health professionals, service organisations and government agencies may also be required to respond to local emergencies to care for the injured or unwell directly affected.

In an emergency, vulnerable populations such as those in hospitals, health care facilities and retirement villages, may require significant and coordinated priority interventions, responses and support for their safety.

NWMR is home to 86 hospitals, with the vast majority located in Melbourne's CBD, including emergency facilities at:

- Alfred Public Hospital (Melbourne)
- Austin Public Hospital (Heidelberg)
- Mercy Womens Hospital (Heidelberg)
- Northern Public Hospital (Epping)
- Royal Childrens Hospital (Parkville)
- Royal Melbourne Hospital (Parkville)
- Royal Victorian Eye and Ear Hospital (East Melbourne)
- Royal Womens Public Hospital (Parkville)
- St Vincents Public Hospital (East Melbourne)
- Werribee Mercy Hospital
- Western Hospital (Footscray)
- Western Hospital (Sunshine)
- Williamstown Public Hospital

197 DHHS (2020): https://www2.health.vic.gov.au/emergencies/shera

NWMR has 15 hospitals with an intensive care unit with a total of 294 beds available. A list of hospitals and their ICU beds is as follows:

- Alfred Public Hospital (56)
- Austin Public Hospital (31)
- Epworth Hospital Freemasons (8)
- Epworth Hospital – Richmond (26)
- John Fawkner Private Hospital (5)
- Melbourne Private Hospital (10)
- Northern Public Hospital (18)
- Royal Childrens Hospital (30)
- Royal Melbourne Hospital (42)
- St Vincent's Private Hospital (19)
- St Vincent's Private Hospital (8)
- Warringal Private Hospital (6)
- Werribee Mercy Hospital (8)
- Western Hospital – Footscray (14)
- Western Hospital – Sunshine (13)

NWMR is also home to 82 health care facilities (including maternal and child health centres, community health centres and community mental health centres), 101 retirement villages and three palliative care catchment areas funded by DHHS and serviced by:

- Mercy Palliative Care (Brimbank, Hobsons Bay, Maribyrnong, Melbourne, Melton, Moonee Valley, Wyndham)
- Melbourne City Mission Palliative Care (Darebin, Hume, Moreland, Yarra)
- Banksia Palliative Care (Banyule, Nillumbik, Whittlesea)[198]

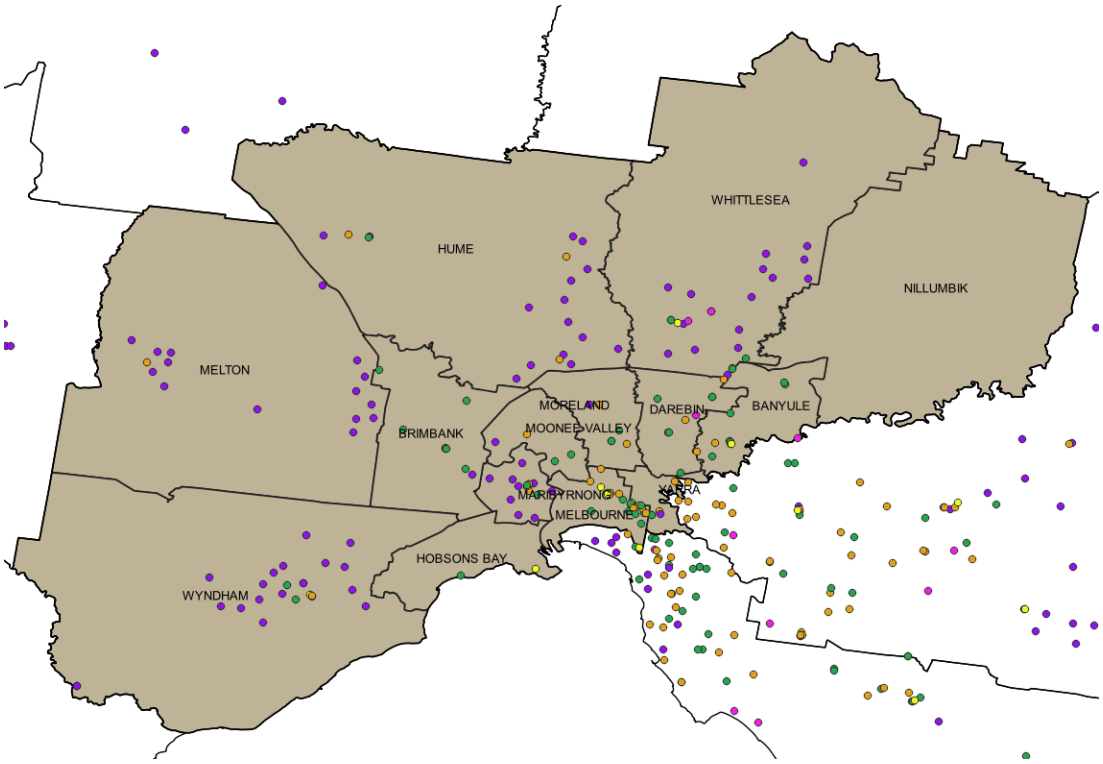
Table 32 shows that Health care facilities are more common in Interface Councils (66; compared to 16 in metro areas); Retirement villages are concentrated in metro areas with the majority in Banyule (16) and Darebin (16). A map of hospitals, health care facilities and retirement villages in NWMR is provided in Figure 27. This indicates that most of the hospitals are in the urban area, while the community health services are located around the urban fringe.

198 https://northwestpalliative.com.au/services_quickguide/nw-metro-regional-map/

Table 32. NWMR Hospitals, Health Care Facilities, Retirement Villages, Aged Care[199]

		Health				
	LGA	Hospitals	ICU Beds	Health Care Facilities[200]	Retirement Villages	Aged Care Facilities
	Banyule	8	6	1	**16**	19
	Brimbank	7	13	1	9	19
	Darebin	7	**0**	2	**16**	**23**
	Hobsons Bay	2	**0**	**0**	**3**	9
	Hume	4	**0**	15	4	13
	Maribyrnong	8	14	9	5	10
	Melbourne	**26**	**204**	**0**	4	**6**
	Melton	1	**0**	15	8	**6**
	Moonee Valley	3	**0**	1	4	19
	Moreland	4	5	1	9	**23**
	Nillumbik	**0**	**0**	**0**	6	8
	Whittlesea	6	18	**19**	5	18
	Wyndham	4	8	17	7	9
	Yarra	6	26	1	5	11
Total	**Metro**	**71**	**268**	**16**	**71**	**139**
	Interface	**15**	**26**	**66**	**30**	**54**
	NWMR	**86**	**294**	**82**	**101**	**193**

199 EMV (2020): Potential Impact Reports by LGA.
200 Including community and maternal-child health centres.



Pink = Community health centre	Orange = General hospital
Purple = Maternal/child health centre	Yellow = General hospital (emergency)
Green = Day procedure centre	

Figure 27. Map of hospitals, health care facilities and retirement villages in NWMR

Table 33 shows the number of people in NWMR who accessed aged care support at some stage during 2018-19 reporting period. This number is part of the number of people in the community who may need some assistance during an evacuation or emergency.

Table 33. Number of people accessing aged care support (2018-19)[201]

	Type of Aged Care			
Age Bracket (years)	**Home**	**Residential**	**Transition**	**Total**
0–49	4	40	2	46
50–54	14	72	-	86
55–59	49	127	7	183
60–64	107	250	5	362
65–69	406	511	13	930
70–74	836	876	24	1,736
75–79	1,204	1,250	35	2,489
80–84	1,573	2,240	59	3,872

201 https://www.gen-agedcaredata.gov.au/Resources/Access-data/2020/March/GEN-data-People-using-aged-care

85–89	1,420	3,046	53	4,519
90–94	710	2,718	27	3,455
95–99	165	916	13	1,094
100+	18	94	2	46
Total	**6,506**	**12,140**	**239**	**18,885**

Figure 28 shows the location of aged care facilities across the North West Metro Region. Most are located in the urban municipalities.

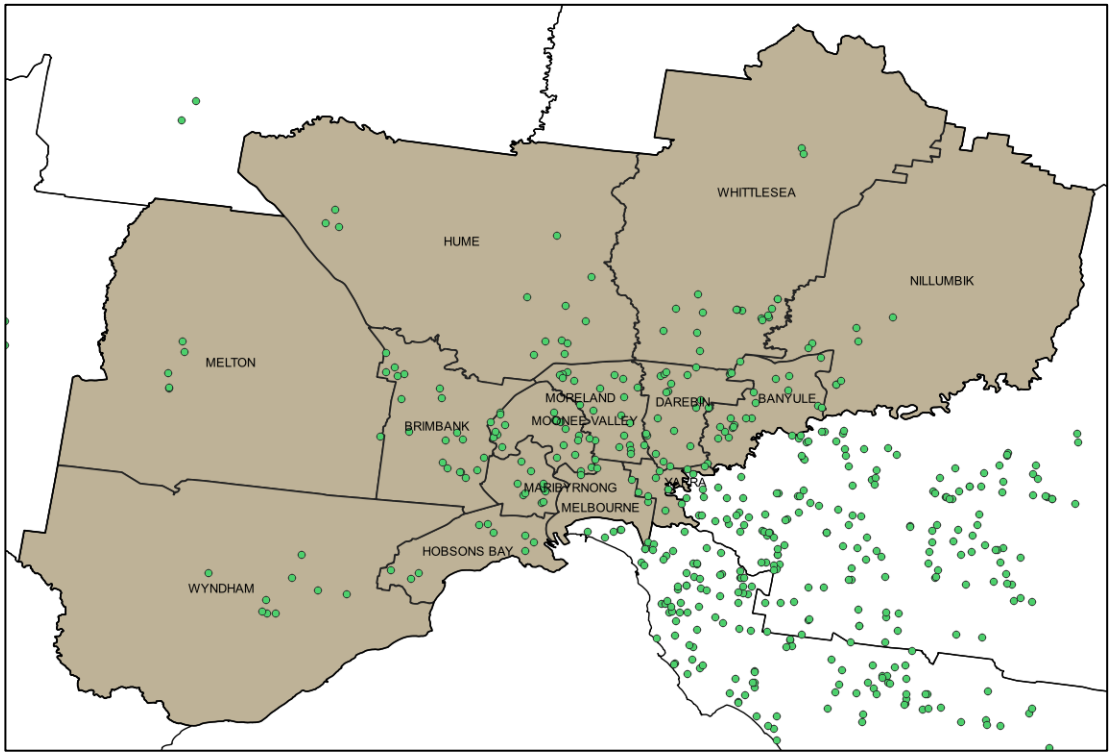


Figure 28. Map of Aged Care facilities in NWMR

8.6 Cultural values and assets

Local Aboriginal Networks or Gathering Places, which provide connections and services for Aboriginal people, are located in Maribyrnong, Wyndham, Hobsons Bay, Hume and Whittlesea.[202]

202 Aboriginal Victoria (2020): https://www.aboriginalvictoria.vic.gov.au/melbourne-local-aboriginal-networks-and-gathering-places

Other significant cultural assets include art galleries and museums, as outlined below:[203]

Table 34. NWMR Art Galleries and Museums by LGA

LGA	Art Galleries and Museums
Banyule	Napier Waller House
Darebin	Bundoora Homestead Art Centre Islamic Museum of Australia
Hobsons Bay	Altona Homestead Arhs Newport Railway Museum Railway Museum Scienceworks St Johns Ambulance Australia Museum The Substation Woods Street Arts Space
Maribyrnong	Melbournes Living Museum of The West
Melbourne	Artplay Australian Centre for The Contemporary Art Australian Centre for The Moving Image (ACMI) Champions Australian Racing Museum Grainger Museum Hellenic Museum Johnson Collection Latrobes Cottage Meat Market Craft Centre Melbourne Immigration Museum Melbourne Maritime Museum Melbourne Museum Museo Italiano Museum of Australian Chinese History National Gallery of Victoria National Sports Museum Old Treasury Building The Ian Potter Centre NGV Australia
Moonee Valley	Incinerator Gallery
Nillumbik	Andrew Ross Museum Eltham Performing Arts Centre Montsalvat
Wyndham	Wyndham Art Gallery Wyndham Cultural Centre
Yarra	Abbotsford Convent Australian Print Workshop Gallery Herring Island Gallery Sutton Centre

Figure 29 shows two layers that represent areas of cultural and heritage sensitivity. The first in orange, shows the areas of cultural heritage sensitivity that are known or likely to contain places and objects of

203 Data Vic (2020): https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest

significance to Aboriginal cultural heritage. These are defined in the *Aboriginal Heritage Regulations 2018* and include areas around designated watercourses and waterways, areas surrounding known Aboriginal cultural heritage places and areas with landforms and soil types that are similar to known cultural heritage places. While the areas shown are more likely to contain a higher number of cultural heritage places and objects, these places can be found all over Victoria where Aboriginal people have lived.[204] The areas in blue highlight locations that have been included in the Victorian Heritage Register showing places, objects and shipwrecks that are currently protected under the *Heritage Act 2017*.[205]

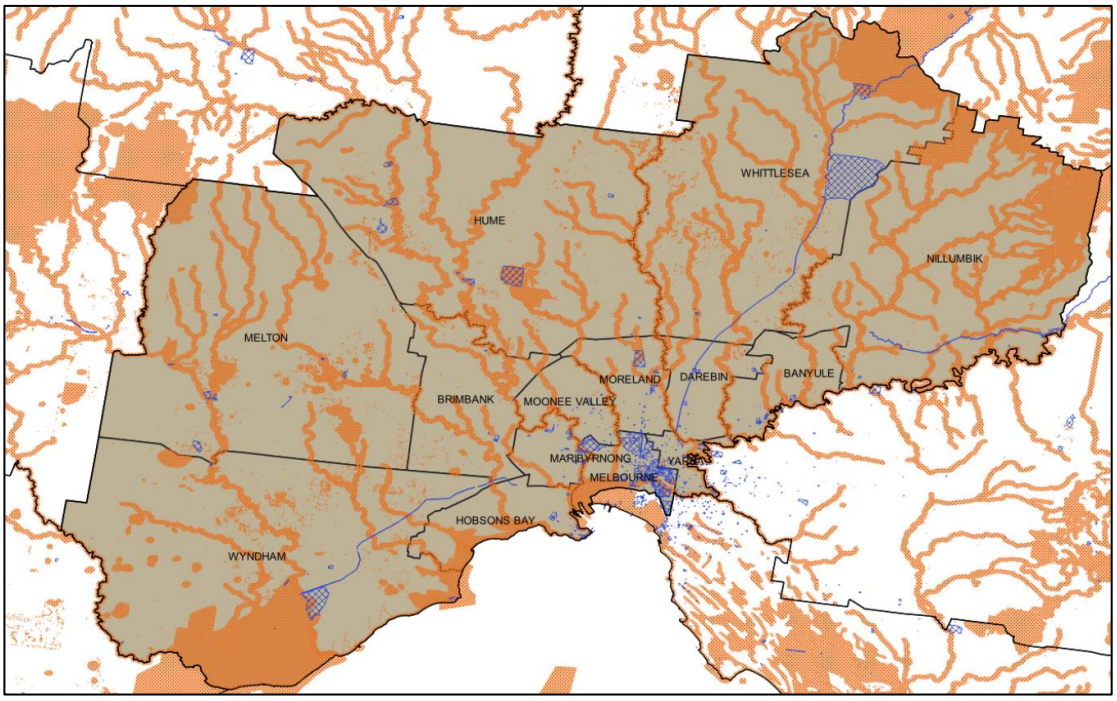


Figure 29. Areas of cultural and heritage significance[206] [207]

8.7 Volunteerism

An indication of a region's level of community volunteering is an important vulnerability factor because volunteers and their social networks can be of assistance during emergencies.

In 2016 it was estimated that approximately 17% of the NWMR population volunteered – in real terms this represents 246,125 people. However, this varied according to LGA: for example, more than a quarter of Nillumbik residents identified as volunteers (25.2%) compared with Brimbank residents (11.9%).

204 https://www.aboriginalvictoria.vic.gov.au/cultural-heritage-sensitivity
205 https://vhd.heritagecouncil.vic.gov.au/
206 https://discover.data.vic.gov.au/dataset/areas-of-cultural-heritage-sensitivity
207 https://discover.data.vic.gov.au/dataset/victorian-heritage-register

Table 35. NWMR Population by volunteer status (2016) [208]

		Volunteering					
		Not a Volunteer		Volunteer		Total	
	LGA	No.	%	No.	%	No.	%
	Banyule	73,425	*78.2%*	20,417	*21.8%*	93,842	*100.0%*
	Brimbank	128,260	*88.1%*	17,346	***11.9%***	145,606	*100.0%*
	Darebin	92,411	*81.8%*	20,578	*18.2%*	112,989	*100.0%*
	Hobsons Bay	55,042	*81.7%*	12,292	*18.3%*	67,334	*100.0%*
	Hume	124,062	*87.3%*	18,075	*12.7%*	142,137	*100.0%*
	Maribyrnong	51,902	*82.1%*	11,335	*17.9%*	63,237	*100.0%*
	Melbourne	87,891	*78.6%*	23,904	*21.4%*	111,795	*100.0%*
	Melton	80,969	*86.4%*	12,729	*13.6%*	93,698	*100.0%*
	Moonee Valley	72,617	*80.8%*	17,306	*19.2%*	89,923	*100.0%*
	Moreland	103,745	*82.0%*	22,816	*18.0%*	126,561	*100.0%*
	Nillumbik	34,943	*74.8%*	11,788	***25.2%***	46,731	*100.0%*
	Whittlesea	127,293	*87.6%*	18,028	*12.4%*	145,321	*100.0%*
	Wyndham	128,548	*85.0%*	22,656	*15.0%*	151,204	*100.0%*
	Yarra	52,382	*75.7%*	16,855	*24.3%*	69,237	*100.0%*
Total	**Metro**	717,675	*81.5%*	162,849	*18.5%*	880,524	*100.0%*
	Interface	495,815	*85.6%*	83,276	*14.4%*	579,091	*100.0%*
	NWMR	**1,213,490**	***83.1%***	**246,125**	***16.9%***	**1,459,615**	***100.0%***

According to the Ministerial Council for Volunteers (2017), approximately 4% of volunteers work for an emergency services organisation[209] and EMV estimates over 100,000 people in Victoria volunteer across a wide range of emergency management agencies.[210]

As at 1 July 2020, CFA Victoria noted its volunteer membership at 53,311 people, with an additional 1,486 junior members.[211]

In addition to well-known volunteer services such as the CFA and SES, other agencies operating within NWMR[212] to assist with advocacy and sector development and the recruitment and management of volunteers include:

- Volunteering Victoria (West Melbourne)
- Darebin Information, Volunteer and Resource Service (Preston)
- Volunteers of Banyule (West Heidelberg)
- Volunteer West (Altona)

208 ABS (2016): https://www.rdv.vic.gov.au/information-portal/table-and-chart
209 Ministerial Council for Volunteers (2017): https://iepcp.org.au/wp-content/uploads/2018/11/MCV-Volunteers-in-Victoria-report.pdf
210 EMV (2015): https://www.emv.vic.gov.au/volunteerstatement
211 CFA (2020): https://www.cfa.vic.gov.au/about/cfa-at-a-glance
212 Volunteering Victoria (2020): https://www.volunteeringvictoria.org.au/for-volunteers/volunteer-support-in-your-region/

- Hume Volunteer Gateway (Broadmeadows)
- Whittlesea Community Connections (Epping)
- Nillumbik Council (Greensborough)
- City of Wyndham (Werribee)

Volunteering is evolving in Victoria, particularly with respect to growing expectations around community responsibility for emergency preparedness, the impact on operations of new communications technology, and the characteristics of volunteers. For example, volunteering styles are becoming more diverse, but also more episodic, while physical locations and office hours are becoming less of a constraint to people volunteering their time and staying connected. However, in their series of reports, Emergency Volunteering 2030,[213] the authors found that:

- Community sector groups anticipate a serious shortage of volunteers in the future, mounting expectations to deliver emergency services, a rise in costs and poorer outcomes for communities.
- Volunteerism managers foresee growing regulation and corporatisation impacting negatively on volunteer sustainability.
- Local government managers have flagged the need to examine how resourcing and funding options and restrictions may be hindering the emergency management sector's ability to respond to the changing landscape of volunteering.

213 DIIS (2019): https://emergencyvolunteeringau.dropmark.com/594398?q=%23Emergency-Volunteering-2030-study%20%23report

9. Economic Environment

An understanding of NWMR's economic resilience can play an important role in emergency management planning by providing some context to how adversity might affect local economies and the degree to which different communities are likely to cope with the ongoing effects of emergencies.

9.1 Economic situation

New modelling from the Department of Treasury and Finance suggests the coronavirus pandemic has had a potentially unprecedented impact on Victoria's economy. It is likely the State will record negative economic growth for the current and next financial years.

- Gross regional product (GRP)[214] is expected to drop by 14% in the June and September quarters as a consequence of lower incomes, loss of consumer and business confidence and disruptions to global supply chains.
- Unemployment is expected to rise to 11% in the September quarter and the number of jobs has already fallen by almost 7% across Victoria since March 2020. [215]

While the true extent of the impact on EMR is unclear, it is likely to reflect the economic trends for Victoria. and may even be harder hit in some areas where construction and international education have witnessed a boom from high immigration and population growth in recent years. According to leading economists, population growth for Victoria was around 140,000 people in 2018 but will likely drop to 40,000 people in 2021. This will reduce the demand for housing and reduce the number of construction jobs.[216]

9.1.1 Key economic indicators

Key economic indicators across NWMR for the period 2017-2018 are summarised below:

- GRP reflects each LGA's contribution to the broader State economy and the value of the local economy.
    - Overall, NWMR contributed over $184 billion to the Victorian economy, which was 47.6% of the total for the State (more than $387 billion).
    - At the LGA level, the City of Melbourne contributed the most at over $91 billion; Nillumbik Shire contributed the least at less than $2 billion.
- GRP per worker provides an indication of workforce participation.

214 GRP
215 DTF (2020): https://www.dtf.vic.gov.au/economic-and-financial-updates/coronavirus-economic-outlook
216 SGS (2020): https://www.theage.com.au/national/victoria/vic-economy-in-biggest-slump-since-depression-20200412-p54j6k.html

  - Overall, NWMR had a slightly lower than average rate of productivity at $121,338 per worker, compared with $127,912 per worker for Victoria.
  - At the LGA level, Melbourne's productivity rate was the highest at $164,872 per worker while Brimbank's was the lowest at $106,059 per worker.

- The number of businesses is an indicator of active trade within the economy.
  - Overall, NWMR hosted 185,966 businesses, representing 32.8% of all businesses in Victoria (566,056).
  - The number of businesses in Metro LGAs (127,611) was more than double the number of businesses in Interface LGAs (58,355).
  - At the LGA level, the City of Melbourne had the highest number of businesses (38,430) while Nillumbik had the lowest (6,438).
- The number of local jobs reflects the health of the labour market.
  - Overall, NWMR provided over 1.3 million jobs, which was 44.3% of the total number of jobs for the State (over 3.0 million jobs).
  - Not surprisingly, Metro LGAs had many more jobs (more than one million) than Interface LGAs (approximately 310,000 jobs).
  - At the LGA level, the City of Melbourne had the highest number of jobs (more than half a million); Nillumbik had the lowest number of jobs (around 16,000).
- The unemployment rate measures the loss of productive resources to the economy.
  - Overall, NWMR's unemployment rate (6.2%) was higher than the State average (4.8%).
  - Interface LGAs had a slightly higher rate of unemployment (6.7%) compared with Metro LGAs (5.9%).
  - The unemployment rate varied greatly across LGAs, from 2.1% in Nillumbik Shire to 11.2% in the City of Brimbank.

Refer Table 36 for a breakdown by LGA.

Table 36. Key economic indicators for NWMR by LGA (2017-2018) [217]

		Economic Indicators				
	LGA	GRP ($ million)	Productivity: GRP per worker ($)	Businesses (No.)	Local jobs (No.)	Unemployment Rate
	Banyule	$5,539	$110,552	10,751	50,105	*3.5%*
	Brimbank	$9,075	**$106,059**	13,597	85,569	***11.2%***
	Darebin	$7,134	$120,190	12,123	59,356	*5.7%*
	Hobsons Bay	$5,428	$127,782	7,019	42,482	*5.8%*
	Hume	$13,794	$118,022	15,829	116,881	*9.2%*
	Maribyrnong	$5,297	$118,389	6,970	44,748	*6.9%*
	Melbourne	**$91,135**	**$164,872**	**38,430**	**552,760**	*3.9%*
	Melton	$3,641	$119,856	7,555	30,382	*8.9%*
	Moonee Valley	$5,388	$119,533	11,007	45,082	*4.8%*
	Moreland	$5,831	$121,681	12,946	47,921	*6.0%*
	Nillumbik	**$1,877**	$113,710	**6,438**	**16,513**	***2.1%***
	Whittlesea	$7,597	$110,079	13,645	69,015	*5.8%*
	Wyndham	$9,442	$122,072	14,888	77,351	*7.5%*
	Yarra	$13,200	$125,932	14,768	104,822	*5.5%*
Total or Average	**Metro**	**$148,027**	$123,888	**127,611**	**1,032,845**	***5.9%***
	Interface	**$36,351**	$116,748	**58,355**	**310,142**	***6.7%***
	NWMR	**$184,378**	**$121,338**	**185,966**	**1,342,987**	***6.2%***
	Victoria	**$387,419**	**$127,912**	**566,056**	**3,028,790**	***4.8%***

9.1.2 Industry and employment

The main industries by number of jobs in NWMR overall in 2016 were Health Care and Social Assistance jobs (117,170), Professional, Scientific and Technical jobs (112,228) and Retail jobs (92,979). However, the most common industries varied across the region:

- Education and Training jobs were the predominant industry in Darebin and Nillumbik, (6,854 and 1,911 jobs respectively).
- Healthcare and Social Assistance jobs were the predominant industry in Banyule (12,571 jobs), Maribyrnong (6,209), Moreland (6,422), Whittlesea (8,081) and Yarra (14,300).
- Manufacturing was the predominant industry in Brimbank (9,585 jobs) and Hobsons Bay (6,368).

217 .id (2020): https://economic-indicators.id.com.au/?Year=2018andStateId=2

- Professional, scientific and technical industries were the predominant industry in the City of Melbourne (77,929).
- Retail jobs were the predominant industry in Melton (3,416 jobs), Moonee Valley (5,867) and Wyndham (7,983).
- Transport, Postal and Warehousing industries were the predominant industries in Hume (17,841 jobs).

Refer Table 37 for a breakdown by LGA.

Table 37. Jobs by industry and LGA for NWMR (2016) [218]

	LGA	Accommodation and Food Services	Construction	Education and Training	Electricity, Gas, Water and Waste Services	Financial and Insurance Services	Health Care and Social Assistance	Manufacturing	Professional, Scientific and Technical	Public Administration and Safety	Retail	Transport, Postal and Warehousing	All Other[219]	Total Jobs
	Banyule	2,285	2,730	4,343	92	548	**12,571**	2,176	2,441	2,369	3,933	660	4,703	**38,851**
	Brimbank	3,492	5,810	5,613	640	572	7,759	**9,585**	1,869	2,428	6,803	7,434	10,037	**62,042**
	Darebin	3,443	2,905	**6,854**	226	815	5,971	4,045	2,567	2,726	6,425	1,431	7,793	**45,201**
	Hobsons Bay	1,852	3,393	2,295	348	442	2,804	**6,368**	1,296	1,486	3,037	4,392	5,291	**33,004**
	Hume	5,078	7,411	5,978	1,307	787	5,028	14,352	1,840	4,425	7,756	**17,841**	12,191	**83,994**
	Maribyrnong	2,548	1,511	3,912	584	633	**6,209**	2,713	1,555	1,716	5,855	2,375	5,635	**35,246**
	Melbourne	29,480	13,436	28,129	8,678	59,916	33,601	10,905	**77,929**	41,658	19,184	16,412	83,394	**422,722**
	Melton	2,036	2,803	3,341	115	359	2,575	1,139	807	1,889	**3,416**	1,211	3,810	**23,501**
	Moonee Valley	2,792	2,469	3,794	89	1,064	4,140	1,324	2,497	3,005	**5,867**	2,103	5,424	**34,568**
	Moreland	2,925	2,725	4,253	139	472	**6,422**	3,280	2,293	2,155	4,393	1,363	6,247	**36,667**
	Nillumbik	1,148	1,704	**1,911**	76	216	1,521	456	1,116	639	1,379	287	2,278	**12,731**
	Whittlesea	3,050	4,853	5,273	502	745	**8,081**	6,376	1,603	1,894	7,121	2,505	7,895	**49,898**
	Wyndham	3,404	4,658	6,263	388	664	6,188	5,913	1,993	3,358	**7,983**	7,882	9,771	**58,465**
	Yarra	6,737	4,241	4,041	898	3,154	**14,300**	3,391	12,422	2,291	9,827	2,790	13,228	**77,320**
Total	**Metro**	55,554	39,220	63,234	11,694	67,616	93,777	43,787	104,869	59,834	65,324	38,960	141,752	**785,621**
	Interface	14,716	21,429	22,766	2,388	2,771	23,393	28,236	7,359	12,205	27,655	29,726	35,945	**228,589**
	NWMR	**70,270**	**60,649**	**86,000**	**14,082**	**70,387**	**117,170**	**72,023**	**112,228**	**72,039**	**92,979**	**68,686**	**177,697**	**1,014,210**

218 ABS (2016): https://www.rdv.vic.gov.au/information-portal/table-and-chart
219 All other jobs includes: administrative and support services; agriculture, forestry and fishing; arts and recreation services; information media and telecommunications; mining; other services; rental, hiring and real estate; and wholesale trade.

9.2 Banking and finance

Banking and finance are a critical infrastructure sector that facilitates financial transactions across service providers and customers, arranges insurance, leverages assets and aims to manage and create wealth. The sector reaches far beyond Victoria's borders and is regulated by the Commonwealth.[220]

Two of Australia's major four banks host their headquarters within NWMR; ANZ and National Australia Bank are both located in Docklands (City of Melbourne).

Key assets and infrastructure within the banking and finance sector include:

- Primary and back-up data centres
- Call centres
- Corporate headquarters
- Operations, processing and trading centres[221]

Key dependencies for the sector include:

- Energy - electricity and gas
- Water
- Telecommunications

9.3 Political and legal factors

There are eight electoral Regions in Victoria. Five Members of Parliament (MPs) represent each Region in the Victorian Parliament's Legislative Council (Upper House). The principal role of people who are elected to represent a Region is to review legislation that has been passed by the Lower House. North West Metro sits within the Western Metropolitan Region.

A breakdown of state and federal electoral divisions can be found below. The Victorian Electoral Commission and the Federal Electoral Commission use different borders distinctions that Emergency Management Regions due to the need to separate groups by population. [222] Therefore, the list below includes all divisions that cross into NWMR:

220 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
221 EMV (2018): https://files-em.em.vic.gov.au/public/EMV-web/2018_All_Sectors_Resilience_Report.pdf
[222] Victorian Electoral Commission Map of districts: https://www.parliament.vic.gov.au/findelectorate/

State electorates in NWMR:

Melton (part)	Sunbury
Macedon (part)	Yuroke
Yan Yean (part)	Mill Park
Eildon (part)	Eltham
Warrandyte (part)	Footscray
Ivanhoe	St Albans
Northcote	Niddrie
Richmond	Brunswick
Melbourne	Essendon
Prahran (part)	Pascoe Vale
Williamstown	Northcote
Altona	Broadmeadow
Tarneit	Thomastown
Kororoit	Mill Park
Sydenham	Bundoora
Werribee (part)	

Federal Divisions:

Lalor	Scullin
Gorton	Wills
Gellibrand	Maribynong
Melbourne	Fraser
Cooper	Calwell (part)
Jagajaga	Macnamara (part)

10. Operational Learnings

The Victorian emergency management sector supports a culture of continuous improvement by:

- Encouraging the sector to share lessons, both positive actions to sustain and areas for improvement
- Encouraging learning from both assurance activities and contemporary good practice
- Focusing on systems of work, rather than the performance of individuals
- Recognising that identifying and implementing sustainable solutions takes time, resources and opportunity

In November 2015, Victoria's first sector-wide lessons management framework, EM-LEARN, was approved. This framework further supports the development of a culture of continuous improvement and outlines a model for lessons management and how it will be implemented into the sector, particularly operational activities initially.

Lessons management involves the identification and learning of lessons captured through assurance and learning activities (including debriefing, monitoring and reviews) occurring before, during and after emergencies. This process of moving from identifying lessons to learning lessons is guided by the lessons management life cycle within the EM-LEARN framework, and should inform emergency management planning to ensure ongoing continuous improvement.

Operational learnings identified from across the State over the past 12 months include:

Declarations

- It was observed that there was little discussion/communications with the regions regarding the State of Disaster declaration for the summer fires, which resulted in confusion around what arrangements were required to be put in place at the regional level to support this. However, the declaration did result in the appointment of a State Relief Coordinator to support relief activities at the regional level and the State Response Controller at the State level which was viewed positively.
- Observations indicate that during the lead-up to a Code Red Declaration on 21 November 2019, there were issues with responding agencies accessing timely intelligence, information and predictions to enhance their operations due to how quickly the data was being updated. Specifically, accessing EM-COP was highlighted as challenging at times.

IT

- IMT's highlighted the difficulties encountered with IT systems, connecting to networks and the hardware in operational facilities. Observations indicate that there are challenges in accessing and using multiple systems including EM-Drive, Webmail, EM-COP, IMS, Fireweb and FIRS.

Evacuation

- Observations indicate that Controllers were hesitant to consider robust evacuation planning until the exact location of the towns requiring evacuation was known. Evacuation planning highlighted the need for targeted messaging to people within evacuation areas, and the importance of having local agencies (i.e. CFA) involved in the evacuation planning process and ensuring that relief centres are located in 'safe' areas.
- Observations indicate that it is difficult to plan for or assume where people will want to go post evacuation or assuming what their needs might be. It is also very important that local councils are involved in the planning and implementation of any evacuation or reception centres.

Planning

- Early identification of potential storm/flood hazards allowed for planning and pre-positioning of storm and flood teams in IMT's. The adoption of standard processes for assuring the implementation of safety alerts related to thunderstorms worked well.

Information Management and Intelligence

- Observations indicate that relief information on VicEmergency was not always consistent with information distributed via community newsletters and other channels and that community communications need to be clear and targeted to the audience.
- Observations indicate that communications between the incident, regional and State tiers could be improved, in terms of building relationships, information sharing and reporting - and that all tiers need to be proactive and take responsibility for ensuring this is done in a clear and timely manner.
- Observations indicate that the lack of an intelligence unit within IMT's and Sector Commanders in the field impedes data collection at the incident level. There is value in establishing an intelligence within ICCs to centrally and consistently coordinate and manage damage assessment and other data which is collected from sources in various formats.
- It was observed that the SCC experienced difficulties in obtaining sufficient intelligence from across the incident and regional tiers. At times there was a divergence of views between the State and incident tiers regarding what the priority intelligence requirements were, which was exacerbated by

the fact that the State tier implemented new requirements - which were added to the existing procedures and products during times of peak operational demand on intelligence teams across all levels.

Personnel

- Fatigue management is a continuing issue. Personnel have concerns on shift length, rostering principles, rostering practices, entitlements and their general understanding of how to self-manage fatigue in relation to assigned shifts.
- Observations indicate staff are being activated into functional roles when they do not necessarily have the right accreditation or experience to perform the role effectively. In addition to being a potential safety issue of having unaccredited staff performing functional roles in an emergency, it also places pressure on others within the functional cell to cover the knowledge/experience gap and can cause frustration across the entire IMT.

11. Data sources and reference materials

Table 38. Metadata details

Item	Details
Report section	5. Regional Context 6. Natural Environment 7. Built Environment 8. Social Environment 9. Economic Environment
Data set	Regional Development Victoria Information Portal
Data source	Online
Location	https://www.rdv.vic.gov.au/information-portal/table-and-chart
Data accessed	July 2020
Data type	Geospatial database
Custodian	DJPR
Publisher	DJPR
Coverage	Victoria
Frequency	Approx. every four years

Item	Details
Report section	6. Natural Environment
Data set	Mean monthly and mean annual temperature data - maximum, minimum and mean (based on standard 30-year period 1961-1990)
Data source	Online
Location	http://www.bom.gov.au/jsp/ncc/climate_averages/temperature/index.jsp
Data accessed	August 2020
Data type	Geospatial database
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Mean monthly, seasonal and annual rainfall data (based on standard 30-year period 1981-2010)
Data source	Online
Location	http://www.bom.gov.au/jsp/ncc/climate_averages/rainfall/IDCraingrids.jsp
Data accessed	August 2020
Data type	Geospatial database
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Design Rainfall Data System
Data source	Online
Location	http://www.bom.gov.au/water/designRainfalls/revised-ifd/
Data accessed	August 2020
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Average annual and monthly days of rain
Data source	Online
Location	http://www.bom.gov.au/jsp/ncc/climate_averages/raindays/index.jsp?period=anandproduct=5mm#maps
Data accessed	August 2020
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Bushfire Prone Areas
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/designated-bushfire-prone-area-bpa
Date produced	Last updated 24/3/2020 – produced 07/09/2011
Data accessed	09/05/2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Major River Basins of Victoria
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/awrc-major-river-basins-of-victoria
Date produced	Last updated 05/09/2020 – produced 01/08/2014
Data accessed	August 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	Unknown

Item	Details
Report section	6. Natural Environment
Data set	Vicmap Lite: Statewide data series depicting major features, public land, vegetation, hydrology, transport and administrative data
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/vicmap-lite
Date produced	Last updated 05/09/2020 – produced 01/08/2014
Data accessed	August 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	As required

Item	Details
Report section	6. Natural Environment
Data set	1 in 100 year flood extent
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/1-in-100-year-flood-extent
Date produced	Last updated 11/4/2020 – produced 01/08/2014
Data accessed	August 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	As required

Item	Details
Report section	6. Natural Environment
Data set	Flood Warning Catchment Areas
Data source	Online
Location	http://www.bom.gov.au/metadata/catalogue/19115/ANZCW0503900441?template=full
Data accessed	August 2020
Data type	Geospatial database
Custodian	BOM
Publisher	BOM
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	7. Built Environment
Data set	Potential Impact Reports (by LGA)
Data source	EM-COP
Location	EM-COP
Date produced	May 2020
Data accessed	July 2020
Data type	Geospatial database
Custodian	EMV
Publisher	EMV
Coverage	Victoria

Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	FOI – Point – Vicmap Features of Interest
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/foi-point-vicmap-features-of-interest
Date produced	Last updated 28/05/2020 – produced 1/05/2009
Data accessed	July 2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	Electricity
Data source	Online
Location	https://data.gov.au/dataset/ds-aurin-aurin%3Adatasource-AU_Govt_GA-UoM_AURIN_DB_national_major_power_stations_2016/details?q=Major%20Power%20Stations
Date produced	Last updated December 2016
Data accessed	August 2020
Data type	Geospatial database
Custodian	Australian Government
Publisher	Australian Government
Coverage	Australia
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	PTV Public Transport
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/public-transport-a-collection-of-ptv-datasets
Date produced	Last updated 30/1/2020 – produced 07/06/2012
Data accessed	09/05/2020
Data type	Geospatial database
Custodian	Public Transport Victoria
Publisher	Public Transport Victoria
Coverage	Victoria
Frequency	Quarterly

Item	Details
Report section	7. Built Environment
Data set	Roads
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/road-network-vicmap-transport
Date produced	Last updated 05/09/2020 – produced 1/08/2014
Data accessed	August 2020
Data type	Geospatial database

Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	EPA Victoria Landfill Register
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/epa-victoria-victorian-landfill-register-vlr-location-polygons
Date produced	11/01/2020
Data accessed	09/05/2020
Data type	Geospatial database
Custodian	EPA
Publisher	EPA
Coverage	Victoria
Frequency	As required

Item	Details
Report section	7. Built Environment
Data set	Emergency Services
Data source	Ambulance Victoria Data Sets
Location	https://www.ambulance.vic.gov.au/ambulance-victoria-data-sets/
Data accessed	August 2020
Data type	Database
Custodian	AV
Publisher	AV
Coverage	Victoria
Frequency	Annually

Item	Details
Report section	8. Social Environment
Data set	Population
Data source	Australian Bureau of Statistics
Location	https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02018-19?OpenDocument
Data accessed	August 2020
Data type	Database
Custodian	ABS
Publisher	ABS
Coverage	Australia
Frequency	As needed – next issue expected for release on 30/03/2021

Item	Details
Report section	8. Social Environment
Data set	Hospital locations
Data source	Online
Location	http://data-dhs.opendata.arcgis.com/datasets/5000b3c446ed419eb590baa3832eb8f7_0
Date produced	Last updated 20/11/2019 – produced 28/07/2016
Data accessed	09/05/2020
Data type	Spatial

Custodian	DHHS
Publisher	DHHS
Coverage	Victoria
Frequency	Unknown

Item	Details
Report section	8. Social Environment
Data set	School enrolments
Data source	Online
Location	https://www.education.vic.gov.au/about/department/Pages/factsandfigures.aspx
Date produced	Last updated 01/07/2019 – produced 01/01/2010
Data accessed	16/06/2020
Data type	Spreadsheet
Custodian	DET
Publisher	DET
Coverage	Victoria
Frequency	Six-monthly

Item	Details
Report section	8. Social Environment
Data set	Aged Care
Data source	Online
Location	https://www.gen-agedcaredata.gov.au/Resources/Access-data/2020/March/GEN-data-People-using-aged-care
Date produced	Last updated 03/03/2020
Data accessed	August 2020
Data type	Spreadsheet
Custodian	Australian Institute of Health and Welfare
Publisher	GEN Aged Care Data
Coverage	Australia
Frequency	Unknown

Item	Details
Report section	8. Social Environment
Data set	Areas of Aboriginal cultural heritage sensitivity
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/areas-of-cultural-heritage-sensitivity
Date produced	Last updated 11/07/2020 – produced 23/05/2018
Data accessed	06/08/2020
Data type	Shapefile
Custodian	DPC
Publisher	DPC
Coverage	Victoria
Frequency	Quarterly

Item	Details
Report section	8. Social Environment
Data set	Victorian Heritage Register
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/victorian-heritage-register
Date produced	Last updated 05/09/2020 – produced 11/05/2016

Data accessed	06/08/2020
Data type	Geospatial database
Custodian	DELWP
Publisher	DELWP
Coverage	Victoria
Frequency	Fortnightly

Item	**Details**
Report section	8. Social Environment
Data set	Areas of Cultural Heritage Sensitivity
Data source	Online
Location	https://discover.data.vic.gov.au/dataset/areas-of-cultural-heritage-sensitivity
Date produced	Last updated 18/05/2020 – produced 20/06/2019
Data accessed	06/08/2020
Data type	Geospatial database
Custodian	DPC
Publisher	DPC
Coverage	Victoria
Frequency	Quarterly

Item	**Details**
Report section	Natural Environment
Data set	Climate average maps reference period 1961 - 1990
Data source	Online
Location	http://www.bom.gov.au/climate/averages/maps.shtml
Data accessed	1/07/2020
Data type	ASCII grid
Custodian	Bureau of Meteorology
Publisher	Bureau of Meteorology
Coverage	Victoria
Frequency	Fortnightly

12. List of Abbreviations

Table 39. List of Acronyms and Abbreviations

Acronym	Description
ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
ARI	Average Reference Interval
BOM	Bureau of Meteorology
BPA	Bushfire Prone Area
CFA	Country Fire Authority
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture
DAWR	Department of Agriculture and Water Resources
DELWP	Department of Environment, Land, Water and Planning (VIC)
DET	Department of Education and Training (VIC)
DHHS	Department of Health and Human Services (VIC)
DISER	Department of Industry, Science, Energy and Resources
DJPR	Department of Jobs, Precincts and Regions (VIC)
DTF	Department of Treasury and Finance
EMLA	Emergency Management Legislation Amendment
EMV	Emergency Management Victoria
EPA	Environment Protection Authority
FDP	Fire Danger Period
FFMV	Forest Fire Management Victoria
GRP	Gross Regional Product
ICC	Incident Control Centre
ICU	Intensive Care Unit
IFD	Intensity-Frequency-Duration
LGA	Local Government Area
MEMP	Municipal Emergency Management Plan
NWMR	North West Metro Region
PTV	Public Transport Victoria
RCC	Regional Control Centre
REMP	Regional Emergency Management Plan
REMPC	Regional Emergency Management Planning Committee
SCC	State Control Centre
SEIFA	Socio-Economic Indexes for Areas
SEMP	State Emergency Management Plan
SES	State Emergency Service (VIC)
SLS	Surf Life Saving (VIC)
SSIP	State Significant Industrial Precinct

13. Document information

13.1 Document details

Criteria	Details
Document title:	Environmental Scan Report: Northern and Western Metropolitan Region
Document owner:	Information Management and Intelligence Team, EMV

13.2 Version control

Version	Date	Description	Author
0.1	14/05/2020	Initial template created	C. Jolly
0.2	15/07/2020	First draft	W. Stephenson
0.3	07/08/2020	Second draft	W. Stephenson
0.4	09/08/2020	Third draft	M. Frew and M. Brereton
1.0	10/08/2020	Draft for initial consultation	C. Jolly
1.1	06/09/2020	Updated based on feedback from IREMPCs	M. Frew, M. Brereton, W. Stephenson, M. Slavtcheva, C. Jolly
1.2	08/09/2020	Proof reading	T. Penfold
2.0	14/09/2020	Final release	C. Jolly

13.3 Document approval

This document requires the following approval:

Name	Title	Organisation
Debra Abbott	Deputy Emergency Management Commissioner	EMV
Andrew Crisp	Emergency Management Commissioner	EMV