



Inquiry into the implications of severe weather events on the national regional, rural, and remote road network

Yarra Ranges Council

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1 INTRODUCTION

1.1 Summary

Yarra Ranges is pleased to make this submission to the Commonwealth Government's inquiry into the implications of severe weather events on the national, regional, rural and remote road network.

Our region is located at the interface of regional and metropolitan Melbourne, where the resilience of our road network is critical for key industries such as tourism and agriculture, as well as community preparedness for severe weather events that frequently impact our municipality.

Leveraging our expertise in building community resilience, Yarra Ranges Council advocates strongly for better infrastructure to support our communities and visitors both day-to-day and through severe weather events. Our advocacy takes a holistic view that considers resilience in terms of how it is **engineered, operationalised across levels of government, and enacted across the community** – borrowing concepts from a recent paper titled “Resilience Framework and Metrics for Energy Master Planning of Communities”¹.

As such, this submission outlines relevant approaches to:

- **Infrastructure investment** – lifecycle costs of sealed roads compared to unsealed roads, treatment options, drainage considerations and private crossovers.
- **Emergency Management and Community impact** – how communities use road assets in regional areas during severe weather events, and challenges presented by the administration of Commonwealth disaster recovery funding.
- **Impacts of roads on water resources** – on sealed and unsealed roads, and climate resilient surface treatments.

1.2 Yarra Ranges Council: Unique Assets and Risks

The Municipality of Yarra Ranges is located on metropolitan Melbourne's eastern fringe and is home to a population of about 160,000. Yarra Ranges covers approximately 2,500 square kilometres and stretches from densely populated outer suburbs to foothills, agricultural valleys and forested areas of the Great Dividing Ranges. It is one of Victoria's largest, most varied and scenic municipalities. It is also the largest area of any metropolitan council in Victoria. There are more than 55 suburbs, townships, small communities and rural areas in the Yarra Ranges.

Our municipality is a unique mix of urban and regional areas, with around 30% of the population dispersed across non-urban areas that represent 97% of the Yarra Ranges overall landmass.

Yarra Ranges' roads:

- Consists of 2,300 kms of road network.
- Council manages 1785 kilometres (78%) of local and collector roads.
- VicRoads manages 515 kilometres (22%) of state highways and arterial roads
- Approximately 734km (40%) of Council-managed roads are unsealed
- VicRoads has approximately 65 km (13%) of unsealed roads

¹ Charani Shandiz S, Foliente G, Rismanchi B, Wachtel A, Jeffers RF. Resilience framework and metrics for energy master planning of communities. Energy. 2020;203:117856.

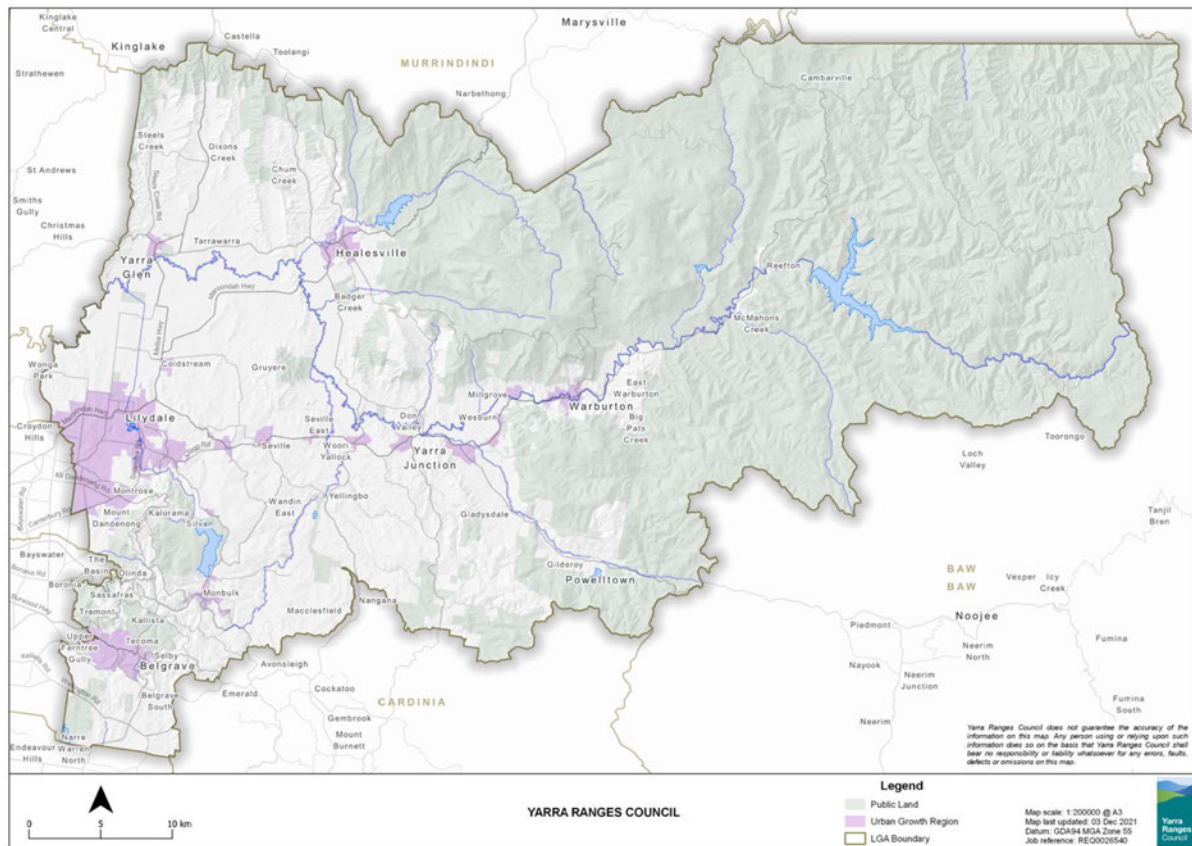


Figure 1: Geographic Boundary of the Yarra Ranges Council.

2 INFRASTRUCTURE INVESTMENT

The changing climate is causing more frequent and severe weather events, which have significant impacts on Council's road assets. This causes disruption to communities, presents ongoing safety risks, impedes access for emergency vehicles and imposes significant costs onto ratepayers.

Unsealed roads are particularly susceptible to damage, particularly through storm events. For instance, the major storm that occurred in October 2022 resulted in over 500 storm damaged roads and blocked drains, with repairs costing in the millions.

As such, unsealed road maintenance is a tenet of Yarra Ranges' climate adaptation efforts. More violent storm water following longer periods of dry weather creates more pressure on the road base, which accelerates road disintegration and reduces the life span of the asset.

Options to manage this include:

- expanding road sealing programs
- modifying maintenance regimes
- retaining canopy cover over unsealed roads to temper impact of downpours.

2.1 Life cycle costs and the benefit of investment in sealing roads

Yarra Ranges Council manages a road network of over 2000km within the municipality, with more than 700km of unsealed roads. These unsealed roads do not provide the same level of service to users as a sealed road and deteriorate at a much faster rate than the sealed network.

With such a large network, Council is not in a financial position to be able to undertake upgrades to

the unsealed road network in its entirety.

Provided below is a typical example of the costs associated with maintaining both an unsealed and sealed road.

From comparing the difference in maintenance costs for both types of roads, a payback period of over 150 years is determined for the upgrading an unsealed road to a sealed road.

This figure of over 150 years indicates that the heavy cost to fully upgrade a road is an unsustainable cost for Council to bear.

| Unsealed Road | Sealed Road |
|---|---|
| \$1 per metre to grade unsealed road, 3-5 grades a year = \$5 per metre each year | Capital cost to construct road with underground drainage: \$2000 per metre |
| 5 yearly re-sheet due to storm events, at \$50 per metre = \$10 per metre each year average | Annual street sweeping and drainage pit cleaning: \$3 per metre each year |
| Drainage maintenance = \$8 per metre each year (based on an average number of requests) | Pavement renewal cost, assuming 15-year asphalt renewal at \$110 per lin. m = $\$110/15 = \7.33 per metre each year |
| Annual cost of maintenance (average): \$23 per metre each year | Annual cost of maintenance (average): \$10.33 per metre each year |
| Annual maintenance saving for sealed pavement = \$12.67 per metre each year | |

Table 1: Annual maintenance cost comparison: unsealed and sealed roads

To overcome the financial burden of capital cost of upgrading unsealed roads, Council continues to advocate for other forms of funding to support road-sealing, particularly in areas prone to severe weather events. Council often partners with landowners to fund road upgrades, while also seeking funds from higher levels of government.

Case study: Roads for the Community

In 2019 the Australian Government committed \$300 million to be shared across the Yarra Ranges and Cardinia Shire to seal hundreds of kilometres of unsealed and unsafe roads over 10 years.

In Yarra Ranges, the Roads for the Community program would have constructed up to 571 prioritised roads unsealed local roads (187 km) across the Dandenong Ranges and regional parts of the municipality. Australian Government funding was leveraged to secure a further \$50 million in funding from abutting property owners, creating a \$200 million program in total.

This funding has halved the cost of road-sealing for residents, making it drastically more affordable and achievable. Without Commonwealth funding support, Council and residents would be unable to cover the cost alone.

This commitment had bipartisan support during the 2019 election, however, funding has recently been reduced to less than \$100 million across the two municipalities. Council is advocating for the full funding amount to be restored, to ensure the benefits can be delivered to communities.



McGregor Road, Healesville – before and after

2.2 Treatments

Sealing roads provides the best long-term maintenance solution for strengthening the resilience of roads in areas like Yarra Ranges, particularly for the benefit it delivers in increasing access for emergency vehicles in high disaster risk areas. Sealed roads are also more resilient against the impact of drivers, drainage issues and cannot wash away.

However, where road sealing is unachievable, a number of alternative solutions may be explored by Council with support from the Australian Government.

Instead of fully sealing roads, Council may lead trials in using lower cost treatments that provide a better level of service and still work to increase the resilience of unsealed roads.

With funding support, Council can undertake trials with aggregate binders, recycled materials or alternative seals to protect existing aggregate pavements. These options should be explored with a payback period of 5-10 years.

Council has also undertaken some internally funded trials on short lengths of its unsealed road network. Due to funding these within Councils operational budgets, Council could only achieve small sample trials.

The trials included:

- **Jacksons Hill Road, Selby.** Trial use of PolyCom aggregate bind, which has been successful. This was applied in August 2021 with a light grade in May of 2022 due to a resident removing a tree and has not been graded since then. Prior to the trial, the grading frequency was 4 times per year.
- **Basin-Olinda Road, Olinda.** Application of GATT (Graded Aggregate Total Treatment) which is a proprietary Boral product. GATT has been successfully applied to the top 1.5Km of Basin-Olinda Rd and is in year 3 of a 5 year trial.
- Recycled asphalt also known as profilings has been successfully used to improve road surfaces in a number of locations. Profilings are only suitable on low traffic roads with minimal drainage issues.
- **Base stabilisation including lime and foamed bitumen** and other options have been considered by Council in the past. These treatments have a demonstrated success of improving unsealed surfaces but they are very costly. Due to limited funding and time constraints these options have been unable to be applied in any efficient program.
- **A dust suppressant polymer** is being trialed this year as part of Council's annual dust suppressant program. This polymer is also expected to bind the road surface and have positive results for the longer term. Due to limited Council funds, the annual dust suppressant program is only applied to a select number of roads.

Case study: Unsealed Road Treatment Trials, Bland Shire Council

Bland Shire Council have carried out trials of different binders and seals over an extensive length of road to provide a comparison. This trial was undertaken with funding assistance from the NSW Government. The draft report is available online.²

² NSW Government (n.d.), [Building Climate Resilient Unsealed Roads \(Unsealed Road Treatment Trial\)](#), NSW Government, accessed 27 February 2023.

Case study: Resilient upgrades financial analysis, Shire of Baw Baw

The Shire of Baw Baw addressed both climate change and financial impacts when upgrading its roads to a more resilient service.

- Extreme rainfall events in 2011 and 2012 led to numerous landslips in the Shire of Baw Baw, resulting in road closures and loss of service to the community.
- Some stretches of road were impacted more than once in the space of a year.
- Council received Natural Disaster Financial Assistance (now Disaster Recovery Funding Arrangements) to replace the affected roads. However, the assistance only covers 'replacement to the same standard'. Also, delays in reimbursements left council financially exposed.
- Baw Baw Shire assessed whether replacing assets to a different standard following a flood or storm had the potential to achieve a better financial outcome for Council and a better economic outcome for the community overall, particularly in the context of climate change.
- **It found that upgrading the road to a more resilient surface was likely to be a more cost-effective option in the medium and longer terms than paying less and replacing to the same standard.**

2.3 Drainage

Drainage is also an important need to protect road pavements. Yarra Ranges has steep terrain which increases stormwater velocities and causes greater damage to pavements in even minor storm events. Yarra Ranges also has areas of quite built-up development (urban fringe), which includes a greater impervious area that increases stormwater runoff and resultant damage to pavements.

Issues resulting from poor drainage systems include:

- Table drain scouring, with council working through many dangerous roads where the drains have become so deep that a vehicle could not pass on the road
- Gravel runs off into resident properties and blocks culverts
- Need to dispose of gravel or re-purpose it, however, it is costly to clean gravel for recycling, and also to have it carted to other sites for fill.

2.4 Private property cross overs

Crossovers are a landowner's responsibility for installation and maintenance as they provide access for that individual landowner.

This arrangement is problematic as unsealed road crossovers consist of piped culverts which are historically undersized or block easily and are not very well maintained. The issue of blocked culverts creates issues to deterioration of unsealed road pavements as the blockage concentrates water back onto the road pavement, which ultimately damages it.

In Yarra Ranges, some properties do not have driveway culverts and property owners have created berms to avoid water and gravel running down and washing out. The interface between Council and private assets requires investment as infrastructure has been informally established and built to varying standards.

3 EMERGENCY MANAGEMENT AND COMMUNITY IMPACT

3.1 Community behaviours and road usage in emergencies

Yarra Ranges is one of the most fire prone areas in Australia. During consultation on the Council Plan 2021-2025, our community rated Emergency Management among their highest priorities for allocation of Council resources.

During the Victorian bushfires in 2009 (Black Saturday), eleven people died in cars, five people died on roads, and five people died near cars while using the road network to self-evacuate.

Decision-making is complex in bushfires and the threat of immediate risk creates erratic decision making. This includes decision to evacuate and use the road networks to escape the immediate threat.

Evacuation occurs at any time throughout the threat of bushfire. Research indicates that people evacuating from bushfires will make key decisions based on their own level of preparedness, with seven typical response behaviours, as shown below³. As such, the behaviour and action of evacuating residents can look very different across the community.

Despite these differences, almost all community members will use the roads at some point during this crucial time, making roads a vital safety network. It also indicates that road usage during the time of self-evacuation will stretch beyond its capacity.

Seven archetypes:

| Archetype | Defining characteristics | Evacuate or remain |
|------------------------------|--|---|
| Responsibility Denier | Believe they are not responsible for their personal safety or for their property | Committed to evacuating but expect others to direct and assist in evacuating and defending their property |
| Dependent Evacuator | Expect the emergency services or others to protect them and their property because they are incapable of protecting themselves | |
| Considered Evacuator | Having carefully considered and planned evacuation, are committed to it as soon as they are aware of a bushfire threat to their property | Committed to self-directed evacuation |
| Community Guided | Seek guidance and assistance from and are influenced by neighbours, community members and media who they see as knowledgeable, well informed and providing good advice | Committed to listening to community advice and evacuating on advice |
| Worried Waverer | Prepare, plan and equip their property and train to defend but worry their lack of practical bushfire fighting experience puts them at risk by remaining | Wavering between evacuating and remaining to defend |
| Threat Denier | Do not believe there is a bushfire risk and therefore that their personal safety or property is threatened | Committed to remain as perceived lack of threat makes evacuation unnecessary |

³ Strahan K and Gilbert J (2020), *The Application of Self-Evacuation Archetypes*, Country Fire Authority, Victorian Government, Melbourne.

| | | |
|--------------------------------|---|---|
| Experienced Independent | Are highly knowledgeable, competent, experienced and self-reliant fighting bushfire | Highly committed to remain because they see themselves as highly experienced/well prepared and committed to protecting assets |
|--------------------------------|---|---|

Evacuation research from the Australian Journal of Emergency Management⁴ outlines variables that can influence travel times for people evacuating during emergencies, including routes becoming blocked or rendered unavailable, shelters reaching capacity or closing, car accidents and road lane reversals. Alongside these variables, there are several key factors that relate to the state and usage of roads that should be considered in emergency management planning. Emerging models and technologies are supporting more accurate predictions of these factors, which include:

- traffic flow at final destinations (shelters)
- the number of vehicles in different parts of the road network
- the number of vehicles that have not yet reached a destination
- the density of vehicles on different road sections.

Fundamentally, roads that are constructed to be safe, accessible and resilient under normal circumstances, will provide for safer usage during emergencies, and also allow authorities to access and protect road assets.

3.2 Disaster Recovery Funding Arrangements

The Disaster Recovery Fund Arrangements (DRFA) enable the State and Commonwealth to provide financial assistance to Local Councils, to support certain relief and recovery measures following an eligible disaster. They do not cover all costs that may be incurred resulting from an eligible disaster.

Costs are initially incurred by Council and then claimed under a complex and stringent set of guidelines. The documentation requirements for the claims are onerous. For example, two full-time resources were employed by Yarra Ranges Council for 12 months to prepare the claims following the June 2021 storms.

Examples of the documentation requirements are:

- Every claim is done by address. Each address must have at least one photo from before the work is done and one photo taken after the work is completed. Large jobs will require additional photos from different angles.
- Every photo must be annotated with:
 - Event number
 - Address of works
 - Latitude and Longitude of address
 - Date and time of photo
- Every address must be invoiced separately on the contractor's invoice, with the costs described and allocated to each address. Summary invoices are not acceptable.
- Claims must be done separately for works on residential properties and essential public assets (for example, roads and roadsides). Therefore, a single contractor's invoice may appear on multiple claims. This must be reconciled and good records maintained so invoices are fully claimed but not duplicated in claims.

The stringent requirements mean that many costs cannot be claimed under DRFA guidelines, for example if the photos are not available or not clear enough. This caused a significant cost impost on

⁴ Kuligowski et al. (2022) 'Evacuation modelling for bushfire: the WUI-NITY simulation platform', *Australian Journal of Emergency Management*, 37(4):40-43

Yarra Ranges Council following the June 2021 storms, adding to the overall challenges Council faces in rebuilding critical infrastructure that is key to community resilience, with delays and rejected claims resulting in further deterioration of damaged assets.

4 IMPACTS OF ROADS ON WATER RESOURCES

4.1 Sealed Roads

New sealed roads can improve safety and amenity for residents but can have a detrimental impact on waterways if not sensitively managed. If unmanaged, risks include concentration of stormwater runoff, erosion, damage to waterways and loss of sensitive aquatic species.

Stormwater has long been recognised as a key threat to waterway health. The level of directly connected imperviousness (DCI – the % of a catchment directly connected to a waterway via piped drainage) has been identified as an important indicator of stream health. Crucially, even small increases in DCI can be damaging, with streams typically degraded once there is 2% or more of connected impervious areas in a catchment⁵.

Sealed road upgrades often increase the volume and frequency of stormwater delivered to urban waterways, as they typically involve the replacement of grassed table-drains with new piped drainage. The new piped drainage system not only delivers runoff from the newly sealed road surface, but also picks up runoff from existing roofs and driveways. Subsequently, the newly connected impervious surfaces can be more than 3 times greater than the area of road itself. Road upgrades can also result in erosion where new drainage concentrates flows, particularly in steep catchments, like those in the Dandenong Ranges. Climate change is likely to exacerbate the negative impact of stormwater on waterways, due to an increase in high intensity rainfall events.

Yarra Ranges Council strives to be an environmentally responsible organisation and addressing the impact of stormwater on waterways is a key objective in our Environment Strategy and Integrated Water Management Plan.

YRC has used two approaches to manage stormwater in the context of sealed road upgrades:

1. passive drainage design, and
2. construction of water sensitive urban design (WSUD) assets.

Passive drainage design involves directing stormwater runoff to grassed or vegetated areas where it can infiltrate the soil. This protects waterways from excessive stormwater runoff and increases soil moisture and groundwater recharge. It can also reduce the cost of road construction by avoiding the need for curb and channel and underground drainage pipes. However, passive drainage relies on the availability of sufficient public land to intercept stormwater. Roads that are steep or have narrow verges may be unsuitable for passive drainage design.

Water sensitive urban design (WSUD) assets, such as swales, raingardens, wetlands and stormwater harvesting systems, may be used to manage stormwater runoff from roads, but are typically more expensive to construct and maintain than passive drainage design solutions.

However, if left untreated, environmental damage caused by concentrated stormwater runoff can be costly to rectify (or irreversible).

For example, in 2019 it cost over \$500,000 to address severe erosion in a single gully in Sassafras caused by concentrated flows due to an upgrade to the Mt Dandenong Tourist Road. This was due to the need to install an underground detention tank to capture and slowly release stormwater at a rate of under 20L/s to avoid further damage in an environmentally sensitive gully.

⁵ Walsh, C. J., Fletcher, T. D., & Ladson, A. R. (2005). Stream restoration in urban catchments through re-designing stormwater systems: looking to the catchment to save the stream. *Journal of the North American Benthological Society*, 24(3), 690–705.

4.2 Unsealed Roads

Yarra Ranges Council 700 km of unsealed roads are graded between 3 and 6 times per year as part of a maintenance program. The frequency of maintenance grading for each road is based on historical information collated from road defects, contract audits and community feedback. Road regrading requires large volumes of water to reshape the road, which is currently sourced from the mains potable supply.

Council also commissions dust suppression activities during the summer months to reduce dust on certain roads. Dry roads are prone to transmitting dust. A road's topography, rainfall, drainage, shading, traffic type and traffic frequency all impact its ability to retain moisture. There are around 320 roads, or 200Km, that receive dust suppression works. Dust suppression is a minor water demand in comparison to road regrading, however, hotter drier conditions predicted under climate change will likely increase the generation of dust from unsealed roads and the volume of water required for dust suppression.

There is a combined average water demand of approximately 511ML per year for unsealed roads regrading and dust suppression in the Yarra Ranges alone. In the context of declining water supply in the Yarra River catchment due to climate change⁶, it makes sense to transition away from potable mains to supply water for roads maintenance.

Much of this water demand could be met with treated stormwater or recycled water, and Council has started to investigate the feasibility of using alternative water supplies for this purpose.

Case study: Climate Resilient Surface Treatments

There are several studies around the world looking at biochar as an additive in asphalt. In one study, biochar reduced the temperature susceptibility and significantly increased the rutting resistance of the asphalt. Another study where biochar was used at ratios of 5%, 10% and 15% showed that the softening point and viscosity increased, and the penetration and thermal sensitivity decreased with increased biochar contents. Biochar can also be used in concrete has been found to increase the strength of concrete by up to 20%.

Trailing products such as biochar in surface road surface treatments would create a circular economy for Yarra Ranges. With a soon to be operational biochar plant, the output could be readily utilised.

⁶ Das, S.K.; Ahsan, A.; Khan, M.H.R.B.; Tariq, M.A.U.R.; Muttill, N.; Ng, A.W.M. (2022). Impacts of Climate Alteration on the Hydrology of the Yarra River Catchment, Australia Using GCMs and SWAT Model. *Water*, 14(3), 445. <https://doi.org/10.3390/w14030445>