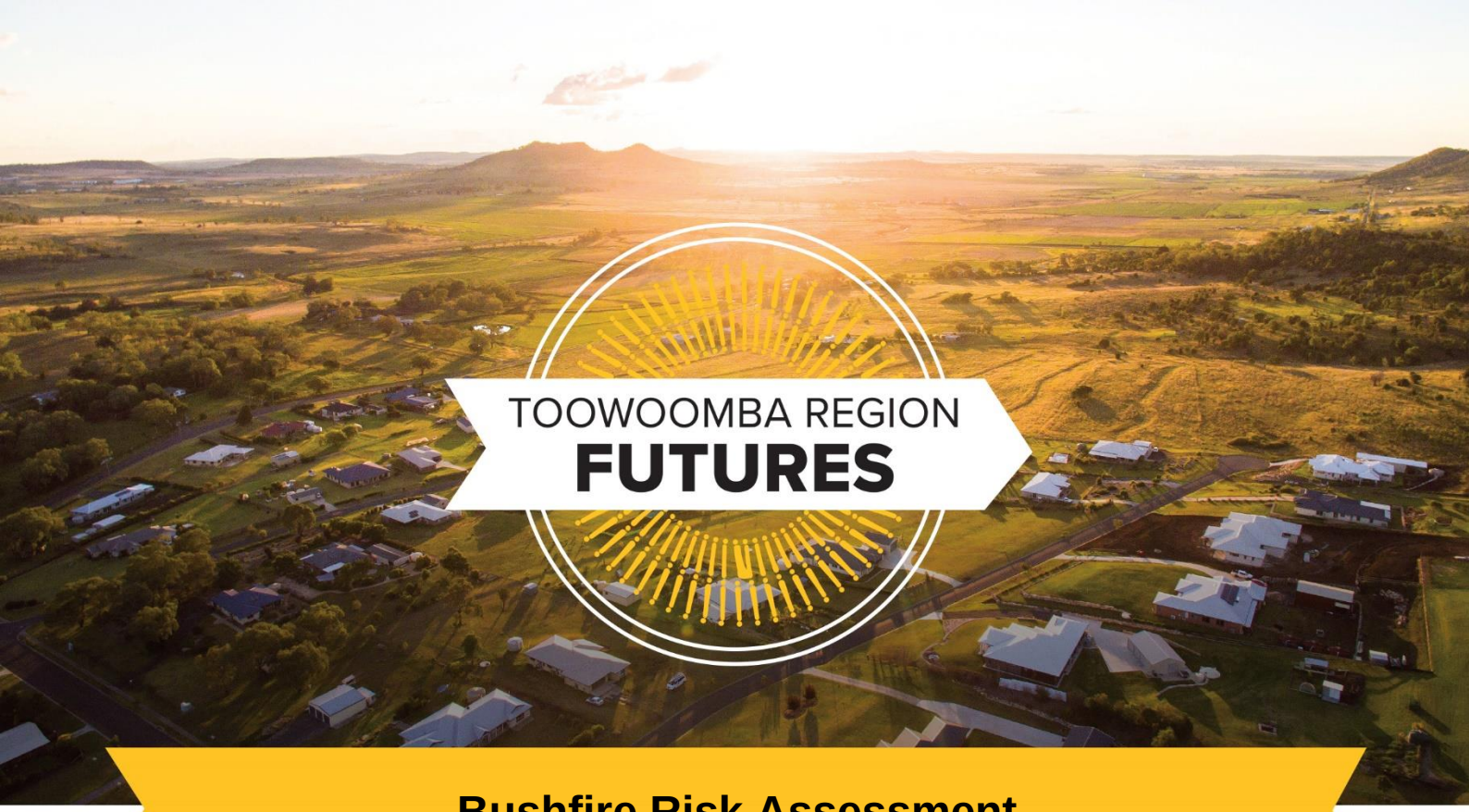

Bushfire Risk Assessment

Why have we done the strategic project, and what did we want to achieve?

The Bushfire Risk Assessment responds to the requirements of State Planning Policy through the preparation of a fit-for-purpose risk assessment for bushfire hazard. The assessment aims to understand the scale of potential bushfire risk across the Region and identify appropriate planning controls.

What are the key components?

The analysis comprises four key parts including a contextual analysis, a detailed risk assessment, a planning-based issues and options report, and draft provisions for eventual incorporation in the new planning scheme.

Who have we consulted with?

- Technical consultation with Council's project working group.
- Targeted engagement with internal teams.
- External consultants in relation to growth management.
- Queensland Fire and Emergency Services and Department of State Development, Infrastructure, Local Government and Planning.

What are the key findings we have learned?

- Areas of higher bushfire risk are located along the Great Dividing Range, including areas of Toowoomba City and from Highfields to Crows Nest.
- Areas east of the New England Highway are highly exposed.
- A combination of strategic and statutory planning mechanisms can be deployed to respond to State interests.

Disclaimer

The following study has been prepared as part of the Toowoomba Region Futures program. It was endorsed by Toowoomba Regional Council at its Ordinary Council meeting on 19 April 2022 as information to aid decision-making. The content of this study does not reflect an adopted policy position of Council and Council's endorsement of it does not include adoption of any policy position, action or recommendation put forward by the study.

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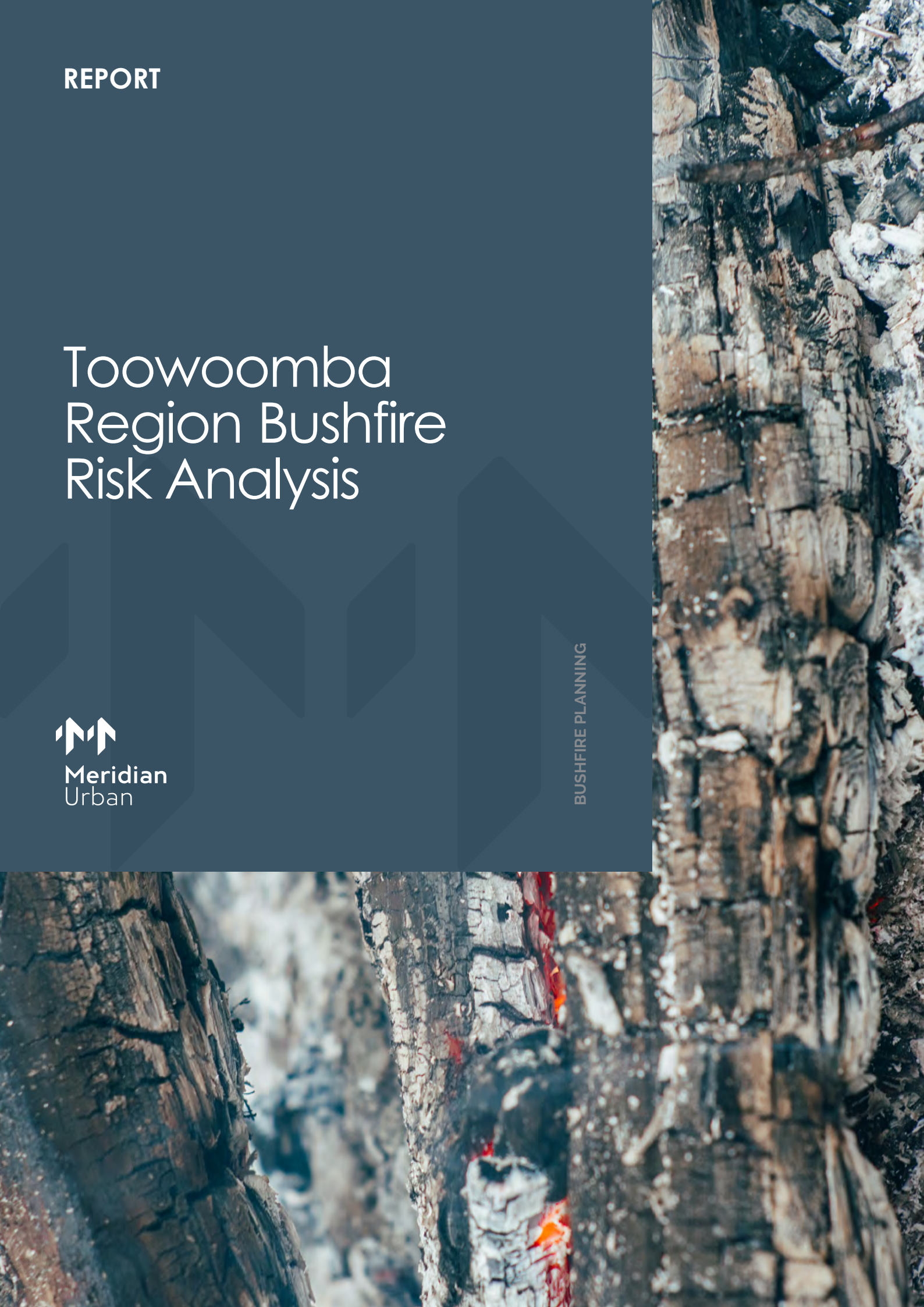
TOOWOOMBA REGION

REPORT

Toowoomba Region Bushfire Risk Analysis

Meridian Urban

BUSHFIRE PLANNING



QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
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PREPARED BY	
SE/LG	21/09/2021
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LG	22/09/2021
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APPROVED FOR ISSUE BY	
LG	27/09/2021

REVISION SCHEDULE

Rev No.	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
A	09/10/2020	DRAFT	SE/LG	LG	SE	LG
B	15/01/2021	DRAFT V2	SE/LG	LG	SE	LG
C	01/02/2021	DRAFT V3	SE/LG	LG	SE	LG
D	19/03/2021	DRAFT V4	SE/LG	LG	SE	LG
E	10/06/2021	DRAFT V5	SE/LG	LG	SE	LG
F	27/09/2021	FINAL	SE/LG	LG	SE	LG

FPAA NSW BPAD Accreditation No. 33131

Member Planning Institute of Australia
Member Fire Protection Association of Australia
Member International Association of Wildland Fire
Member Natural Hazard Mitigation Association (USA)
Member of Association of Fire Ecology

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

DISCLAIMER

This document has been prepared for Toowoomba Regional Council. No liability is accepted by Meridian Urban or any employee or sub-consultant of Meridian Urban with respect to its use by any other person.

This report is prepared for the benefit of the named Client only. No third party may rely upon any advice or work completed by Meridian Urban in relation to the services, including this report, except to the extent expressly agreed in writing by Meridian Urban.

It is acknowledged and agreed that the subject area of this report may be subject to bushfire hazard. The Client acknowledges and agrees that Meridian Urban has not created or contributed to the creation or existence of this hazard and the Client indemnifies Meridian Urban for claims arising out of or resulting from a bushfire event except to the extent attributable to the negligence of Meridian Urban.

The Client agrees that Meridian Urban shall have no liability in respect of any damage or loss incurred as a result of bushfire.

Executive Summary

This Toowoomba Bushfire Risk Analysis comprises three (3) component parts:

The above approach seeks to inform the policy position, strategic planning and statutory (planning instrument) response as part of the Toowoomba Region Futures program and the preparation of a new Toowoomba Region Planning Scheme.

This Executive Summary is divided into two components, the first in relation to the risk assessment observations, with the second component relating to the land use planning issues and options to address the nature of bushfire hazard and risk via relevant policy, strategic and statutory planning opportunities as part of the formulation of a new Toowoomba Region Planning Scheme.

Risk assessment observations

This bushfire risk assessment has been commissioned by Toowoomba Regional Council (herein referred to as 'Council'), as part of a broader bushfire risk analysis to support the Toowoomba Region Futures Program.

The intent of this risk assessment is to examine and understand the potential nature of bushfire risk to people, property and the environment across the Toowoomba Region now, and into the future.

This assessment seeks to inform Council's strategic land use planning approach to the Toowoomba Region, adopting a risk-informed evidence base upon which to consider potential strategic land use planning options.

It achieves this by adopting risk-based principles to determine appropriately risk-informed zoning and other strategic planning controls.

This fit-for-purpose risk assessment is prepared pursuant to the current State Planning Policy July 2017 (SPP), and the State interest guidance materials which are required to be appropriately integrated into a local planning instrument. Specifically, this risk assessment addresses Policy 2, having regard to Policy 1 and Policies 3-6 of the State interests.

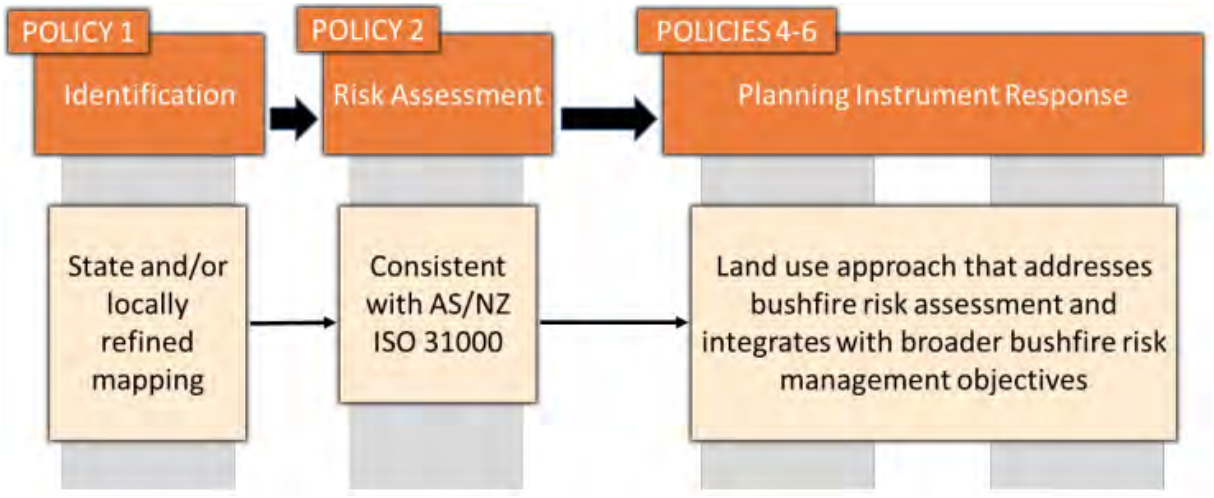


Figure - Process for integration of state interest policies into local planning instruments (Source: Queensland Government, 2019)

Risk assessment roadmap

The risk assessment roadmap, featured over page, provides a conceptual outline of the key components of this risk assessment. It maps out how the various aspects of risk have been considered, to inform the consideration of risk tolerance and acceptability, as well as potential land use planning mitigation options and the risk assessment recommendations.

Figure - Risk assessment roadmap

Identified land use planning risks

Based on the analysis of bushfire risk data, the following strategic land use planning risks are identified for the Toowoomba Region:

Table - Summary of identified strategic land use planning risks relating to bushfire hazard in the Toowoomba Region

No.	Identified risk
1	Hazard exposure may change in certain locations over time to a higher hazard class, as a result of climate change.
2	Certain parts of the evacuation network may be compromised in a fire event, and may impact the ability to evacuate.
3	Grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact.
4	Considerable risk to community facilities, services and infrastructure within the community facilities zone is present.
5	Recovery and reconstruction may be long and costly.
6	A proportion of residents and businesses do not have adequate insurance cover.
7	Certain land uses within interface locations may inadvertently impact on the ability to implement certain forms of hazard reduction, due to the risk magnitude of mitigation activities.
8	Land and fire management activities may face added pressure from expanding development in interface areas. Ecological assets may be impacted.
9	Emergency services may face increased burden from expanded development in interface areas.
10	Lands zoned for future development growth are highly exposed to potential bushfire hazard, particularly the rural residential and emerging community zones. Water supply and servicing is required to be resolved.
11	The low density residential zone is relatively exposed, incorporating a high percentage of existing housing stock within the Toowoomba Region.
12	Vulnerable facilities exist in locations subject to bushfire hazard and which may require evacuation.
13	Ability to evacuate may be complicated by exposure of the road network to bushfire attack, fragmented vegetation, land parcels, zoning, and limited route options.
14	Township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion.
15	Evacuation of some townships with limited road connectivity may experience evacuation challenges.

Summary of key observations

The key observations drawn from the analysis and evaluation of potential bushfire related risks across the Toowoomba Region are summarised as follows:

- overall, this risk assessment identifies areas of potential overrepresentation of potential bushfire hazard under the current State-wide bushfire prone areas mapping, particularly in relation to small and isolated patches and corridors of vegetation within the Toowoomba urban area. This is likely to be addressed by forthcoming amendments to the mapping, undertaken by the State government.
- irrespective of the above, the Toowoomba Region is a fire-prone landscape, and its characteristics including fire weather and vegetation communities are continuing to evolve, translating to a higher likelihood of fire into the future as a result of climate change factors.
- the role of settlement policy, strategic and statutory land use planning can yield significant opportunities to reduce risk and ensure further growth is oriented to locations where the risk profile is as low as reasonably practicable. This process provides clarity and certainty to subsequent development assessment processes.
- those precincts of the Toowoomba Region identified as subject to a higher bushfire risk profile, pursuant to the QERMF risk analysis matrices, include:
    - Toowoomba urban area
    - Crows Nest – Rosalie
    - Millmerran.
- these locations experience an elevated fire frequency compared with other areas of the region, which experience relatively less fire events – largely due to the fragmentation and limited extent and connectively of vegetation across the Condamine Plains.
- these areas also comprise considerably higher fuel loads, which (in areas) are amongst the highest in Queensland along the Great Dividing Range and Toowoomba Escarpment area, of approximately 35 tonnes per hectare.
- the topography along the Toowoomba Escarpment and Great Dividing Range is steep, which combined with its extensive fuel load, has the potential to derive significant fire intensity and behaviour under certain conditions.
- the majority of fire-driven winds in this region are likely to emanate from the west, from the dry continental interior. This may mean a lower likelihood of fire moving upward on the Escarpment or the Great Dividing Range however, fire frequency mapping indicates that fire in these locations is still relatively high.
- the vulnerability to fire in the above locations is high to extreme. The housing stock in each precinct is relatively aged, on proportion, and the majority are not constructed to AS3959 standard or current planning provisions. Many locations also do not include observable asset protection zones separating dwellings from the source of hazard.
- the consequence of fire in the above locations is moderate to major having regard to the potential risks to life, property, infrastructure, environmental and economic values.
- some townships across the region include lands with the ability to accommodate further residential development, and therefore population increase. This is largely associated with the rural residential zone, of which there appears to be a relative surplus across some communities. These townships include Hampton, Crows Nest and

Millmerran. The same is also consistent for Cecil Plains, largely associated with potential for further development in the township zone.

- in these same areas, exposure of the key evacuation route network is also observed.
- the above observations are consistent with the nature of transitional zoning and land use which are typically located at the urban bushland interface. This is part of the function of these zones.
- a spectrum of planning options exist to consider the hazard and risk profile for these locations, to be considered by Council as part of its settlement policy formulation underpinning the preparation of the new planning scheme.
- in relation to primary future growth areas of the region, the Toowoomba Escarpment and Great Dividing Range provides a significant physical constraint to the immediate east of the Toowoomba urban area. It is acknowledged that current and historical strategic planning activities have identified the city to Highfields corridor as a key growth corridor within the region, which is likely to be sustained and expanded into the future.
- land to the east of the New England Highway is subject to significant fuel loads and steep topography. Future growth therefore should seek to avoid any further densification of development and population in this location. It is noted that Council's disaster management efforts already focus extensively on working with communities across the Toowoomba Escarpment.
- having regard to the city to Highfields corridor, lands to the south (Mount Kynoch – west of the highway) and west of Highfields incorporates mostly medium potential bushfire hazard, which presents a pockets or patches of isolated bushland in a highly fragmented manner. Some small, isolated areas of higher hazard exist in the area west of Highfields however, this is significantly limited in comparison with that area east of the New England Highway.
- potential future growth of the Highfields corridor may limit risk by orientating development to the immediate west of Highfields, in Woolmer and Cawdor towards Meringandan, and south of Meringandan Road. In this location, statutory planning measures may be more effective in limiting risk to a tolerable level.
- in relation to the Toowoomba urban area, that area to the west of the city including parts of Glenvale, Drayton, Westbrook and parts of Wellcamp is subject to highly fragmented and isolated pockets of potential bushfire hazard, with a limited incidence of high or very high hazard. The extent of hazard in this location is significantly lower than those areas to the east, along the Toowoomba Escarpment.
- it is acknowledged the escarpment area of the city has been historically developed over time, and is exposed to relatively high hazard. It is also relatively vulnerable, based on the nature of construction and types of land uses.
- *ShapingSEQ* identifies a combination of consolidation (infill) as well as expansion in order to accommodate further growth of the region. Thus over time, it may be assumed that properties within the bushfire prone area along the escarpment may be redeveloped. Whilst design and construction provisions may apply, land use provisions may equally limit considerable population increase in this area. Whilst it is recognised that infill targets may apply, the bushfire prone area of the Toowoomba Escarpment is not identified as a location where increased density infill development should be encouraged or supported, where involving potential population increase.
- a combination of Council planning, disaster management, engineering, roads and transport, parks and open space should collaborate to address the resilience of the existing rural residential communities to the west of Millmerran. Further expansion of

rural residential development in this location should not be supported on the basis of the existing bushfire risk profile of this location.

Mitigation options

A risk register has been prepared which identifies a spectrum of potential planning mitigation measures, in response to the strategic risks identified by this risk assessment. The implementation of relevant mitigation measures are explored as part of Part C of this Bushfire Risk Analysis, the Planning Issues and Options Analysis.

The following mitigation options are relevant for various precincts of Toowoomba Region.

Toowoomba urban area precinct:

- growth areas and development is contemplated in locations where hazard exposure is lowest possible.
- infill development opportunities may over time address a portion of existing building risk, however ideally this should avoid increased population exposure via increased density activities (i.e. multi unit dwellings etc.).
- some rural residential zoned land in the Toowoomba urban area is capable of accommodating further development within the bushfire prone area of the Toowoomba Escarpment. The zoning rationale of these allotments should be revisited.
- existing risk will require treatment via continued land and fire management practices, disaster management arrangements, community education and household preparation.
- identification of new road connections to facilitate growth which aid evacuation opportunities, providing increased route options.
- focus future growth expansion in locations where additional road network connections can be facilitated to support development.
- identify potential key existing pinch points in the urban network where opportunities exist to add works into the LGIP to achieved improve evacuation potential.
- growth expansion should consider the impact on adjoining land managers in managing hazard and risk.
- statutory planning measures which provide for asset protection may alleviate demand on emergency services, and enable more time, and provide emergency services with more options during an event. Statutory controls can also mitigate the risk of urban fire intrusion.
- retention of policy position to avoid community facilities and vulnerable facilities in bushfire prone areas (applicable across the region).
- a local law to assist with compliance of bushfire management plans in perpetuity may be a worthwhile consideration (applicable across the region).

Clifton – Greenmount, Pittsworth and Jondaryan precincts:

- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.
- clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.

Crows Nest – Rosalie precinct:

- road corridor treatments could be considered for key locations to reduce fuel loads along key evacuation route corridors.
- identification of new road connections to facilitate growth which aid evacuation opportunities, providing increased route options.
- QFES use of NSPs in key townships where evacuation may be challenged, and clear messaging on their purpose.
- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.
- clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.

Millmerran precinct:

- road corridor treatments could be considered for key locations to reduce fuel loads along key evacuation route corridors.
- identification of new road connections to facilitate growth which aid evacuation opportunities, providing increased route options.
- use of NSPs in key townships where evacuation may be challenged, and clear messaging on their purpose.
- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.
- clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.
- council planning, disaster management, engineering, roads and transport parks and open space should undertake a charrette process to unpack and identify risk issues and opportunities to enhance the existing resilience of rural residential areas west of Millmerran. Possible opportunities to enhance the resilience of these communities, to explore, may include:
  - improved road connections;
  - improved water supply options (including shared static supplies);
  - ongoing investment in early warning infrastructure (including understanding its limitations and challenges);
  - assistance with APZ clearing or incentives;
  - community champions to assist engender behavioural change and preparedness; and
  - liaise with Gladstone Regional Council to share learnings from the Deepwater fire.

Summary of risk assessment recommendations

A summary of key recommendations identified by this risk assessment are outlined below, for further consideration as part of the Toowoomba Region Futures Program:

1. Work with the State government as part of ongoing updates and amendment processes supporting the State-wide BPA mapping to address the patch and corridor mapping issues observed by the risk assessment within the Toowoomba urban area.
2. Consider the quantum of potential for growth in the townships of Hampton, Crows Nest, west of Millmerran and Cecil Plains relative to their hazard and risk profile and exposure of evacuation networks to identify appropriate risk-responsive land use planning controls.
3. Consider a policy of avoidance of vulnerable facilities in the bushfire prone area across the region. Where such uses are necessary, contemplate the strength of statutory controls which acknowledges these uses rarely require a bushfire building response under AS3959.
4. Explore the opportunity to align the definition of vulnerable uses (defined by the SPP guidance materials) with that which applies to flood under the current planning scheme, to aid in consistency.
5. Consider the existing exposure and vulnerability elements of this risk assessment, to support and inform Council's broader disaster management risk assessment processes pursuant to the QERMF.
6. Consider the opportunity to introduce design related aspects into the bushfire hazard overlay code, having regard to the provisions contained in the Bushfire Resilient Building Guidance for Queensland Homes, released by the Queensland Government. Design elements currently form a major gap in bushfire resilience planning provisions.
7. Explore opportunities for statutory planning provisions to appropriately address the bushfire resilience of land uses and activities not subject to AS3959 including short term accommodation, tourist activities, fuel stations, feed lots, hay storage, industrial activities and vulnerable facilities and critical infrastructure where these cannot be avoided in a bushfire prone area.
8. Ensure the new planning scheme appropriately balances the competing planning policy issues of biodiversity and environmental protection with bushfire protection and mitigation.
9. Consider the need for a bushfire planning scheme policy as part of the new planning scheme. This may provide detail to assist in achieving consistency of bushfire hazard assessments and management plans submitted to Council via the development assessment process. It may deal with standardisation of FFDI inputs, provisions for asset protection zones, evacuation road network guidance and vegetation management information.
10. Collaborate across Council to determine appropriate pathways for compliance for ongoing compliance of approved bushfire management plans, and options to ensure these are communicated appropriately to property owners in perpetuity. A local law approach may assist.
11. Upon identification of potential growth areas and urban form framework, addendum bushfire risk analysis should be undertaken to verify the risk-responsiveness of the settlement policy and test the draft planning scheme provisions prior to State interest review.

12. Ensure zoning and other settlement policy decisions are informed by considerations for evacuation, having regard to:
    - the existing and potential exposure of the road network to bushfire attack
    - the ability to provide / retain multiple egress route options
    - the capacity of the road network to support emergency evacuation
    - road network design and construction
    - identifying and mitigating potential route bottlenecks during emergency evacuation.
13. Consider a settlement policy which focusses on expansion of existing growth corridors and urban areas west of city and west of Highfields. Avoid a settlement policy which enables continued expansion east of the New England Highway or north of Meringandan Road, on the western side of the highway.
14. Consider the integration of provisions within the statutory context which focus on mitigating the risk of urban fire intrusion for new settlement at the urban bushland / grassland interface.
15. Consider the potential development yield of existing rural residential zoned allotments along the escarpment, the intention of the existing zoning rationale, and the tolerability of further development, relative to the risk profile of this location.
16. Develop a suite of criteria to inform ongoing growth and urban form planning, to ensure bushfire resilience is factored in as part of these processes.
17. Consider the development of whole-of-township community bushfire management plans, developed via multi-disciplinary input from across Council, for Hampton, Crows Nest and Cooyar.
18. On balance of the observations of this risk assessment and having regard to the findings of the 2020 University of Southern Queensland study into community preparedness across the Toowoomba Region Escarpment, consider the development of a bespoke education program to support communities to better understand their risk and prepare for bushfire. This may include support for business continuity planning with an emphasis on the agricultural sector.
19. Ensure the new planning scheme provisions are sufficiently robust to avoid further rural residential expansion within bushfire prone areas west of Millmerran.
20. Council planning, disaster management, engineering, roads and transport parks and open space should undertake a charrette process to unpack and identify risk issues and opportunities to enhance the existing resilience of rural residential areas west of Millmerran.

Planning issues and options observations

The following table provides a summary of the planning options identified by this report, for Council's consideration, with regard to the manner in which bushfire hazard and risk can and should be addressed by the new planning scheme for the region.

These options are also mapped to the specific plan-drafting approaches set out by the 'Integrating State Interests into Planning Schemes – Guidance for Local Governments' document which is the guidance material supporting the implementation of the State Planning Policy. This detail is provided in the concluding summary section of this report.

Table - Summary of bushfire risk-responsive planning options for Council consideration

Option No.	Planning aspect	Planning options for Council consideration
1	Mapping and hazard identification	Work with the State government as part of ongoing updates and amendment processes supporting the state-wide bushfire prone areas mapping to address the patch and corridor mapping issues observed by the risk assessment within the Toowoomba urban area, and adopt the revised mapping as the bushfire hazard overlay mapping for the purposes of the new planning scheme.
2	Regulatory linkages	Section 1.6 of the new planning scheme can / should specifically identify the buffer area as forming part of the designated bushfire prone area to avoid any potential for uncertainty. The designation of the bushfire prone area for the purposes of the Building Regulation must be undertaken in accordance with the 'Integrating building works into local planning instruments – guideline for local governments' document.
3	Regulatory linkages	Council may consider, as part of any forthcoming amendment for the current TRPS, to specifically cite the scheme's bushfire hazard overlay mapping as the designated bushfire prone area for the purposes of section 32(a) of the Building Act 1975 and section 12 of the Building Regulation 2006 in relation to Building Work regulated by the planning scheme.
4	Regulatory linkages	Council may consider, as part of any forthcoming major amendment for the current TRPS, to adopt the current state-wide bushfire prone areas map to replace the current overlay mapping, and introduction of new code provisions as an interim risk-reduction measure before the new planning scheme is adopted and comes into effect.
5	Policy	The strategic intent can / should recognise the potential risk of bushfire to human life and property and that development is required to ensure an acceptable or tolerable level of risk is achieved.
6	Strategic planning and zoning	Where growth (expansion or infill) is proposed in Toowoomba City, in the Highfields and Cabarlah area, and in Crows Nest, Council may consider bushfire hazard exposure as a key factor as part of any zoning decisions to accommodate future growth.
7	Policy and statutory drafting	Council may consider a consolidated review of locations susceptible to multiple hazards (including flood and landslip) and specifically identify within the strategic intent of the new planning scheme, higher risk locations in the region where growth and development should be avoided.
8	Policy and statutory drafting	The strategic intent of the new planning scheme could be bolstered and provide a strength of strategic direction where specific higher risk locations, or circumstances / criteria that give rise to elevated risk, are identified.

Option No.	Planning aspect	Planning options for Council consideration
9	Policy and statutory drafting	Council could consider the incorporation of disaster risk reduction outcomes as a facet of sustainable urban development, if this objective is retained as part of the new planning scheme.
10	Policy and statutory drafting	Council may consider outlining its strategic policy intent with regard to the protection of the natural environment from clearing for the exclusive purpose of bushfire protection within the strategic framework of the new planning scheme. On balance, the onus may be placed on the development to be appropriately sited to avoid unnecessary vegetation clearing.
11	Policy and statutory drafting	Council may wish to emphasise the changing fire weather conditions for the region as a result of climate change as part of the strategic framework in the new planning scheme.
12	Policy and statutory drafting	Acknowledging the risk from natural hazards posed to the community including, but not exclusive to bushfire, Council may consider refining the linkages between sustainable and safe communities, sustainable urban development and natural hazard risk reduction within the new planning scheme.
13	Policy and statutory drafting	Council may consider a multi-hazard approach to commentary in the strategic framework of the new scheme which avoids vulnerable uses in higher risk hazard areas, not exclusive to just flood hazard.
14	Policy and statutory drafting	Council can adapt the vulnerable use definition in the new planning scheme to relate to multiple hazards, and ensure code provisions and references to vulnerable uses in hazard overlay codes align to the same definition, insofar as possible.
15	Policy and statutory drafting	Council may consider expanding the range of land uses considered to be 'vulnerable uses' where there are shared vulnerabilities across multiple hazards.
16	Policy and statutory drafting	Council may consider specifically citing emergency evacuation during a natural hazard event as a key aspect of access and mobility narratives within the new planning scheme.
17	Policy and statutory drafting	Council may consider specifically citing the need to support emergency access and evacuation processes during a natural hazard event as a key aspect of infrastructure and servicing narratives within the new planning scheme.
18	Policy and statutory drafting	Opportunity exists to incorporate strategic statements into strategic framework narratives on infrastructure and servicing into the new planning scheme. A strategic outcome may include that bushfire protection is supplemented through adequate water supply provision.
19	Policy and statutory drafting	Council may consider revised commentary from an economic development perspective within the strategic framework which

Option No.	Planning aspect	Planning options for Council consideration
		focuses on ensuring economic development opportunities achieve an acceptable or tolerable level of risk.
20	Policy and statutory drafting	Council should consider a risk-responsive approach to levels of assessment for certain land uses / higher risk locations in bushfire prone areas as part of the new planning scheme, in line with the expectation of plan-drafting under the SPP 2017.
21	Policy and statutory drafting	Council may consider the draft purpose provisions contained within the draft assessment benchmarks under the SPP bushfire guidance 2021 to solidify a position on avoidance of intolerable risk outcomes, as well as aspects involving vulnerable uses, vegetation removal and rehabilitation, and demand on emergency services. Council's existing policy position in relation to the consideration of evacuation should be retained.
22	Policy and statutory drafting	Council may consider the example assessment benchmark provisions under the SPP bushfire guidance 2021 as a base upon which a new overlay code is constructed for the Toowoomba Region, noting it requires significant variation to ensure it is locally fit-for-purpose to meet Council's and the community's needs.
23	Policy and statutory drafting	Council may consider matters associated with bushfire hazard beyond the Bushfire Hazard Overlay Code, particularly with regard to environmental significance / biodiversity overlays and specific zone and development codes.
24	Policy and statutory drafting	Council may consider the value and benefit of a Bushfire Hazard Planning Scheme Policy to communicate its expectations on various aspects of bushfire mitigation measures which may be employed to comply with the overlay code.
25	Policy and strategic planning	The options for Council consideration in relation to responding to potentially intolerable risk locations in the region comprise a suite of the following: • back-zoning of existing urban or residential zoned land; ○ specific allotments across the region would need to be identified, the options weighed, and a Feasible Alternatives Assessment Report prepared in satisfaction of the Ministers Guidelines and Rules (MGR); • use of zoning controls to establish appropriate land use intent, and drive a desired settlement pattern; • use of zone-based precincts which establish specific bushfire resilient provisions for certain locations which use planning controls to limit increased risk (i.e. minimum lot size provisions, siting and design controls, access and evacuation requirements, etc.); and • utilisation of categories of development and assessment for specific land uses and development in specific locations (i.e. zone-based precincts) which can

Option No.	Planning aspect	Planning options for Council consideration
		ensure that non-desirable land uses trigger higher levels of assessment with the ability for Council to use all relevant parts of the planning scheme, beyond just the overlay code, as the assessment benchmarks, and also ensure the best possible outcomes for other uses where existing use rights may exist but which will benefit from being subject to requirements.
26	Policy and statutory drafting	Council may consider identifying potential bushfire risk-responsive growth locations as part of its broader settlement strategy.
27	Policy and statutory drafting	If Options 14 and 15 are not possible, Council could consider the adoption of a special definition for 'bushfire vulnerable uses' or the like. Alternatively, a table can be embedded at the end of the bushfire hazard overlay code which outlines the nature of vulnerable uses relevant for the Toowoomba Region however this may raise complexities for development assessment.
28	Policy and statutory drafting	Council may consider a similar policy position for hazardous facilities as it does for vulnerable uses.
29	Policy	Council is to decide its policy position in relation to avoidance of vulnerable uses and hazardous facilities in bushfire prone areas in the first instance. The desired approach in terms of the strength of scheme provisions to enable a merits-based assessment for specific circumstances, and what they may entail, or not at all would also form part of these considerations. Council's existing policy for vulnerable uses in flood prone areas may provide the opportunity to ensure consistency in terms of how multiple hazards are considered by the local planning instrument.
30	Policy	Council may consider the policy positions relative to varying bushfire risk profiles to inform its policy settings both in terms of settlement strategy as well as statutory instrument formulation.
31	Strategic planning and zoning	Any new zoning rationale considered as part of the growth management process must consider the two intolerable risk multipliers (exposure to very high fireline intensity and potentially constrained ability to evacuate) before any changes (for example, from rural to low density residential or emerging community) are made to the current settlement pattern within the region.
32	Strategic planning and zoning Statutory drafting	Consider the settlement policy approach for Rural residential zoned lands on the Toowoomba Escarpment between Preston in the south and Harlaxton in the north, including the viability of a bushfire resilient precinct which places a limit on future increased development density and population growth in location which is exposed to Very High Potential Bushfire Hazard. The level of assessment for certain forms of development in this location, within this zone, may also be augmented to reflect its risk profile.

Option No.	Planning aspect	Planning options for Council consideration
33	Strategic planning and zoning Statutory drafting	Consider the relevance of a bushfire resilient precinct as part of the Rural residential zone (which can apply to different parts of the region) with specific bushfire resilience provisions (i.e. such as minimum allotment size requirements) as a measure to place a limit on future increased development density and population growth in location which is exposed to Very High Potential Bushfire Hazard. The level of assessment for certain forms of development in this location, within this zone, may also be augmented to reflect its risk profile.
34	Policy and strategic planning	Consider a settlement policy for Prince Henry Heights, including consideration given to the need to limit the opportunity for existing risk to be further exacerbated by additional exposure of persons and property.
35	Statutory drafting	Consider the introduction of planning triggers for secondary and multiple road access / egress requirements as part of the RaL assessment benchmarks within the new Bushfire Hazard Overlay Code.
36	Strategic planning and zoning	Consider using the Cova framework as a tool to analyse the ability to evacuate for potential growth areas, as part of Council's growth management activities under the Toowoomba Region Futures Program.

Next steps

This report is provided to inform policy and the formulation of draft planning scheme provisions, both strategic and statutory in nature, for Council to take forward and consider as part of the broader Toowoomba Region Futures Program.

It is further intended the narratives in relation to the issues regarding how bushfire is addressed through the local planning framework is considered as part of the growth management process.

Toowoomba Regional Council

Toowoomba Region Bushfire Risk Analysis

CONTENTS

BUSHFIRE RISK ANALYSIS

Part A - Context Analysis

Meridian Urban

1 Introduction

This contextual review has been commissioned by Toowoomba Regional Council (herein referred to as 'Council'), as part of a broader bushfire risk analysis to support the Toowoomba Region Futures Program. The intent of this review is to explore and understand the contextual elements relating to potential bushfire hazard and risk as it currently exists.

This contextual *review focuses on the demographic, physical and meteorological characteristics of the Toowoomba region, the current policy environment, recent bushfire inquires and cutting-edge research.*

The broader bushfire risk analysis, of which this review forms part, will develop cutting edge, locally refined and pragmatic land use planning approaches to bushfire risk management to enhance the protection of the Toowoomba community from the threat of natural hazard.

It is intended that four broad components of the work are to be underpinned by the same contextual evidence base which seeks to integrate the best fire science and strategic land use planning approaches, with local knowledge and regional circumstances derived from extensive local stakeholder engagement, (Figure 1).

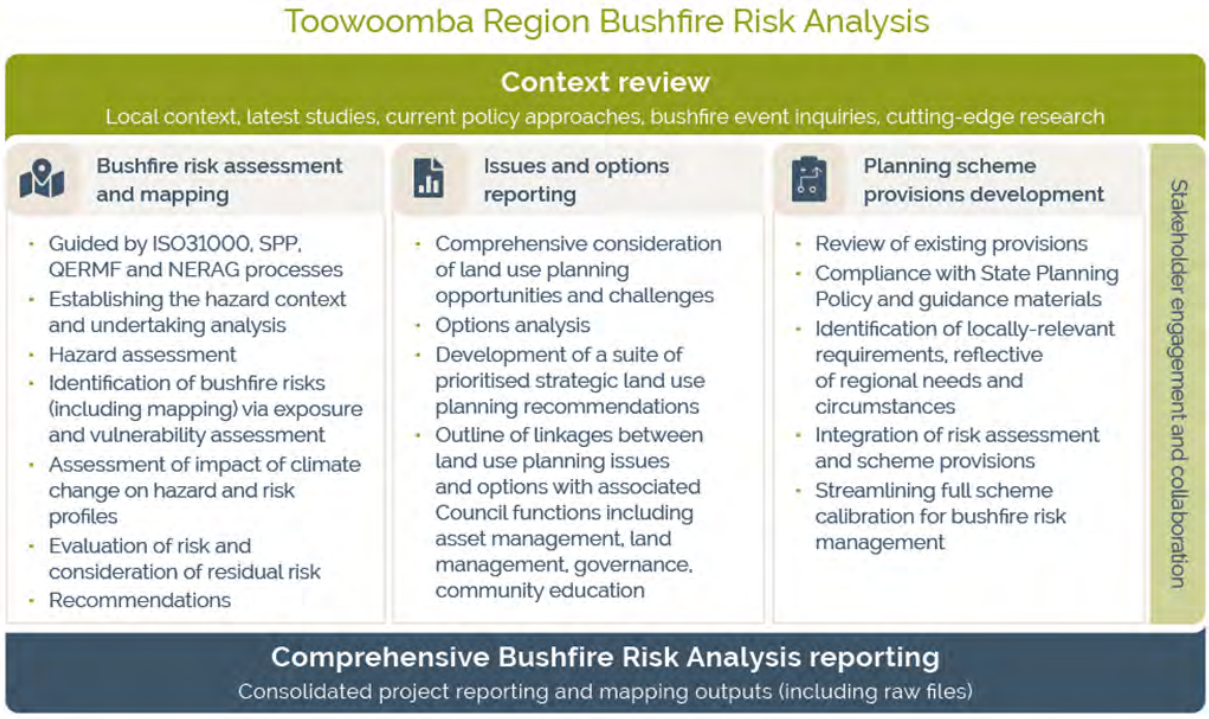


Figure 1 - Toowoomba Region bushfire risk analysis project framework and staging

This approach is required pursuant to the current State Planning Policy (SPP) and its guidance materials prepared by the State government, which together articulate the suite of bushfire hazard and risk considerations which are required to be appropriately considered as part of strategic planning activities in Queensland.

The preparation of a contextual review and analysis is the first phase of the risk assessment process pursuant to the *National Emergency Risk Assessment Guideline* (NERAG) and in accordance with AS/NZS ISO 31000 – Risk Management.

1.1 Contextual review

Pursuant to NERAG and AS/NZS ISO 31000, the essential first stage of any natural hazard risk assessment process is establishing the context to understand the policy and regulatory

environment, the physical environment, weather and climatic trends and event history (AIDR, 2017).

Part A of the Bushfire Risk Analysis therefore considers the following:

2 Toowoomba Region overview

The Toowoomba Region is part of the Darling Downs, at the western extent of South East Queensland. The region spans 12,973 square kilometres encompassing the Great Dividing Range in the east, where the principle centre of Toowoomba is located. From Toowoomba city, the region spans north approximately 85 kilometres, south approximately 50 kilometres and west approximately 90 kilometres. The region is bound by the local government areas of South Burnett Region to the north, Somerset Region and the Lockyer Valley Region to the east, the Southern Downs Region and Goondiwindi Region to the south and the Western Downs Region to the west.

Supporting the principle centre of Toowoomba city, the region consists of a number of regional centres including Cambooya, Clifton, Goombungee, Greenmount, Highfields, Millmerran, Oakey, Pittsworth and Yarraman which are interspersed throughout the region (Figure 2).

Figure 2 - Geographic extent of the Toowoomba Region

The city of Toowoomba is located approximately 125 kilometres west of Brisbane immediately west of the Great Dividing Range, a prominent ridge separating the Darling Downs and Moreton regions. Toowoomba is the largest non-capital inland city in Australia and serves as the principle urban and economic centre of the Darling Downs providing healthcare, manufacturing, retail and education services to the broader region. Toowoomba city has experienced gradual expansion on the city fringes with residential and rural residential development occurring. A substantial enterprise / industrial area is also located west of the city.

Outside of the urban areas, the region is predominately considered as 'rural' and is primarily used for agricultural purposes including for grazing, vegetable growing and cropping. Some forestry uses occur within the south-west of the region in Kumbarilla and Dunmore State Forests (QGSO, 2020).

The region serves as a prominent logistical hub and a major inland port providing important road, rail and air services. A number of national highways intersect the region which provide transport and freight linkages to surrounding regions and into New South Wales. Freight rail lines are also provided across the region as well as the planned Inland Rail. The Toowoomba Wellcamp Airport also provides freight and passenger services.

Areas along the Great Dividing Range in the east include steep gullies and ridges up to 900m AHD. Away from the range, the majority of the Toowoomba Region is characterised by relatively flat plain lands with some low lying hills and valleys to as low as 390m AHD. The region includes a number of State Forests and National Parks particularly in the south-west and northern parts of the region.

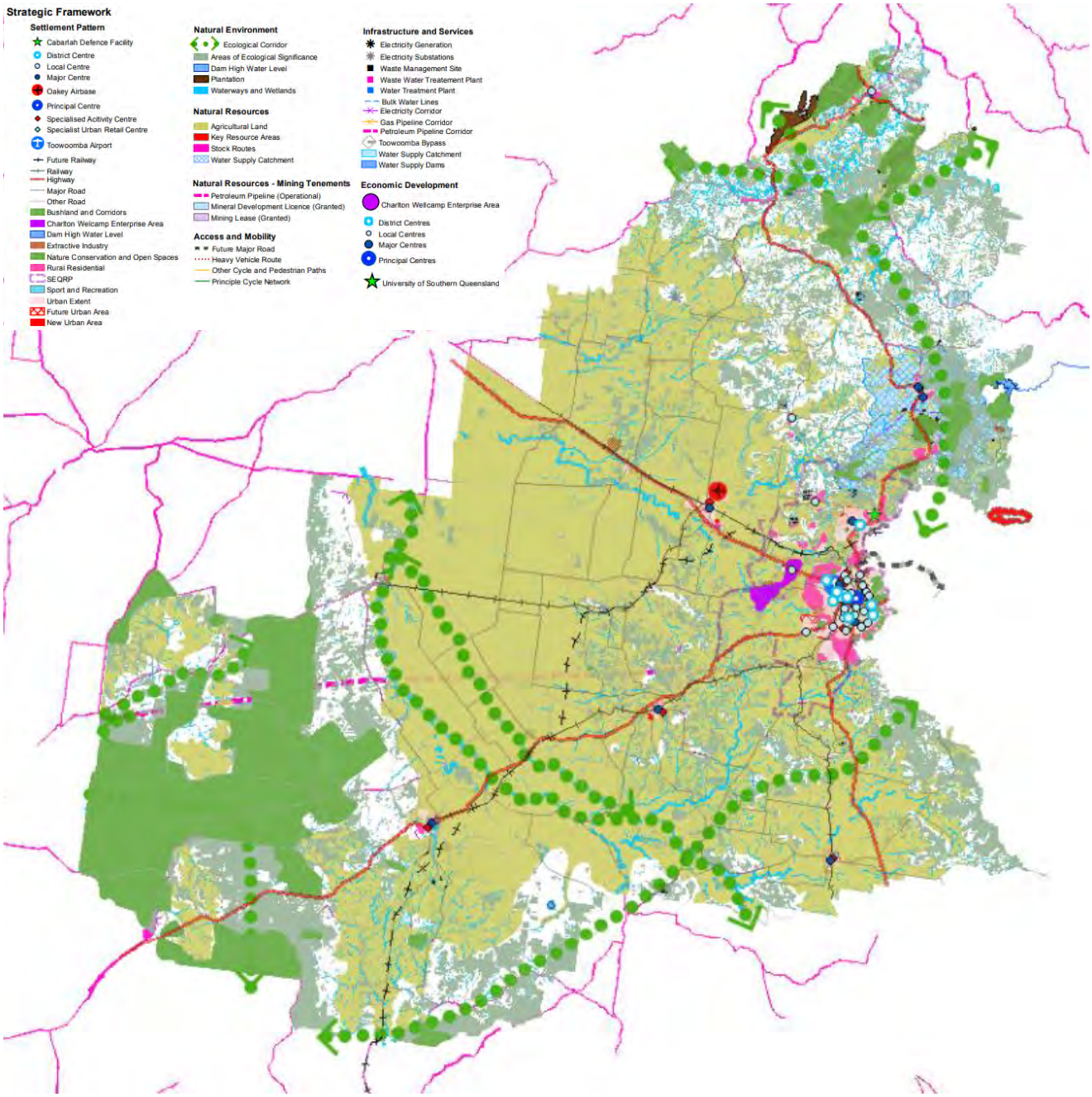


Figure 3 - Settlement pattern of the Toowoomba Region (Toowoomba Regional Council, 2017)

2.1 Demographic and socio-economic context

In terms of loss of life and injuries, in Australia bushfire registers as the second highest disaster cause, after heatwave, and greater than flood and storm (Deloitte Access Economics, 2017). It is therefore important to understand the demographic and socio-economic context of the region when considering bushfire hazard.

As of the 2016 Census, the Toowoomba Region maintains a resident population of 160,779 people (ABS, 2016). It should be noted however, the vast majority of the population (81.3 per cent, or 130,722 people) reside within the urban extents of Toowoomba city (defined as the 'Significant Urban Area' level geography of the ABS which includes the outer suburbs of Highfields, Westbrook and Hodgson Vale). Noting the centralised nature of the region, it is relevant to consider the demographic and socio-economic factors within an 'urban' and 'rural' context (refer to Error! Reference source not found.).

The demographic profile of the Toowoomba Region indicates a slightly older population compared with that of Queensland, with a higher proportion of both youth (aged 14 and under) and seniors (aged 65 and older) present. When interrogated further, it can be seen that the rural areas of the region skew towards an older demographic, with a higher proportion of seniors than the urban centre of Toowoomba.

Table 1 - Demographic and socio-economic snapshot of Toowoomba Region (ABS, 2016)

	Toowoomba Urban Area	Toowoomba Rural Area	Toowoomba Region	Queensland
Median age	37	44	38	37
14 years and under	20.4%	19.7%	20.3%	19.4%
65 years and older	17.0%	21.0%	17.8%	15.3%
Indigenous population	4.0%	4.1%	4.0%	4.0%
Persons requiring assistance	5.8%	6.2%	5.9%	5.2%
Occupied dwellings	47,572 (81.7%)	10,632 (18.3%)	58,204	1,656,831
Dwellings without a vehicle	6.3%	2.6%	5.6%	6.0%
Non-English speaking households	8.2%	4.3%	7.5%	14.6%

*Based on 2016 ABS Census data. 'Toowoomba Urban Area' is based on the ABS 'Significant Urban Area' geography. 'Toowoomba Rural Area' incorporates the balance of the region.

Having regard to the above demographic and socio-economic analysis, generally the population of the Toowoomba Region does not exhibit any particular, statistically-significant differences from the Queensland State averages. Acknowledging however, the rural area population skews toward an older demographic and a slightly higher proportion of individuals requiring assistance than the urban area.

3 Understanding bushfire hazard

Bushfire is a type of natural hazard which is commonplace across Queensland and Australia. While land and fire management efforts seek to reduce fuels across managed estates such as national parks, reserves, conservation areas and other public bushland areas, fire is endemic to the Australian landscape and will continue to occur.

Ignition factors can vary and include natural ignitions from lightning strikes, as well as human-caused ignitions. These ignitions can be accidental, occurring from the use of power tools, campfires which have not be appropriately extinguished, heavy equipment and farming machinery, and in some cases they can be caused by electricity infrastructure. They can also be deliberately lit.

There are several factors, beyond ignition, which contribute to bushfire hazard. These include:

Fire weather | **Climate drivers and influences** | **Vegetation and fuels** | **Topography**

A hazard is different to risk. A hazard is the presence of factors which may give rise to an event. A risk is the consideration of likelihood and consequence of an event, as well as factors of exposure, vulnerability and tolerability.

Part B – Risk assessment of the Bushfire Risk Analysis will contemplate these aspects across the Toowoomba Region in detail.

There are also different types of fire:

- ground (including grass fires);
- surface; and
- crown (or canopy).

Crown or canopy fires generally produce the highest output of energy and thus, are the most severe form of bushfire. Crown fires typically occur when bushfire hazard conditions deteriorate, and fire danger is increased. Crown fires also rely strongly on vertical fuel continuity, and as such, the surface layer of fuels (the understorey) is key. This is where most land and fire management efforts are focussed.

3.1 Elements of bushfire hazard

This section provides an overview of the factors which contribute to bushfire hazard. The specific context of these factors across the Toowoomba Region is provided later in Part A.

3.1.1 Fire weather

In this area of Queensland hot-air fire wind is typically generated by west, north-west and south-westerly winds and cool-air fire wind is generated by south-westerly winds, both of which are prevalent during Southern Queensland's fire season which extends from August to March. The extent of annual fire seasons can vary year-on-year due to macro-climatic

conditions. In some situations, south-easterly winds can drive bushfire behaviour which is an important consideration for the Toowoomba Escarpment area due to its eastern orientation.

Other fire weather conditions must also be contemplated such as preceding weather conditions (such as low rainfall or drought), air temperature and relative humidity. If the area has been subject to drought or low rainfall for a period of time, vegetation health tends to deteriorate with increased leaf drop, curing and drying. This contributes to increased ground fuel loads and general ignition susceptibility. Prolonged dry periods also reduce soil moisture content.

The Forest Fire Danger Index (FFDI) is a commonly used method to readily advise the community of the likely ability of fire suppression based on fire weather and fuel type (specifically forest), which is used to inform the Fire Danger Rating (FDR) System which guides the communication of bushfire warnings across Australia, refer to the following figure.

It is noted, the FDR system is currently being revised and a new FDR will replace that outlined at the figure below in 2022, across Australia.

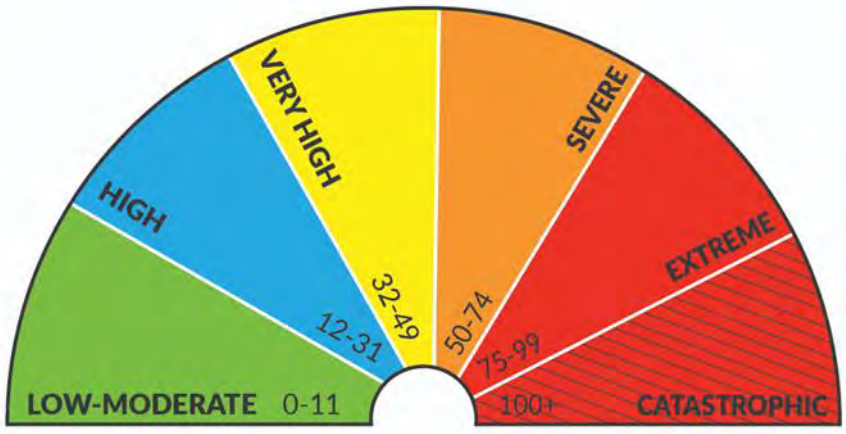


Figure 4 - Fire danger ratings and corresponding FFDI values

3.1.2 Climate drivers and influences

There are a number of climate influences which can give rise to more severe periods of increased fire danger for parts of Australia, and influence seasonal fire weather. The Indian Ocean Dipole (IOD) is one of the key drivers of Australia's climate, producing dryer conditions in positive phases, and wetter conditions in negative phases (BoM, 2020).

Another profound influence is the El Nino Southern Oscillation (ENSO), which is the oscillation between El Niño and La Niña conditions. El Niño conditions generally result in below average rainfall for much of eastern Australia (BoM, 2020). When El Niño coincides with a positive IOD, the two phenomena can reinforce their dry effects (BoM, 2020). El Niño conditions generally result in more frequent and dangerous fire weather days (Abram *et al*, 2021).

Other influences can also contribute to drier and warmer conditions, including the Southern Annular Mode (SAM).

In 2020 the Bureau of Meteorology issued a Special Climate Statement detailing the climatic factors which contributed to dangerous fire weather conditions in the 2019-20 fire season, confirming large areas of Australia had their highest accumulated FFDI for December in 2019. It also notes 2019 had the highest December accumulated FFDI for Australia as a whole, continuing the pattern seen in the spring period. Interestingly, the ENSO in 2019 was neutral as classified by BoM and instead, the variability of the IOD and SAM were important in driving the dry and hot conditions that elevated the fire risk during the Black Summer fire season of 2019-20 (Abram *et al*, 2021).

Climate change is largely associated with anthropogenically forced climate trends as a result of greenhouse gas emissions. Over time, fire weather conditions across large parts of Australia will continue to deteriorate as a result of increased temperatures, lower rainfall, hotter nights, lower soil and biomass moisture content and accumulation and changes to fuel loads more broadly (Abram *et al*, 2021).

3.1.3 Vegetation and fuels

Fuel load, arrangement and connectivity (or conversely, fragmentation) represents a considerable component in dictating the behaviour of fire in terms of intensity, rate of spread and flame height. Different vegetation groups yield different fire behaviour and intensities by virtue of their characteristics such as density, arrangement, fuel loads and other characteristics.

Vertical and horizontal continuity of fuels is also a considerable factor. Vegetation characteristics guide estimates on how quickly fire might spread and the likely fire behaviour and intensity which may occur.

3.1.4 Topography

Topography and to a lesser degree, aspect, also influence fire behaviour and intensity. Topography can have a drastic affect, with the rate of speed doubling for every 10 degrees of upslope and slowing by half for every 10 degrees of downslope, as a general rule.

Aspect can also affect bushfire behaviour, where areas with northerly or westerly aspects experience a higher level of solar access than those areas with a southern or eastern aspect. Notwithstanding, in times of drought and below average rainfall moisture levels in soil and vegetation in more sheltered areas with southerly and easterly aspects can also decrease substantially giving rise to significantly higher fuel abundance where the preceding fire regime has been less frequent or intense.

Aspect is also important in terms of understanding key fire runs or fire paths, being those tracts of the landscape which may 'convey' fire.

Effective slope is the term used for the slope of land beneath hazardous vegetation.

Site slope represents the topography between a building or receptor and the hazardous vegetation.

3.2 How bushfires move across the landscape

How bushfires transition across the landscape is a function of the factors listed above, and can be considered at both the micro and macro levels.

At the micro level, ignitions are initially carried by leaf litter or tree trunks which are projected forward on the prevailing localised wind. Fire will spread along the ground, and also vertically, into surface-level (understory) vegetation, as flame height grows. This can preheat tree canopy vegetation which may also ignite under certain conditions. Bushfire will produce ember attack which will be blown ahead of the fire front, causing spot ignitions and spot fires. The fire will also emit radiant heat.

These are known as 'bushfire attack mechanisms' and are a particular focus of land use planning and building provisions, given their threat to people, property, infrastructure and the environment. Further details on bushfire attack mechanisms follows.

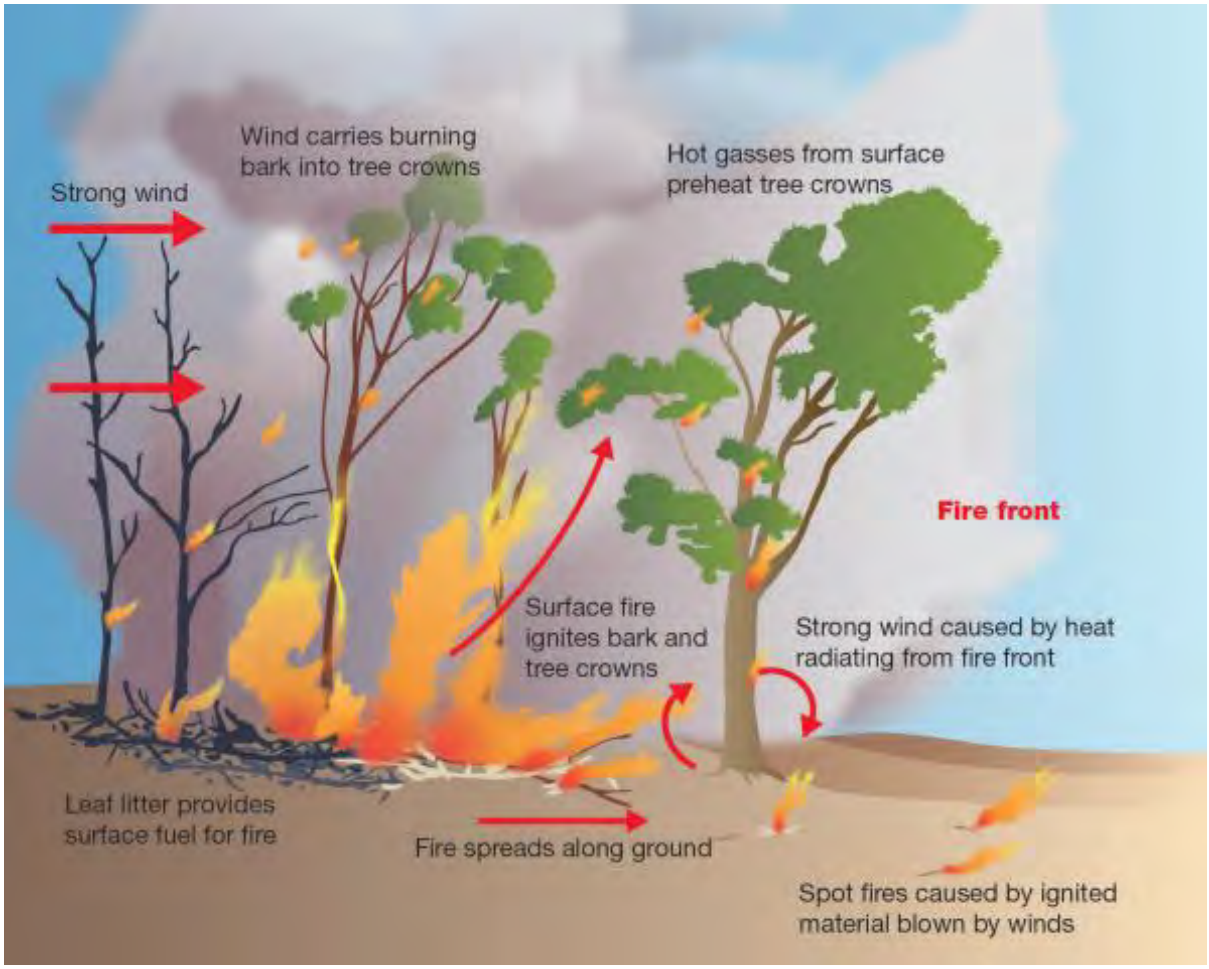


Figure 5 - Movement of fire across the landscape (Source: GTANSW)

At the macro level, various atmospheric influences also play a role in the transition of fire across the landscape and this is particularly relevant in larger events where fire produce pyrocumulonimbus clouds.

Smoke plumes of hot air will rise over the fire ground, forming a convection column which cools in the atmosphere, before transitioning into cloud form. In some instances this can produce thunderstorms and lightning, which can lead to further ignitions and spot fires ahead of the fire front.

3.3 Bushfire attack mechanisms

This section provides a brief overview of the bushfire attack mechanisms which may impact upon life, property and the environment.

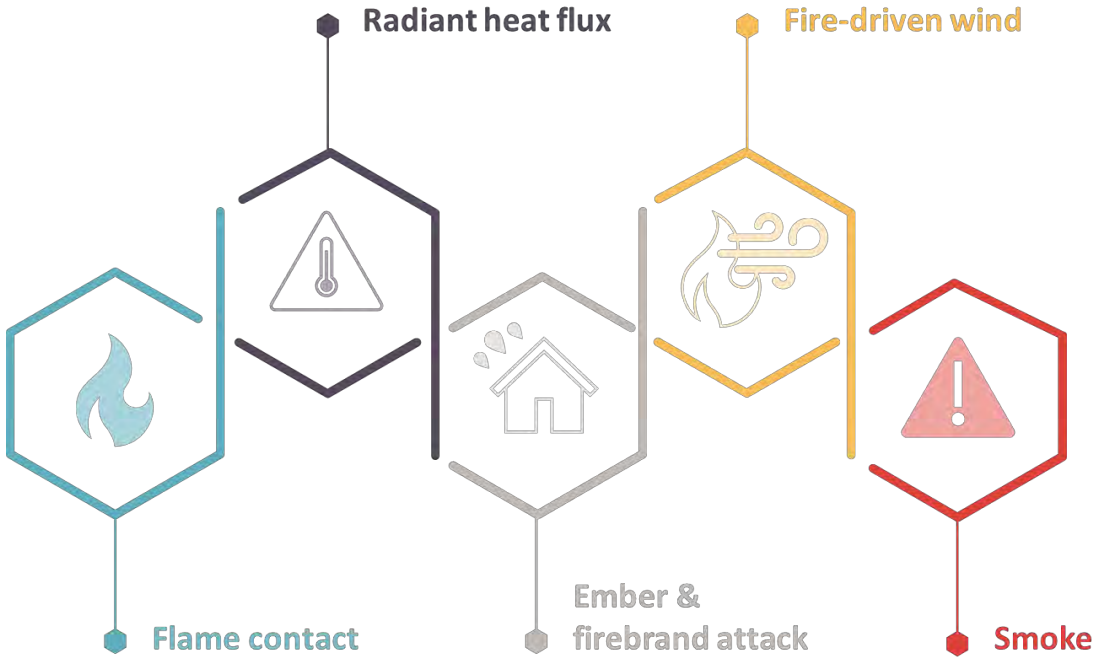


Figure 6 - Bushfire attack mechanisms

- *flame contact* refers to flame contact from fire, where the flame which engulfs burning vegetation comes in to contact with buildings, assets or people. It is estimated that between 10 to 20 per cent of buildings lost to bushfire occur as a direct result of flame attack (CSIRO, 2014);
- *radiant heat flux* is the heat energy released from the fire front which radiates to the surrounding environment. It remains one of the leading causes of fatalities due to bushfire. In terms of impacts on buildings, radiant heat can pre-heat materials making them susceptible to ignition, can cause non-piloted ignition to certain materials at specific temperatures and can severely damage and melt materials Radiant heat can also damage building materials such as window glazing, allowing openings into a building through which embers may enter. Radiant heat impact is an especially important factor in building-to-building ignition. The figure below outlines the observed effects of radiant heat exposure for persons and buildings;

Radiant heat flux kW/m²	Observed effect
1	Maximum for indefinite skin exposure
3	Hazardous conditions, firefighters expected to operate for a short period (10 minutes)
4.7	Extreme conditions, firefighters in protective clothing will feel pain after 60 seconds of exposure
6.4	Pain after 8 seconds of skin exposure
7	Likely to be fatal to unprotected person after exposure for several minutes
10	Critical conditions, firefighters not expected to operate in these conditions although they may be encountered. Considered to be life threatening in less than 60 seconds in protective equipment. Fabrics inside a building could ignite spontaneously with long exposure.
12.5 (BAL-12.5)	Volatiles from wood may be ignited by pilot after prolonged exposure. Standard float glass could fail during the passage of a bushfire.
16	Blistering of skin after 5 seconds
19 (BAL-19)	Screened float glass could fail during the passage of a bushfire.
29 (BAL-29)	Ignition of most timbers without piloted ignition (3 minutes of exposure) during the passage of a bushfire. Toughened glass could fail.
40+	Flame zone – exposure to direct flame contact from fire front.

Figure 7 - The effects of radiant heat (Source: NSW RFS, 2006)

- *ember and firebrand attack* relates to the convective forces of bushfire which raises burning embers into the atmosphere on prevailing winds, depositing them to the ground ahead of the fire front to spark spot fires (also referred to as spotting). Firebrands are typically larger items of burning material such as bark which can also stay alight for some time, and can be more dangerous to humans. Ember attack will usually occur ahead of the arrival of the fire front. Embers attack the vulnerabilities of buildings and is estimated to cause between 80 and 90 per cent of building loss as a result of bushfire (CSIRO, 2014);
- the convective forces of bushfire typically result in strong to gale force *fire driven winds* which can, on occasion, lead to building damage. The typical effects of fire driven wind include the conveyance of embers, damage from branches and debris hitting the building and breaking windows; and
- *smoke* emission remains a secondary effect of bushfire and is one which is typically not addressed by bushfire assessments but is a relevant aspects of risk assessment. This is for two reasons, the first relates to the potentially severe impact of smoke emission on the human respiratory system. Toxic smoke emission can occur, particularly where buildings, furnishings, materials and the insides of vehicles are ignited or exposed to extreme radiant heat (i.e. materials start to melt). Secondly. It can reduce visibility which can result in challenging evacuation conditions.

3.4 Understanding life and property loss

The purpose of the Bushfire Risk Analysis is to understand the potential quantum of risk that bushfire hazard poses to life, property and the environment with specific regard to the role of land use planning. It is intended this work will underpin and provide the evidence base upon which locally-specific land use planning controls, from strategic to statutory, can be deployed to limit and reduce exposure of people and property to bushfire threat.

Several seminal bodies of research have been compiled which provide insight into various aspects of life and property loss, in particular:

Understanding life loss in bushfire events

In 2012, the CSIRO in conjunction with the former Bushfire Corporative Research Centre undertook a comprehensive study into matters of both life and house loss across utilising over 110 years (1901-2011) of data across 260 bushfire events (Blanchi et al. 2012). Over this period, a total of 825 known civilian and firefighter fatalities have occurred (Blanchi et al. 2012).

Important findings of this seminal research are as follows:

- it is evident that fire weather and proximity to forest are very strong contextual drivers for defining the potential for fatalities to occur;
- 85 per cent of fatalities occur within 100m of bushland;
- 50 per cent of all recorded facilities have occurred on days exceeding FFDI 100 (most fatalities occur as a result of infrequent but high magnitude events);
- late evacuation is the most common activity persons were engaged in at time of death (30.3 per cent) followed by sheltering inside a structure (24.8 per cent) and defending a property outside (22.4 per cent);
- for those instances where sufficient data is available with respect to fatalities occurring during the act of evacuation, most were trapped on roads by either fallen trees or become bogged, the remainder having run off the road due to poor visibility as a result of smoke conditions;
- in terms of location of fatal exposure, 50 per cent occurred out in the open (including persons found outside structures and outside vehicles), 28 per cent occurred inside structures and in events where FFDI exceeded 100, fatalities within structures represented over 75 per cent of life loss;
- the percentage of fatalities within structures appears to be increasing over time, mostly attributed to the 2009 Victorian Bushfires where 118 of the 173 fatalities occurred inside a structure;
- during the 2009 Victorian Bushfires, findings demonstrate that most of those persons who lost their lives 'could not respond appropriately to the risk the bushfire presented' on that day;
- increasing percentages of fatalities occurring within structures in later fires (1965-2011) were persons aged 65 and over, as well as those with physical and / or mental disability;
- most fatalities occur between the hours of 3pm and 9pm – when FFDI is at its peak (3pm) and when summer cool-change winds occur. 90 per cent of fatalities occur immediately after afternoon wind changes;
- 41.9 per cent of fatalities which occurred from 1965 to 2011 'were aware of the fire with enough time to save their lives; had a fire plan and were following intended actions which were ineffective', with 21.8 per cent who also had enough time to save their lives but either had no fire plan or that plan was not followed, and

includes persons who were 'waiting to see'. 10.9 per cent were unaware of a fire and only realised when it was too late, and a further 10.7 per cent were either children or adults following the instructions of another person. 6.1 per cent were either physically or mentally incapable of implementing an effective survival strategy (Blanchi et al. 2012).

Understanding risk to property

The CSIRO, in conjunction with the Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC), remain among the leading property loss research agencies in Australia, having produced a multitude of reports, studies and tools to assist in developing a solid evidence base to support policy-level decision-making.

With respect to property loss, CSIRO studies have found that approximately 98 per cent of all building loss has been found to occur on days when the FFDI exceeded 45 (Blanchi & Lucas, 2010). In events where the FFDI exceeds 50, fire suppression at any part of a fire line is virtually impossible due to the intensity and unpredictable behaviour of a fire (Leonard & Blanchi, 2012).

Land use planning, building design, fuel management, strategic intervention of fire brigades and community preparedness are the only effective defence mechanisms available once the FFDI has exceeded 50 (Blanchi & Lucas, 2010; Leonard & Blanchi, 2012).

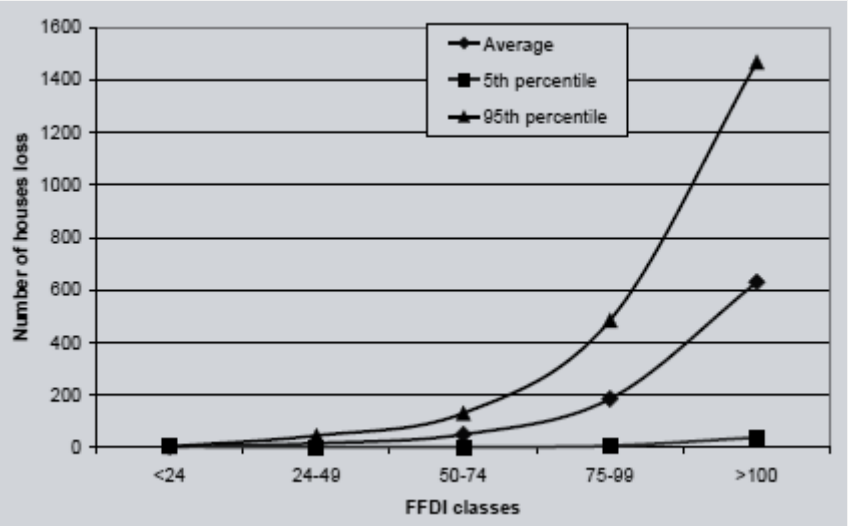


Figure 8 - Average house losses for different FFDI classes (Source: Leonard & Blanchi, 2012)

Extensive property loss research reveals that approximately 80 per cent of property loss occurs within 100m of the bushland interface, with the full extent of loss typically occurring within circa 700m of the bushland interface in urban contexts (Leonard & Blanchi, 2012; McAneney & Chen, 2004 and Ahern & Chladil, 1999). This is particularly relevant given recent bush fire events across the world which have penetrated urban areas.

The 2020 Royal Commission into National Natural Disaster Arrangements and the NSW Bushfire Inquiry noted the loss and damage of properties beyond 100m of bushland and in un-mapped areas from the 2019/20 Black Summer Bushfires. However, it is understood the extent of this occurrence was consistent with the observations above.

4 Policy and regulatory context

This section provides an overview of the policy and regulatory context and frameworks relating to bushfire protection in Queensland, as relevant to this review and the broader bushfire risk analysis for the Toowoomba Region.

These key instruments demonstrate a 'line of sight' with respect to the cascading relevance from legislation and regulation, to national best practices instruments, previous inquiries, risk assessments and studies as well as leading Australian and international fire and risk research.

4.1 National policy settings and guidance materials

The national policy landscape relating to natural hazard risk management maintains a strong focus on implementation of the United Nations' *Sendai Framework* through improving the understanding of risk across all sectors and all levels of government, stakeholders and the community through a shared responsibility for building resilient communities. In particular:

- given the alignment with the Sendai Framework, there is naturally a focus on understanding risk, sharing risk information and using improved technologies to understand risk;
- there is a focus on understanding risks to the social, built, economic and natural environments;
- there is a strong focus on building 'disaster resilient communities' by improving the community's understanding of risk and their vulnerabilities, and taking a shared responsibility approach in building resilience to natural hazards such as bushfire;
- planning is presented in the *National Strategy for Disaster Resilience* as an important element of shaping disaster resilient communities;
- efforts and resources should be targeted to priority disaster risks and mitigation opportunities, and exposure to unreasonable risks from hazards avoided or suitable arrangements to minimise risks implemented;
- with regards to recovery and rebuilding, there is a focus on considering the appropriateness of rebuilding in the same location, or rebuilding to a more resilient standard to reduce future risks;
- many of the *National Disaster Risk Reduction Framework* strategies apply to the planning sector;
- the *National Climate Resilience and Adaptation Strategy* not only aligns with the premise that resilience building is a shared responsibility and that there is a need for an evidence-base, risk management approach, but also identifies the importance of factoring climate change into decisions through collaborative and values-based choices and the need to revisit decisions and outcomes regularly;
- ***Profiling Australia's Vulnerability*** brings to the forefront the importance of understanding the relationship between community values and vulnerabilities, including the vulnerabilities of systems that communities rely on, to strengthen resilience. It identifies that trade-offs need to be made between social, built, economic and natural environment factors at the local level when making decisions, and that incentives need to be embedded to guide decision making;
- the *National Emergency Risk Assessment Guidelines (NERAG) Handbook* produced by the Australian Institute for Disaster Resilience provides a nationally consistent approach to risk assessment and prioritisation to support the implementation of strategy. It provides a contextualised, emergency-related risk assessment

methodology consistent with *AS/NZS ISO 31000: 2018 Risk management – principles and guidelines*;

- pursuant to the *National Construction Code* and the *Building Code of Australia*, development on land within a designated Bushfire Prone Area is required to be assessed against and comply with the construction requirements of *Australian Standard AS3959-2018 – Construction of Buildings in Bushfire Prone Areas*. A designated Bushfire Prone Area is established by the Bushfire Hazard Overlay map within a planning instrument, or pursuant to Part 1.6 of a planning scheme or a bushfire hazard overlay code;
- of particular relevance in the incorporation of natural hazards and risk into planning processes, the Australian Institute for Disaster Resilience *Land Use Planning for Disaster Resilient Communities Handbook* provides a summary of regulatory instruments, spatial instruments and assessment processes and their role in disaster resilience, aligned with the Planning Institute of Australia's *National Land Use Planning Guidelines for Disaster Resilient Communities*; and
- the *Evacuation Planning Handbook* prepared by the Australian Institute for Disaster Resilience provides a suite of considerations for evacuation planning, using the five nationally-recognised stages of the evacuation process. The Handbook articulates the relevant aspects of community-level evacuation planning which are to be considered as part of evacuation planning processes.

4.2 State-based policy and regulation

The state-wide policy and regulatory environment relating to natural hazard risk management and bushfire protection maintains a strong focus on protection of life, property and the environment. This is aligned with the state's commitment to secure a liveable, sustainable and prosperous Queensland. Those aspects of the state-wide policy and regulatory framework which contribute to this includes:

- recognising, equipping, integrating and collaborating to drive towards an innovative and resilient Queensland that manages the risks and harnesses the opportunities of a changing climate through the *Queensland Climate Adaptation Strategy 2017-2030 – Pathways to a climate resilient Queensland* and its subsequent *sector adaptation plans*;
- the four objectives of the *Queensland Strategy for Disaster Resilience* and its implementation plan, *Resilient Queensland 2018-2021*;
- the emergency management principles under the *Queensland State Disaster Management Plan* align with national approaches, including those related to adopting a comprehensive approach, understanding an all-hazards approach, building local disaster management capacity and supporting the *Queensland Disaster Management Arrangements* (QDMA) pursuant to the *Disaster Management Act 2003*;
- the *Queensland Bushfire Plan 2020* articulates the principles and priorities for bushfire risk management in Queensland through prevention, preparedness, response and recovery. Risk-based land use planning and building and construction provisions are identified as key prevention and mitigation measures for bushfire disaster risk reduction in Queensland. It also articulates the QDMA provisions, roles and responsibilities specifically relevant to bushfire hazard in Queensland;
- the *Queensland Emergency Risk Management Framework* (QERMF) promotes opportunities for collaboration and communication between Government, industry stakeholders and the community across the three disaster management levels (Local, District and State) in Queensland. It also promotes the need for identification and communication of residual risk across these levels;

- the *Changes to Fire Weather in Queensland 2019* by the Australian Bureau of Meteorology a general trend towards warming and greater number of days with a higher fire danger rating, including for the Toowoomba Region;
- the *Queensland State Natural Hazard Risk Assessment 2017* identifies the vital role of the state and local governments in planning for and managing sustainable development through, in part, increasing the resilience of communities through prevention and mitigation with improved land use planning provisions for avoidance, mitigation, and response and recovery;
- the *State Infrastructure Plan* includes a strategic objective for improving the sustainability and resilience of Queensland's infrastructure;
- the *Planning Act 2016* regulates planning in Queensland and provides strategic guidance for planning for bushfire resilience. This includes regulating the relationship between planning and building, regional planning approaches, compliance with the SPP and the regulation of development application processes;
- the Act also includes provisions for Councils to prepare strategic planning frameworks which articulate the long-term vision for land use in local areas;
- the *Fire and Emergency Services Act 1990* outlines the responsibilities to extinguish or control fires in Queensland;
- the *State Planning Policy* establishes the strategic and statutory planning requirements which are relevant to the State interest of natural hazards, risk and resilience, which includes bushfire hazard and risk. It requires strategic planning processes to consider the nature of potential bushfire risk and key strategic issues, to determine if development is appropriate in its risk context;
- the *Integrating state interests into planning schemes – guidance for local governments* document was released in 2021 and provides non-statutory guidance for local government in integrating the State interest for bushfire into local planning instruments and processes. This includes guidance on the preparation of fit-for-purpose risk assessments;
- a compendium State interest guidance material document, *Bushfire resilient communities – technical reference guide for the State planning policy State interest* ***'Natural Hazards, Risk and Resilience – Bushfire'*** was released in 2019. Prepared by QFES, this guidance material provides further detail with regard for local planning processes and the preparation of bushfire hazard assessments;
- regional-level planning instruments further guide the strategic planning approaches adopted by local governments in South East Queensland, including *ShapingSEQ: South East Queensland Regional Plan 2017* and the *Darling Downs Regional Plan 2013;*
- the *Bushfire Resilient Building Guidance for Queensland Homes* document is a guide released by the Queensland Reconstruction Authority in conjunction with the CSIRO which provides information about improving the bushfire resilience of new and existing Queensland homes. It incorporates retrofitting information for existing homeowners, as well as tips for new building and renovation design.

1.1.1.1 SPP state interests for natural hazards, risk and resilience

The State Planning Policy (SPP) identifies natural hazards, risk and resilience as a state interest and seeks to 'ensure natural hazards are properly considered in all levels of the planning system'. In relation to bushfire hazard and risk, the SPP identifies how the state interest can be appropriately integrated into local planning instruments, as summarised in the table below:

Table 2 - Natural hazards State interests

Mapping	In support of the SPP state interest, state-wide bushfire prone area mapping has been developed. The mapping identifies three potential bushfire intensity classes being very high, high and medium. A potential impact buffer surrounds all areas. The SPP identifies that the bushfire prone area mapping must be appropriately integrated and can be locally refined by a local government in a local planning instrument (subject to approval by the Planning Minister), in a way that achieves the state interest policy.
Fit-for-purpose risk assessment	In order to appropriately integrate the with the SPP, a fit-for-purpose risk assessment is required to be undertaken to support the provisions of a planning scheme relating to bushfire risk. The purpose of a fit-for-purpose risk assessment is to 'understand the likelihood, severity and potential consequences of a bushfire event for existing and proposed communities, property and infrastructure.'
Planning provisions	The fit-for-purpose risk assessment informs the provisions of a local planning instrument. These provisions should, for existing and new development in bushfire prone areas, seek to achieve an acceptable or tolerable level of risk.

Where undertaking a fit-for-purpose risk assessment, the objective will be to comply with the following policy positions as established in the technical reference guide for the SPP, 'Bushfire Resilient Communities, October 2019' prepared by QFES:

Table 3 - QFES policy positions outlined in the 'Bushfire Resilient Communities' technical reference guide

Policy 1 – Mapping is robust and locally relevant.	As a minimum, the State Planning Policy Interactive Mapping System (SPP IMS) bushfire prone area mapping must be identified and applied to local government planning schemes. Local governments should refine the SPP IMS bushfire prone area mapping, using the refinement process outlined in this document, and then adopt the refined mapping in their specific planning scheme. QFES may be able to assist local governments with limited resources, in this process
Policy 2 – A fit-for-purpose risk assessment informs plan-making or amendments to achieve an acceptable or tolerable level of risk to people and property in bushfire prone areas.	Local governments should undertake a risk assessment when making or amending a planning scheme. To understand the consequences of a potential bushfire event, the risk assessment should consider the exposure, vulnerability and resilience of communities and their assets to a bushfire as a first step in proposing a planning response. A risk assessment is a methodical assessment, considering the specific circumstances of the local government area. Preferably, the risk assessment: will be consistent with AS/NZS ISO 31000:2018 Risk Management – Principles and Guidelines1

	is undertaken by a suitably qualified person (further detailed in Section 10). A comprehensive risk assessment may not be required for every planning scheme amendment, depending on the scope of the proposed instrument and whether an assessment has been previously undertaken. QFES can provide advice to local governments early in the planning process to scope a risk assessment that is suited to the nature of the proposed scheme amendments (i.e. a risk assessment that is fit-for-purpose).
Policy 3 – The planning scheme or amendments following a risk assessment are based on the principle of avoidance as the first priority, and then mitigation of the risk to an acceptable or tolerable level.	The outcomes of the risk assessment should inform the drafting of the local planning strategic framework and assessment benchmarks to ensure a clear approach to managing bushfire risk. Avoidance of the risk would include a local government minimising the expansion or increased density of existing development in mapped bushfire prone areas, particularly: vulnerable uses community infrastructure for essential services materials that are hazardous in the context of bushfire hazard. After this, managing bushfire risk should be based on achieving an acceptable or tolerable level of risk for both existing and new development in bushfire prone areas. An acceptable risk is a level that is sufficiently low to require no new treatments or actions to allow communities to live with the risk without further action. A tolerable risk is low enough to allow the exposure to a natural hazard to continue but high enough to require new treatments or actions to reduce that risk. Communities can live with this level of risk, but as much as is reasonably practical should be done to reduce the risk. This may include planning responses for: reducing the likelihood of the risk (avoidance) reducing the consequences of the risk (mitigation and hazard management over time). What constitutes an acceptable or tolerable level of risk will vary among local government areas and community context. If appropriate, community consultation could be undertaken to understand tolerance levels to bushfire risk and identify possible treatment options.

Policy 4 – Disaster management capacity and capabilities are maintained to mitigate the risks to people and property to an acceptable and tolerable level.	Mitigation involves a local government including provisions in its planning scheme to ensure subdivision layout: locates low fuel separation areas, such as roads, managed open spaces and large lots, to separate people from hazard does not hinder emergency service access and functions through active measures including: ensuring sufficient access areas (e.g. via perimeter roads or fire trail and working areas) for firefighters and vehicles between assets and vegetation allowing for vegetation management and wildfire response to provide opportunities to establish control lines from which hazard reduction or back- burning operations can occur allows safe access and egress routes ensures water supply in both reticulated and non-reticulated areas. Mitigation also involves local governments including provisions in their planning scheme for Bushfire Management Plans (BMPs) for ongoing vegetation management that maintains identified low fuel separation areas.
Policy 5 – Lot and neighbourhood layout and design mitigates the risks to people and property to an acceptable and tolerable level.	Mitigation involves local governments including provisions in their planning scheme for: new subdivision design to minimise the interface with bushfire prone areas and facilitate connections to safe evacuation routes landscape design and management that does not increase the level of bushfire risk or mechanisms of bushfire attack. The key mitigation approach for houses involve a local government defining all or part of its area as a designated bushfire prone area in accordance with section 12 of the Building Regulation 2006. This in turn triggers the requirement for adherence to Australian Standard 3959–2018 Construction of buildings in bushfire-prone areas at the building development application stage.
Policy 6 – Vulnerable uses are not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service, there is no suitable alternative location and site planning can appropriately mitigate the risk.	The local government should include provisions in its planning scheme which articulate this policy position. If located in a bushfire prone area, vulnerable uses maintain disaster management capacity and capabilities, and mitigate the risks to people and property to an acceptable and tolerable level (see Policy 4).

Policy 7 – Revegetation and rehabilitation avoids an increase in the exposure or severity of bushfire hazard.	Local governments should include provisions in their planning schemes which articulate this policy position and do not result in an unacceptable level of risk or an increase in the potential bushfire intensity level.
Policy 8 – Development does not locate buildings or structures used for the storage or manufacture of materials that are hazardous in the context of a bushfire within a bushfire prone area unless there is no suitable alternative location.	The local government should include provisions in its planning scheme which articulate this policy position. If located in a bushfire prone area, the risks to public safety and the environment from the release of these materials during and after a bushfire event must be mitigated by positioning it: outside any asset protection zone applying to other buildings or structures on the site as close to the edge of the bushfire prone area as possible. If located in a bushfire prone area, the storage or manufacture of materials that are hazardous in the context of a bushfire must be managed through: maintenance of appropriate disaster management capacity and capabilities mitigation of the risks to people and property to an acceptable and tolerable level (see Policy 4).
Policy 9 – The protective function of vegetation arrangements that can mitigate bushfire risk are maintained.	Local governments should include provisions in their planning schemes to mandate BMPs that uphold the protective function of vegetation arrangements, such as species selection, landscape design and ongoing vegetation management.
Policy 10 – Community infrastructure for essential services are not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service and there is no suitable alternative location, and further, the infrastructure can be demonstrated to function effectively during and immediately after a bushfire event.	Local governments should include provisions in their planning schemes which articulate this policy position. If located in a bushfire prone area, community infrastructure for essential services must be secured by: maintenance of appropriate disaster management capacity and capabilities mitigation of the risks to people and property to an acceptable and tolerable level (see Policy 4).

4.3 Local policy, regulation and strategies

4.3.1 Local policy and regulation

The *Toowoomba Regional Planning Scheme* (Planning Scheme) commenced in July 2012 and is the current statutory local planning instrument made by the Council for the region. The Planning Scheme regulates development within the region including how development must consider bushfire hazard and risk. The Planning Scheme seeks to manage bushfire risk via an avoid or mitigate approach. The Planning Scheme addresses bushfire risk in the following ways:

- the Planning Scheme addresses bushfire risk within the strategic framework and also via the Bushfire Hazard Overlay which is supported by mapping and assessment benchmarks, against which development applications require assessment;
- despite bushfire risk being addressed in the Planning Scheme, the current SPP (SPP July 2017) is identified as not being appropriately reflected;
- for Building Work regulated under the Planning Scheme, the 'bushfire prone area' is not specifically designated in accordance with section 32(a) of the *Building Act 1975* and section 12 of the *Building Regulation 2006* for the purposes of triggering assessment against AS3959:2018. The manner in which Section 1.6 of the current Planning Scheme is written does not specifically cite the Bushfire Hazard Overlay Map as the trigger for assessment of AS3959:2018;
- section 3.3 of the Planning Scheme provides the strategic framework theme of settlement pattern which seeks to ensure that areas exposed to natural hazards (including bushfire) are managed so to ensure that risks to life, land use and natural systems are avoided or mitigated;
- section 3.4 of the Planning Scheme provides the strategic framework theme of settlement pattern which acknowledges that the threat of natural hazards (including bushfire) can be expected to change;
- the Bushfire Hazard Overlay provides mapping which identifies 'High Fire Risk' and 'Medium Fire Risk' areas. The overlay applies to all development contained within these areas;
- the levels of assessment for the overlay ensures that telecommunications facilities (in any zone) and some community activity uses (being community care centres, community uses and educational establishments where within the Principal or Major Centre zones) that were not otherwise assessable are assessable development and are subject to code assessment;
- all other development that would otherwise be accepted development must meet the requirements for accepted development established in the Bushfire Hazard Overlay Code;
- the purpose of the Bushfire Hazard Overlay Code is to "protect the safety of people and property in bushfire risk areas". The purpose is achieved through a number of overall outcomes which seek to mitigate against the risk of bushfire by:
    - not increasing the exposure of people and property to an unacceptable bushfire hazard risk;
    - mitigate bushfire risk through design, ensuring evacuation routes are provided, avoiding the location of hazardous goods are not exposed to bushfire hazard and ensuring an adequate water supply is provided; and
    - ensuring essential community infrastructure is able to function without disturbance during and after a bushfire event;

- the performance and acceptable outcomes of the code establish the specific requirements for achieving the overall outcomes. These requirements include:
  - development is connected to the Council's reticulated water supply and water supply outlets readily available, or an on site water storage system is provided;
  - development is located outside of land subject to a high or medium bushfire risk unless a Bushfire Management Plan is provided and complied with;
  - development incorporates appropriate setbacks to hazardous vegetation (being the greater of 10m or 1.5 times the predominant canopy height) and fire breaks are provided; and
  - development that involves the construction of new roads ensures that all roads are through roads and road design is capable of providing access to fire fighting and other emergency vehicles;
- the *Bushfire Hazard Study 2009* was commissioned by Toowoomba Regional Council to inform the preparation of the Toowoomba Regional Planning Scheme following the amalgamation of local governments in 2008. The study identified the need for further vegetation studies which was undertaken through the *Vegetation Extension Study 2010*;
- the *Mapping Matters of Local Environmental Significance (MLES) for the Toowoomba Region Technical Report 2020* was commissioned by Toowoomba Regional Council as part of ongoing work being undertaken by Council in relation to MLES and alignment with the SPP 2017. The report refines the MLES category definitions and mapping methodology and layers; and
- the *Toowoomba Regional Planning Scheme Review Final Report* was undertaken consistent with Council's statutory requirement to review the Planning Scheme every 10 years. The review concluded that, while no fundamental deficiency was identified in the current Planning Scheme, the preparation of a new planning scheme was recommended to address key issues. Key issues relevant to this body of work include ensuring compliance with the current State Planning Policy and further development of policies and strategies relating to temperate climate and for climate resilience and adaptation.

4.3.2 Local strategies

A number of local processes and strategies which guide Council decision-making in relation to the management of bushfire hazard and risk have been prepared. These include:

- a *Local Disaster Management Group* (LDMG) is established for Toowoomba Region, pursuant to the QDMA with representation from Council as well as all relevant combat agencies and support agencies and services. The focus of this committee is on the prevention of, preparation for, response to and recovery from emergencies which impact the local community;
- the *Local Disaster Management Plan 2015* sets out to detail the arrangements for the coordination and management of resources, to ensure and maintain safe communities within the region prior to, during and after a disaster. It identifies the risk of bushfire as 'significant';
- the Local Disaster Management Plan defines roles and responsibilities of responders and community partners, informs disaster management responses at regional and State levels and outlines the nature of support provided by the Committee.
- Council also maintains a number of locally-relevant policies and strategies including, for example:

- Toowoomba Regional Community Plan;
- Toowoomba Region Economic Development Strategy;
- Open Space Strategy;
- Green Infrastructure Strategy (Toowoomba Green.IS); and
- Local Government Infrastructure Plan.

4.4 Royal Commissions and inquiries

Over the years, more than 50 inquiries have been conducted nationally in relation to bushfire, resulting in almost 900 recommendations. This is considerable in comparison to the number of flood-related inquiries over the same period at just 15, yielding 328 recommendations. This includes Royal Commissions, independent, audit, agency, Coronial and Parliamentary inquiries (BNHCRC, 2019).

Aspects relevant to this risk analysis are as follows:

- the 2020 *Royal Commission into National Natural Disaster Arrangements* was undertaken following the devastating 2019/20 fire season which affected Australia, commonly referred to the 'Black Summer' fires. The Royal Commission noted that state and local governments should be required to consider present and future disaster risk through plan making processes. The Royal Commission also had regard to aspects of mitigation, cultural burning, climate projects and data applications, and building provisions;
- the *Victorian Bushfires Royal Commission* (VBRC) which concluded in 2010 after the Black Saturday fires of 7 February 2009 also contemplated the role of land use planning in bushfire disaster risk reduction. Of the 67 recommendations made by the VBRC, 18 recommendations related specifically to land use planning;
- the inclusion of planning-related findings as a result of inquiries dates back to the *1939 Royal Commission (the Stretton) report* which identified a clear need to incorporate bushfire risk considerations into policy, including planning;
- similar observations and findings are made across other Royal Commission and Inquiry reports, over the decades across the country. One of the key challenges for planning in this regard is the continued expansion or encroachment of urban areas into bushland and scrub areas. In 1984, following the Ash Wednesday fires in Victoria and South Australia, two reports identified specific planning-based measures for bushfire risk reduction. Many of these measures continue to form the basis of risk treatment today at the property level;
- The 2012 *Productivity Commission Inquiry Report on Barriers to Effective Climate Change Adaptation* identified the prioritised need for land use planning systems across the country to enable risk management approaches to incorporate climate change risks into planning decisions at the state, regional and local government levels.
- the 2014 *Productivity Commission Inquiry into National Disaster Funding Arrangements* identified a range of recommendations, with key observations including the governments over-invest in post-disaster reconstruction and under-invest in resilience and mitigation to limit the impact of risk and disaster, and that regulations affecting the built environment have a significant influence on the exposure and vulnerability of communities to natural hazards. While building regulations have generally been effective, there is a need to transparently incorporate disaster risk management into land use planning;
- the Inspector-General Emergency Management (IGEM) has conducted a number of recent reviews into Queensland bushfire events including the *2018 Queensland Bushfires Review*. Finding 11 of this review identifies scope to emphasis the role of land use planning and to improve education and advice about bushfire risk as complementary mitigation strategies, and that effort should be made to improve land use planning (Finding 17);
- the above review was supported by an independent review of the impacts of heatwave on bushfire risk in Queensland, prepared by the Bushfire and Natural Hazard Cooperative Research Centre (BNHCRC); and

- further reviews have been undertaken by IGEM following the 2019-20 fire season, including the *Queensland Bushfires Review – Report 2: 2019-20.*

4.5 Bushfire risk and land use planning research

An extensive evidence-base of academic research is available in Australia which informs policy approaches as well as operational approaches. A considerable base of land use planning and bushfire specific research has been conducted, particularly following Black Saturday in 2009, as well as events which have occurred over recent years including the Wye River and Tathra fires.

Key bodies of research include:

- the 2020 University of Southern Queensland report on *Bushfire Mitigation and Preparation on the Toowoomba Region Escarpment*, funded by Get Ready Queensland, provides a comprehensive insight and analysis of community risk perception, as well as preparation and mitigation. It provides a suite of recommendations for Council's consideration. It acknowledges challenges relating to community risk perception following development assessment processes, where residents may be unaware of bushfire hazard, their risk or any bushfire management plans for their property (Ryan et al. 2020);
- the *Community Preparedness and Responses to the 2017 New South Wales Bushfires* research paper reviewed the reactions of the NSW community when faced with threat from a bushfire emergency. The research revealed that even when notified, the at-risk community tends to remain where they are to observe the bushfire for themselves, adopting a 'wait and see' approach. Despite a change in focus on warning messaging since the 2009 Black Saturday fires for catastrophic events, most people still do not intend to leave before there is a fire on such days (Whittaker & Taylor, 2018);
- *Planning and Bushfire Risk in a Changing Climate* examines the role of urban and regional planning in relation to bushfire risk in Australia. The research provides a deeper understanding of the contribution of urban and regional planning to managing fire risk throughout Australia. Differing perceptions of fire and various planning responses by States and Territories provide a rich policy environment for multiple sectors to consider. Added to this complexity are expanding urban areas across Australia and the challenges of continuing urban development in regions that are already experiencing environmental change and predictions of an even hotter environment and an increased potential for fire risk. A key finding is the need for a more integrated approach to planning for fire risk that better connects planners with emergency management (Norman et al. 2014);
- the Australian Business Roundtable for Disaster Resilience and Safer Communities, together with Deloitte Access Economics, released the report *Building Resilience to Natural Disasters in our States and Territories* in 2017. At 2017, the total cost of disasters across Queensland was an average of $11bn per year. This is forecast to escalate to $18bn per year by 2050 having regard to direct and indirect tangible costs as well as intangible costs. Over the past decade, Queensland has borne 60 per cent of the total economic costs of disasters in Australia. Mainstreaming resilience into planning, land use and building requirements is identified as a key strategy in embedding resilience in decision-making but noting also that land use planning systems are yet to fully embrace their role in mitigating the risks to loss of life, property damage and destruction of vital infrastructure arising from natural hazards (Deloitte Access Economics, 2017);
- the 2020 report *Integrated Urban Planning for Natural Hazard Mitigation* identifies that risk modelling for urban edge development remains relatively limited in Australia, and

that it is common for future growth area identification processes to progress significantly, well before adequate risk assessment. The inclusion of critical decision criteria, requirements for scenario testing, allocation of roles and establishment of suitable forums can significantly improve future growth risk assessments. The report identifies a suite of findings to assist in frontload risk considerations into strategic planning activities (March et al. 2020);

- the 2019 paper entitled *Future Risk Framework: Understanding* ***tomorrow's risk and*** *what we can do to reduce it* notes the continuous increases over time in disaster risk due to factors such as climate change, population growth, economic development and an ageing population. The paper presents a risk framework comprising four main steps to quantify future risk. These steps include the exploration of drivers of future risk, development of plausible future scenarios, parameterisation of scenarios and simulation of impact of scenarios to develop an increased understanding of future risk. This progresses assessment from a primarily qualitative approach to one which is more quantitative in nature (Riddell et al. 2019);
- in 2019 the Bureau of Meteorology (BoM) partnered with QFES to deliver the report *Changes in fire weather in Queensland*, identifying a rise in maximum temperatures, a fall in annual rainfall and increased annual accumulated forest fire danger index (FFDI) of 51 per cent in South East Queensland. The report also identifies an earlier start to the annual bushfire season is occurring in South East Queensland; and
- the BoM has released a series of *Special Climate Statements* in relation to recent fire weather in Queensland and eastern Australia, including SCS 68 – Widespread heatwaves during December 2018 and January 2019; SCS 72 – Dangerous bushfire weather and heat in Spring 2019; and SCS 73 – Extreme heat and fire weather in December 2019 and January 2020.

5 Toowoomba Region disaster resilience context

Disaster resilience is the capacity to prepare for, absorb and recover from natural hazards, and to learn, adapt and transform in ways that enhance these capacities in the face of future events. Disaster resilience arises from many social, economic and institutional capacities and the mix of these capacities in a community conveys how well it is positioned to absorb and adapt to natural hazards.

In 2020 the BNHCRC released the Australian Disaster Resilience Index which assesses disaster resilience using factors that encapsulate the resources and abilities to prepare for, absorb and recover from natural hazards (coping capacity), or that enable learning, adaptation and problem solving (adaptive capacity).

The Australian Disaster Resilience Index applies a top-down assessment approach, using data derived from secondary sources and a formative measurement model (see below). In combination with the capacities approach, the Australian Disaster Resilience Index therefore assesses the capacities for disaster resilience that emerge from structural settings. Understanding the Australian Disaster Resilience Index as the capacity for disaster resilience is vital to interpreting the index and comparing among different places in Australia (BNHCRC, 2020).

The Australian Disaster Resilience Index provides a nationally standardised assessment of the capacities for disaster resilience across the entire country. While the index covers the whole country, the spatial resolution for reporting is a Statistical Area Level 2 (SA2) level (BNHCRC, 2020).

Figure 9 - Diagram of the formative measurement model which underpins the Australian Disaster Resilience Index (Source: BNHCRC, 2020)

The capacities for disaster resilience are made up of eight themes that capture dimensions of disaster resilience:

- social character;
- economic capital;
- emergency services;
- planning and the built environment;
- community capital;
- information access;
- social and community engagement; and
- governance and leadership.

The SA2s which comprise the Toowoomba local government area generally rank as 'Moderate' on the BNHCRC disaster resilience index scale. The index describes moderate resilience as follows:

> '*Communities in areas of moderate disaster resilience have some capacity to use available resources to cope with adverse events, and some capacity to adjust to change through learning, adaptation and transformation.*
>
> *Moderate disaster resilience is generally contributed by moderate levels of coping and adaptive capacity, which in turn are associated with moderate levels of economic capital, moderate provision of and access to services, moderate community cohesion and variable encouragement for adaptive learning and problem solving*' (BNHCRC, 2020).

Moderate resilience varies from 'High' resilience which is described by the Index as follows:

> 'Communities in areas of high disaster resilience have enhanced capacity to use available resources to cope with adverse events, and enhanced capacity to adjust to change through learning, adaptation and transformation. Factors contributing to high disaster resilience may include employment, education, income, good access to or provision of resources and services, strong community cohesion and ample opportunities for adaptive learning and problem solving' (BNHCRC, 2020).

In the context of preparation of a new planning instrument for the Toowoomba Region, the role of strategic planning extends beyond mere land use provision and built environment considerations. It also has regard to matters of employment generation, industry diversification and economic prosperity, and community and social cohesion.

Thus, there remains the opportunity for the role of the new Toowoomba Regional Planning Scheme to drive enhanced resilience outcomes, including for bushfire resilience, through multiple avenues.

5.1 Disaster resilience factors

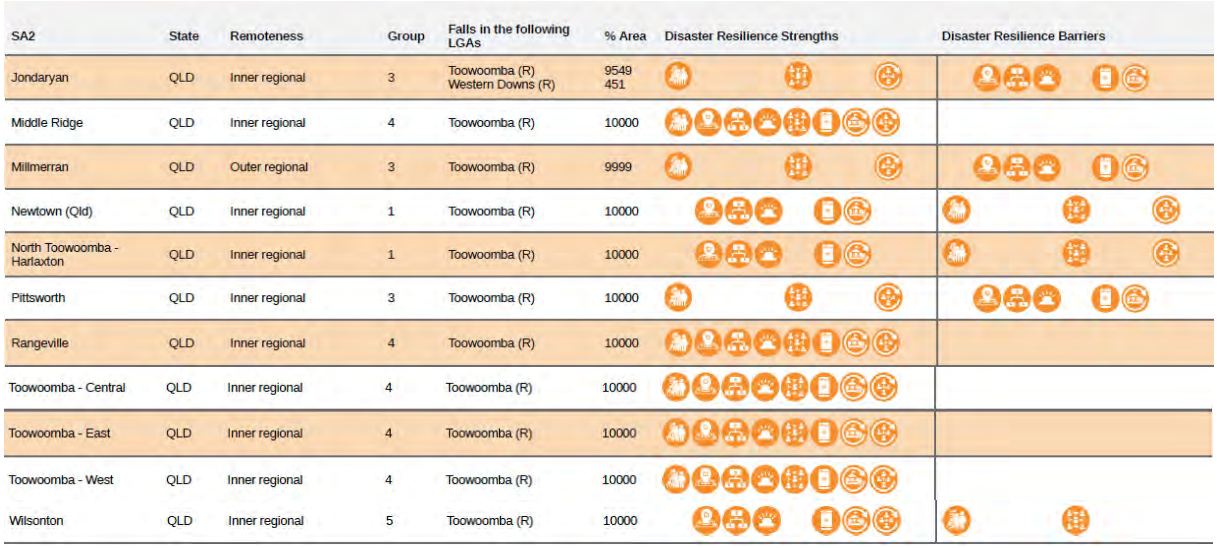
The eight themes or factors of disaster resilience which are contemplated by the Index are outlined as follows.

Table 4 - Disaster resilience factors (Source: BNHCRC, 2020)

Disaster resilience factor		Description
	Social character	The social and demographic characteristics of the community. Factors such as household and family composition, age, sex, education, employment, disability, language, and length of residence have well-

		known influences on capacity to prepare for, respond to and recover from natural hazards.
	Economic capital	The economic characteristics of the community. Economic capital can contribute to the reduction of losses from natural hazard events through improved mitigation and risk management, individual flexibility and adaptation, enhanced recovery, market continuity and business continuity.
	Emergency services	The presence and resourcing of emergency services. Emergency management is a core government service and is integral to natural hazard preparation, response and recovery. Emergency services undertake a range of activities to assist communities before, during and after natural hazards.
	Planning and the built environment	The presence of legislation, plans, structures or codes to protect communities and their built environment. Land use planning articulates and regulates relationships between development and hazards. Planning reduces current and future risk and enhances the readiness and capacity of organisations to respond to events.
	Community capital	The cohesion and connectedness of the community. Social capital is a resource that facilitates collective action for mutual benefit. Sense of community fosters participation, community competency, pro-social behaviour and preparedness through working with others to solve shared local problems.
	Information access	The potential for communities to engage with natural hazard information. Telecommunication and internet access is vital to information sharing before, during and after natural hazard events. Community engagement activities benefit communities through capacity building, social connectedness, self-reliance, training, awareness of risk and psycho-social preparation.
	Governance and leadership	The capacity within communities to adaptively learn and transform in the face of complex change. Adaptive communities have support and resources to manage complex change and to renew for mutual benefit. Characteristics of adaptive communities include social engagement, trust, cooperation, learning and wellbeing.
	Social and community engagement	The capacity within organisations to adaptively learn, review and adjust policies and procedures, or to transform organisational practices. Adaptive institutions have conditions suited to the development of the skills, knowledge and culture for managing complex change. They have flexibility and can learn from experience, innovate and adjust.

The figure below outlines the disaster resilience strengths and barriers for each SA2 within the Toowoomba local government area.



SA2	State	Remoteness	Group	Falls in the following LGAs	% Area	Disaster Resilience Strengths	Disaster Resilience Barriers
Jondaryan	QLD	Inner regional	3	Toowoomba (R) Western Downs (R)	9549 451		
Middle Ridge	QLD	Inner regional	4	Toowoomba (R)	10000		
Millmerran	QLD	Outer regional	3	Toowoomba (R)	9999		
Newtown (Qld)	QLD	Inner regional	1	Toowoomba (R)	10000		
North Toowoomba - Harlaxton	QLD	Inner regional	1	Toowoomba (R)	10000		
Pittsworth	QLD	Inner regional	3	Toowoomba (R)	10000		
Rangeville	QLD	Inner regional	4	Toowoomba (R)	10000		
Toowoomba - Central	QLD	Inner regional	4	Toowoomba (R)	10000		
Toowoomba - East	QLD	Inner regional	4	Toowoomba (R)	10000		
Toowoomba - West	QLD	Inner regional	4	Toowoomba (R)	10000		
Wilsonton	QLD	Inner regional	5	Toowoomba (R)	10000		

Figure 10 - Disaster resilience factors report for SA2 regions comprising the Toowoomba local government area (Source: BNHCRC, 2020)

A range of strength factors are evident across the Toowoomba Region. Common barriers which are identified by the Index are generally observed outside of the Toowoomba Urban Area. These include:

- planning and the built environment;
- economic capital;
- information access; and
- governance and leadership.

With specific regard to planning and the built environment, a range of data inputs are used by the index to understand the character of the built environment within each SA2 area. These inputs include the consideration of the percentage of caravan and improvised dwellings, percentage of dwellings constructed pre and post-1981, commercial dwelling constructed post-1981, number of Council staff, new dwellings as a proportion of old dwellings, etc.

5.2 Adaptive and coping capacities

Adaptive capacity across the Toowoomba Region, based on the above, is observed as 'Moderate', which reflects the region's capacity to adjust to change through learning, adaptation and transformation.

In relation to coping capacity however, communities across the region may vary. Communities in and around the Toowoomba Urban Area are likely to experience enhanced coping capacity, to draw upon available resources to prepare for, endure and recover from an event. This decreases to 'low' for all areas outside the Toowoomba Urban Area, signalling constraints in the ability to draw upon resources to prepare for, endure and recover from events (BNHCRC, 2020).

Overall the Index helps to paint a picture of relevant disaster resilience considerations for the region however, this is a broad assessment and specific consideration of resilience factors can vary from household to household based on a range of circumstances, personal values and past experiences with disaster events.

6 Toowoomba Region bushfire hazard context

The following sections set out the specific factors relating to the bushfire hazard context for the Toowoomba Region.

6.1 Designated bushfire prone lands

The bushfire hazard overlay map contained within the current Planning Scheme is intended to designate that area which the planning scheme identifies within the bushfire hazard overlay.

As noted previously, for Building Work regulated under the Planning Scheme, the 'bushfire prone area' is not specifically designated in accordance with section 32(a) of the Building Act 1975 and section 12 of the Building Regulation 2006 for the purposes of triggering assessment against AS3959:2018. The manner in which Section 1.6 of the current Planning Scheme is written, does not specifically cite the Bushfire Hazard Overlay Map as the trigger for assessment of AS3959:2018.

The current Planning Scheme overlay mapping was prepared in 2010, based on the best available data at the time and the methodology set out by the former SPP 1/03 which was repealed in 2013. The methodology employed by the former SPP 1/03 does not incorporate the level of fire science introduced as part of the new State-wide bushfire prone areas mapping. The current overlay map includes two (2) hazard categories, rather than the three adopted by the state which reflect fireline intensity classes. It also does not incorporate a 100 metre buffer around designated bushfire prone lands which is also subject to potential flame contact and radiant heat exposure.

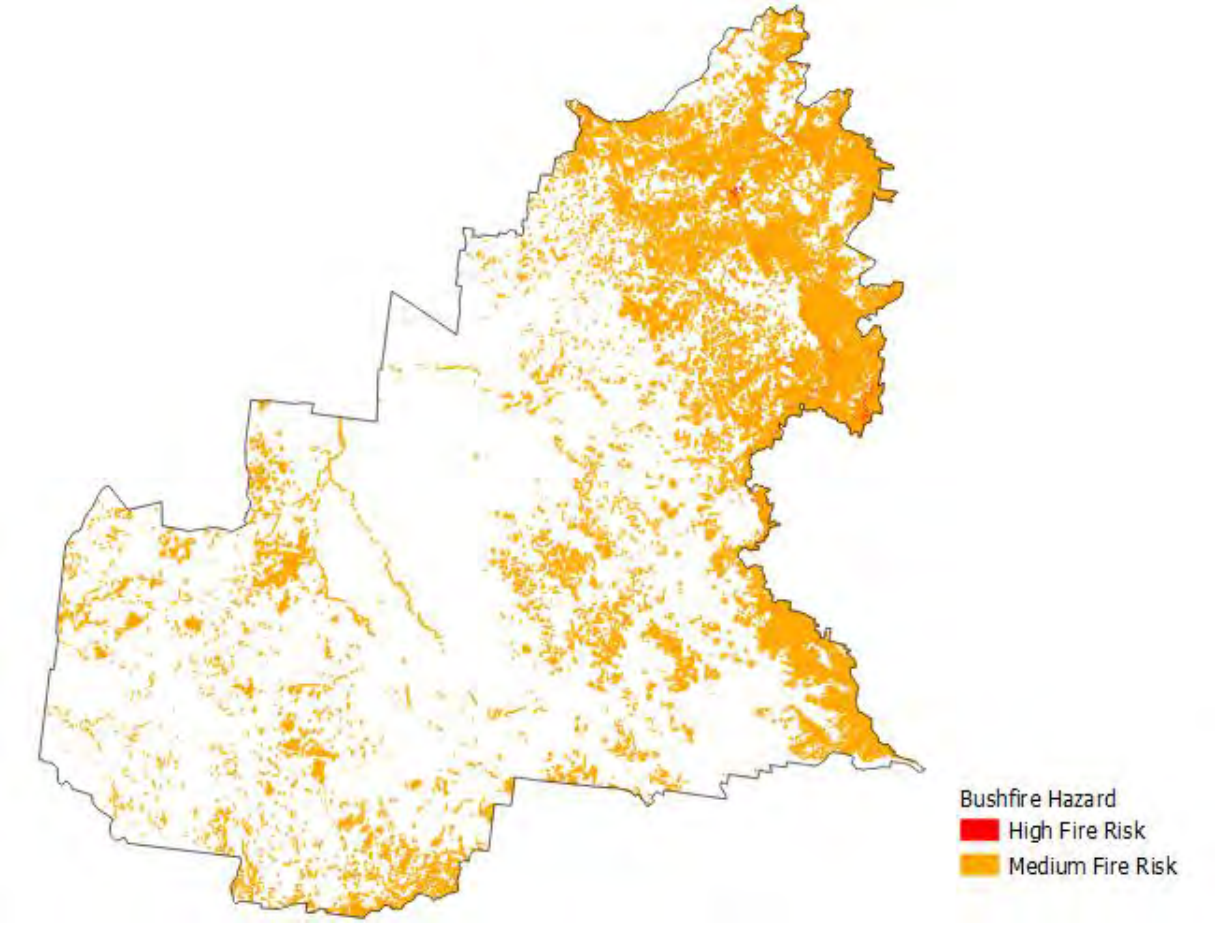


Figure 11 – Current Planning Scheme Bushfire Hazard Overlay Mapping (Source: Toowoomba Regional Council, 2017)

6.1.1 State-wide bushfire prone lands mapping

In 2014, the CSIRO in conjunction with QFES, released the '*New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland*'. This methodology underpins the fire science which is incorporated into the current SPP mapping. This mapping is also regularly updated. In 2017, the CSIRO released addendum methodological information, '*Estimating the Potential Bushfire Hazard of Vegetation Patches and Corridors: An enhancement of Queensland's methodology for State-wide mapping of bushfire prone areas*'.

The State-wide mapping methodology has been subject to peer review processes and has been found to be highly accurate, yielding an estimated 85 per cent level of accuracy based upon recent innovation in fire science and is considered a substantial advancement in bushfire hazard mapping in Queensland. The mapping methodology is based upon potential fire line intensity using the MacArthur Mk 5 Forest Fire Danger Meter and inputs of total fuel load and effective slope to derive a potential rate of fire spread. A 100m 'buffer' area is also applied under the SPP (replicating the approach under AS3959:2018 – Construction of Buildings in Bushfire Prone Areas), being the zone in which ember attack and radiant heat remain most relevant, adjacent to the actual hazard.

It is understood the Planning Scheme bushfire hazards overlay mapping was prepared prior to the introduction of the State-wide mapping, hence the divergence between the two maps.

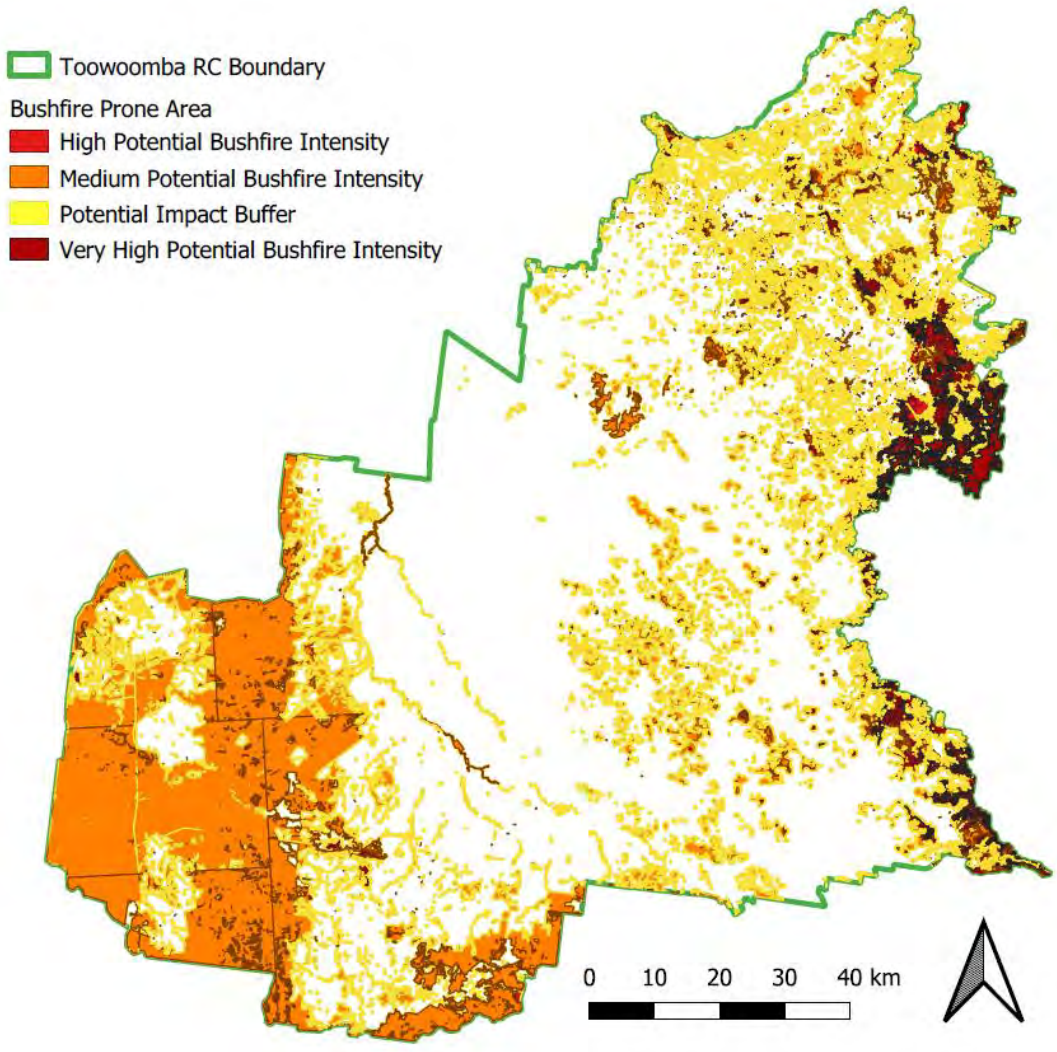


Figure 12 - Extract of the State-wide bushfire prone areas mapping for the Toowoomba Region (Source: QSpatial Catalogue, 2020)

As illustrated by the state-wide bushfire prone areas mapping for Toowoomba, the highest levels of mapped hazard occur along the Toowoomba Escarpment, with particular areas of increased hazard potential to the north-east of the CBD between Highfields and north of Crows Nest, and also along the southern area of the Escarpment to the east of Greenmount and Clifton.

Areas of hazard occur across the Condamine plains, largely associated with areas of remnant vegetation which are interspersed amongst agricultural lands.

Areas of increased hazard are also present in the western extent of the local government area to the west of Millmerran and Cecil Plains, and the south-east of Millmerran in the areas of Bringalily and Leyburn.

6.2 Climate and fire weather

It is noted that fire weather conditions in the Toowoomba Region are different to that experienced in South East Queensland, due to the warm and temperate climate experienced.

This is characterised by a low diurnal temperature range near the coast to a high diurnal range inland. This climate zone is identified to experience four distinct seasons, including mild winters with low humidity and hot to very hot summers with moderate humidity (ABS, 2012).

Rainfall occurs during the warm season from November until March with an average annual rainfall of 724mm, with more rainfall in the east along the Great Dividing Range. Severe storms occasionally affect the region which can include lightning strikes which a key form of bushfire ignition (BOM, 2020). August is historically the driest month for the Toowoomba Region.

6.2.1 Projected impacts of climate change

Council is currently working with Queensland University of Technology and the University of Southern Queensland on a Warm Temperate Climate Design study which includes an examination of the influences associated with the warm temperate climate region, which accounts for a relatively small portion of the state.

As part of this study, data from five weather stations has been drawn upon, including Toowoomba, Oakey, Dalby, Warwick and Kingaroy, three of which are located outside the local government area. Data from the Climate Futures Dashboard produced by the Department of Environment and Science has also been utilised.

Key observations of climate change impacts relevant to fire weather in the Toowoomba Region include:

- there has been a discernible decrease in precipitation trends in the region over the past 50 years;
- a clear increase in mean annual maximum temperature has been recorded over recent decades which is characteristic of current climate change observations which are reflective of a general warming of the Australian climate;
- the Climate Futures Dashboard provides a series of climate change projections which are based on 40 global climate models. The Warm Temperate Climate Design Study utilises two scenarios:
    - RCP8.5: High emissions scenario (current circumstances without mitigation); and
    - RCP4.5: Moderate emissions scenario with stabilisation.
- based upon these projections the following climate change projections are drawn for the Toowoomba Region:

- *precipitation* for annual seasons:
  - general decline of rainfall from 2050, to 2070 and 2090. The decline in precipitation is greater under the current unabated (RCP8.5) scenario compared with the stabilised emissions scenario (RCP4.5).
- *mean temperatures* for annual seasons:
  - considerable temperature increase from 2050, to 2070 and 2090 of approximately 2.25 degrees Celsius under the stabilised emissions scenario (RCP4.5). Under the current unabated scenario (RCP8.5), an increase to mean temperatures for annual seasons of 4.3 degrees Celsius is projected.
- *hot days* for annual seasons:
  - considerable increase in the number of hot days experienced each season from an additional 7.9 days in 2030, 14 in 2050, 20 in 2070 and over 21 in 2090 under the stabilised emissions scenario (RCP4.5).
  - under the current unabated scenario (RCP8.5), an increase in the number of hot days experienced each season from an additional 10 days in 2030, 20 in 2050, 31 in 2070 and almost 50 in 2090 is projected.
  - the above is on top of hot days currently experienced each season.
- *hot nights* for annual seasons:
  - considerable increase in the number of hot nights experienced each season from an additional 17 night in 2030, 27 in 2050, 37 in 2070 and approximately 40 in 2090 under the stabilised emissions scenario (RCP4.5).
  - under the current unabated scenario (RCP8.5), an increase in the number of hot nights experienced each season from an additional 16 days in 2030, 40 in 2050, 70 in 2070 and almost 100 in 2090 is projected.
  - the above is on top of hot night currently experienced each season.

The above indicates that irrespective of climate action to reduce greenhouse gas emissions, we are locked into an existing level of climate change to 2090. The factors of which speak to a hotter and drier environment for the Toowoomba Region. This is likely to give rise to increased fire frequency and potentially consequences across the region.

Hot nights in particular are a critical factor for consideration in fire suppression. To date, reduced temperatures during the night provide a key opportunity for firefighters to supress and contain running fires. During the Black Summer fires, fireground temperatures in the evening were not much less than during the day, eliminating this critical opportunity for fire response.

6.2.2 Influence of climate change on fire weather

The 2018-19 and 2019-20 fire weather seasons were record breaking for Queensland.

In 2020 the Bureau of Meteorology issued a Special Climate Statement detailing the climatic factors which contributed to dangerous fire weather conditions in the 2019-20 fire season, confirming large areas of Australia had their highest accumulated FFDI for December in 2019. It also notes 2019 had the highest December accumulated FFDI for Australia as a whole, continuing the pattern seen in the spring period across Queensland.

The BoM report 'Changes to Fire Weather in Queensland' released in 2019 provides that the time series of annual accumulated FFDI for the Central South sub-region (which includes the Toowoomba Region) from 1950 to 2018 has increased by 27 per cent.

The average annual occurrence of days of FFDI of 50 or higher has increased by 104 per cent over the same period. BoM states this data should be used with caution however, FFDI is significant given the associate spike in house loss for events of FFDI 50 or more.

The BoM report also identifies the annual highest daily FFDI has risen strongly in the Central South sub-region, by up to 14 points.

The impact of climate change on fire weather is complex. It is not as simple as an elevated FFDI, but involves a likely increased frequency of both higher fire danger days, as well as more frequent fire danger days. Longer fire seasons which start earlier and extend over a longer period are projected (Douglas, 2017), with a cascading impact on fuel reduction opportunities in cooler months.

The work of Douglas (2017) which focuses extensively on the impact of climate change on fire weather for land use planning notes 'a trend to more severe fire weather conditions, however the changes range from subtle to pronounced. These results have implications for adaptation in future land use decision making'.

Catastrophic fire weather events may be rare in nature, and fires in these conditions can be considered as outliers when compared with the frequency of lower FFDI events. However, it remains the responsibility of strategic land use planning to consider the risks associated with higher magnitude and rarer events. In flood risk management this is often referred to as the probable maximum flood.

6.2.3 Wind speed and direction

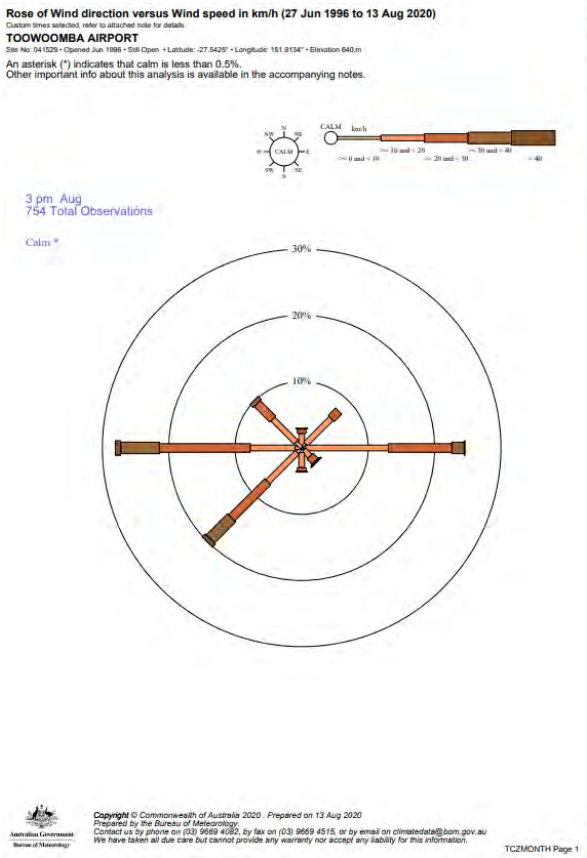
Wind speed and direction data has been obtained from BoM for the Toowoomba and Oakey Airport weather stations. Monthly climate statistics from 'Climate Data Online' provide wind information for the region for the period from 1996 to 2020 for Toowoomba, and from 1973 to 2020 for Oakey Airport (BoM, 2020).

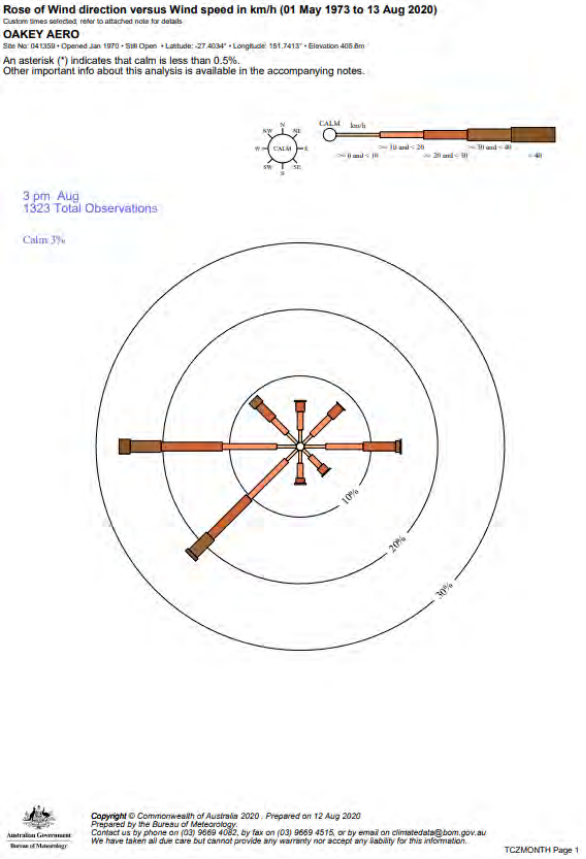
Monthly statistics for the 3pm observations (around the time where FFDI peaks each day) have been considered for each month of the fire season from August to January, and then annually.

For the months of August and September, both weather stations are dominated by westerly biased winds, which is consistent with the dry fire winds typically experienced around this time of the year. From October onwards, the prevailing winds switches to become easterly dominated, noting the area around Oakey experiences more variable wind speeds and direction compared with Toowoomba.

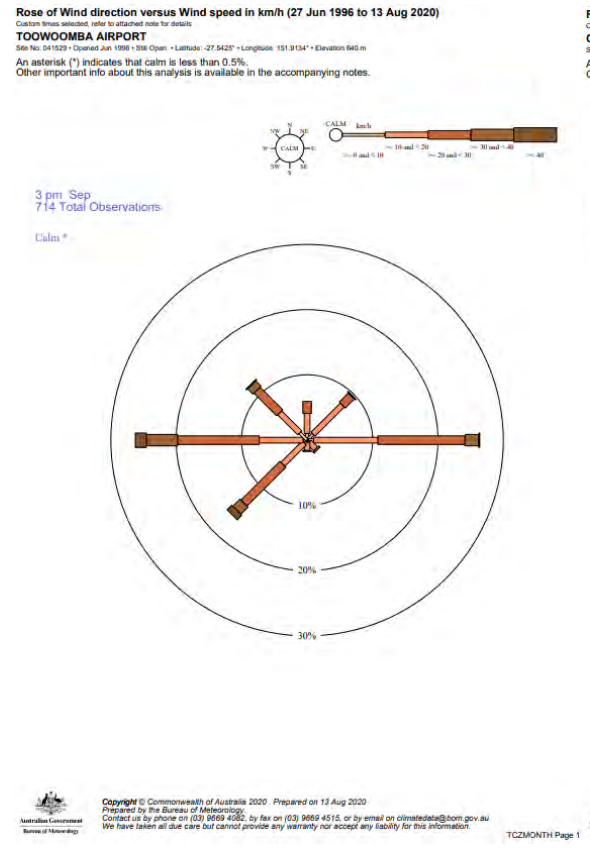
This is particularly relevant in consideration of the magnitude of potential hazard relative to the Escarpment area of the region.

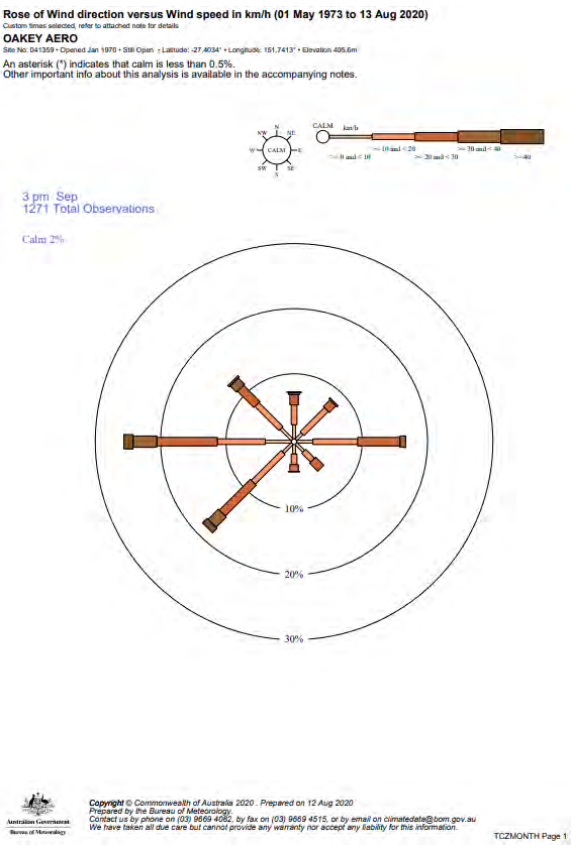
6.2.3.1 August



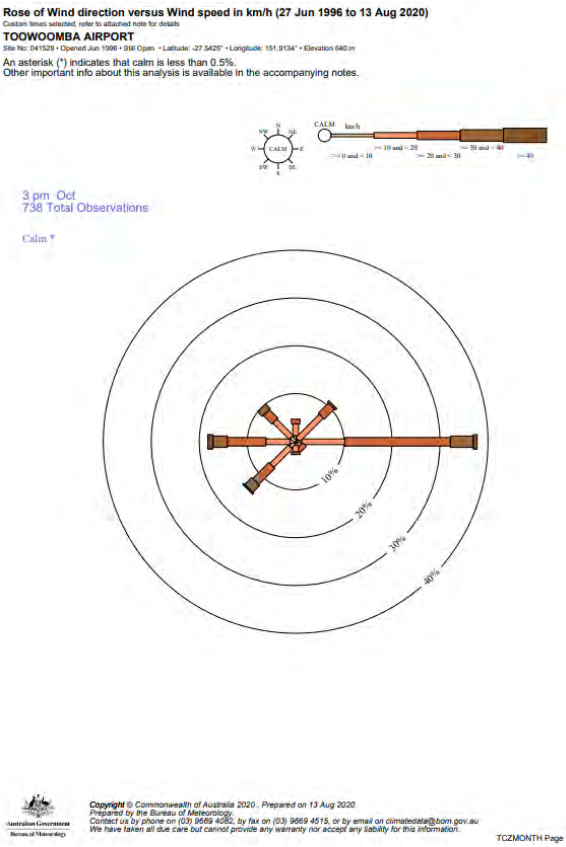


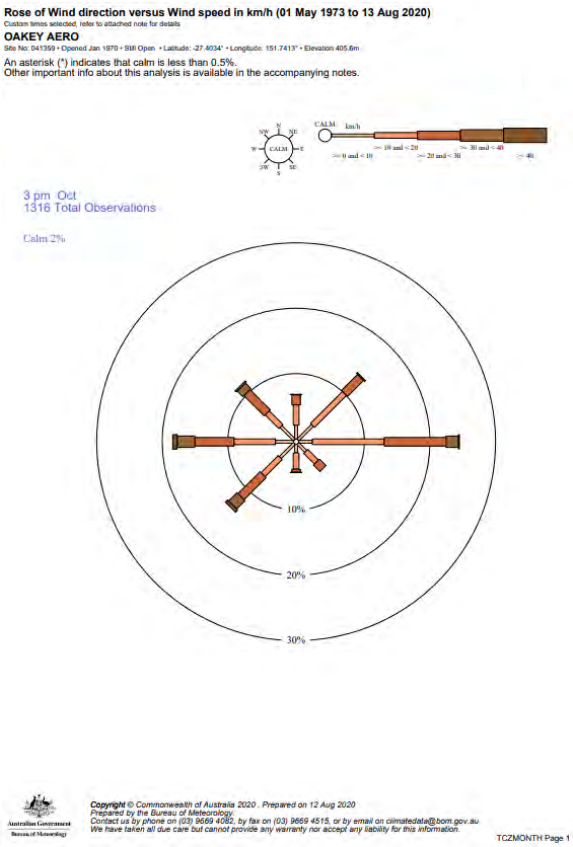
6.2.3.2 September



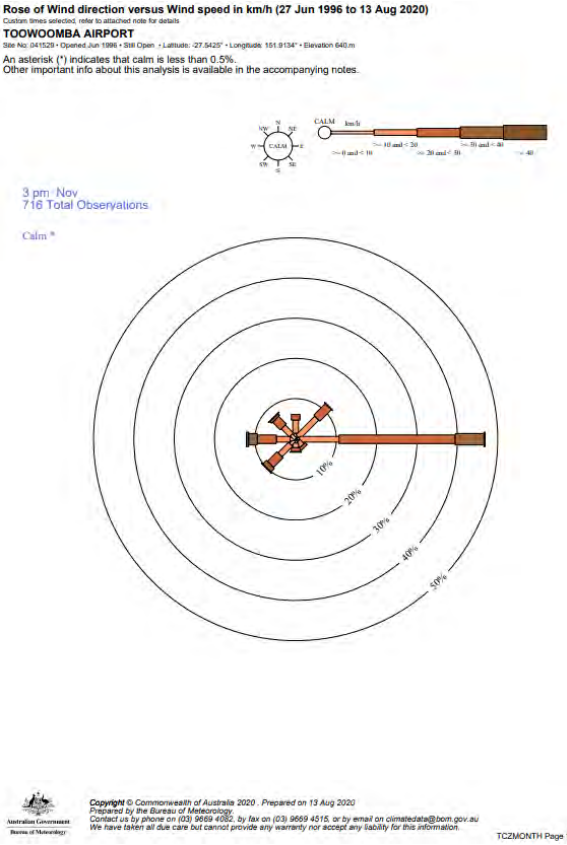


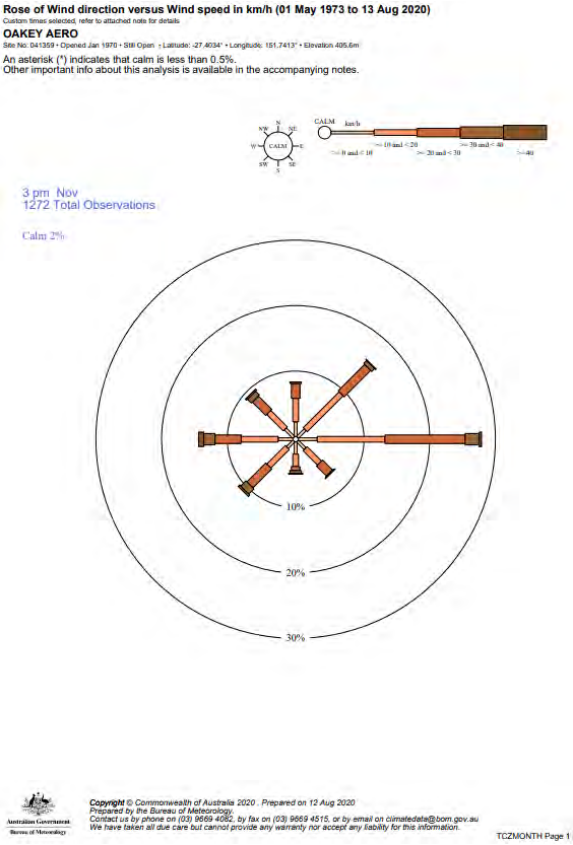
6.2.3.3 October





6.2.3.4 November



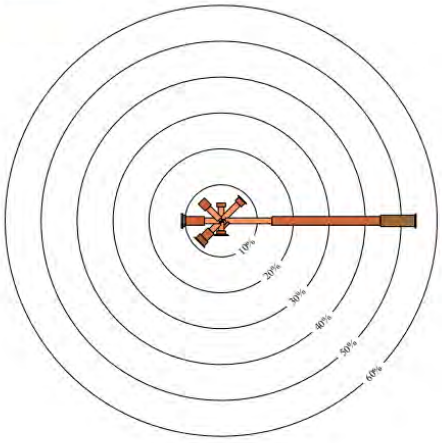


6.2.3.5 December

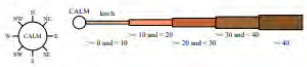
Rose of Wind direction versus Wind speed in km/h (27 Jun 1996 to 13 Aug 2020)
Custom times selected, refer to attached note for details
TOOWOOMBA AIRPORT
Site No: 041529 • Opened Jun 1996 • Still Open • Latitude: -27.5425° • Longitude: 151.9134° • Elevation 640.m
An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

3 pm Dec
742 Total Observations

Calm *

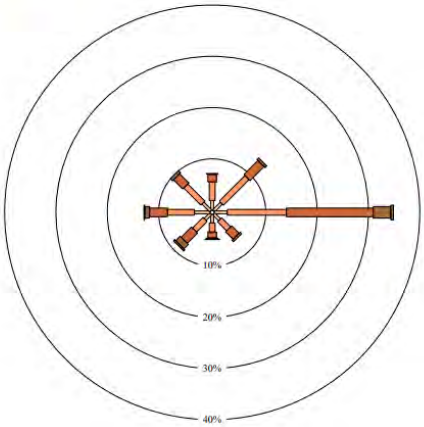


Rose of Wind direction versus Wind speed in km/h (01 May 1973 to 13 Aug 2020)
Custom times selected, refer to attached note for details
OAKEY AERO
Site No: 041359 • Opened Jan 1970 • Still Open • Latitude: -27.4034° • Longitude: 151.7413° • Elevation 405.6m
An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



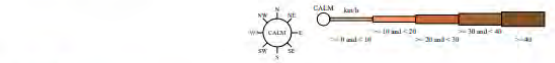
3 pm Dec
1177 Total Observations

Calm 2%



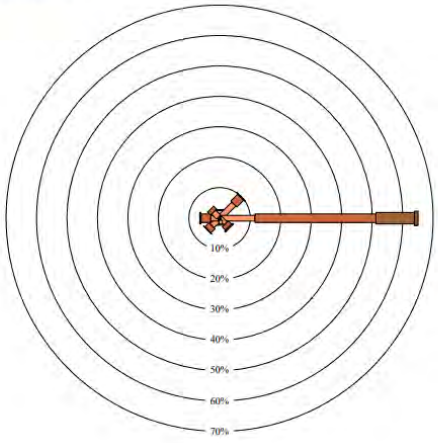
6.2.3.6 January

Rose of Wind direction versus Wind speed in km/h (27 Jun 1996 to 13 Aug 2020)
Custom times selected, refer to attached note for details
TOOWOOMBA AIRPORT
Site No: 041529 • Opened Jun 1996 • Still Open • Latitude: -27.5425° • Longitude: 151.9134° • Elevation 640.m
An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm Jan
739 Total Observations

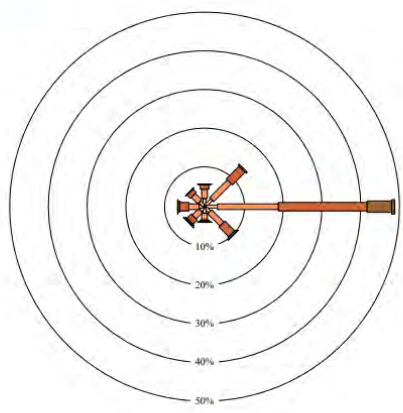
Calm *



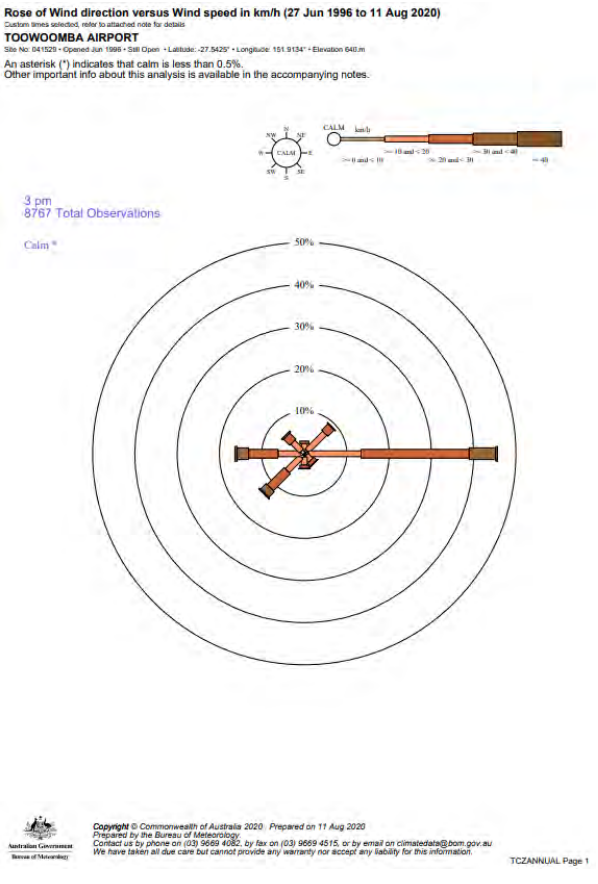
Rose of Wind direction versus Wind speed in km/h (01 May 1973 to 13 Aug 2020)
Custom times selected, refer to attached note for details
OAKEY AERO
Site No: 041359 • Opened Jan 1970 • Still Open • Latitude: -27.4034° • Longitude: 151.7413° • Elevation 405.6m
An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

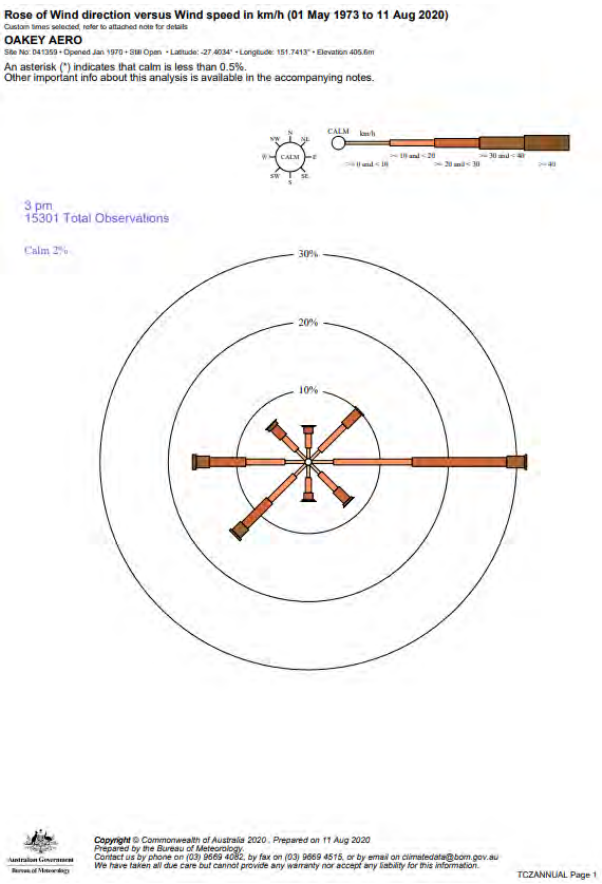
3 pm Jan
1173 Total Observations

Calm 1%



6.2.3.7 Annual





6.2.4 Rainfall

Mean rainfall data is available via BoM's 'Climate Data Online' facility, with data for Toowoomba collected over a 24-year period from 1996 to 2020, and for 50 years at Oakey Airport from 1973 onwards (BoM, 2000).

Mean rainfall across the region is variable, as a factor of the scale of the local government area. Generally, mean rainfall each month is higher for Toowoomba than measured at Oakey Airport. The highest mean rainfall months each year typically occur in December, January and February which can reach over 100 millimetres.

Rainfall drops significantly in the March to April period before increasing gradually from September through the Spring months. This places the months of August and September as the period of increased bushfire hazard, with low soil and biomass moisture contents from the drier winter period combining with rising daytime temperatures, low relative humidity and strong dry westerly winds.

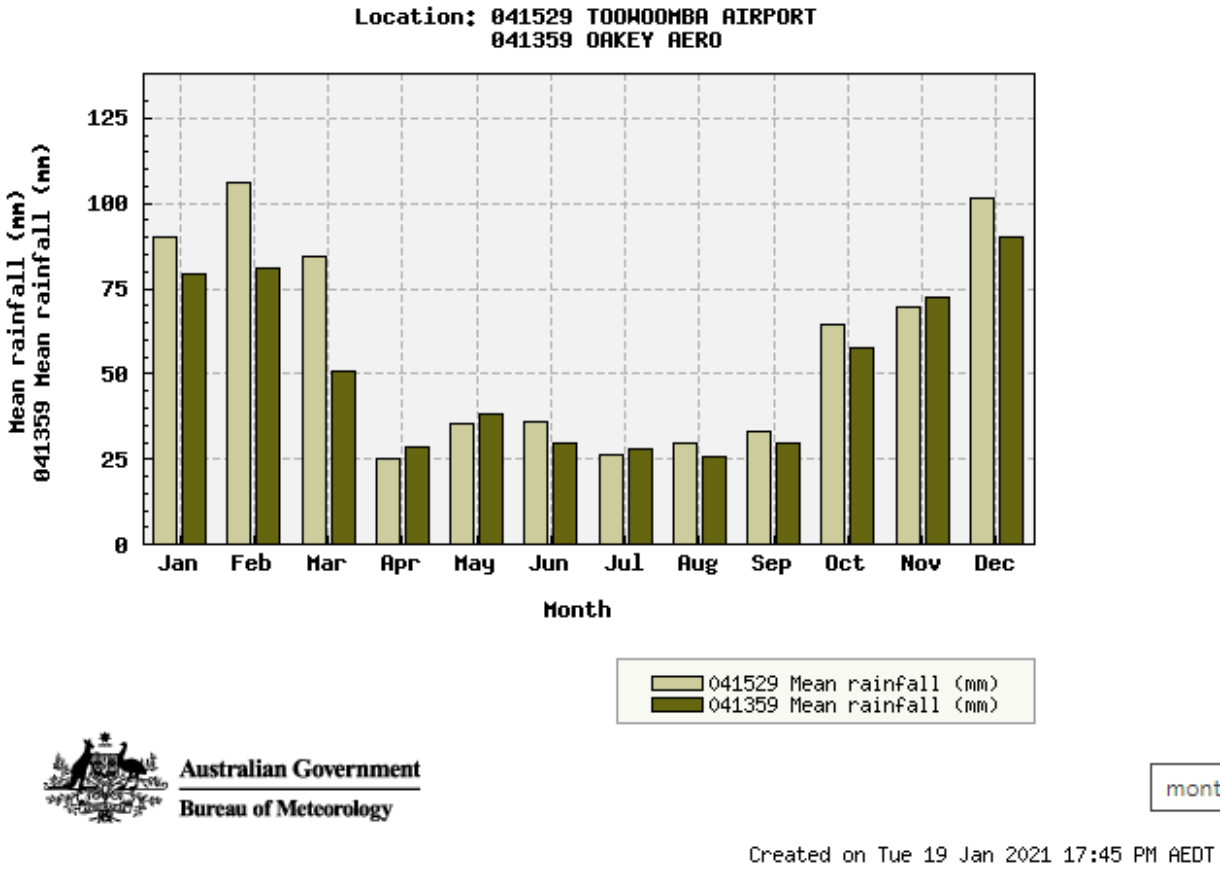


Figure 13 - Mean rainfall for the Toowoomba (041529) and Oakey Airport (041359) weather stations (Source: BoM, 2020)

6.2.5 Relative humidity

Mean 3pm relative humidity data, measured as a percentage is available via BoM's 'Climate Data Online' facility, with data for Toowoomba collected over a 14-year period from 1996 to 2010, and for 37 years at Oakey Airport from 1973 to 2010 (BoM, 2000). The 3pm daily mean is representative of generally time that FFDI peaks each day.

The mean relative humidity exhibited across the two weather stations in the region shows an obvious relationship, with generally consistent rises and falls but where data recorded at Oakey Airport is consistently lower than that recorded for Toowoomba. This indicates a general trend of lower rates of relative humidity in the western area of the Toowoomba Region, compared with the eastern area.

The period of lowest relative humidity, and conducive to increased fire weather, occurs in August, September and October of each year, which aligns with other meteorological elements to give rise to increased fire danger at the end of Autumn and early Spring months.

This weather pattern is generally consistent with anecdotal evidence provided by project stakeholders, describing a difference between fire weather in the eastern portion of the region compared with the western extent. The area of change between the two is identified to occur in the area of the Condamine Plains which extend north – south through the centre of the local government area.

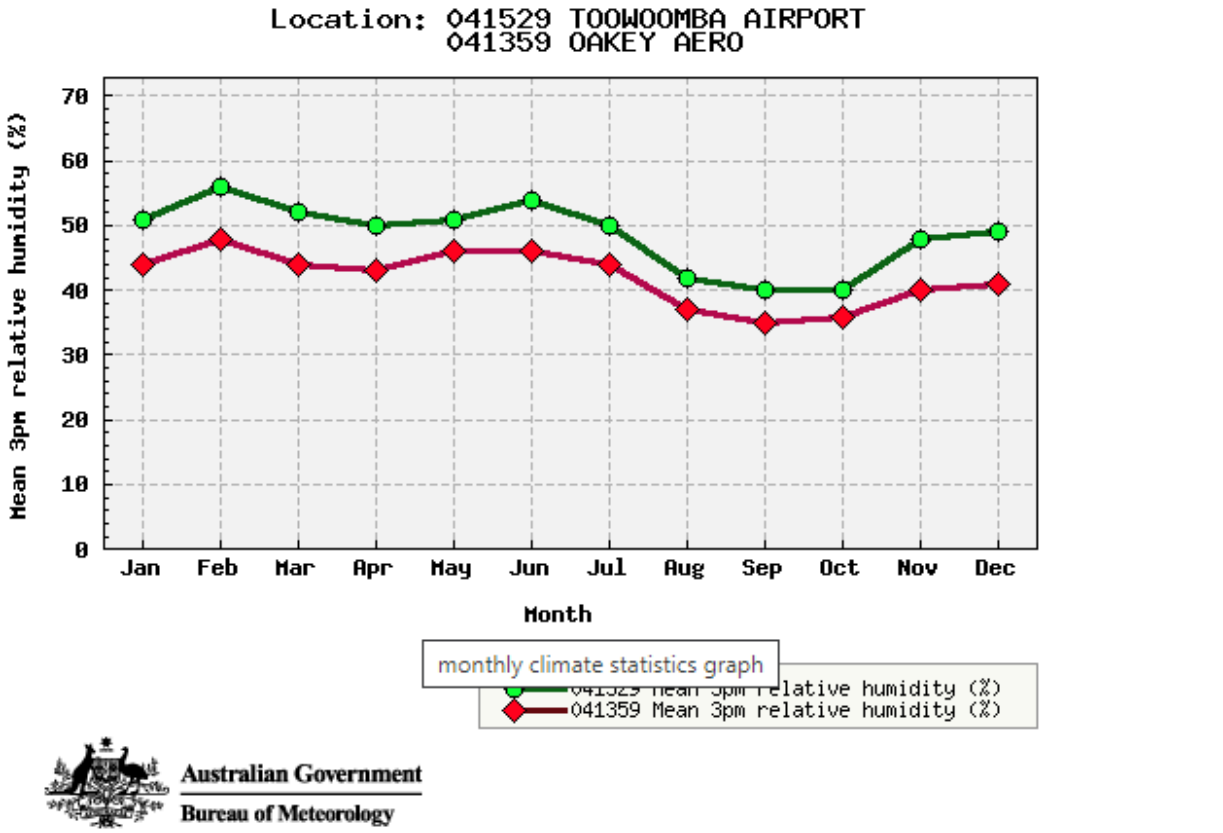


Figure 14 - Mean 3pm relative humidity for Toowoomba (041529) and Oakey Airport (041359)

6.2.6 Localised fire weather

The state-wide bushfire prone areas mapping is based upon 1 in 20 year Annual Return Internal (ARI) (generally equivalent to a 5 per cent Annual Exceedance Probability (AEP)) climate-adjusted FFDI values. These values increase in scale from the north-east to the western part of the region, estimated up to FFDI 75, (Figure 12).

The 2019 'Changes to Fire Weather in Queensland' report prepared by BoM for the Queensland Fire and Emergency Services indicates a change in extreme annual (highest daily) FFDI from 1950-2018, indicating a consistently positive trend of between 15 and up to 49 FFDI points in different areas of the Toowoomba region, refer to the figure below (BoM, 2019).

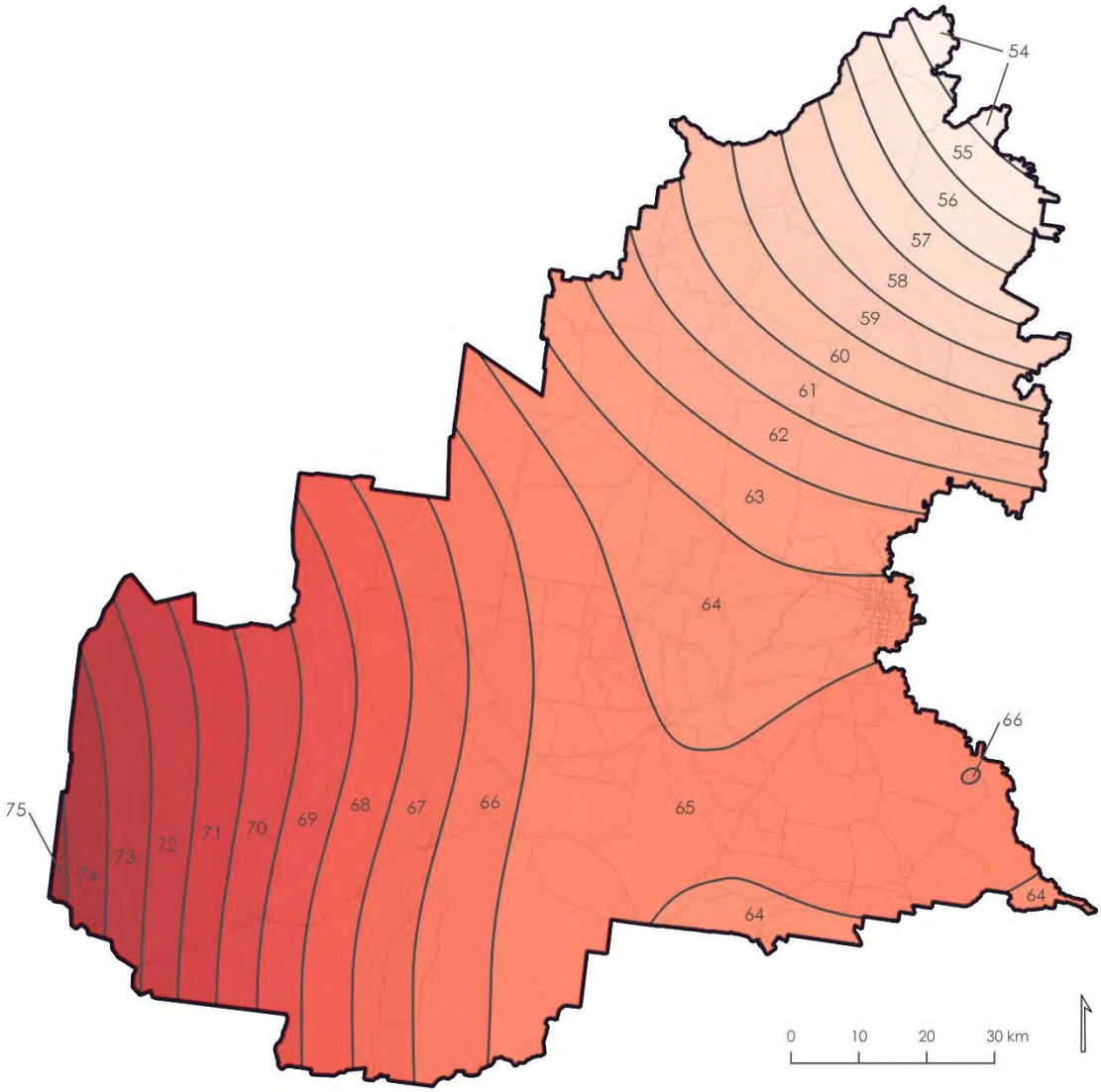


Figure 15 - Climate-adjusted 1 in 20 year fire weather (FFDI) for the Toowoomba Region (Source: QSpatial Catalogue, 2020)

The report indicates the influence of the Great Dividing Range on higher FFDI is significant. East of the Great Dividing Range, the coastal areas of the state do not appear to be subject to the same extent of higher FFDI days as those areas to the west of the Great Dividing Range. This is critical for the Toowoomba Region, in its distinction from South East Queensland in terms of its propensity for increased fire weather on an annual basis.

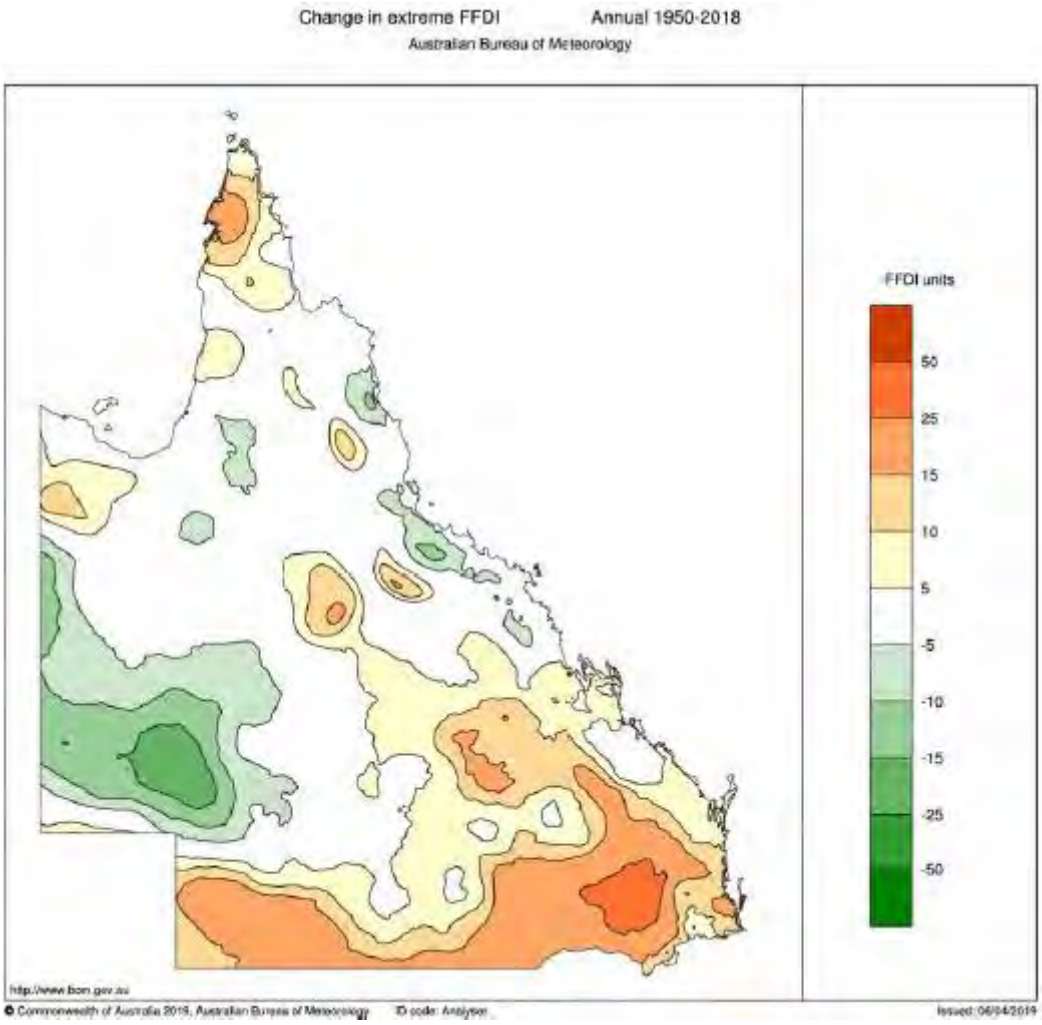


Figure 16 - Linear trend in annual highest daily FFDI (in FFDI units per decade, top) and total linear change (in FFDI units, bottom) across Queensland for the period 1950-2018 (Source: BoM, 2019)

From a temporal perspective, observed FFDI trends appear to be experiencing an uptick from the mid-1980's onwards which is reflective of observed precipitation and climatic trends across the state for the same period.

In addition, the fire season is commencing on average 26 days earlier than observed at the beginning of the BoM study period, and finishing approximately 12 days later and this is marked by the first occurrence of FFDI days of 80+ in the state (BoM, 2019). This just so happens to occur in the South West region, but usually further west in the state than the Toowoomba Region.

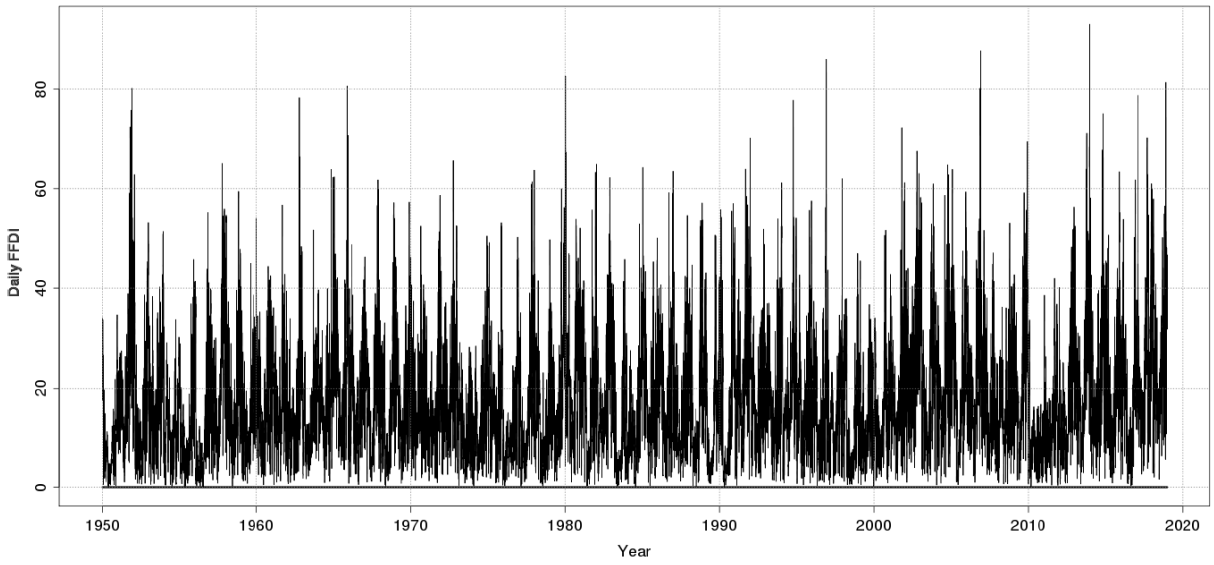


Figure 17 - Time series of daily FFDI averaged across the Central South sub-region (1950-2018). The day with the highest spatial average for the sub-region was 3 January 2014 at circa FFDI 95) (Source: BoM, 2019)

In summary, the following climatic and fire weather observations are apparent for the Toowoomba Region:

- current climate-adjusted 5 per cent AEP FFDI values for the region range from around 55 in the north-east (around Yarraman) to approximately 75 in the western parts of the region;
- it currently experiences annual FFDI values which are higher than those experienced in South East Queensland;
- the frequency of higher FFDI days is increasing;
- the annual fire season has grown longer over recent decades, and is likely to continue to do so;
- precipitation has, over recent years, decreased across the region and this is expected to continue to decrease into the future;
- temperatures across the region over recent years have increased and is projected to continue to do so as a result of climate change.

6.3 Vegetation and fuels

Fuel load, arrangement and connectivity (or conversely, fragmentation) represents a considerable component in dictating to a large degree the behaviour of fire in terms of intensity, rate of spread and flame height. Different vegetation groups yield very different fire behaviour and intensities by virtue of their characteristics such as density, arrangement, fuel loads and other characteristics.

Vertical and horizontal continuity of fuels is also a considerable factor. Vegetation characteristics guide estimates on how quickly fire might spread and the likely fire behaviour and intensity which may occur.

The indicative extent of vegetation across the local government area is present in green in the figure below.

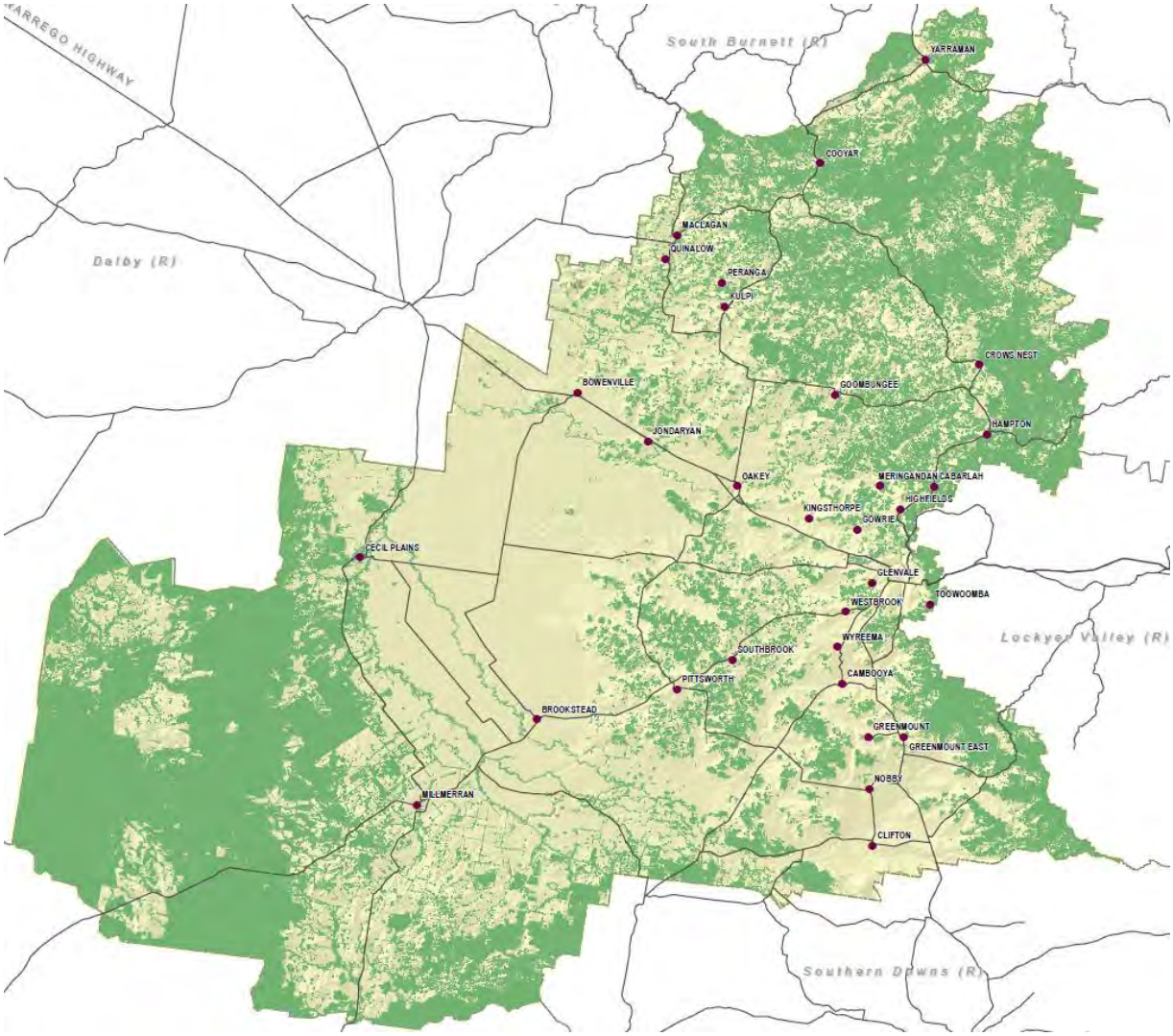


Figure 18 - General extent of vegetation (in green) and agricultural lands (in yellow) (Source: GHD, 2010)

6.3.1 Vegetation communities and hazard classes

Regional Ecosystem status is used to identify relevant vegetation hazard classes (VHCs), pursuant to the QFES Bushfire Resilient Communities technical reference guide. This system translates Regional Ecosystems into a series of VHCs which represent vegetation community typologies, against which potential fuel load and continuity is established.

The vegetation characteristics of the Toowoomba Region are largely characterised by open forest and woodland vegetation, punctuated by grasslands and agricultural lands.

In the east, the Toowoomba Escarpment is dominated in large part by open eucalypt forest, growing more dense near gully areas, and featuring increased understory vegetation. Areas of wet sclerophyll forest are extensive. This vegetation community is particularly evident in pockets on the Escarpment in the Toowoomba Urban Area, extending north to Highfields (where spotted gum open forest is also present), and through to Hampton and north of Crows Nest. Other vegetation classes which occur in this area include spotted gum forest, moist to dry eucalypt forest, eucalypt woodlands and wet eucalypt tall woodland.

The complex topography of this area coupled with very high fuel loads (up to an estimated 35 tonnes per hectare) presents a very high bushfire hazard. It is this location where the Pechey fires burnt through in November 2019.

Escarpment suburbs within the Toowoomba Urban Area[1] (based on Statistical Local Area 2 boundaries) adjoin wet tall eucalypt open forest and woodlands, moist to dry eucalypt forest and woodlands and pockets of spotted gum, principally in the areas of Highfields, Spring Bluff and Cabarlah. The Escarpment suburbs south of Harlaxton and through to Top Camp adjoin moist to dry eucalypt woodland, vine forests, and a small pocket of spotted gum forest, of varying fuel loads.

The southern Escarpment area to the east of Clifton and Greenmount is dominated by dry eucalypt open forest with fuel loads of over 20 tonnes per hectare. Smaller pockets of dry eucalypt woodlands also occur in the area.

Across the Condamine plains, vegetation classes comprise pockets of dry eucalypt open forest, fragmented by agricultural lands. While this area is highly fragmented, crops and grasslands across production lands can contribute to rapid fire spread. In the north-eastern portion of the region, the diversity of vegetation classes is likely to generate erratic fire behaviour on the basis of mixed fuel loads and composition.

West of Millmerran and Cecil Plains, a change in topography and geology gives rise to areas of dense dry eucalypt forest and woodlands, interspersed with ironbox woodland and cypress pine woodlands.

A list of the common VHCs evident across the Toowoomba Region are included at Appendix A, based on current Regional Ecosystem mapping.

Figure 15 illustrates the spatial distribution of VHCs across the region, demonstrating a strong relationship with the hazard extents and magnitudes identified at Figure 10.

[1] Including SA2s of Cambooya – Wyreema; Toowoomba – West; Drayton – Harristown; Darling Heights; Middle Ridge; Rangeville; Toowoomba – Central; Newtown; Toowoomba – East; North Toowoomba – Harlaxton; Wilsonton; Highfields; and Gowrie.

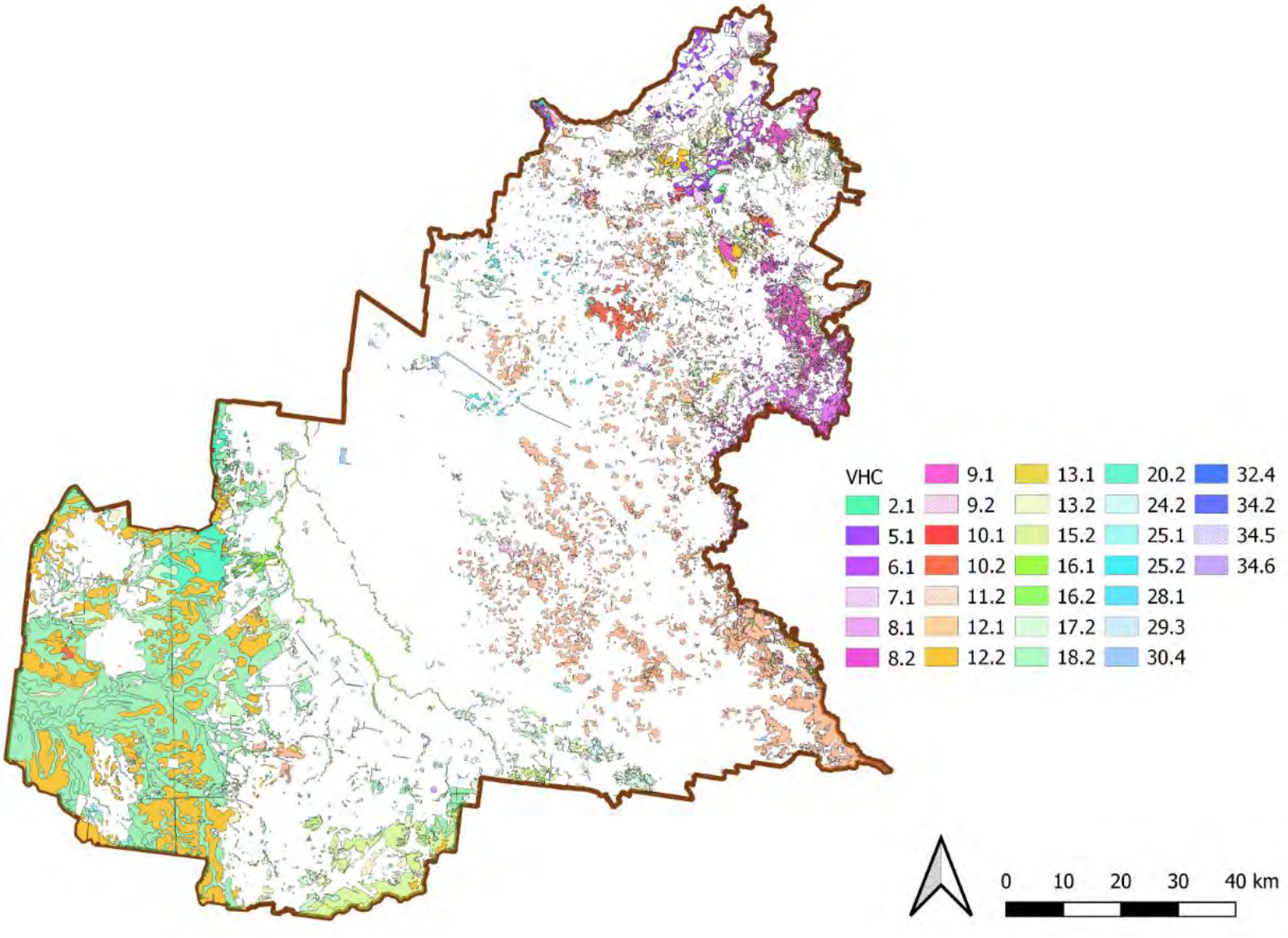


Figure 19 - Overview of vegetation hazard classes across the Toowoomba Region

6.4 Topography and geology

The City of Toowoomba is located approximately 125 kilometres west of Brisbane immediately west of the Great Dividing Range, a prominent ridge separating the Darling Downs and Moreton regions.

Areas along the Great Dividing Range in the east include steep gullies and ridges up to 900m AHD. Away from the range, the majority of the Toowoomba Region is characterised by relatively flat plain lands with some low lying hills and valleys to as low as 390m AHD.

The expansive flat plains which dominate the region form part of the Condamine catchment which flows north-westerly through the local government area to meet with the Balonne River to the west. This areas collectively forms part of the headwaters of the Murray-Darling Basin.

West of Millmerran and Cecil Plains the topography becomes more complex as it transitions into Bringalily State Forest and Kumbarilla State Forest.

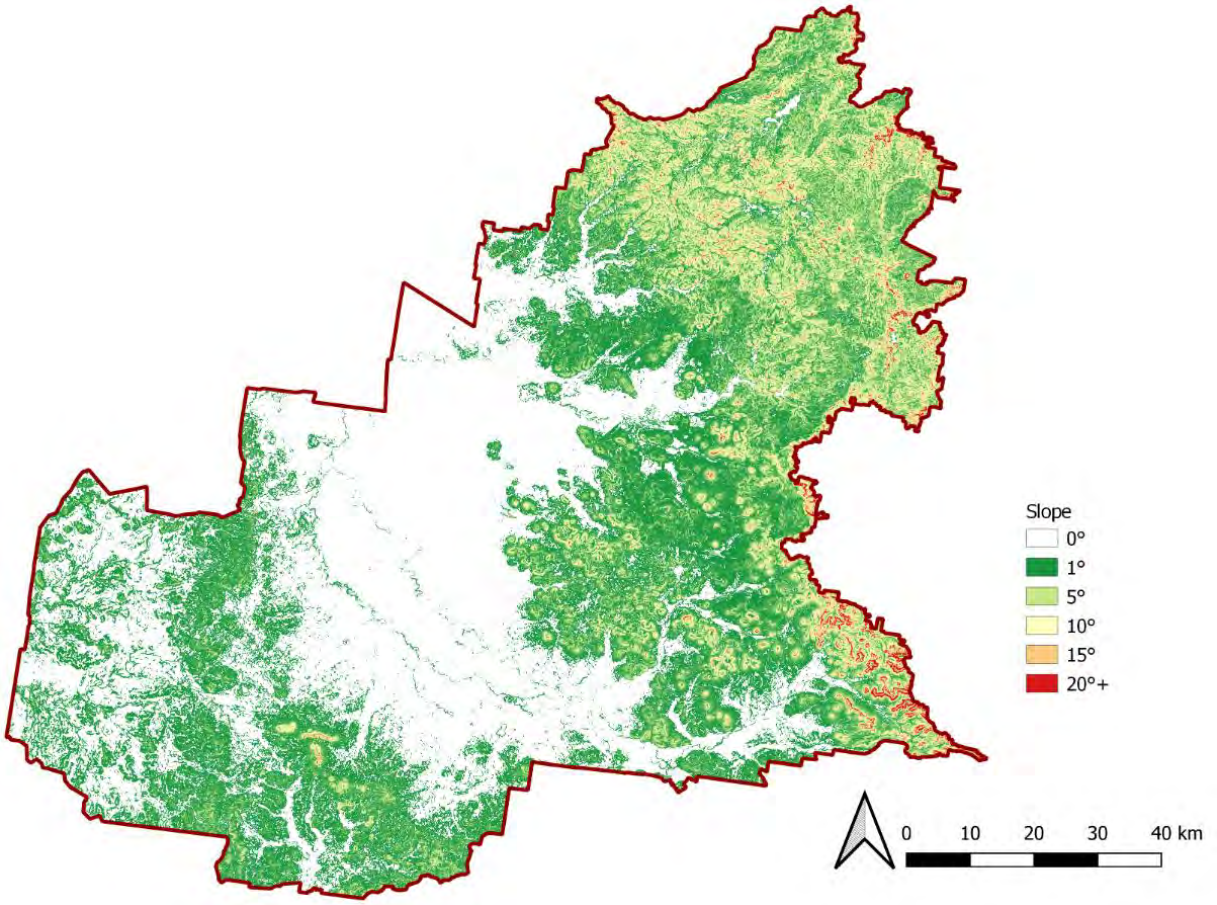


Figure 20 - Heat map of slope across the Toowoomba Region

The Toowoomba Region consists of a diverse geology. The northern part of the region consists of predominately metamorphic and granite rock near the Great Dividing Range. Basalt plains and hills spread from the north to the south-east. The central part of the region, which is characterised by relatively flat plain lands consisting of alluvial river and creek flats. The south-west part of the region, where forestry areas are identified, is characterised by old loamy and sandy plains and ironstone jump-ups (Figure 21).

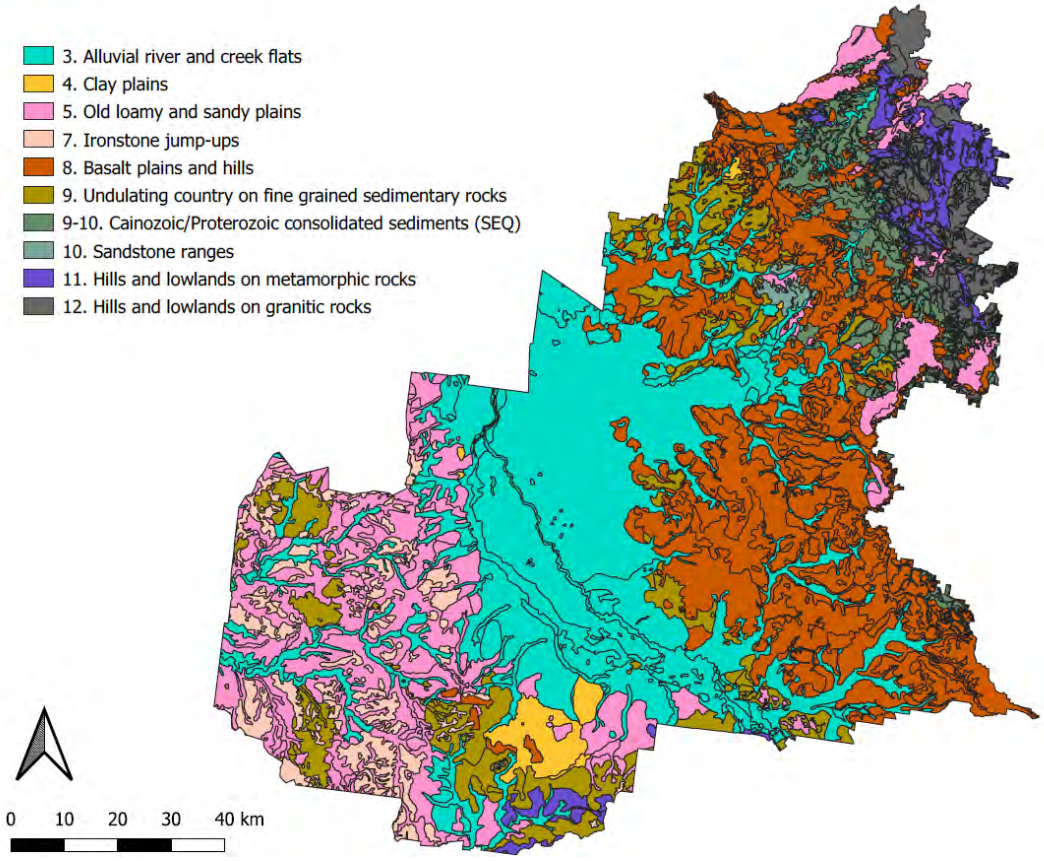


Figure 21 – Geological landzones of the Toowoomba Region (Source: QSpatial Catalogue, 2020)

6.5 Fire history

Fire history is an important parameter for examination, as it gives an indication of aspects of potential likelihood and consequence, which are two factors which give rise to the consideration of risk.

The history of fire in the Toowoomba Region is extensive. Recent fire events in 2020 included fires at Jubilee Park, Crows News, Dunmore and Millmerran.

The 2019-20 fire season saw major fire events across the Toowoomba Region, notably including the Pechey fire near Crows Nest and the Millmerran and Cypress Gardens fires. These fires were major events in a season which saw a level of fire activity across eastern Australia of a magnitude which has not been experienced on record. The climate and weather drivers of these events is covered in earlier sections of this report.

The Pechey fire started in mid-November 2019 and burnt approximately 21,000 hectares before it was contained by fire services in late November after burning for 16 days. Approximately six dwellings were lost as well as other buildings and equipment.

5 emergency alerts were issued for the event. The ignition source of the fire was not able to be determined.

Figure 22 - Pechey fire, south of Crows Nest in November 2019 (Source: Nine News, 2019)

In early December 2019, the Millmerran, Cypress Gardens and Forest Ridge fires in the Western Creek State Forest led to the evacuation of more than 50 residents. The fire front alone spanned a distance of over 16 kilometres in width and burnt an area of approximately 1,200 hectares. Two dwellings and other buildings were lost, and others were damaged, with firefighters saving more than 40 dwellings under extreme conditions. The fire overran a number of roads, constraining evacuation options as the fire advanced.

The Millmerran fire burnt for a period of eight days and the ignition source of the event was not able to be determined.

Figure 23 - Millmerran fire burning at Cypress Gardens and Forest Ridge in December 2019 (Source: QFES, 2019)

Figure 24 - Millmerran fire front (Source: Nine News, 2019)

Other events over time have impacted on the region, including the evacuation of residents along the Escarpment on certain occasions.

Landsat and Sentinel 2 imagery of fire frequency for the period from 2011 to 2016 reflects the vegetation hazard class, topographical variations and bushfire prone areas mapping contained in this report, with high fire frequency occurring in the higher hazard areas of the region, including:

- areas around the Toowoomba Urban Area;
- areas in the northern parts of the region around Crows News, Cooyar and north of Goombungee;
- the southern portion of the Escarpment, east of Clifton and Greenmount; and
- the areas to the west of Cecile Plains and Millmerran.

It should be noted this data does not capture fire activity since 2016, data for which is not currently publicly available. It also does not differentiate between bushfires and prescribed burns, and so it is expected that increased fire frequency would occur in higher hazard locations as part of fire and land management programs.

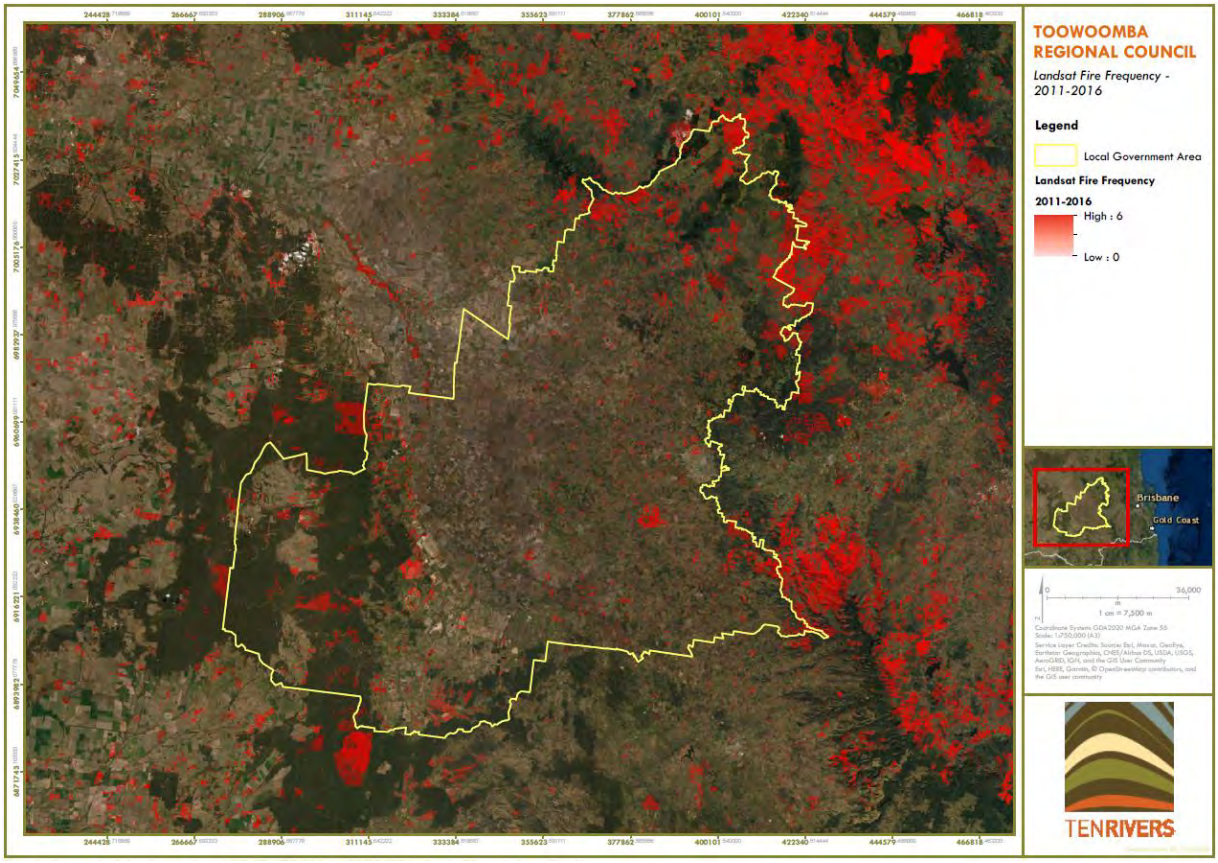


Figure 25 - Fire frequency mapping for the Toowoomba Region for the period 2011-2016 (Source: Data obtained via QSpatial Catalogue and prepared by Ten Rivers, 2020)

6.6 Landscape fire hazard and strategic-level risks

This Contextual Review of the elements which influence local bushfire hazard across the Toowoomba Region indicates that the environment *already experiences considerable fire activity and is likely to become more prone to bushfire into the future*.

This is highlighted by the following observations:

- bushfire is endemic to the Toowoomba Region, with an extensive history of events which have given rise to property loss and community evacuation over recent decades;
- recent climate and weather trends indicate the hazard and risk profile of the Toowoomba Region has already changed in comparison with decades prior to the 1980's;
- climate influences are projected to continue to change over future decades, which is likely to generate an increased likelihood of fire across the region;
- the intensity and behaviour of fire may increase over future decades across the region as rainfall decreases and mean temperatures increase, giving rise to longer periods of drought, lower soil and biomass moisture, changes to vegetation communities and increases in ground fuels and dead materials; and
- longer fire seasons are already occurring and projected to increase over future decades.

From a spatial perspective the topography, vegetation and fuel dynamics across the region combine to highlight a number of *key areas where increased bushfire hazard is present*. These include:

- the Crows Nest area in the north-east of the region, north of Goombungee, where higher fuel loads are evident and terrain is complex;
- the Escarpment suburbs within the Toowoomba Urban Area, between Cabarlah and Top Camp. This presents a key interface area where higher risk (due to the presence of people and property) is present;
- the southern extent of the Escarpment, east of Clifton and Greenmount as a function of fuel load and typology, and topography;
- grassfire hazard across the Condamine plains; and
- that portion of the region west of Cecil Plains and Millmerran where rural residential and several large-scale agricultural activities intermix with extensive tracts of dry eucalypt forest across areas of complex terrain.

These observations generally align with the 2009 Bushfire Hazard Study prepared by the former Conics, which also made high-level representations on locations of higher bushfire hazard across the Toowoomba Region.

These areas will provide the context for focus of Part B of the Bushfire Risk Analysis, which comprises the risk assessment.

BUSHFIRE RISK ANALYSIS

Part B - Risk Assessment

Meridian Urban

1 Introduction

This bushfire risk assessment has been commissioned by Toowoomba Regional Council (herein referred to as 'Council'), as part of a broader bushfire risk analysis to support the Toowoomba Region Futures Program. The intent of this risk assessment is to examine and understand the potential nature of bushfire risk to people, property and the environment across the Toowoomba Region now, and into the future.

This risk assessment focusses on the potential likelihood and consequence of bushfire risk across the Toowoomba Region, insofar as it relates to strategic land use planning, having regard to factors of exposure, vulnerability and tolerability.

This assessment seeks to inform Council's strategic land use planning approach to the Toowoomba Region, adopting a risk-informed evidence base upon which to consider potential strategic land use planning options.

It achieves this by adopting risk-based principles to determine appropriately risk-informed zoning and other strategic planning controls.

This fit-for-purpose risk assessment is prepared pursuant to the current *State Planning Policy July 2017* (SPP), and the State interest guidance materials which are required to be appropriately integrated into a local planning instrument.

The risk assessment process is based upon that set out by the *National Emergency Risk Assessment Guideline* (NERAG) and in accordance with AS/NZS ISO 31000 – Risk Management, having regard to the critical elements of likelihood, exposure, vulnerability, tolerability and consequence with consideration of existing and potential future risk exposure framed by an analysis of:

- risks to people;
- risks to property;
- risks to infrastructure; and
- potential cascading environmental and economic risks.

2 Risk assessment scope

The purpose of this landscape-scale strategic risk assessment is to assess the nature of bushfire risk associated with the Toowoomba Region and to recommend land use planning controls for the area under a new Planning Scheme which responds to the specific bushfire risk profile of the area.

The broader bushfire risk analysis, of which this risk assessment forms part, will develop cutting edge, locally refined and pragmatic land use planning approaches to bushfire risk management to enhance the protection of the Toowoomba community from the threat of natural hazard.

This risk assessment forms Part B of the bushfire risk analysis. The planning scheme provisions development forms Part C – Planning issues and options.

This risk assessment adopts a risk-based land use planning lens in the critical analysis of the magnitude of potential risk likelihood, exposure, vulnerability, tolerability and consequence having regard to a range of scenarios to test a variety of risk outcomes, and mitigation and treatment opportunities. This process seeks to inform Council decision making in relation the preparation of a new Planning Scheme, having regard to the risk profile of the Toowoomba region.

This approach seeks to satisfy the current State Planning Policy (SPP) and its guidance materials prepared by the State government, which together articulate the suite of bushfire hazard and risk considerations which are required to be appropriately considered as part of strategic planning activities in Queensland.

2.1 Assumptions and exclusions

The following assumptions and exclusions apply to this risk assessment:

- it is assumed the evidence sources utilised to inform this risk assessment are accurate and up-to-date, and can be reasonably relied upon for the purposes of its application;
- this risk assessment is not a bushfire management plan;
- it may offer options or recommendations for Council consideration as part of strategic land use planning processes pursuant to its obligations under the SPP. It does not make any decisions in relation to land use;
- it is assumed a range of other planning-related issues are likely to be taken into account as part of Council's consideration of the observations made by this risk assessment;
- this risk assessment seeks to analyse the extent of bushfire risk relevant to the Toowoomba Region with respect to the existing situation and potential future risk, based upon a series of defined scenarios. This assessment makes no inference as to the probability of any scenario coming to fruition;
- the scenarios adopted for the purpose of this assessment are hypothetical only, designed to test a range of potential risk profiles, mitigation options and residual risk profiles to determine potential 'optimal' options having regard to bushfire risk; and
- this assessment does not incorporate any traffic modelling or analysis with regard to bushfire emergency evacuation, and remains qualitative in this regard only.

3 Guiding methodologies

In order to appropriately inform strategic land use planning controls, a fit-for-purpose bushfire risk assessment is necessary in order to examine potential risk and the nature of potential risk-responsive planning controls to address the various aspects of bushfire risk across the Toowoomba Region.

3.1 Objectives and priorities

The objectives and priorities of this fit-for-purpose risk assessment are:

1. the delivery of *risk-informed land use planning* policy, strategy and statutory controls to underpin a new Planning Scheme for the Toowoomba Region;
2. the *quantification of risk* across the Toowoomba Region to formulate policy and strategy responses across the spectrum of:
    - avoid;
    - mitigate;
    - accept; and
    - transfer.
3. the identification of any *potential acceptable or tolerable risk opportunities* where development could be considered subject to statutory provisions. This includes understanding how land management and other bushfire protection measures can be undertaken to facilitate potential development having regard to risk to life and property;
4. identification of the relevant *strategic and statutory planning provisions* which may be considered in response to the above matters.

3.2 Principles

The principles of this risk assessment serve as the foundation which guide the approach and implementation of methodologies. This risk assessment is:

- evidence-based;
- stakeholder-led, guided by specialist expertise;
- locally contextualised;
- fit-for-purpose;
- both quantitative and qualitative in assessment;
- guided by benchmarks to appropriately determine 'acceptable risk';
- transparent to ensure integrity of process; and
- aligned with the strategic planning requirements of SPP and its guidance materials.

3.3 Process

As established above, this risk assessment process is undertaken through the specific lens of risk-based land use planning and using the processes outlined by the *National Emergency Risk Assessment Guidelines* (NERAG) published by the Australian Institute for Disaster Resilience (AIDR) as well as AS/NZS ISO 31000: 2018 Risk management: principles and guidelines (ISO 31000).

This process aligns with that required by the SPP and its guidance materials.

Risk assessment framework

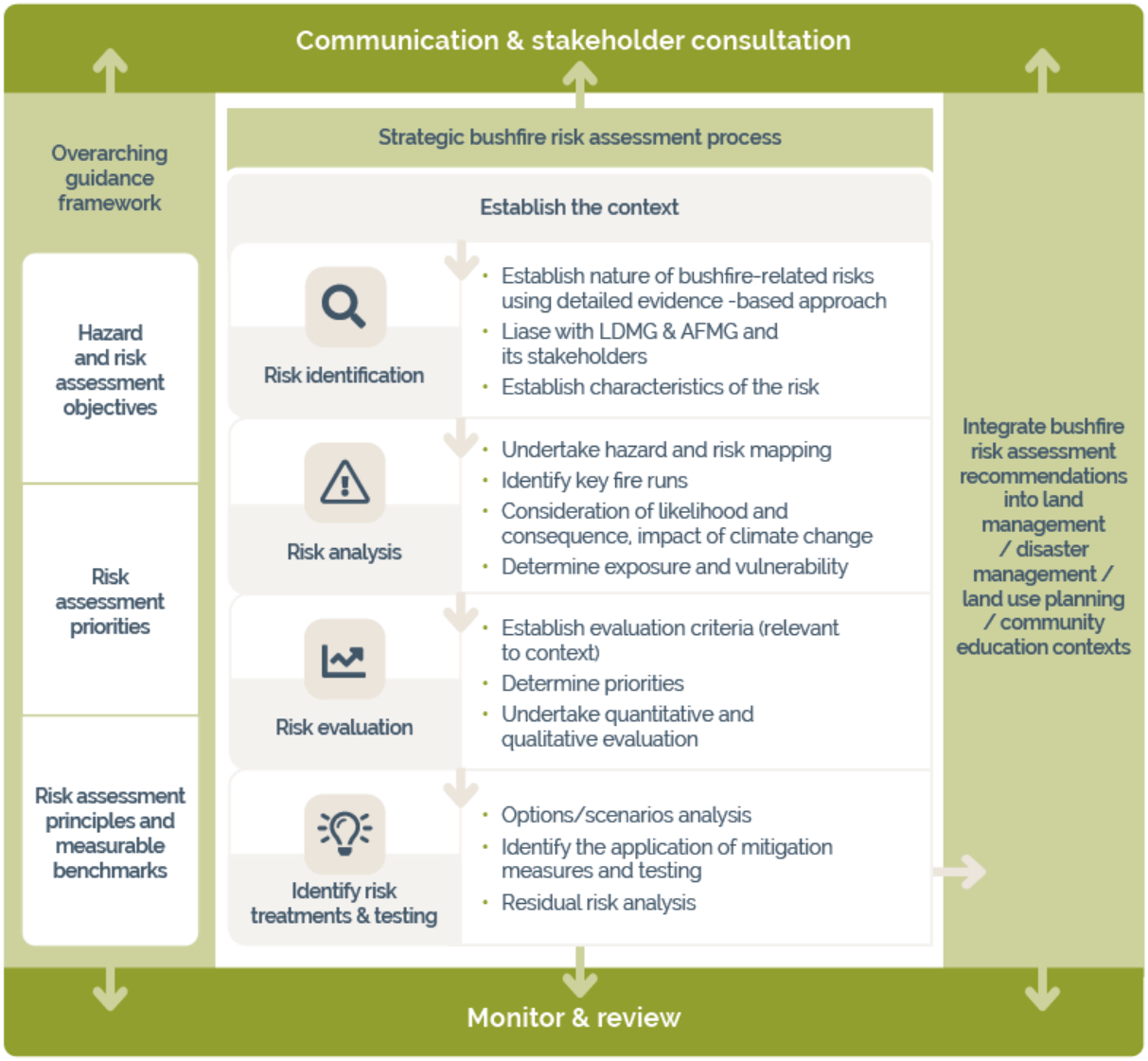


Figure 26 - Fit-for-purpose risk assessment framework in accordance with NERAG

Pursuant to NERAG and AS/NZS ISO 31000, the essential first stage of any natural hazard risk assessment process is establishing the context to understand the policy and regulatory environment, the physical environment, weather and climatic trends and event history (AIDR, 2017). The contextual analysis that underpins this risk assessment is contained in Part A.

How risk is considered by strategic land use planning processes accords with the NERAG framework, but attracts different procedures than may otherwise applied in operational contexts. This is an important distinction to make.

The AIDR Land Use Planning for Disaster Resilient Communities Handbook identifies how risk management procedures are applied in strategic land use planning contexts, outlined below.

Risk management procedure	Land use planning procedure
Establishing the context	Visioning, overarching desired futures
Risk assessment	Analysis of the circumstances and problems/opportunities
Selection of risk treatment options	Identification of planning alternatives, and evaluation and selection of them
Risk treatment implementation	Planning implementation
Ongoing communication and consultation	Communication and consultation
Ongoing monitoring and review	Monitoring effects and adjusting

Figure 27 - Parallels between land use planning and risk management procedures (Source: AIDR, 2020)

3.4 An integrated approach

This risk assessment also incorporates an integrated and multi-disciplinary approach to the consideration and quantification of bushfire risk.

While this risk assessment is planning-based in its focus, it is necessary to consider the multitude of disciplines and mitigation approaches beyond land use planning that combined, enhance overall bushfire resilience.

This approach fundamentally recognises that it is not the role of strategic land use planning to necessarily avoid or reconcile all aspects of risk, but to contemplate the magnitude of risk in varying scenarios to consider how the quantum of mitigation measures may reduce risk exposure, or not, and whether such risk can reasonably be expected to limit risk to life, property and the environment to an acceptable or tolerable level.

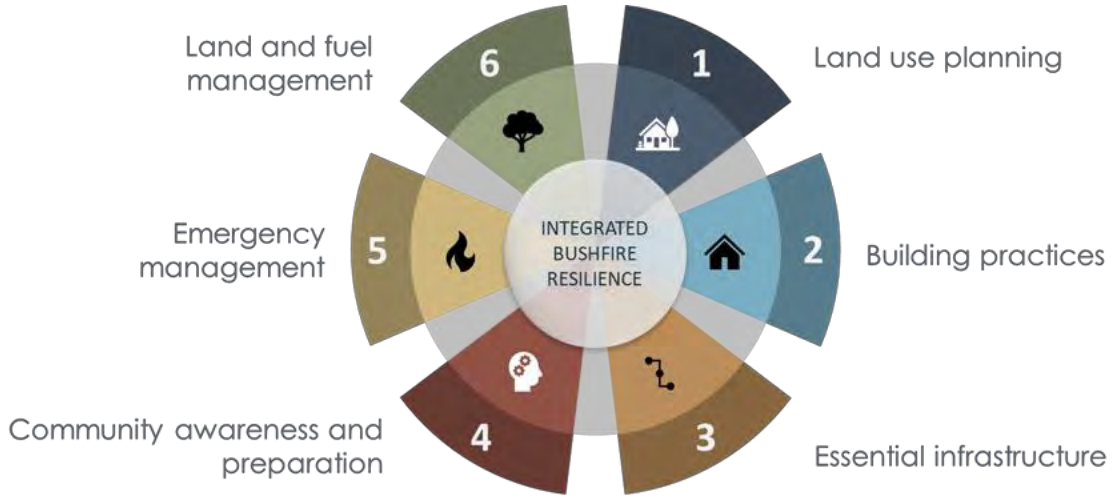


Figure 28 - An integrated approach to bushfire resilience

As part of this integrated approach, this risk assessment has regard to the Queensland Emergency Risk Management Framework prepared by Queensland Fire and Emergency Services (QFES). This framework is intended to be contemplated by multi-disciplinary approaches, including land use planning activities.

While the framework diverges in certain respects from NERAG, the overarching framework remains similar. This risk assessment has regard to the provisions of the Queensland Emergency Risk Management Framework, to that extent possible.

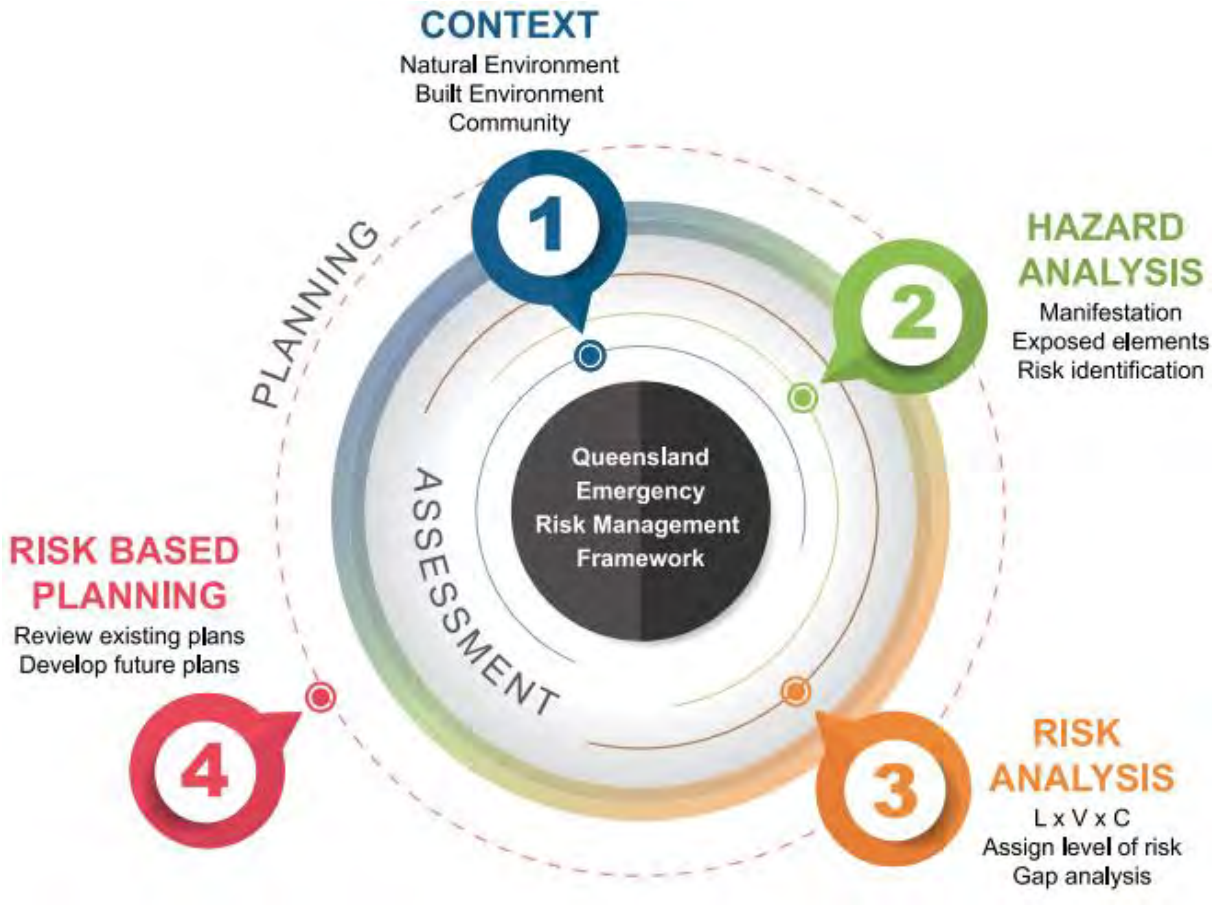


Figure 29 - The Queensland Emergency Risk Management Framework (Source: QFES, 2018)

3.5 Project technical stakeholders

A series of stakeholder engagement activities were undertaken as part of the technical development of this work, alongside Toowoomba Regional Council as the project sponsor.

The purpose of this engagement was to gather the required technical input from various stakeholders in order to prepare the work, and test methodologies and findings.

An overview of the technical stakeholder engagement is outlined below.

Table 5 - Summary of project stakeholder engagement

Project stakeholder	Date	Description
Project inception meeting	14 September 2020	Project inception, project management requirements, objectives and principles, and approaches to engagement.

Project stakeholder	Date	Description
Council land and fire management team	27 October 2020	Discussion on land and fire management activities on Council-owned estate across the region.
Council disaster management team	6 November 2020	Discussion on previous events and impacts, nature of known risks and key localities, community preparedness and objectives for resilient land use planning.
Council development assessment team	6 November 2020	Discussion of previous development applications, contentious issues and challenges for policy implementation.
Department of State Development, Infrastructure, Local Government and Planning and Queensland Fire and Emergency Services (Planning)	17 November 2020	Objectives and requirements of the State Planning Policy and guidance materials, expectations for fit-for-purpose risk assessments, data access and use and detailed methodology overview.
Darling Downs Area, Rural Fire Service – Queensland Fire and Emergency Services	23 November 2020	Discussion on previous events and impacts, nature of known risks and key localities, community preparedness and objectives for resilient land use planning.
Council disaster management team	23 November 2020	Field visits of key higher hazard locations across the Escarpment.
Queensland University of Technology	12 January 2021	Overview of Warm Temperate Climate Study and scope.
Council strategic planning team	12 February 2021	Project update and discussion of detailed risk analysis methodology.
Council project working group	22 March 2021	Presentation of draft risk assessment, observations and recommendations to the project working group.
Department of State Development, Infrastructure, Local Government and Planning and Queensland Fire and	8 April 2021	Presentation of draft risk assessment, observations and recommendations to key project stakeholders.

Project stakeholder	Date	Description
Emergency Services (Planning)		
Council project working group workshop	28 April 2021	Presentation and overview of draft risk assessment, review of Council survey on planning scheme provisions, risk-based workshop.
Council project working group	24 May 2021	Brief overview of planning issues and options reporting.
Councillor workshop	26 May 2021	Overview of risk assessment observations and issues and options policy workshop.

3.6 State interest compliance

In 2017 the current SPP came into statutory effect. Further to the SPP are two non-statutory guidance documents both released in 2019, including:

- Natural hazards, risk and resilience – bushfire: State planning policy – state interest guidance material (December 2019); and
- Bushfire resilient communities – technical reference guide for the State planning policy State interest 'Natural hazards, risk and resilience – bushfire' (October 2019).

This risk assessment considers the SPP and its guidance material as a consolidated package of State expectations with regard to satisfaction of the State interest for bushfire hazard, risk and resilience.

One of the key additions to the current SPP and its guidance material which sets it apart from previous editions is the requirement for fit-for-purpose risk assessments for the natural hazards which continue a State interest, including bushfire. This process aims to ensure that bushfire risk is appropriately considered as part of strategic planning activities, having regard to the nature of potential risk rather than mere compliance with statutory bushfire protection measures.

State interest policy two (2) for natural hazards, risk and resilience establishes the expectations of a fit-for-purpose risk assessment which guide how the strategic consideration of bushfire risk it to be integrated into strategic planning processes. These include:

- the characteristics of the bushfire hazard in the area;
- the relevant fire and fire weather history of the area;
- the population and land uses currently exposed to bushfire hazard;
- the anticipated growth of the community and the options for accommodating that growth;
- the location of current and proposed community infrastructure and services;
- the suitability of existing studies to inform the risk assessment;
- the potential social, economic and environmental impacts that would result from a bushfire event; and

- local and district disaster management planning, including emergency response and recovery capacities.

The *Bushfire Resilient Communities Technical Reference Guide* prepared by QFES articulates a further ten (10) policy positions with regard to land use planning for bushfire hazard in Queensland. These are specifically addressed in the following section.

This risk assessment responds to the requirements of the SPP and State interest guidance materials, with relevant policies of the Bushfire Resilient Communities Technical Reference Guide also functioning as the 'acceptable risk criteria' benchmarks for the assessment, as outlined below.

3.7 Acceptable risk criteria and benchmarking

The determination of outcomes which represent 'acceptable' or 'tolerable' risk versus 'intolerable' risk, and those measures, treatments and controls which might assist in achieving mitigated residual risk, must be measured against a set of benchmarks, or risk acceptability criteria. This provides clarity and transparency of assessment against key criteria.

The acceptable risk criteria established for this risk assessment are derived from the Bushfire Resilient Communities Technical Reference Guide policies.

Due to the multiplicity of criteria, this enables a clear measurement of risk across multiple factors, being the core principles which strategic planning outcomes are sought to satisfy. It clearly articulates the suite of standards which strategic planning outcomes are expected to meet.

This risk assessment adopts a principles-based approach to the determination of 'acceptable or tolerable' risk, being that risk which is considered within the risk tolerance appetite of land use planning authorities, or which is considered sufficiently low that it is deemed acceptable.

The approach adopted aligns with that of the 'ALARP' principle relating to risk tolerance levels set out by both the Australian Institute of Disaster Resilience 2020 *Land Use Planning for Disaster Resilient Communities Handbook*, and the 2016 Planning Institute of Australia publication, the *National Land Use Planning Guidelines for Disaster Resilient Communities*.

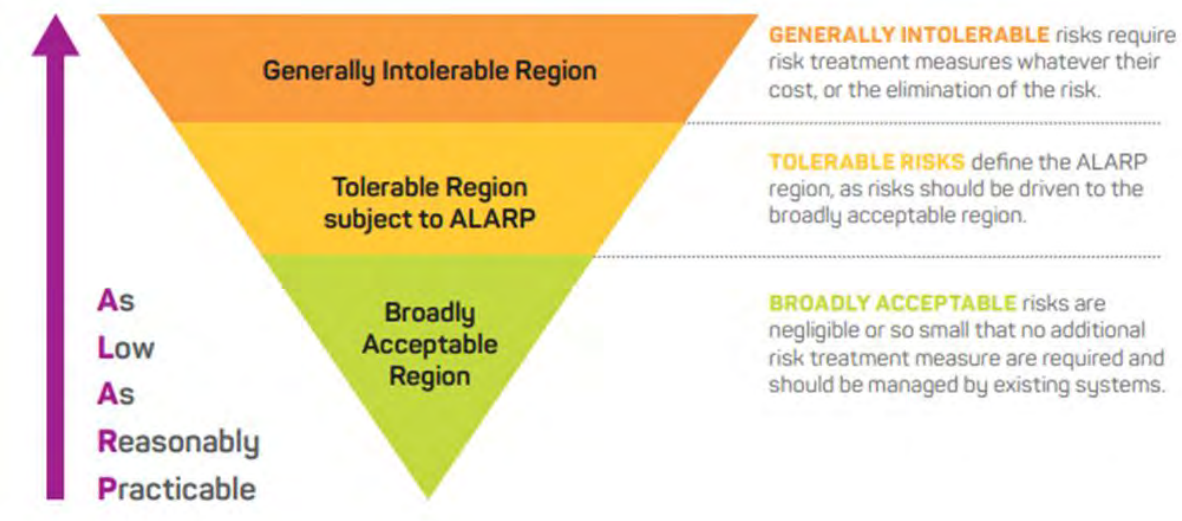


Figure 30 - The 'ALARP' principle for risk tolerance (Source: AIDR, 2020)

It is likely the assessment of strategic planning options against these benchmarks may not be 'black or white' or a clear 'pass or fail'. This is because qualitative and contextual

considerations which extend beyond the contemplation of bushfire risk, relating to other strategic planning matters, are likely to apply.

To this end, this acceptable risk methodology adopts the 'traffic light' methodology of the ALARP approach, where the quantum of quantitative and qualitative aspects of the risk assessment are considered against a system which indicates potential levels of risk acceptability or tolerability.

Table 6 - Risk acceptance / tolerability benchmark assessment system

Risk benchmark	Description as per SPP 2017
Acceptable	A risk that, following an understanding of the likelihood and consequences, is sufficiently low to require no new treatments or actions to reduce risk of the natural hazard further. Individuals and society can live with this risk without feeling the necessity to reduce the risk any further.
Tolerable, subject to treatment	A risk that, following an understanding of the likelihood and consequences, is low enough to allow the exposure to the natural hazard to continue, and at the same time high enough to require new treatments or actions to reduce risk. Society can live with this risk but believes that as much as is reasonably practical should be done to reduce the risks further.
Intolerable	A risk that, following an understanding of the likelihood and consequences, is so high that it requires actions to avoid or reduce the risk. Individuals and society will not accept this risk, and measures are to be put in place to reduce the risk to at least a tolerable level.

The determination risk acceptability or tolerance is essential in the consideration of appropriate risk-informed strategic planning, land use allocation and development controls which are needed to respond to the nature and potential level of risk, as part of the contemplation of Planning Scheme controls.

It must be noted that risk levels vary across the landscape, thus a place-based approach is required which considers specific locations across the Toowoomba Region.

The following table outlines the risk acceptability / tolerability benchmarks against which risk is to be analysed and evaluated, relative to different risk treatment options. It is informed by the strategic land use policies set out in the Bushfire Resilient Communities Technical Reference Guide prepared by QFES.

Table 7 - Acceptable risk criteria and benchmarks against which residual risk is measured for this assessment

BRC Policy	QFES policy approaches which guide acceptable and tolerable risk
Mapping	Mapping is robust and locally relevant.
Fit-for-purpose risk assessment	A fit-for-purpose risk assessment informs plan-making or amendments to achieve an acceptable or tolerable level of risk to people and property in bushfire prone areas.
Avoidance, or mitigate to an acceptable or tolerable level	The planning scheme or amendments following a risk assessment are based on the principle of avoidance as the first priority, and then mitigation of the risk to an acceptable or tolerable level.

BRC Policy	QFES policy approaches which guide acceptable and tolerable risk
Disaster management	Disaster management capacity and capabilities are maintained to mitigate the risks to people and property to an acceptable and tolerable level.
Urban design	Lot and neighbourhood layout and design mitigates the risks to people and property to an acceptable and tolerable level.
Vulnerable uses	Vulnerable uses are not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service, there is no suitable alternative location and site planning can appropriately mitigate the risk.
Revegetation, rehabilitation and land management	Revegetation and rehabilitation avoids an increase in the exposure or severity of bushfire hazard.
Hazardous activities and storage	Development does not locate buildings or structures used for the storage or manufacture of materials that are hazardous in the context of a bushfire within a bushfire prone area unless there is no suitable alternative location.
Protective functions	The protective function of vegetation arrangements that can mitigate bushfire risk are maintained.
Community infrastructure	Community infrastructure for essential services is not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service and there is no suitable alternative location, and further, the infrastructure can be demonstrated to function effectively during and immediately after a bushfire event.

3.8 Geographic extent

This risk assessment relates to the Toowoomba local government area, as identified in Part A – Contextual Analysis.

For the purposes of Park B – Risk Assessment, the region is divided into six precincts based on the boundaries of the Statistical Area Level 2 (SA2) as per the Australia Bureau of Statistics Australian Statistical Geography Standard (ASGS) (some manipulation of SA2 boundaries was required to ensure alignment with the LGA boundary). The Toowoomba urban area is an amalgamation of several SA2 areas and is consistent with the Toowoomba Significant Urban Area (SUA) as defined under the ASGS.

The Toowoomba urban area adopted for the purposes of this risk assessment also reflects that area of the Toowoomba Region identified as part of *Shaping SEQ: South East Queensland Regional Plan 2017* as the Toowoomba urban area extent.

Figure 31 - Risk assessment precincts for localised consideration

3.9 Bushfire prone areas mapping

To inform this risk assessment, two (2) hazard mapping sets are used:

1. Council's existing bushfire hazard overlay mapping; and
2. existing State-wide bushfire prone areas (BPA) mapping.

3.9.1 Existing bushfire hazard overlay mapping

The bushfire hazard overlay map contained within the current Planning Scheme was derived using the former SPP 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide. SP 1/03 was repealed in 2013 before the new State-wide mapping methodology was released in 2014. For planning instruments being prepared around that period, retention of the former mapping methodology is common.

The overlay mapping includes two (2) hazard classes including 'Medium fire risk' and 'High fire risk' however, the mapping represents hazard, as opposed to risk.

Refer to Part A – Contextual Analysis for region-wide mapping imagery.

3.9.2 Existing State-wide BPA mapping

The existing State-wide BPA mapping which supports the SPP was prepared in 2015, and updated (for South East Queensland only) in 2017.

The State's current bushfire hazard mapping methodology was released in 2014 and prepared by the CSIRO in conjunction with QFES. The methodology is set out in the following documents:

- *New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland;*
- *Estimating the Potential Bushfire Hazard of Vegetation Patches and Corridors: An enhancement of Queensland's methodology for State-wide mapping of bushfire prone;* and
- *Bushfire Resilient Communities technical reference guide.*

The mapping methodology is based upon potential fire line intensity using the MacArthur Mk 5 Forest Fire Danger Meter and inputs of total fuel load and effective slope to derive a potential rate of fire spread. A 100m 'buffer' area is also applied under the SPP (replicating the approach under AS3959:2018 – Construction of Buildings in Bushfire Prone Areas), being the zone in which ember attack and radiant heat remain most relevant, adjacent to the actual hazard.

The State-wide mapping methodology comprises four (4) hazard classes:

3. Medium potential bushfire intensity;
4. High potential bushfire intensity;
5. Very high potential bushfire intensity; and
6. Potential impact buffer (100m).

Refer to Part A – Contextual Analysis for region-wide mapping imagery.

3.9.3 Verification process

Pursuant to the provisions of the Bushfire Resilient Communities technical reference guide which constitutes guidance material under the SPP, local verification of the current State-wide BPA mapping has been undertaken for the Toowoomba Region, as part of this Bushfire Risk Analysis.

This process considers the accuracy of data inputs and resultant bushfire hazard class outputs, ostensibly relating to fireline intensity.

The State-wide BPA mapping is intended to form the bushfire hazard overlay map of the new Toowoomba planning scheme.

The State-wide BPA mapping is regularly updated by QFES. As such, it may be the case the State-wide BPA mapping is updated following this risk assessment and prior to the adoption of the new planning scheme. Any updates are likely to incorporate the 2020 Regional Ecosystem dataset. Having regard to this risk assessment it is considered unlikely that updated mapping (based on the existing methodology) would result in any significant changes to the risk profiles identified by this risk assessment. This matter was discussed with the Department and QFES during the preparation of this assessment.

A BPA mapping verification report has been prepared by Ten Rivers and is attached at Appendix A.

Overall, this risk assessment along with the verification report identifies the current BPA mapping likely overrepresents the magnitude of bushfire hazard across the Toowoomba Region. In large part, it appears the BPA mapping continues to include small patches and corridors which, pursuant to the 2017 methodology addendum for patch and corridor filtering prepared by CSIRO, has been removed from the South East Queensland portion of the BPA mapping but not elsewhere across the state.

Particularly in the Toowoomba urban area, small patches and corridors of hazard would likely be removed from the mapping with an updated filtering approaches for patches and corridors, of the specifications outlined by the 2017 CSIRO mapping methodology addendum report.

A recommendation of this risk assessment is that Council works alongside the State government as part of ongoing updates and amendment processes supporting the State-wide BPA mapping.

3.10 Mapping data assumptions and limitations

This risk assessment was undertaken on the basis of the following data assumptions and limitations:

- data sources are as provided by TRC and as made publicly available, refer to Appendix B for further detail;
- the analysis excludes land within the Toowoomba Railway Parklands Priority Development Area;
- Local plans have not been considered as part of this analysis, where Local Plans exist, the underlying zoning as presented in the zoning map has been utilised;
- where relevant, the analysis considers zoned land only (i.e. unzoned land, such as road reserve and the like is excluded);
- the State-wide BPA dataset includes a 100 metre buffer around the extent of the LGA to capture buffer areas arising from mapped hazard outside of the LGA boundary;
- in order to derive dwelling exposure in urban areas, the following considerations were taken into account:
    - there is no known publicly available dataset that accurately identifies residential buildings within significant urban areas (such as Toowoomba City);
    - to establish a measure for number of dwellings, residential lot parcels within the Residential zones category (i.e. Low density residential and Low-medium density residential) were utilised based from provided Council data;
    - common property was excluded by removing all '0' lot numbers;
    - lot parcels below 30m² were excluded so to ensure access restriction strips and redundant land did not form part of the analysis;
    - parcels below 1 hectare were considered as 1 dwelling and parcels greater than 1 hectare were separately considered as 'developable'. 1 hectare is considered to be a reasonable depiction as to what is realistically developable on a broad scale; and
    - as per the above, exposure is cadastral based.
- in order to derive dwelling exposure in non-urban areas, the following considerations were taken into account:
    - building point data is significantly more accurate outside of urban areas and was therefore overlayed with the rural, rural residential and township zone; and
    - as per the above, exposure in this instance is point based (due to lot size, cadastral exposure is not considered to provide an accurate determination).
- dwelling exposure within 'growth' areas was based off the emerging community zone with the following considerations:
    - lot parcels below 200m² were excluded so to ensure access restriction strips and redundant land did not form part of the analysis;
    - common property was excluded by removing all '0' lot numbers;
    - lot parcels less than 1 hectare were considered to be 'developed' for the purpose of this analysis; and
    - lot parcels greater than 1 hectare were considered to be 'developable'.

- for the purposes of residential exposure, the analysis did not consider land in zones other then those identified above;
- nursing homes are based on geocoded addresses and aligned with the underlying cadastral boundaries to form a cadastral assessment; and
- road exposure is based on a road centreline and considers highways, secondary roads and local connector roads only and does not consider local streets, laneways or other minor roads.

4 Risk identification

This section identifies the land use planning related risks relating to bushfire hazard across the Toowoomba Region.

4.1 Risk identification methodology

The Queensland Disaster Management Arrangements (QDMA), Queensland Emergency Risk Management Framework (QERMF) and Queensland Strategy for Disaster Resilience (QSDR) identify the broad framework for the consideration of risks from natural hazards in Queensland.

This section largely relates to Process 1 of the QERMF.

Figure 32 - Process 1 of the QERMF (Source: QFES, 2018)

From resilience to recovery, five (5) lines of operation guide the types of risk which are contemplated by formal processes, and which are adopted for the purposes of this risk assessment. This also aligns with the approach adopted by NERAG.

Figure 33 - Resilience and recovery lines of operation (Queensland Government, 2019)

In order to understand the nature of potential risks associated with bushfire hazard across the region, a quantitative GIS-based analysis of hazard mapping was first performed. This process was conducted using:

1. the current bushfire hazard overlay map contained within the Toowoomba Regional Planning Scheme; and
2. the current 5 per cent annual exceedance probability (AEP) (generally equivalent to a 1 in 20 year annual return interval (ARI)) climate-adjusted state-wide bushfire prone areas mapping prepared by the Queensland Government, contained within the SPP Interactive Mapping System (IMS).

Generalised extreme value analysis (GEV) assists to understand the annual return internal (ARI) of localised fire weather, which can then be converted into an annual exceedance probability (AEP). Derived by Douglas et al. 2014, the GEV methodology provides a scientific basis for planning, development and building construction in bushfire prone areas.

> '*The underlying principle is to use the recurrence of fire weather as measured by FFDI as the planning or design fire weather reference. The recurrence is determined by the applying the GEV analysis to local historical weather data of limited time period. The resultant distribution is fitted with an appropriate regression curve which allows the extrapolation beyond the available weather data recording period. The derived FFDIs corresponding to the nominated recurrence is compared with the FFDIs based on traditional empirical methods*' (Douglas et al. 2014).

The current State-wide mapping methodology for Queensland is based upon a 1 in 20 year ARI that is climate adjusted. Elsewhere in Australia, mapping and fire weather scenarios to support planning decisions are generally based upon a 1 in 50 year ARI fire weather event.

For the purposes of this assessment, the 5 per cent AEP event is adopted. Whilst it is acknowledged the QERMF identifies the need for the consideration of the most likely and credible worst-case scenarios that may occur, bushfire behaviour modelling to inform these is outside the scope of this assessment.

The 5 per cent FFDI for the Toowoomba Region is between approximately 65 and 75 (east to west).

The GEV methodology identifies a 2 per cent FFDI of between approximately 70 and 80 for the Toowoomba Region, and a 1 per cent FFDI of between 75 and 85.

The above is based on data calibrated at the nearby Miles weather station.

These fire weather projections, based on historic daily FFDI data derived from BoM, enables the consideration of increasing fire weather characteristics for the Toowoomba Region, for planning purposes. This includes graduating FFDI values from east to west across the region, as discussed in Part A – Contextual Analysis.

Whilst the Miles weather station is located outside of the region and reflects slightly higher FFDI values than experienced in the Toowoomba Region, it is generally reflective and enables this risk assessment to consider projected climate conditions using extreme value analysis. The purpose for this approach is to consider the nature of hazard and potential risks across the region under changing (worsening) climate conditions, supporting the rigour of the overall risk assessment.

The highest recorded fire weather event for the Central South sub-region (of which Toowoomba forms part) was FFDI 95, on 3 January 2014 (BoM, 2019).

Given the order of difference between a 5 per cent and a 1 per cent event, of a maximum of just 10 FFDI value points, this risk assessment does not model a 2 per cent or 1 per cent event magnitude.

The mapping outlined above, with the exception of Council's current overlay, are based on fireline intensity hazard classes. These classes seek to illustrate, based on specific data inputs, the potential magnitude of bushfire hazard based upon a calculation of fireline intensity.

Fireline intensity is a measure of fire intensity at the fire front. It is measured as the amount of energy released per metre width of the fire edge (CSIRO, 2013).

As noted by Leonard et al. (2014) '*at a landscape scale, the preferred metric for indicating the potential severity of these impact mechanisms is fireline intensity. Fireline intensity is a standardised measure of the rate that an advancing head fire would consume fuel energy per unit time per unit length of fire front introduced by Byram (1959)*'.

Pursuant to research conducted by Tolhurst, dwelling loss rates are observed to increase where fireline intensity exceeds 30,000 kW/m. As noted earlier by this Bushfire Risk Analysis, increased house loss is also observed in events where FFDI exceeds 50. Direct firefighting is not possible where fireline intensity exceeds 3,500 kW/m.

As per the State's bushfire prone areas mapping methodology, the potential bushfire intensity classes are:

Table 8 - Potential bushfire intensity classes and fireline intensity ranges as per the statewide mapping methodology (Source: CSIRO, 2014)

Potential bushfire intensity class	Potential fireline intensity
1. Very High (potential intensity)	40,000+ kW/m
2. High (potential intensity)	20,000 – 40,000 kW/m
3. Medium (potential intensity)	4,000 – 20,000 kW/m

Where fireline intensity is below 4,000 kW/m (including for grassfire), the potential bushfire intensity is considered low and is removed from consideration for land use planning in Queensland.

For each of the mapping approaches identified above, the GIS-based data analytics has considered:

3. the extent of mapped bushfire hazard relative to the planning cadastre;
4. the 100 metre bushfire hazard buffer (area in which radiant heat and member attack may occur around bushfire hazard areas);
5. a 500 metre and 700 metre hazard buffer extent, based on house loss research from bushfire events across Australia;
6. the settlement pattern (zoning) as per the Toowoomba Regional Planning Scheme.

Critical to the analysis of risk, existing Australian research reveals that 80-90 per cent of property loss occurs within 100 metres of the bushland interface, and this is the basis for current planning and building policy and regulation across Australia.

Additionally, comprehensive data interrogation performed by CSIRO demonstrates that 85 per cent of bushfire fatalities in 260 events from 1901 to 2011 have occurred within the first 100 metres of the bushland interface, including persons attempting to evacuate (Blanchi et al. 2012).

Recent research finds that dwelling and property loss can and does routinely occur beyond this 100 metre extent.

The findings handed down by the National Natural Disaster Arrangements Royal Commission following the 2019-2020 'Black Summer' fire season identified that almost all of the dwellings lost during those events were located within 500m of bushland.

In the 2003 Canberra bushfires, and other events over time, property and dwelling loss has occurred within circa 700m of the bushland interface in urban contexts (Leonard & Blanchi, 2012; McAneney & Chen, 2004 and Ahern & Chladil, 1999). This is particularly relevant given recent bush fire disasters across the globe which have penetrated urban areas.

To this end, consideration of flame contact, radiant heat flux and ember attack surrounding bushfire hazard sources to 100 metres, 500 metres and 700 metres (representing the full or maximum extent of loss observed to date in Australia) has been considered by this risk assessment.

It is noted the 100 metre extent remains the basis of planning policy in Queensland across Australia. This report does not suggest a change to this but rather, seeks to consider the context of the broader landscape around bushfire prone areas for a fulsome consideration of potential bushfire risk.

Table 9 - Indicative distances between hazardous vegetation and loss from bushfire for severe events (Source: Leonard et al. 2014, Leonard & Blanchi, 2009, McAneney et al. 2009, Ahern & Chladil, 1999)

Bush Fire Attack Mechanism	Typical upper distance for 80% of all house losses (m)	Typical upper distance for house ignition from forest (m)	Maximum reach (km)
Primary ember attack	100	500-700	10
Radiant heat exposure	70	160	N/A
Flame contact/exposure	50	100	N/A

The above analysis was conducted for the entire Toowoomba Region, and each SA2 precinct as per Section 3.8, for localised refinement of analysis and observations.

4.2 Region-wide risk exposure and vulnerability

The Toowoomba Region is part of the Darling Downs, at the western extent of South East Queensland. The region spans 12,973 square kilometres encompassing the Great Dividing Range in the east, where the principal centre of Toowoomba is located. From Toowoomba city, the region spans north approximately 85 kilometres, south approximately 50 kilometres and west approximately 90 kilometres. The region is bound by the local government areas of South Burnett Region to the north, Somerset Region and the Lockyer Valley Region to the east, the Southern Downs Region and Goondiwindi Region to the south and the Western Downs Region to the west.

Supporting the principal centre of Toowoomba city, the region consists of a number of regional centres including Cambooya, Clifton, Goombungee, Greenmount, Highfields, Millmerran, Oakey, Pittsworth and Yarraman which are interspersed throughout the region

4.2.1 Fire history

The history of fire in the Toowoomba Region is extensive. Recent fire events in 2020 included fires at Jubilee Park, Crows News, Dunmore and Millmerran.

The 2019-20 fire season saw major fire events across the Toowoomba Region, notably including the Pechey fire near Crows Nest and the Millmerran and Cypress Gardens fires. These fires were major events in a season which saw a level of fire activity across eastern Australia of a magnitude which has not been experienced on record.

Other events over time have impacted on the region, including the evacuation of residents along the Escarpment on certain occasions.

Higher fire frequencies are observed in the higher hazard areas of the region based on Landsat and Sentinel 2 imagery (refer to Part A – Contextual Analysis), including:

- areas around the Toowoomba Urban Area;
- areas in the northern parts of the region around Crows News, Cooyar and north of Goombungee;
- the southern portion of the Escarpment, east of Clifton and Greenmount; and
- the areas to the west of Cecile Plains and Millmerran.

4.2.2 Overview of existing exposure

The following data tables provide an overview of potential bushfire hazard exposure within the Toowoomba Region.

Table 10 – Toowoomba Region hazard exposure snapshot

Toowoomba Region snapshot	
Area	12,973 square kilometres
Estimated population[2]	160,779
Estimated dwelling count[3]	63,600
Estimated dwellings subject to bushfire hazard[4]	Approximately 6,797

[2] ABS, 2021
[3] Ibid.
[4] QSpatial, 2021

Toowoomba Region snapshot	
Nursing homes facilities subject to hazard	4 (of 22 in total)
Child care facilities subject to hazard	7 (of 117 in total)
Schools subject to hazard	19 (of 95 in total)
Hospitals subject to hazard	0 (of 10 in total)
Power generation facilities subject to hazard	1 (of 6 in total)
Electrical substations subject to hazard	11 (of 34 in total)
Telecommunications towers subject to hazard	Data not available
Fuel stations subject to hazard	2 (of 44 in total)
Water pumping stations subject to hazard	17 (of 39 in total)
Water treatment plants subject to hazard	4 (of 7 in total)
Wastewater treatment plants subject to hazard	3 (of 7 in total)

A map of exposed elements is included at Appendix C, for each precinct within the Toowoomba Region.

Based on the average household size for Toowoomba of 2.48 persons per dwelling (ID Consulting, 2016), the following table outlines the potential exposure of existing residential dwellings and resident population within the Toowoomba Region.

Table 11 - Detailed summary of estimated dwelling and resident exposure within the Toowoomba Region

Estimated dwellings and residents within mapped bushfire prone areas		
Hazard exposure extent	Approximate potential dwelling exposure	Estimated existing resident exposure
Within 100m of bushfire hazard	6,797	16,856 persons
Within 500m of bushfire hazard	24,107	59,785 persons
Within 700m of bushfire hazard	31,299	77,621 persons

A geospatial analysis of the existing land use zones within the Toowoomba Region, and its SA2 precincts, has been undertaken, refer to Appendix D for an extract of this data set. This includes a breakdown of exposure to each potential hazard class, based on fireline intensities as per Table 8 above.

Table 12 – Toowoomba Region hazard exposure overview

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to mapped bushfire hazard	8.84	13.33
Subject to flame contact or radiant heat flux (hazard and 100m buffer)	17.83	19.74
Subject to potential bushfire hazard (500m buffer)	41.12	34.89
Subject to potential bushfire hazard (700m buffer)	49.48	39.53
Key roads* subject to flame contact or radiant heat flux	N/A	19.75

* Key roads are identified as Level 1, 2, 3 and 4 roads in the road hierarchy.

4.2.3 Comparative analysis

A comparative analysis across the region's precincts is provided via the tables below which consider:

- bushfire exposure (percentage of precinct area);
- dwelling exposure; and
- resident person exposure.

Detailed data analysis for each precinct is provided in the following sections.

4.2.3.1 Existing risk

The following tables provide a summary comparative analysis between each precinct across the region.

Table 13 - Comparative analysis of bushfire exposure relative to the current State-wide BPA mapping

Precinct	% Subject to mapped bushfire hazard	% Subject to flame contact or radiant heat flux (hazard and 100m buffer)	% Subject to potential bushfire hazard (500m buffer)	% Subject to potential bushfire hazard (700m buffer)	% Key roads* subject to flame contact or radiant heat flux
Toowoomba urban area	19.67	32.97	62.35	71.4	13.76
Crows Nest – Rosalie	28.16	49.13	82.16	88.86	36.69
Clifton – Greenmount	23.75	34.13	57.07	64.96	15.78
Pittsworth	12.49	22.45	47.7	54.9	13.99

Precinct	% Subject to mapped bushfire hazard	% Subject to flame contact or radiant heat flux (hazard and 100m buffer)	% Subject to potential bushfire hazard (500m buffer)	% Subject to potential bushfire hazard (700m buffer)	% Key roads* subject to flame contact or radiant heat flux
Jondaryan	6.87	11.43	25.51	30.7	7.82
Millmerran	21.94	30.73	50.34	55.79	28.68
TOTAL Toowoomba Region	13.33	19.74	34.89	39.53	19.75

* Key roads are identified as Level 1, 2, 3 and 4 roads in the road hierarchy.

The following table examines the extent of exposure of each precinct to varying levels of potential bushfire hazard, as a portion of each precinct and based on the current State-wide BPA mapping.

It is noted that a 100 metre buffer around each hazard class has been allocated for the purposes of this assessment in order to more fulsomely consider the magnitude of hazard exposure. The current State-wide BPA mapping allocates a 100 metre buffer around the entire bushfire prone land area, irrespective of hazard class. On this basis, the figures below reflect increased exposure percentages compared with the data above, as hazard classes are considered on an individual basis, with areas of 'overlap' of hazard classes and buffer counted as part of each relevant hazard class.

Table 14 - Comparative analysis of hazard class exposure relative to the current State-wide BPA mapping

Precinct	**% Subject to 'Medium'** potential hazard (including buffer)	**% Subject to 'High'** potential hazard (including buffer)	**% Subject to 'Very High' potential ha**zard (including buffer)
Toowoomba urban area	23.49	15.52%	11.87
Crows Nest – Rosalie	35.77	25.37	17.47
Clifton – Greenmount	29.18	16.51	11.75
Pittsworth	22.23	3.57	0.33
Jondaryan	11.38	0.53	0.08
Millmerran	30.86	3.82	0.29
TOTAL Toowoomba Region	27.63	10.58	6.3

The following table outlines the estimated number of dwellings relative to bushfire hazard, based on the geospatial analysis undertaken. It is noted this data is based on a number of assumptions which are outlined in Section 3.10, it is used to provide a general estimate of potential dwelling exposure across the region.

Table 15 - Comparative analysis of dwelling exposure relative to the current State-wide BPA mapping

Precinct	Dwellings within 100m of bushfire hazard	Dwellings within 500m of bushfire hazard	Dwellings within 700m of bushfire hazard
Toowoomba urban area	4,216	17,594	23,709
Crows Nest – Rosalie	1,228	3,125	3,403
Clifton – Greenmount	264	662	812
Pittsworth	306	714	914
Jondaryan	454	1,167	1,454
Millmerran	329	845	1,007
TOTAL Toowoomba Region	6,797	24,107	31,299

Based on the average household size for Toowoomba of 2.48 persons per dwelling (ID Consulting, 2016), the table below provides an estimate of potential exposed resident population.

Table 16 - Comparative analysis of resident persons exposure relative to the current State-wide BPA mapping

Precinct	Resident persons within 100m of bushfire hazard	Resident persons within 500m of bushfire hazard	Resident persons within 500m of bushfire hazard
Toowoomba urban area	10,455	43,633	58,798
Crows Nest – Rosalie	3,045	7,750	8,439
Clifton – Greenmount	654	1,641	2,013
Pittsworth	758	1,770	2,266
Jondaryan	1,125	2,894	3,605
Millmerran	815	2,095	2,497
TOTAL Toowoomba Region	16,856	59,785	77,621

The following table provides a snapshot of hazard (irrespective of hazard) exposure across relevant zones, within each precinct. More comprehensive data is available at Appendix D, which includes a breakdown of exposure across each hazard class.

Table 17 - Comparative analysis of zone exposure to bushfire hazard (including 100m buffer) relative to the current State-wide BPA mapping

Precinct	Emerging community	Low density residential	Rural residential	Rural	Township	Community facilities
Toowoomba urban area	34.45	21.26	46.51	33.0	11.41	27.09
Crows Nest – Rosalie	N/A	32.02	63.55	47.82	30.23	77.84
Clifton – Greenmount	N/A	N/A	N/A	34.27	8.85	19.3
Pittsworth	N/A	N/A	N/A	22.31	11.43	23.83
Jondaryan	N/A	8.67	45.21	11.47	4.37	8.25
Millmerran	N/A	N/A	0.66	42.04	60.37	34.55
TOTAL Toowoomba Region	34.45	20.64	44.61	30.09	13.94	24.23

Key zoning analysis insights (drawn from geospatial analysis of hazard and zoning datasets, a snapshot for which is included at Appendix D):

- almost 20 per cent of the key evacuation route network (road hierarchy levels 1, 2, 3 and 4) in the region is subject to potential flame contact or radiant heat;
- considerable extents of the key evacuation route network is exposed to potential flame contact and radiant heat within the Crows Nest – Rosalie and Millmerran precinct, at almost 40 per cent and 30 per cent respectively;
- the highest extent of dwelling and potential resident population exposure is apparent with the Toowoomba Urban Area and Crows Nest – Rosalie precincts;
- those areas with the highest exposure to potential flame contact and / or radiant heat flux are the Toowoomba Urban Area, Crows Nest – Rosalie and Clifton – Greenmount precincts;
- mapped bushfire hazard under the State-wide mapping methodology identifies a higher percentage of land as subject to potential bushfire hazard compared with the current planning scheme overlay mapping. Due to the extent of fragmentation of the current overlay mapping, land within 500-700m of hazard is significant. Much of this land is mapped as hazard pursuant to the State-wide mapping methodology;
- the rural residential zone is overrepresented as subject to bushfire hazard, with almost 45 per cent of this zone either constituting hazard or within 100m of hazard. 15 per cent of land in this zone is potentially subject to flame contact or radiant heat exposure;
- the above is followed closely by the emerging community zone, with over a third of this zone across the region either constituting hazard or within 100m of hazard;
- over 80 per cent of each of these zones is within 500m of hazard, and 90 per cent of each zone is within 700m;

- land within the community facilities and township zones are also relatively highly exposed, with around 50 per cent of these zones within 500m of mapped hazard. This is significant in the consideration of the potential for urban fire intrusion within smaller townships, land zoned for community infrastructure and interface areas;
- the limited development zone occupies a high percentage of very high bushfire prone land, which aligns with the very purpose of this zone;
- compared with the overlay mapping of the current planning scheme, the low density residential area is subject to higher classes of potential bushfire hazard (and fireline intensities), with almost 10 per cent of this zone within 100m of very high potential bushfire hazard; and
- land within rural and industrial zones are exposed, but to a lesser degree than other zones highlighted above.

The sections which follow provide a more detailed analysis of exposure and vulnerability relative to each precinct of the region, including specific detail of higher risk aspects and locations within each.

The risk profiles of key zones in the Toowoomba urban area precinct including the rural residential and emerging community zones, which is poised to accommodate future development growth in the area, are subject to higher risk profiles than indicated under the current planning scheme based on exposure to bushfire attack mechanisms.

The incidence of exposure to bushfire hazard within these zones is higher than for any other zone, including the low density residential zone which incorporates a relatively high level of existing risk exposure, but which is still lower than the rural residential and emerging community zones.

This indicates that development growth in the Toowoomba Region is largely occurring in bushfire prone areas, which will result in increased risk exposure across the region, into the future.

Statutory planning measures, combined with other bushfire protection measures such as building, landscaping, land and fire management and disaster management may assist to mitigate risk. However, identified higher risk locations should be avoided through strategic planning measures.

4.2.3.2 Future exposure under climate change

Daily 3pm FFDI data for the Miles weather station, prepared by BoM, has been used to derive 1 in 50 year ARI and 1 in 100 year ARI fire weather events, based on historic data dating back to June 1972. Whilst the Miles weather station is located outside the region, it provides a relatively proximate understanding of potential FFDI (especially for the western extent of the region), for which the QFES, FFDI contour data can be utilised to identify a proximate (highest) FFDI for the Toowoomba Region. These FFDI values are as follows:

- 1 in 20 year ARI (5 per cent AEP) FFDI 55 – 75;
- 1 in 50 year ARI (2 per cent AEP) FFDI 60 – 80; and
- 1 in 100 year ARI (1 per cent AEP) FFDI 65 – 85.

The potential impacts of climate change generally translate to a more fire prone environment. Whilst increased FFDI values potentially augment rates of flammability and bushfire behaviour and intensity, the spatial context of hazard does not increase. Areas of Medium or High potential hazard may increase, and areas not currently identified as bushfire prone may become bushfire prone, however this cannot be determined with any level of accuracy at this time.

4.2.4 Summary of identified region-wide risks

Based on the analysis of this data, the following risk observations at Table 18, also included within the risk register at Appendix E, are identified for the Toowoomba Region, relative to the following risk typologies:

Table 18 - Summary of identified region-wide risks

Risk typology	Location(s)	Risk description / statement
	Toowoomba Region	Hazard exposure may change in certain locations over time to a higher hazard class, as a result of climate change.
	Toowoomba Region	Certain parts of the evacuation network may be compromised in a fire event, and may impact the ability to evacuate.
	Toowoomba Region	Grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact.
	Toowoomba Region	Considerable risk to community facilities, services and infrastructure within the community facilities zone is present.
	Toowoomba Region	Recovery and reconstruction may be long and costly.
	Toowoomba Region	A proportion of residents and businesses do not have adequate insurance cover.
	Toowoomba Region	Certain land uses within interface locations may inadvertently impact on the ability to implement certain forms of hazard reduction, due to the risk magnitude of mitigation activities.
	Toowoomba urban area Crows Nest - Rosalie	Land and fire management activities may face added pressure from expanding development in interface areas. Ecological assets may be impacted.

Risk typology	Location(s)	Risk description / statement
	Toowoomba urban area Crows Nest - Rosalie	Emergency services may face increased burden from expanded development in interface areas.
	Toowoomba urban area Crows Nest - Rosalie	Lands zoned for future development growth are highly exposed to potential bushfire hazard, particularly the rural residential and emerging community zones. Water supply and servicing is required to be resolved.
	Toowoomba urban area	The low density residential zone is relatively exposed, incorporating a high percentage of existing housing stock within the Toowoomba Region.
	Toowoomba urban area	Vulnerable facilities exist in locations subject to bushfire hazard and which may require evacuation.
	Crows Nest – Rosalie Millmerran	Ability to evacuate may be complicated by exposure of the road network to bushfire attack, fragmented vegetation, land parcels, zoning, and limited route options.
	Clifton – Greenmount Millmerran	Township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion.
	Clifton – Greenmount Millmerran	Evacuation of some townships with limited road connectivity may experience evacuation challenges.

4.3 Precinct-based risk exposure and vulnerability

4.3.1 Toowoomba urban area precinct

The Toowoomba urban area precinct includes the following SA2 areas which take in the Toowoomba CBD and surrounding suburbs:

- Cambooya – Wyreema;
- Toowoomba – West;
- Drayton – Harristown;
- Darling Heights;
- Middle Ridge;
- Rangeville;
- Toowoomba – Central;
- Newtown;
- Toowoomba – East;
- North Toowoomba – Harlaxton;
- Wilsonton;
- Highfields; and
- Gowrie.

This precinct is the most urbanised and populated precinct of the Toowoomba Region, and is located at the summit of the Toowoomba Escarpment.

4.3.1.1 Fire run aspect

In terms of key fire runs relevant to the Toowoomba urban area precinct, it is surrounded to the north, east, south and west by hazardous vegetation. Thus, fire impact within the precinct can occur on any number of prevailing wind situations. However, the more significant potential fire run is from the east, running up or along the Toowoomba Escarpment. Fire behaviour in these situations is likely to be intense and fast moving by virtue of the vegetation hazard class and topography.

4.3.1.2 Overview of existing exposure

The following data tables provide an overview of potential bushfire hazard exposure within the Toowoomba urban area precinct.

Table 19 - Toowoomba urban area precinct hazard exposure snapshot

Toowoomba urban area precinct snapshot	
Portion of Toowoomba Region	5.61 per cent
Estimated population[5]	118,680
Estimated dwelling count[6]	52,000

[5] Geoscience Australia, 2021
[6] Ibid.

Toowoomba urban area precinct snapshot	
Estimated dwellings subject to bushfire hazard[7]	Approximately 4,216
Nursing home facilities subject to hazard	3 (of 15 in the precinct)
Child care facilities subject to hazard	7 (of 105 in the precinct)
Schools subject to hazard	10 (of 63 in the precinct)
Hospitals subject to hazard	0 (of 7 in the precinct)
Power generation facilities subject to hazard	0 (of 0 in the precinct)
Electrical substations subject to hazard	3 (of 13 in the precinct)
Telecommunications towers subject to hazard	Data not available
Fuel stations subject to hazard	1 (of 29 in the precinct)
Water pumping stations subject to hazard	8 (of 18 in the precinct)
Water treatment plants subject to hazard	1 (of 1 in the precinct)
Wastewater treatment plants subject to hazard	0 (of 1 in the precinct)

A map of exposed elements is included at Appendix C.

The following table outlines the potential exposure of existing residential dwellings and resident population within the Toowoomba urban area precinct.

Table 20 - Detailed summary of estimated dwelling and resident exposure within the Toowoomba urban area precinct

Estimated dwellings and residents within mapped bushfire prone areas		
Hazard exposure extent	Potential dwelling exposure	Estimated existing resident exposure
Within 100m of bushfire hazard	4,216	10,455
Within 500m of bushfire hazard	17,549	43,633
Within 700m of bushfire hazard	23,709	58,798

A geospatial analysis of the existing land use zones within the Toowoomba urban area precinct has been undertaken, refer to Appendix D for an extract of this data set. This includes a breakdown of exposure to each potential hazard class, based on fireline intensities as per Table 8 above.

[7] QSpatial, 2021

Table 21 - Toowoomba urban area precinct hazard exposure overview

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to mapped bushfire hazard	20.48	19.67
Subject to flame contact or radiant heat flux (hazard and 100m buffer)	37.19	32.97
Subject to potential bushfire hazard (500m buffer)	64.94	62.35
Subject to potential bushfire hazard (700m buffer)	73.18	71.4
Subject to 'Medium' potential hazard (including buffer)	43.74	23.49
Subject to 'High' potential hazard (including buffer)	5.15	15.52
Subject to 'Very High' potential hazard (including buffer)		11.87
Key roads subject to flame contact or radiant heat flux	N/A	13.76

4.3.1.3 Summary of data observations

Based on the data above, the following observations are relevant for the Toowoomba urban area precinct:

- whilst one of the smallest precincts of the region, the Toowoomba urban area occupies the majority of the regions' population and urban development;
- of the quantum of potentially sensitive assets and uses within the Toowoomba urban area precinct, the majority or located outside of the bushfire prone area. A small number of nursing homes, child care centres and schools within the precinct are identified as potentially exposed;
- a large proportion of land identified as bushfire prone is within a non-urban zone. However, these zones share a significant interface with adjoining urban (predominantly residential) areas;
- the following areas are surrounded or largely adjacent to very high potential hazard:
    - areas of Blue Mountain Heights, Highfields, Spring Bluff and Cabarlah to the east of the New England Highway (higher hazard is more fragmented to the west);
    - Harlaxton;
    - Mount Lofty;
    - Prince Henry Heights;

- Redwood;
- Rangeville;
- Middle Ridge; and
- Top Camp.

- the above areas are dominated by existing urban residential development, rural residential development, emerging communities and some rural zoned lands;
- the New England Highway is a key evacuation route to the south, for residents to the north of Toowoomba. Within the Toowoomba urban area precinct it is largely flanked by existing development, but does transition through several bushland areas;
- the New England Highway traverses a higher hazard area to the south of the CBD, north of Top Camp. A fire event in this location may require evacuees to move west, instead of north towards the CBD; and
- the length of the interface zone (along the Escarpment) increases the extent of exposure within the precinct however, it is unlikely the entire Escarpment would be involved in one singular fire event. Notwithstanding, it does expose a relatively high proportion of existing and potential future growth areas to high and very high potential hazard. The location of urban development and persons gives rise to elevated risk potential.

4.3.1.4 Risk exposure and vulnerability profile

The Toowoomba urban area precinct incorporates the majority of the region's population, existing housing stock, infrastructure and services. Approximately 30 percent of this precinct is within 100m of potential bushfire hazard. The urbanised nature of much of the precinct limits the extent of its interface with bushfire prone land, however it is largely surrounded by potential bushfire hazard.

The Toowoomba Escarpment represents a particular area of potential risk, where existing and new urban development are located in very close proximity to high fuel loads and steep downslopes which can carry fire rapidly up the Escarpment, and is capable of generating intense and erratic fire behaviour. This is a relatively known risk, which Council has expended time and resources over recent years to investigate aspects of preparedness and mitigation amongst residents living along the Escarpment.

Much bushfire prone land in this precinct is already zoned as limited development (constrained land), which is mostly consistent of very high and high bushfire prone land. This is entirely consistent with the intent of this zone, and reflects Council's existing approach to limited development in locations subject to higher levels of hazard.

Flame contact, radiant heat exposure and ember attack are all relevant to the consideration of bushfire hazard in this precinct. Fire driven winds and smoke are also relevant.

Flame contact and radiant heat exposure are particularly likely across residential zoned land (most of which has been previously developed over Toowoomba's history) along the Escarpment. Ember attack from conflagration moving eastward up the range is likely to produce significant ember attack by virtue of the type of vegetation in this area.

Building vulnerability from ember attack extends well beyond the mapped 100m buffer around bushfire prone lands. Research to date indicates that maximum house and building loss from ember attack in more extreme bushfire events is in the realm of 500-700m and this is largely a result of settlement pattern, dwelling and building density, the vulnerabilities of buildings constructed prior to the introduction of AS3959 standards, and landscaping (including timber fencing).

The majority of aged care, educational and health services are located in the Toowoomba urban area precinct. Several of these are located within mapped bushfire prone areas (within 100m of bushfire prone land). The evacuation of vulnerable persons from these facilities can be complex, stressful and challenging. Continued proliferation of vulnerable facilities in bushfire prone areas should ideally be arrested into the future, to limit ongoing increases of vulnerable persons in exposed areas.

Particular aspects of existing risk exposure and potential vulnerability include:

- Anglicare SQ Symes Thorpe Home for the Aged;
- Toowoomba Anglican School;
- Fairholme College;
- Fairview Heights State School;
- Youth with a Mission Prince Henry Heights;
- electrical substation facility at New England Highway at Top Camp;
- Mount Kynoch Water Treatment Plant;
- James Byrne Centre;
- Koojarewon Youth Camp;
- Highfields State School; and
- Amaroo Environmental Education Centre.

It is largely the case for exposure of existing facilities that disaster management risk arrangements pursuant to the QDMA and treatments identified via the QERMF process are more applicable. It is recommended Council consider these facilities as part of those processes.

From a planning perspective however, expansion or reuse of these facilities, largely zoned for community facilities activities, requires specific consideration of bushfire hazard and risk as part of any development assessment process.

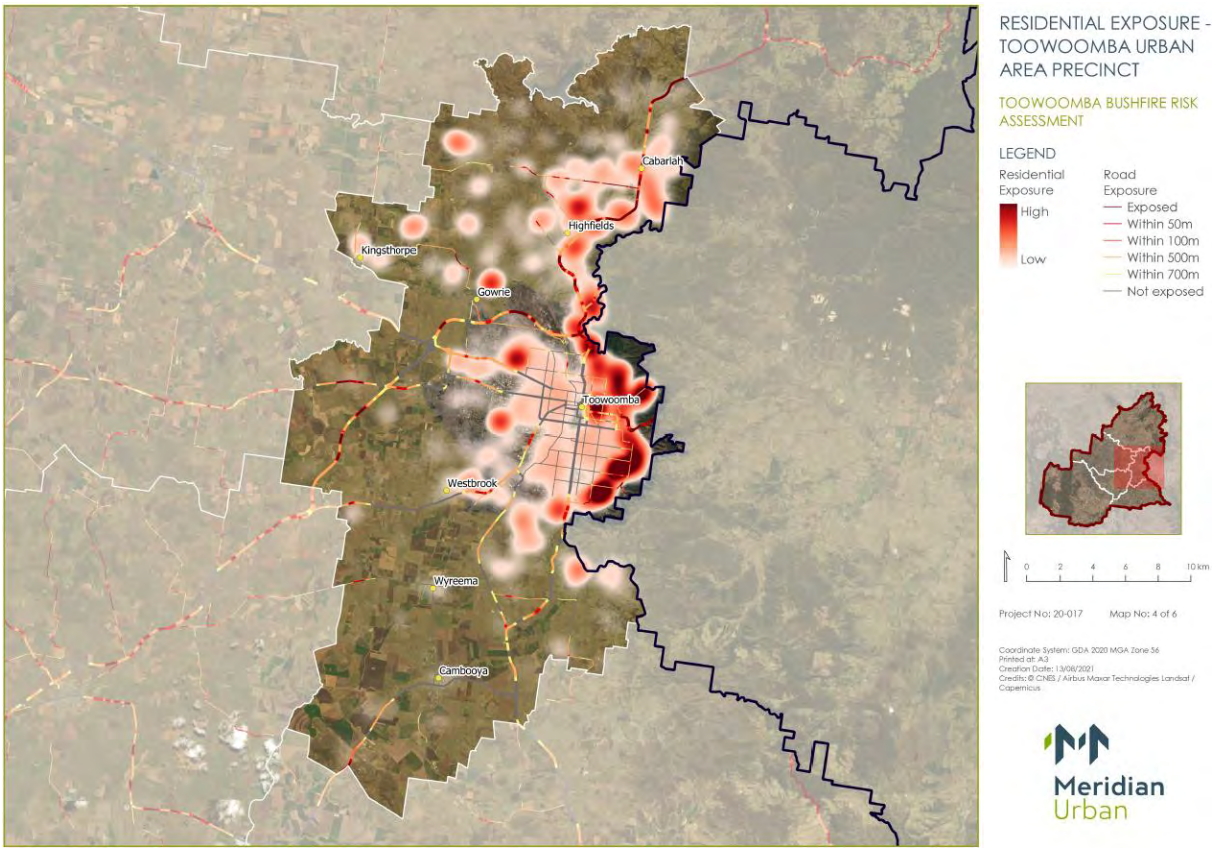


Figure 34 - Toowoomba urban area residential exposure heat mapping

4.3.1.5 Summary of identified risks

Based on the analysis of this data, the following risk observations are identified for the Toowoomba urban area precinct:

1. lands zoned for future development growth are exposed to potential bushfire hazard, particularly the rural residential and emerging community zones;
7. hazard exposure may change in certain locations over time to a higher hazard class, as a result of climate change;
8. existing vulnerable facilities exist in locations subject to bushfire hazard and may require evacuation;
9. land and fire management activities may face added pressure from expanding development in interface areas;
10. emergency services may face increased burden from expanded development in interface areas and
11. certain parts of the evacuation network may be compromised in a fire event, and may impact the ability to evacuate.

4.3.2 Crows Nest – Rosalie precinct

The Crows Nest – Rosalie precinct includes the northern area of the region including large rural communities and the townships of:

- Hampton;
- Pechey;
- Ravensbourne;
- Crows Nest;
- Cooyar;
- Yarraman;
- Maclagan;
- Quinalow; and
- Goombungee.

This precinct is one of the most heavily vegetated areas in the region, and includes vegetation communities with high fuel loads and areas of complex terrain. These areas are interspersed by grazing and cropping lands.

4.3.2.1 Fire run aspect

In terms of key fire runs associated with the Crows Nest – Rosalie precinct, the eastern extent is more highly vegetated and forms part of the Great Dividing Range. Previous fire events in this location have included large, campaign fires with dynamic prevailing wind conditions. This has led to fires which change course frequently. In terms of fire runs, westerly driven events may be more common however, easterly and south-easterly events are a particular concern. Fire behaviour in these situations is likely to be intense and fast moving by virtue of the vegetation hazard class and topography.

For cropping and grazing land, grassfire hazard may be present, however current mapping approaches in Queensland do not map grassfire hazard. Fireline intensities associated with grassfire are much lower, but can move very fast. Strategic on-property fire breaks can assist to mitigate the potential for grassfire spread between properties and paddocks, or where fire may run out of or into areas of remnant bushland adjoining rural lands.

4.3.2.2 Overview of existing exposure

The following data tables provide an overview of potential bushfire hazard exposure within the Crows Nest – Rosalie precinct.

Table 22 – Crows Nest – Rosalie precinct hazard exposure snapshot

Crows Nest – Rosalie precinct snapshot	
Portion of Toowoomba Region	25.05 per cent
Estimated population[8]	8,560
Estimated dwelling count[9]	3,800

[8] ABS, 2021
[9] Ibid.

Crows Nest – Rosalie precinct snapshot	
Estimated dwellings subject to bushfire hazard[10]	Approximately 1,228
Nursing home facilities subject to hazard	0 (of 1 in the precinct)
Child care facilities subject to hazard	0 (of 3 in the precinct)
Schools subject to hazard	3 (of 8 in the precinct)
Hospitals subject to hazard	0 (of 0 in the precinct)
Power generation facilities subject to hazard	0 (of 0 in the precinct)
Electrical substations subject to hazard	3 (of 6 in the precinct)
Telecommunications towers subject to hazard	Data not available
Fuel stations subject to hazard	0 (of 2 in the precinct)
Water pumping stations subject to hazard	6 (of 8 in the precinct)
Water treatment plants subject to hazard	3 (of 3 in the precinct)
Wastewater treatment plants subject to hazard	2 (of 2 in the precinct)

A map of exposed elements is included at Appendix C.

The following table outlines the potential exposure of existing residential dwellings and resident population within the Crows Nest – Rosalie precinct.

Table 23 - Detailed summary of estimated dwelling and resident exposure within the Crows Nest – Rosalie precinct

Estimated dwellings and residents within mapped bushfire prone areas		
Hazard exposure extent	Potential dwelling exposure	Estimated existing resident exposure
Within 100m of bushfire hazard	1,228	3,045
Within 500m of bushfire hazard	3,125	7,750
Within 700m of bushfire hazard	3,403	8,439

A geospatial analysis of the existing land use zones within the Crows Nest – Rosalie precinct has been undertaken, refer to Appendix D for an extract of this data set. This includes a breakdown of exposure to each potential hazard class, based on fireline intensities as per Table 8 above.

[10] QSpatial, 2021

Table 24 – Crows Nest - Rosalie precinct hazard exposure overview

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to mapped bushfire hazard	37.03	28.16
Subject to flame contact or radiant heat flux (hazard and 100m buffer)	56.31	49.13
Subject to potential bushfire hazard (500m buffer)	84.83	82.16
Subject to potential bushfire hazard (700m buffer)	90.44	88.86
Subject to 'Medium' potential hazard (including buffer)	51.86	35.77
Subject to 'High' potential hazard (including buffer)	4.18	25.37
Subject to 'Very High' potential hazard (including buffer)		17.47
Key roads subject to flame contact or radiant heat flux	N/A	36.69

4.3.2.3 Summary of data observations

Based on the data above, the following observations are relevant for the Crows Nest – Rosalie precinct:

- the precinct occupies a quarter of the area of the Toowoomba Region, with almost 40 per cent the key evacuation route network within the precinct subject to potential flame contact or radiant heat. This presents a significant risk for evacuation;
- almost all of the dwellings within the precinct are within 700 metres of potential hazard. Whilst this does not mean these properties may be impacted, it is worthy of consideration from an evacuation perspective;
- three (3) existing schools are located within the bushfire prone area;
- electrical substation assets are exposed, along with the only water treatment facility within the precinct;
- the precinct is the highest exposed to very high potential bushfire hazard, by virtue of fuel loads and steep terrain; and
- there is no land currently zoned for emerging community in the precinct. However, land zoned for low density residential, rural residential, rural, township and community facilities are all highly exposed when compared with the exposure of the same zones in other precincts.

4.3.2.4 Risk exposure and vulnerability profile

The Crows Nest – Rosalie precinct represents one of the more highly exposed precincts within the region, which is largely associated with urban and rural residential growth in the Highfields to Crows Nest corridor area.

The confluence of high fuel load communities and complex topography of the Great Dividing Range define the Crows Nest – Rosalie precinct in terms of likely fire behaviour, which was largely demonstrated by the conditions experienced during the 2019 Pechey fires.

Almost 80 per cent of land zoned for community facilities in the precinct is subject to hazard, including a considerable proportion that is exposed to very high potential hazard.

Rural residential zoned land is also highly exposed, including exposure to very high potential hazard for a larger proportion of the zone than observed for other zones. Almost 65 per cent of rural residential zoned land is within 100m of identified bushfire hazard. This is followed by the rural zone at 50 per cent.

As an area of potential future growth for the Toowoomba Region, appropriate strategic planning should be applied to limit development in higher risk locations, and ensure sufficient statutory provisions are implemented to limit risk to a tolerable level elsewhere.

Particular aspects of existing risk exposure and potential vulnerability include:

- electrical substation facilities at Perseverance Creek and Cressbrook;
- Ironbark of St Peter's Lutheran College;
- Cooyar State School;
- Yarraman Waste Water Treatment Plant; and
- Haden State School.

It is largely the case for exposure of existing facilities that disaster management risk arrangements pursuant to the QDMA and treatments identified via the QERMF process are more applicable. It is recommended Council consider these facilities as part of those processes.

From a planning perspective however, expansion or reuse of these facilities, largely zoned for community facilities activities, requires specific consideration of bushfire hazard and risk as part of any development assessment process.

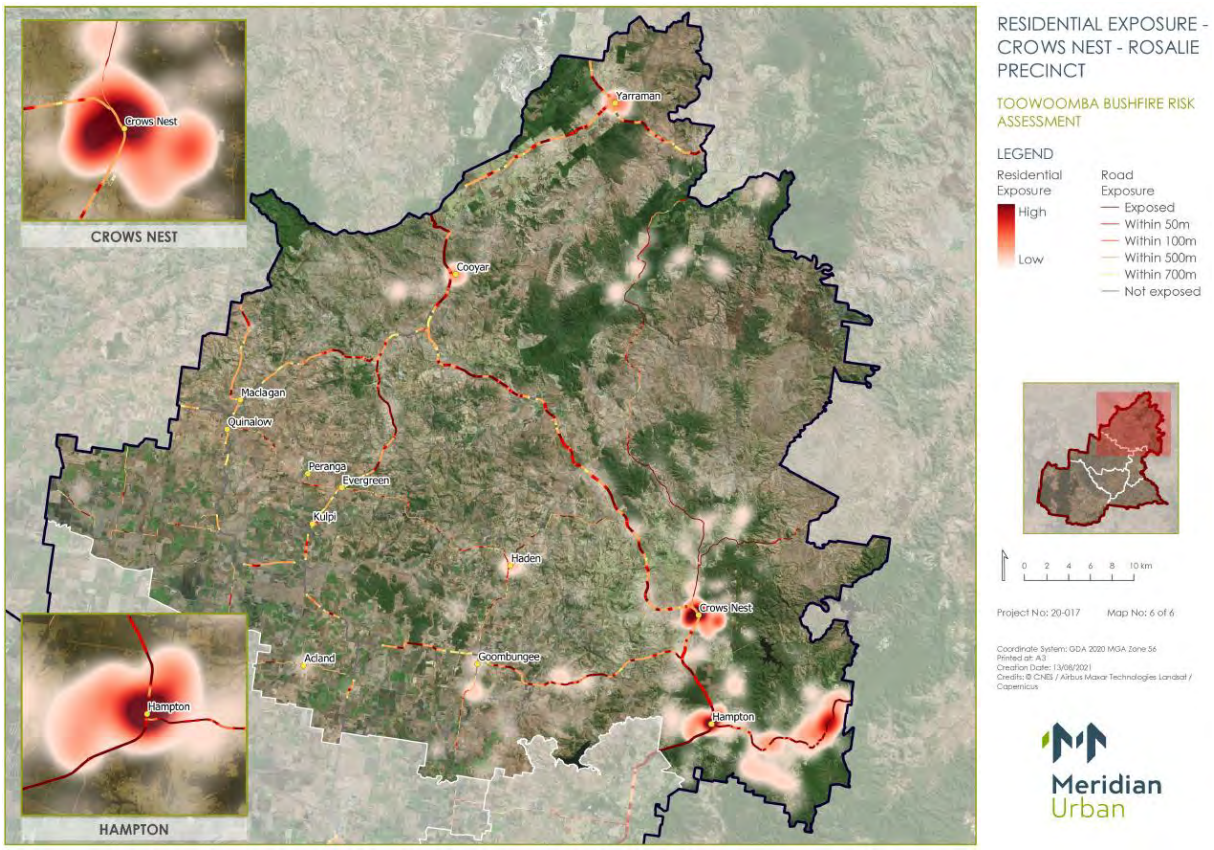


Figure 35 - Crows Nest - Rosalie residential exposure heat mapping

4.3.2.5 Summary of identified risks

Based on the analysis of this data, the following risk observations are identified for the Crows Nest – Rosalie precinct:

1. considerable risk to community facilities, services and infrastructure within the community facilities zone is present;
2. lands zoned for future development growth are highly exposed to potential bushfire hazard, particularly the rural residential and emerging community zones;
3. hazard exposure may change in certain locations over time to a higher hazard class, as a result of climate change;
4. land and fire management activities may face added pressure from expanding development in interface areas;
5. emergency services may face increased burden from expanded development in interface areas; and
6. ability to evacuate may be complicated by exposure of the road network to bushfire attack, fragmented vegetation, land parcels, zoning and limited route options.

4.3.3 Clifton – Greenmount precinct

The Clifton – Greenmount precinct includes the south-eastern area of the region including large rural communities and the townships of:

- Greenmount;
- East Greenmount;
- Nobby;
- Clifton; and
- Pilton.

This precinct is dominated in large part by rural lands utilised for cropping and grazing. The Darling Downs Zoo is located in this precinct. To the east, the precinct straddles the Great Dividing Range and presents similar vegetation communities and terrain as that to the north. It is dominated by dry eucalypt open forest with fuel loads of over 20 tonnes per hectare. Smaller pockets of dry eucalypt woodlands also occur in the area.

4.3.3.1 Fire run aspect

In terms of key fire runs associated with the Clifton – Greenmount precinct, the eastern extent is more highly vegetated, transitioning to rural activities in the central and western areas of the precinct. Westerly driven events may be more common in this precinct however, easterly (including north and south-easterly) events are a particular concern given the location of communities relative to the Great Dividing Range. Fire behaviour in these situations is likely to be intense and fast moving by virtue of the vegetation hazard class and topography.

For cropping and grazing land, grassfire hazard may be present with lower fireline intensities, but which can be fast moving. Strategic on-property fire breaks can assist to mitigate the potential for grassfire spread between properties and paddocks, or where fire may run out of or into areas of remnant bushland adjoining rural lands.

4.3.3.2 Overview of existing exposure

The following data tables provide an overview of potential bushfire hazard exposure within the Clifton – Greenmount precinct.

Table 25 – Clifton – Greenmount precinct hazard exposure snapshot

Clifton – Greenmount precinct snapshot	
Portion of Toowoomba Region	10.35 per cent
Estimated population[11]	4,600
Estimated dwelling count[12]	2,000
Estimated dwellings subject to bushfire hazard[13]	Approximately 264
Nursing home facilities subject to hazard	0 (of 1 in precinct)
Child care facilities subject to hazard	0 (of 1 in precinct)
Schools subject to hazard	2 (9)

[11] Geoscience Australia, 2021
[12] Ibid.
[13] QSpatial, 2021

Clifton – Greenmount precinct snapshot	
Hospitals subject to hazard	0 (of 1 in precinct)
Power generation facilities subject to hazard	0 (of 0 in precinct)
Electrical substations subject to hazard	0 (of 2 in precinct)
Telecommunications towers subject to hazard	Data not available
Fuel stations subject to hazard	0 (of 0 in precinct)
Water pumping stations subject to hazard	0 (of 2 in precinct)
Water treatment plants subject to hazard	0 (of 0 in precinct)
Wastewater treatment plants subject to hazard	0 (of 1 in precinct)

A map of exposed elements is included at Appendix C.

The following table outlines the potential exposure of existing residential dwellings and resident population within the Clifton – Greenmount precinct.

Table 26 - Detailed summary of estimated dwelling and resident exposure within the Clifton – Greenmount precinct

Estimated dwellings and residents within mapped bushfire prone areas		
Hazard exposure extent	Potential dwelling exposure	Estimated existing resident exposure
Within 100m of bushfire hazard	264	654
Within 500m of bushfire hazard	662	1,641
Within 700m of bushfire hazard	812	2,013

A geospatial analysis of the existing land use zones within the Clifton – Greenmount precinct has been undertaken, refer to Appendix D for an extract of this data set. This includes a breakdown of exposure to each potential hazard class, based on fireline intensities as per Table 8 above.

Table 27 – Clifton – Greenmount precinct hazard exposure overview

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to mapped bushfire hazard	19.8	23.75
Subject to flame contact or radiant heat flux (hazard and 100m buffer)	31.16	34.13

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to potential bushfire hazard (500m buffer)	51.85	57.07
Subject to potential bushfire hazard (700m buffer)	59.07	64.96
Subject to 'Medium' potential hazard (including buffer)	36.05	29.18
Subject to 'High' potential hazard (including buffer)	1.73	16.51
Subject to 'Very High' potential hazard (including buffer)		11.75
Key roads subject to flame contact or radiant heat flux	N/A	15.78

4.3.3.3 Summary of data observations

Based on the data above, the following observations are relevant for the Clifton - Greenmount precinct:

- little in the way of infrastructure assets is exposed within the precinct, thus the majority of exposure relates to residential dwellings and rural and agricultural activities;
- a small number of dwellings are identified as subject to potential bushfire hazard, relative to the total number of projected dwellings within the precinct;
- of the building stock present, the majority was constructed prior to the introduction of AS3959 standards in Queensland, and largely prior to the introduction of current planning provisions; and
- of the road network that is subject to potential exposure, the majority is in the eastern area of the precinct, with evacuation opportunities available to the west, including to townships.

4.3.3.4 Risk exposure and vulnerability profile

This precinct is largely zoned for rural activities, township activities, extractive industry, other industry and open space uses.

Approximately one third of the rural zone in this precinct is subject to bushfire hazard, which is in line with expectation of zoning relative to bushfire prone areas outside of urban centres. Land zoned as township appears to be within buffer areas of bushfire hazard, with 50 per cent of township zoned land within 500m of potential bushfire hazard. This presents a risk in relation to township fire intrusion, similar to urban fire intrusion where increased densities, building vulnerabilities and landscaping combine to heighten the potential risk for fire runs to encroach into townships.

Particular aspects of existing risk exposure and potential vulnerability include:

- Ramsay State School; and
- Greenmount State School.

It is largely the case for exposure of existing facilities that disaster management risk arrangements pursuant to the QDMA and treatments identified via the QERMF process are more applicable. It is recommended Council consider these facilities as part of those processes.

From a planning perspective however, expansion or reuse of these facilities, largely zoned for community facilities activities, requires specific consideration of bushfire hazard and risk as part of any development assessment process.

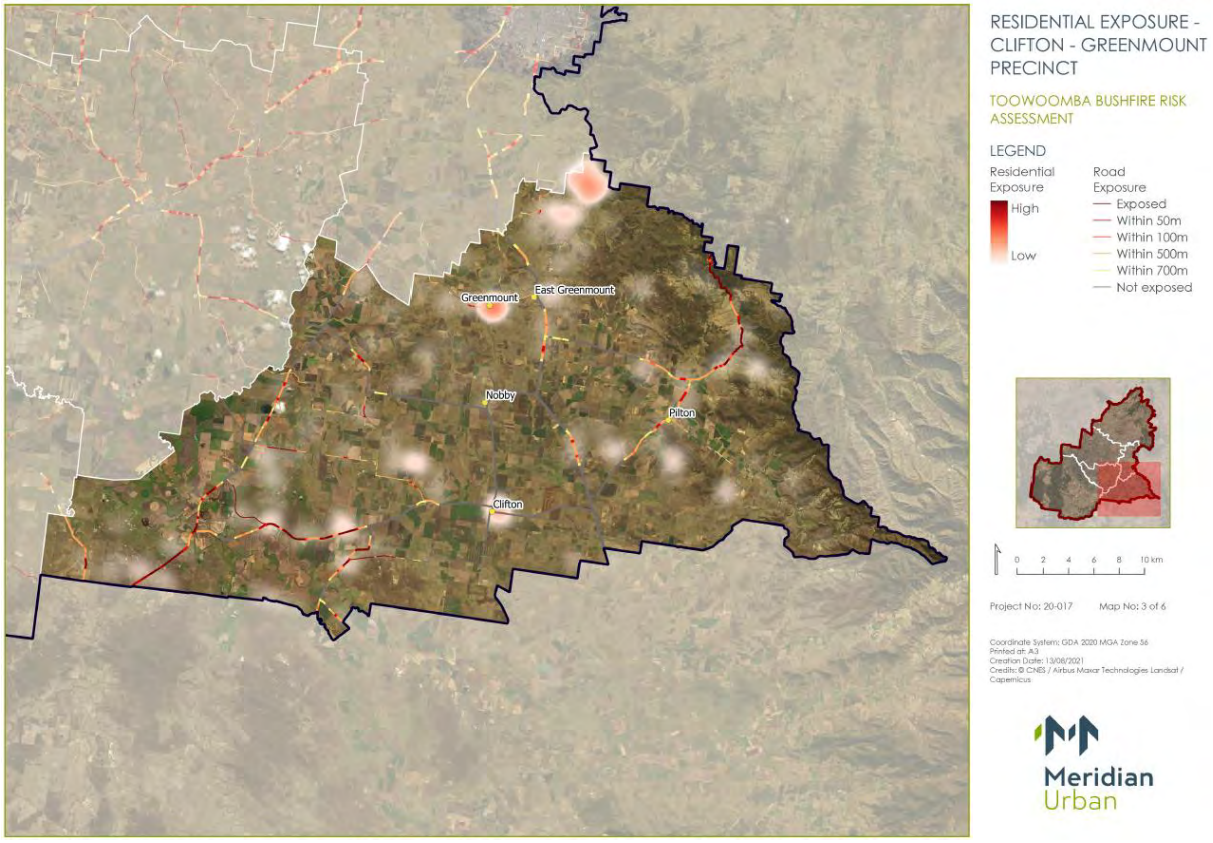


Figure 36 - Clifton - Greenmount residential exposure heat mapping

4.3.3.5 Summary of identified risks

Based on the analysis of this data, the following risk observations are identified for the Clifton – Greenmount precinct:

1. grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact;
2. township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion; and
3. evacuation of some townships with limited road connectivity may experience evacuation challenges.

4.3.4 Pittsworth precinct

The Pittsworth precinct encompasses the central area of the region including large rural communities and the townships of:

- Pittsworth;
- Southbrook;
- Athol; and
- Umbiram.

This precinct is dominated in large part by rural lands utilised for cropping and grazing, with a several large-scale agricultural operations occurring across the area. Extractive industries are also present in the Pittsworth precinct. Vegetation in the precinct is highly fragmented and largely dominated by grasslands, increasing exposure to potential fast-moving grassfire.

4.3.4.1 Fire run aspect

In terms of key fire runs associated with the Pittsworth precinct, hot and dry westerly fire winds from the continental interior dominate fire activity in this part of the region. Reduced vegetation and increased grasslands, grazing and cropping lands give rise to grassfire hazard exposure. Strategic on-property fire breaks can assist to mitigate the potential for grassfire spread between properties and paddocks, or where fire may run out of or into areas of remnant bushland adjoining rural lands. Areas of asset protection around major agricultural activities, including feedlots and the like, is key for grassfire protection in this precinct.

4.3.4.2 Overview of existing exposure

The following data tables provide an overview of potential bushfire hazard exposure within the Pittsworth precinct.

Table 28 – Pittsworth precinct hazard exposure snapshot

Pittsworth precinct snapshot	
Portion of Toowoomba Region	8.13 per cent
Estimated population[14]	4,300
Estimated dwelling count[15]	2,100
Estimated dwellings subject to bushfire hazard[16]	Approximately 306
Nursing home facilities subject to hazard	0 (of 1 in precinct)
Child care facilities subject to hazard	0 (of 3 in precinct)
Schools subject to hazard	1 (of 5 in precinct)
Hospitals subject to hazard	0 (of 0 in precinct)
Power generation facilities subject to hazard	0 (of 2 in precinct)
Electrical substations subject to hazard	3 (of 5 in precinct)

[14] Geoscience Australia, 2021
[15] Ibid.
[16] QSpatial, 2021

Pittsworth precinct snapshot	
Telecommunications towers subject to hazard	Data not available
Fuel stations subject to hazard	0 (of 5 in precinct)
Water pumping stations subject to hazard	1 (of 3 in precinct)
Water treatment plants subject to hazard	0 (of 1 in precinct)
Wastewater treatment plants subject to hazard	0 (of 1 in precinct)

A map of exposed elements is included at Appendix C.

The following table outlines the potential exposure of existing residential dwellings and resident population within the Pittsworth precinct.

Table 29 - Detailed summary of estimated dwelling and resident exposure within the Pittsworth precinct

Estimated dwellings and residents within mapped bushfire prone areas		
Hazard exposure extent	Potential dwelling exposure	Estimated existing resident exposure
Within 100m of bushfire hazard	306	758
Within 500m of bushfire hazard	714	1,770
Within 700m of bushfire hazard	914	2,266

A geospatial analysis of the existing land use zones within the Pittsworth precinct has been undertaken, refer to Appendix D for an extract of this data set. This includes a breakdown of exposure to each potential hazard class, based on fireline intensities as per Table 8 above.

Table 30 – Pittsworth precinct hazard exposure overview

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to mapped bushfire hazard	8.4	12.49
Subject to flame contact or radiant heat flux (hazard and 100m buffer)	19.68	22.45
Subject to potential bushfire hazard (500m buffer)	44.11	47.7
Subject to potential bushfire hazard (700m buffer)	51.53	54.9

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to 'Medium' potential hazard (including buffer)	25.59	22.23
Subject to 'High' potential hazard (including buffer)	0	3.57
Subject to 'Very High' potential hazard (including buffer)		0.33
Key roads subject to flame contact or radiant heat flux	N/A	13.99

4.3.4.3 Summary of data observations

Based on the data above, the following observations are relevant for the Pittsworth precinct:

- the only wastewater treatment facility in the precinct is exposed to potential hazard;
- three (3) electrical substations are exposed, and one (1) school;
- a relatively low number of dwellings are exposed to potential hazard, noting areas of fragmented bushland which surround the township of Pittsworth; and
- fragmented hazard persists between the township and its road connection with Toowoomba city.

4.3.4.4 Risk exposure and vulnerability profile

This precinct is largely zoned for rural activities, township activities, extractive and high impact industry and open space uses.

Approximately one quarter of the rural zone in this precinct is subject to bushfire hazard, which is in line with expectation of zoning relative to bushfire prone areas outside of urban centres. Land zoned as township appears to be within buffer areas of bushfire hazard, with 40 per cent of township zoned land within 500m of potential bushfire hazard. This presents a risk in relation to township fire intrusion, similar to urban fire intrusion where increased densities, building vulnerabilities and landscaping combine to heighten the potential risk for fire runs to encroach into townships.

Almost a quarter of community facilities zoned land within the Pittsworth precinct is within 100m of mapped bushfire hazard. Community facilities zones can accommodate a broad range of land uses from community and essential infrastructure, health services, aged care, retirement facilities and educational facilities. The zoning rationale for community facilities zoned land will require a specific risk-based land use policy response which balances bushfire risk against community need for small rural communities across the region.

Particular aspects of existing risk exposure and potential vulnerability include:

- Yarranlea Solar Farm;
- Yarranlea and Yarranlea North electrical substations;
- Brigalow Solar Farm; and
- Broxburn electrical substation.

It is largely the case for exposure of existing facilities that disaster management risk arrangements pursuant to the QDMA and treatments identified via the QERMF process are more applicable. It is recommended Council consider these facilities as part of those processes.

From a planning perspective however, expansion or reuse of these facilities, largely zoned for community facilities activities, requires specific consideration of bushfire hazard and risk as part of any development assessment process.

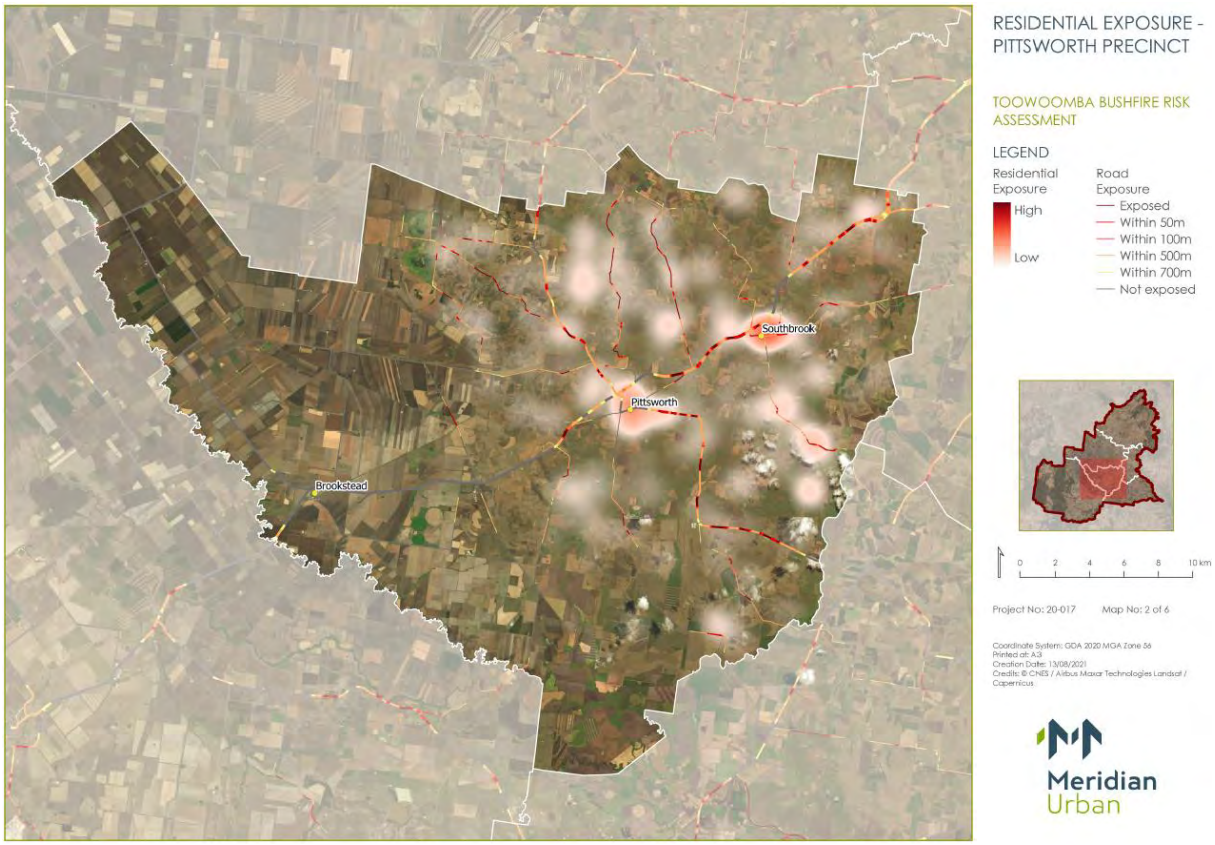


Figure 37 - Pittsworth residential exposure heat mapping

4.3.4.5 Summary of identified risks

Based on the analysis of this data, the following risk observations are identified for the Pittsworth precinct:

1. grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact;
2. township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion; and
3. considerable risk to community facilities, services and infrastructure within the community facilities zone is present.

4.3.5 Jondaryan precinct

The Jondaryan precinct includes the northern Condamine plains area of the region including large rural communities and the townships of:

- Oakey;
- Jondaryan; and
- Bowenville.

This precinct is dominated in large part by rural lands utilised for cropping, known to be a fertile area of the region given its location on the Condamine floodplain. Vegetation in the precinct is highly fragmented and largely dominated by crops and grasslands, with exposure to potential fast-moving grassfire during dry periods.

4.3.5.1 Fire run aspect

In terms of key fire runs associated with the Jondaryan precinct, hot and dry westerly fire winds from the continental interior dominate fire activity in this part of the region. Reduced vegetation and increased cropping lands and grasslands give rise to potential grassfire hazard which increases during dry periods.

4.3.5.2 Overview of existing exposure

The following data tables provide an overview of potential bushfire hazard exposure within the Jondaryan precinct.

Table 31 – Jondaryan precinct hazard exposure snapshot

Jondaryan precinct snapshot	
Portion of Toowoomba Region	16.03 per cent
Estimated population[17]	7,000
Estimated dwelling count[18]	2,900
Estimated dwellings subject to bushfire hazard[19]	Approximately 454
Nursing home facilities subject to hazard	0 (of 2 in precinct)
Child care facilities subject to hazard	0 (of 3 in precinct)
Schools subject to hazard	2 (of 7 in precinct)
Hospitals subject to hazard	0 (of 1 in precinct)
Power generation facilities subject to hazard	0 (of 3 in precinct)
Electrical substations subject to hazard	1 (of 5 in precinct)
Telecommunications towers subject to hazard	Data not available
Fuel stations subject to hazard	0 (of 3 in precinct)

[17] Geoscience Australia, 2021
[18] Ibid.
[19] QSpatial, 2021

Jondaryan precinct snapshot	
Water pumping stations subject to hazard	1 (of 1 in precinct)
Water treatment plants subject to hazard	0 (of 0 in precinct)
Wastewater treatment plants subject to hazard	0 (of 1 in precinct)

A map of exposed elements is included at Appendix C.

The following table outlines the potential exposure of existing residential dwellings and resident population within the Jondaryan precinct.

Table 32 - Detailed summary of estimated dwelling and resident exposure within the Jondaryan precinct

Estimated dwellings and residents within mapped bushfire prone areas		
Hazard exposure extent	Potential dwelling exposure	Estimated existing resident exposure
Within 100m of bushfire hazard	454	1,125
Within 500m of bushfire hazard	1,167	2,894
Within 700m of bushfire hazard	1,454	3,605

A geospatial analysis of the existing land use zones within the Jondaryan precinct has been undertaken, refer to Appendix D for an extract of this data set. This includes a breakdown of exposure to each potential hazard class, based on fireline intensities as per Table 8 above.

Table 33 – Jondaryan precinct hazard exposure overview

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to mapped bushfire hazard	2.95	6.87
Subject to flame contact or radiant heat flux (hazard and 100m buffer)	7.93	11.43
Subject to potential bushfire hazard (500m buffer)	23.72	25.51
Subject to potential bushfire hazard (700m buffer)	29.95	30.7
Subject to 'Medium' potential hazard (including buffer)	11.04	11.38
Subject to 'High' potential hazard (including buffer)	0	0.53

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to 'Very High' potential hazard (including buffer)		0.08
Key roads subject to flame contact or radiant heat flux	N/A	7.82

4.3.5.3 Summary of data observations

Based on the data above, the following observations are relevant for the Jondaryan precinct:

- little in the way of infrastructure assets is exposed within the precinct, thus the majority of exposure relates to residential dwellings and rural and agricultural activities;
- a small number of dwellings are identified within 100 metres of potential hazard however, this expands considerably when considering the number of dwellings within 700 metres; and
- exposure of the road network within the precinct, and linking it with Toowoomba city is relatively limited.

4.3.5.4 Risk exposure and vulnerability profile

This precinct is largely zoned for rural activities, township activities, low density residential, industry and specialised centre uses.

Almost half of the dwelling and resident population of Jondaryan is located within 700 metres of bushfire hazard.

Over 45 per cent of the rural residential zone in this precinct is located within 100m of Medium potential bushfire hazard. Exposure to township zoned land is also observed. Whilst the majority of land uses in the precinct relate to specialised centre activities and rural activities, the townships of Oakey and Jondaryan support surrounding rural residential activities which are particularly exposed. Less than ten per cent of low density residential zoned land is within 100m of mapped bushfire hazard.

Particular aspects of existing risk exposure and potential vulnerability include:

- Tangkam electrical substation.

It is largely the case for exposure of existing facilities that disaster management risk arrangements pursuant to the QDMA and treatments identified via the QERMF process are more applicable. It is recommended Council consider these facilities as part of those processes.

From a planning perspective however, expansion or reuse of these facilities, largely zoned for community facilities activities, requires specific consideration of bushfire hazard and risk as part of any development assessment process.

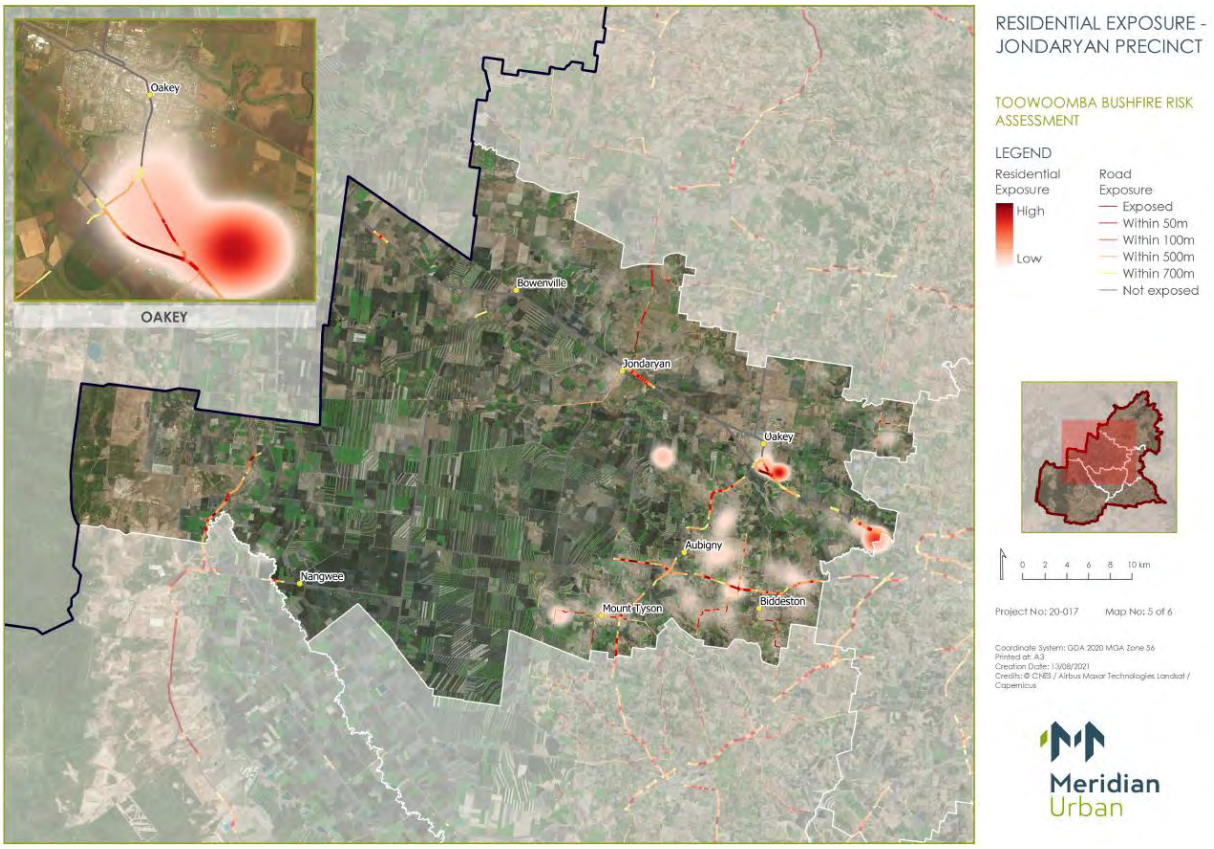


Figure 38 - Jondaryan residential exposure heat mapping

4.3.5.5 Summary of identified risks

Based on the analysis of this data, the following risk observations are identified for the Jondaryan precinct:

1. lands zoned for future development growth are highly exposed to potential bushfire hazard, particularly the rural residential and emerging community zones;
2. grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact;
3. township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion; and
4. considerable risk to community facilities, services and infrastructure within the community facilities zone is present.

4.3.6 Millmerran precinct

The Millmerran precinct is the largest (by land area) of the Toowoomba precincts and encompasses the western area of the region including large rural communities and the townships of:

- Millmerran;
- Millmerran Woods;
- Millmerran Downs;
- Cypress Gardens;
- Forest Ridge;
- Wattle Ridge; and
- Cecil Plains.

This precinct is dominated in large part by rural lands utilised for cropping, grazing and large-scale agricultural operations which includes feedlots and piggeries. Extractive industry is also present in the area, along with major items of infrastructure including the Millmerran power station.

Expansive rural residential communities are located south-west of Millmerran including Cypress Gardens, Forest Ridge and Wattle Ridge. These historical subdivisions are located amongst dense vegetation and steep country.

4.3.6.1 Fire run aspect

In terms of key fire runs associated with the Millmerran precinct, hot and dry westerly fire winds from the continental interior dominate fire activity in this part of the region. This area has been impacted by large-scale recent fire events, which required the evacuation of residents in the rural residential communities west of Millmerran.

The area is largely dominated by dense dry eucalypt forest and woodlands, interspersed with ironbox woodland and cypress pine woodlands, with communities interspersed in this area and to the immediate east of an expansive western fire path.

4.3.6.2 Overview of existing exposure

The following data tables provide an overview of potential bushfire hazard exposure within the Millmerran precinct.

Table 34 – Millmerran precinct hazard exposure snapshot

Millmerran precinct snapshot	
Portion of Toowoomba Region	34.83 per cent
Estimated population[20]	3,100
Estimated dwelling count[21]	1,400
Estimated dwellings subject to bushfire hazard[22]	Approximately 329
Nursing home facilities subject to hazard	1 (of 2 in precinct)

[20] Geoscience Australia, 2021
[21] Ibid.
[22] QSpatial, 2021

Millmerran precinct snapshot	
Child care facilities subject to hazard	0 (of 2 in precinct)
Schools subject to hazard	1 (of 3 in precinct)
Hospitals subject to hazard	0 (of 1 in precinct)
Power generation facilities subject to hazard	1 (of 1 in precinct)
Electrical substations subject to hazard	1 (of 3 in precinct)
Telecommunications towers subject to hazard	Data not available
Fuel stations subject to hazard	1 (of 5 in precinct)
Water pumping stations subject to hazard	1 (of 5 in precinct)
Water treatment plants subject to hazard	0 (of 1 in precinct)
Wastewater treatment plants subject to hazard	1 (of 2 in precinct)

A map of exposed elements is included at Appendix C.

The following table outlines the potential exposure of existing residential dwellings and resident population within the Millmerran precinct.

Table 35 - Detailed summary of estimated dwelling and resident exposure within the Millmerran precinct

Estimated dwellings and residents within mapped bushfire prone areas		
Hazard exposure extent	Potential dwelling exposure	Estimated existing resident exposure
Within 100m of bushfire hazard	329	815
Within 500m of bushfire hazard	845	2,095
Within 700m of bushfire hazard	1,007	2,497

A geospatial analysis of the existing land use zones within the Millmerran precinct has been undertaken, refer to Appendix D for an extract of this data set. This includes a breakdown of exposure to each potential hazard class, based on fireline intensities as per Table 8 above.

Table 36 – Millmerran precinct hazard exposure overview

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to mapped bushfire hazard	6.62	21.94

% of precinct	Existing overlay mapping (%)	Current State-wide BPA mapping (%)
Subject to flame contact or radiant heat flux (hazard and 100m buffer)	15.03	30.73
Subject to potential bushfire hazard (500m buffer)	41.58	50.34
Subject to potential bushfire hazard (700m buffer)	52.07	55.79
Subject to 'Medium' potential hazard (including buffer)	20.25	30.86
Subject to 'High' potential hazard (including buffer)	0	3.82
Subject to 'Very High' potential hazard (including buffer)		0.29
Key roads subject to flame contact or radiant heat flux	N/A	28.68

4.3.6.3 Summary of data observations

Based on the data above, the following observations are relevant for the Millmerran precinct:

- almost 30 per cent of the road network is exposed to potential flame contact or radiant heat, having regard to level 1, 2, 3 and 4 roads within the network hierarchy;
- whilst only a limited number of dwellings are identified as potentially exposed, the dwelling stock within the area was largely constructed prior to the introduction of AS3959 standards in Queensland;
- the majority of dwellings which are exposed are within rural residential areas, and are dispersed amongst heavy vegetation;
- a large proportion of the population within the precinct is situation within 700 metres of potential hazard, this is relevant from an evacuation perspective;
- over 50 per cent of land in the precinct is within 500 metres of potential hazard; and
- one (1) nursing home is exposed to potential bushfire hazard, as is one (1) school, an electrical substation and a power generation facility. The only wastewater treatment facility in the precinct is also exposed.

4.3.6.4 Risk exposure and vulnerability profile

This precinct is largely zoned for rural activities, township activities, large-scale agricultural operations and rural living.

The Millmerran precinct comprises large areas of continuous bushland which includes areas of steep topography. This area represents the largest tract of bushland in Toowoomba Region. Rural living and rural residential activities are interspersed with these bushland areas, particularly around Cypress Gardens, Forest Ridge and Wattle Ridge.

Cecil Plains adjoins large tracts of bushland to the west which forms part of a corridors of vegetation linking with Kumbarilla State Forest. The corridor is interrupted to some degree by grassland paddocks and a cotton facility however, spotting from fires in the State Forest present a particular risk for Cecil Plains in larger events.

From an exposure perspective, hazard classes across much of the Millmerran Precinct is identified as medium, rather than high or very high. However, a considerable spatial extent of land is exposed. This is particularly apparent for land in the township, rural and community facilities zones.

Particular aspects of existing risk exposure and potential vulnerability include:

- Cecil Plains electrical substation;
- portions of Cecil Plains State School;
- Cecil Plains Sewage Treatment Plant;
- Millmerran Power Station; and
- Western Creek electrical substation.

It is largely the case for exposure of existing facilities that disaster management risk arrangements pursuant to the QDMA and treatments identified via the QERMF process are more applicable. It is recommended Council consider these facilities as part of those processes.

From a planning perspective however, expansion or reuse of these facilities, largely zoned for community facilities activities, requires specific consideration of bushfire hazard and risk as part of any development assessment process.

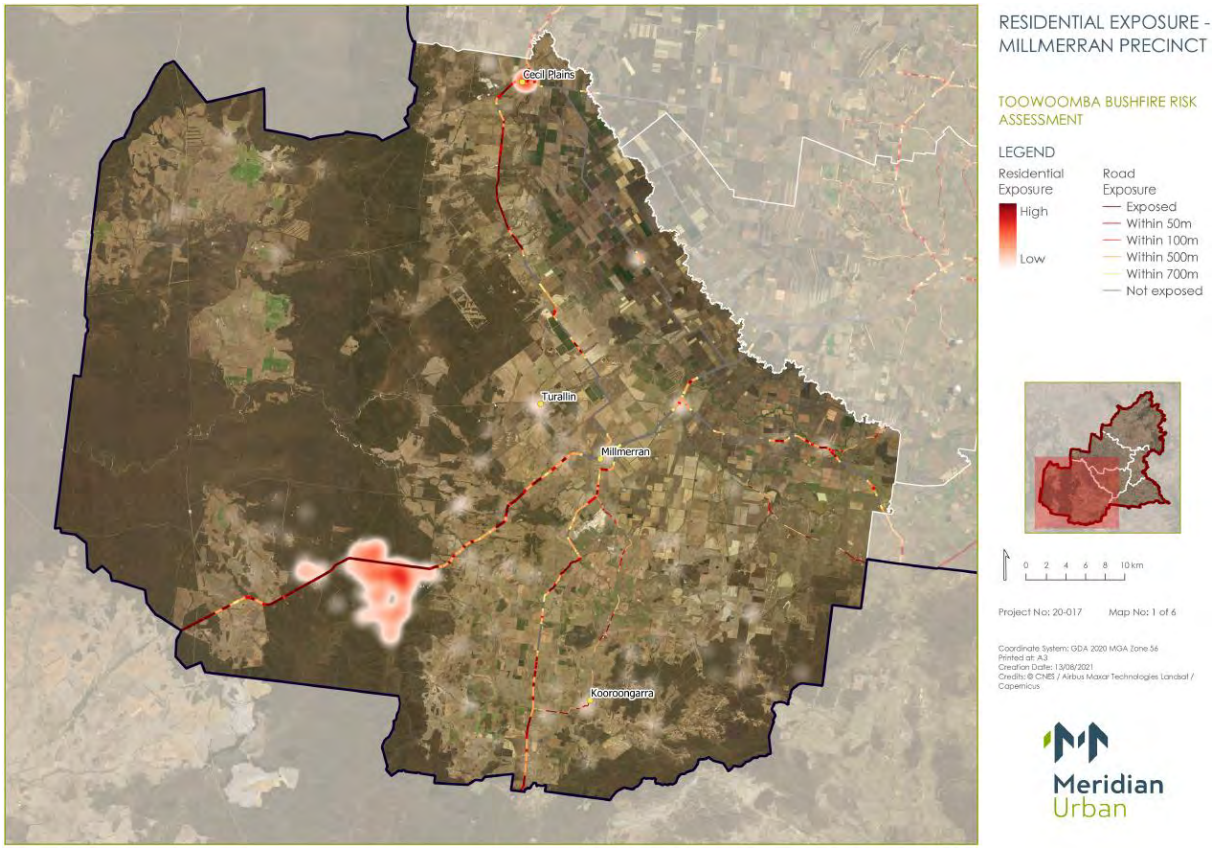


Figure 39 - Millmerran residential exposure heat mapping

4.3.6.5 Summary of identified risks

Based on the analysis of this data, the following risk observations are identified for the Millmerran precinct:

1. township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion;
2. rural residential communities to the west of Millmerran are considerably exposed, largely to potential medium hazard. Exposure to high or very high potential hazard in the area is limited;
3. grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact; and
4. ability to evacuate may be complicated by exposure of the road network to bushfire attack, fragmented vegetation, land parcels, zoning, and limited route options.

5 Risk analysis

This section provides a detailed analysis of the identified land use planning related risks relating to bushfire hazard across the Toowoomba Region.

5.1 Analysis methodology

The risk analysis methodology aligns, and indeed follows, the risk analysis methodologies and matrices set out by the QERMF, as illustrated below.

Figure 40 - Process 2 of the QERMF (Source: QFES, 2018)

5.2 Analysis of overall risk likelihood

This risk assessment seeks to support long-term land use planning. As such, this approach of this risk assessment assumes bushfire events and impact are expected to occur within the region.

The table below outlines the event likelihood definitions, as per the QERMF.

Likelihood Table		
Historical Likelihood	**Likelihood Level**	**Definition**
Has occurred 3 or more times in the last year or at least each year over the last 5 years	**Almost Certain**	Almost certain to occur in most cases
Has occurred twice in the last 5 years	**Likely**	Likely chance of occurring in most cases
Has occurred twice in the last 10 years	**Possible**	Might occur in most cases
May occur, and has occurred once in the last 20 years	**Unlikely**	Not expected to occur in most cases
May only occur in exceptional circumstances or has occurred only once in the last 50 years or more	**Rare**	Will only occur in exceptional circumstances and has not occurred in most cases

Figure 41 - QERMF event likelihood table (Source: QFES, 2018)

Different parts of the region have experienced bushfire events over time. One of the limitations in determining likelihood accurately is the availability of complete event data dating back over decades. To this end, the table below utilises known event information and fire frequency

data to identify potential event likelihood across the region, with some areas demonstrating a higher likelihood of fire impact than others.

The table below considers the potential for fire impact, rather than fire occurrence. This acknowledges from a land use planning perspective, it is the likelihood of impact of bushfire on values (people, dwellings, infrastructure assets) that is most critical to consider, rather than the probability of fire occurring at all.

For the Toowoomba urban area, a key aspect of the consideration of likelihood of impact is its location on the Escarpment, require less common easterly-driven winds to propagate fire from the east. Hot dry westerlies are more common for the majority of the region, but the effect of easterlies on the Toowoomba urban area precinct must not be discounted.

Table 37 - Likelihood assessment for each precinct as per QERMF

SA2 Precinct	Likelihood of bushfire impact
Toowoomba urban area	Likely
Crows Nest – Rosalie	Almost certain
Clifton – Greenmount	Likely
Pittsworth	Possible
Jondaryan	Possible
Millmerran	Almost certain

Irrespective of the above and as mentioned, land use planning must assume a fire event will occur. To this end, a more appropriate analysis of likelihood is the likelihood of a consequence occurring, rather than the overall likelihood of a fire event itself occurring.

This accords with the approach of Handbook 7 – Managing the Floodplain, which guides the assessment of flood related impacts.

5.3 Analysis of overall risk vulnerability

In terms of vulnerability, the Toowoomba Region as a whole is typified by housing stock which was constructed prior to the introduction of AS3959 standards in Queensland, and largely prior to current planning provisions.

Whilst the Toowoomba urban area precinct is relatively highly exposed to potential bushfire hazard, the main areas of service provision are outside of the bushfire prone area. As a legacy of historical strategic planning approaches in Toowoomba, limited assets and sensitive facilities are exposed, though some are. Some of these include critical infrastructure services.

For the Crows Nest – Rosalie and Millmerran precincts, a greater extent of rural residential and township zoned land is exposed, where dwelling stock was constructed prior to AS3959 standards and is located in expansive bushland areas where asset protection zones are also relatively limited. This is coupled with the moderate to high exposure to considerable bushfire behaviour potential.

The assessment of vulnerability below considers the detail for each precinct identified at Section 4 of Part B.

Table 38 - Vulnerability assessment for each precinct based on Appendix 2 of QERMF

SA2 Precinct	Vulnerability to bushfire impact
Toowoomba urban area	High
Crows Nest – Rosalie	Extreme
Clifton – Greenmount	Moderate
Pittsworth	Moderate
Jondaryan	Moderate
Millmerran	Extreme

5.4 Analysis of overall risk consequence

Consequence is considered on balance of the extent of people, dwellings and assets which are exposed, noting the Toowoomba urban area is more densely populated and developed. A bushfire event impacting this area of the region is likely to sustain higher economic losses, increased impacts on the built environment, and potential for increased threat to or impacts on human life.

However, in this location the evacuation to relative safety (i.e. to the centre of the urban area) is more readily available compared with other areas of the region. This risk of late decisions to evacuate (for various reasons) remains a key factor.

This is particularly relevant to areas within the Crows Nest – Rosalie and Millmerran precincts, where decisions to evacuate need to potentially be made very early in order to avoid higher consequence outcomes. This is by virtue of the nature of land uses and relationship with bushland areas, which is not necessarily separated.

For the more agricultural and rural areas of the region including the Clifton – Greenmount, Pittsworth and Jondaryan precincts, the primary risk may be economic in nature.

Table 39 - Assessment of risk consequence for each precinct as per Appendix 3 of the QERMF

SA2 Precinct	Consequence of bushfire impact
Toowoomba urban area	Major
Crows Nest – Rosalie	Moderate
Clifton – Greenmount	Minor
Pittsworth	Minor
Jondaryan	Minor
Millmerran	Moderate

5.5 Level of risk

The QERMF provides a fit-for-purpose risk matrix which incorporates the assessment of vulnerability, in addition to likelihood and consequence factors.

The QERMF risk matrix is as follows:

Table 40 - Risk matrix as per Appendix 4 of the QERMF

Table 3 - Risk Matrix

Having regard to the assessment of likelihood (of impact), vulnerability and consequence for each precinct, the overall risk levels for the Toowoomba Region are outlined below.

Table 41 - Assessment of risk level for each precinct in accordance with the risk matrix at Appendix 4 of the QERMF

SA2 Precinct	Level of risk
Toowoomba urban area	High (H10)
Crows Nest – Rosalie	High (H11)
Clifton – Greenmount	Medium (M7)
Pittsworth	Low (L6)
Jondaryan	Low (L6)
Millmerran	High (H11)

In recognition of the above, it is noted this assessment of risk relates to bushfire risk specifically from a land use planning perspective. The risk analysis has not been prepared for the purposes of disaster management and thus, relates to matters of planning, settlement and building policy and strategy, and does not represent an appraisal of asset-based vulnerability or exposure.

The Council QERMF process, underway at the time this risk analysis was undertaken, will cover these aspects under separate cover.

It is noted the above provides a place-based consideration of potential risk level. These levels are relatively comparative to the risk level for bushfire hazard identified by Council's Local Disaster Management Plan (LDMP) which attributes a likelihood rating of 'likely' and a consequence magnitude of 'moderate' for the Toowoomba Region, with an overall risk rating of 'significant'.

6 Risk evaluation

This evaluation of risks contemplates planning-related risk to life and property, and other aspects of risk, having regard to the likelihood of consequences occurring.

6.1 Evaluation methodology

The risk evaluation process provides an assessment of the planning related risks across the Toowoomba Region, established by the risk identification process, across the relevant 'lines of operation' or risk typologies.

Built environment
Risks to property, buildings and infrastructure

Roads and transport
Risks associated with evacuation

Human and social
Risks to life and people, vulnerable persons and emergency services

Economic
Risk to economic productivity and stability, insurance, recovery and reconstruction costs

Environmental
Risks to environmental assets and land and fire management

It is noted some identified risks incorporate several different risk issues, for example, one risk may encompass aspects of human and social risk, built environment risk and roads and transport risk, which are each reasonably associated with the one risk. Where this occurs, the identified risk is discussed separately, relative to each risk typology below.

6.2 Built environment (settlement and built form) risks

Built environment risks are contemplated in advance of potential human and social risks (including risk to life, and harm to life) given the relevance of the built environment and settlement policy in informing potential risks to life.

Road and transport (evacuation risks) are considered separately, and also inform potential risks to life.

The built environment risks identified by this risk assessment include:

- considerable risk to community facilities, services and infrastructure within the community facilities zone is present;
- vulnerable facilities exist in locations subject to bushfire hazard and which may require evacuation;
- lands zoned for future development growth are highly exposed to potential bushfire hazard, particularly the rural residential and emerging community zones;
- the low density residential zone is relatively exposed, incorporating a high percentage of existing housing stock within the Toowoomba urban area;
- township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion;
- evacuation of some townships with limited road connectivity may experience evacuation challenges; and
- rural residential communities to the west of Millmerran are highly exposed to the threat of bushfire.

Evaluation of these risks is expanded upon below.

6.2.1 Community facilities, services and infrastructure

As noted by this risk assessment, the prevalence of community facilities zoned land identified within the bushfire prone area is relatively high, especially for the Crows-Nest Rosalie precinct where almost 80 per cent of community facilities zoned land is identified as subject to potential bushfire hazard.

Despite the above, this is not necessarily out of character, particularly in densely vegetated locations where limited opportunity is available in other locations, and generally service particular activities which maybe associated with other features such as dams and water supply facilities, and this is identified to be the case in the Crows Nest – Rosalie precinct. The reason the extent of exposure is substantially higher in this precinct is due to the scale of several parcels of community facilities zoned land relating to Perseverance Creek Dam and the Cressbrook Dam catchment.

As part of Council's QERMF process, an assessment of existing treatment measures can be undertaken and a determination made on the need for additional measures, where permitting which may involve the provision of asset protection zones, shielding (masonry walls to provide radiant heat protection for certain assets), maintenance programs to manage vegetation and fuel loads, facility upgrades over time to increase protection, and so on.

From a planning policy perspective, the State interest policies identify a desire to limit infrastructure and facilities within bushfire prone areas, unless overwhelming community need may exist. This policy position will be explored with Council to inform the preparation of appropriate statutory planning provisions.

6.2.2 Vulnerable facilities

The historical settlement policy of the Toowoomba Region appears to have largely avoided the proliferation of potentially vulnerable facilities within bushfire prone areas. Those that do appear within bushfire prone areas are dominated by educational facilities, and several nursing homes.

It must be noted that aged care, nursing homes, child care centres and schools are not required to be assessed against AS3959, or be constructed to any bushfire protection standard. This can be undertaken on a voluntary basis however, for the purposes of this risk assessment it has to be assumed these facilities have not been constructed to a bushfire attack level classification.

Herein lies a policy issue between planning and building provisions. In the knowledge these facilities do not necessitate any construction specifications to respond to bushfire hazard, the continued location of facilities of this nature is, as outlined by the State interest policy, intended to be avoided in hazard exposed locations.

This aspect must form an area of policy focus as part of the formulation of the new planning instrument.

6.2.3 Exposure of potential growth areas and rural residential land

Having regard to the exposure of several zones where development (and population) growth is associated, these zones appear to be overrepresented in their exposure to potential bushfire hazard, particularly in those precincts where growth of the Toowoomba Region more generally, is likely to occur.

Under the current planning scheme, there is no emerging community zoned land within the Crows Nest – Rosalie precinct. However, rural residential zoned land is relatively highly exposed, with over 60 per cent of the over 6,660 hectares of rural residential land within the Crows Nest – Rosalie precinct exposure to potential hazard.

Much of this hazard exposure is in the high or very high categories.

Outside of the Toowoomba urban area, the majority of the Toowoomba Region is identified a 'priority agricultural area' under the *Darling Downs Regional Plan*. Priority living areas are also established around the existing townships of the Toowoomba Region.

For rural residential zoned lands larger than the minimum lot size and within the priority living area, there remains the potential for increased development density and population. This is relevant for all parts of the region, beyond the Crows Nest – Rosalie precinct, including the Millmerran precinct which also comprises a significant level of rural residential zoned land.

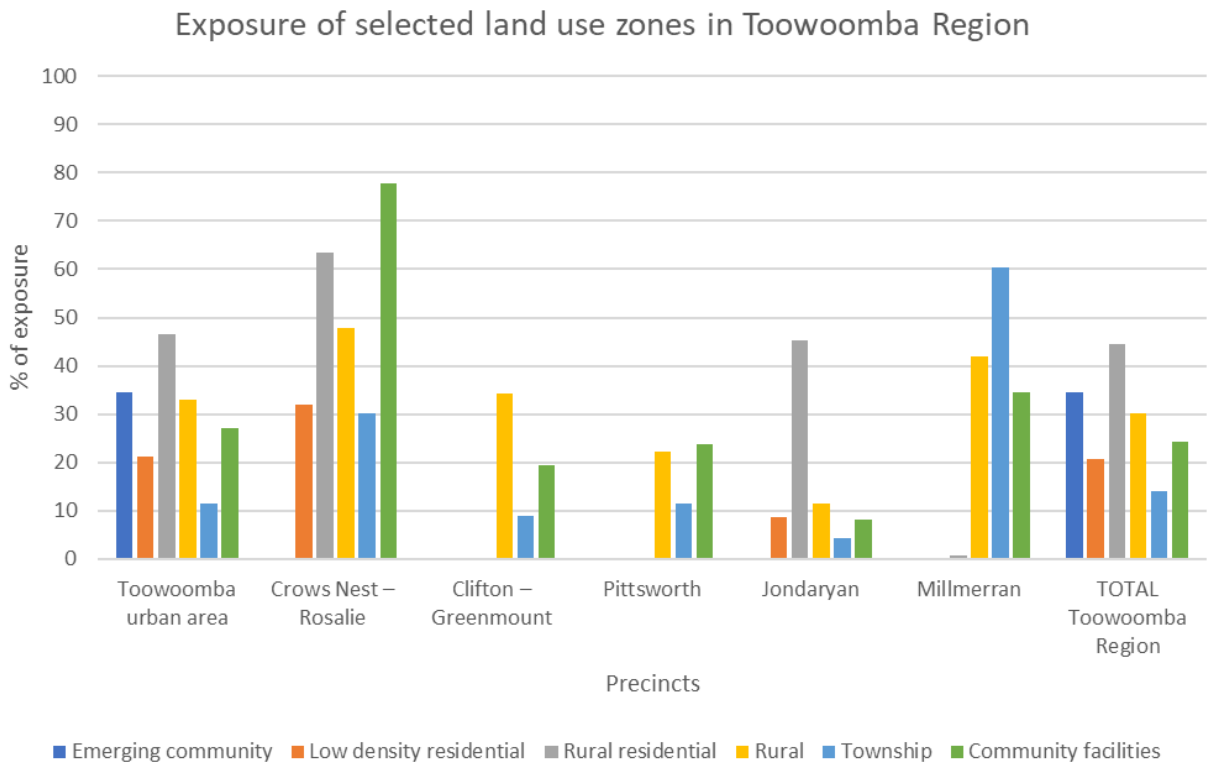


Figure 42 - Summary of exposure of selected existing land use zones in the Toowoomba Region

The exposure of rural residential zoned land, and similarly rural zoned land, should be somewhat anticipated as these zones are often located at the urban bushland interface and act as transitionary areas. It is also the case that these zones may typically provide for the ability for implementation of asset protection zones, as minimum lot sizes are sufficiently large enough to cater for such. However, for existing development this is dependent upon landholders understanding the extent of vegetation management and maintenance that can be lawfully conducted on private freehold land, and the subsequent physical and / or financial capacity to implement such measures in perpetuity.

For the Crows Nest – Rosalie and Millmerran precincts, being two higher risk precincts within the region, further ability for rural residential development on existing rural residential zoned land in the communities of Hampton, Crows Nest and Millmerran is available. This includes land which is subject to potential bushfire hazard, both internal and external to the zoned parcels. This is also the case for Cecil Plains, in relation to potential continued growth within the existing township zone. Rural residential areas west of Millmerran, and also in and around Ravensbourne are already largely zoned for rural purposes, which places a limit of potential for further extensive growth.

With regard to the Toowoomba urban area in particular, a considerable proportion of which is contained within the urban footprint or rural living area under *ShapingSEQ*, it is likely further growth in the region will be largely concentrated within and around this precinct.

The Toowoomba to Highfields growth corridor continues to take shape on the basis of existing and historical strategic planning and this is likely to continue into the future as the Toowoomba urban area accommodates further growth. These areas to the south and immediate west of Highfields are generally dominated by lower fuel class vegetation communities including:

- Vegetation Hazard Class (VHC) 11.2 – most to dry eucalypt woodlands (potential fuel load of 13 t/ha); and
- VHC 38.5 – discontinuous irrigated cropping and horticulture (potential fuel load of 2.0 t/ha).

Small, isolated pockets of other vegetation communities are also apparent however, these are highly fragmented in nature. These communities are largely identified to comprise VHC 7.1 – semi-evergreen to deciduous microphyll vine forests (potential fuel load of 12 t/ha).

To the immediate east of the Highfields urban area the nature of vegetation comprises a substantially higher fuel load, which is also apparent in retained pockets of bushland within the urban area itself. VHC 8.1 being wet eucalypt tall open forest is extensive in this location, and represents one of the highest fuel load vegetation communities in Queensland at 35 t/ha. This vegetation class is consistently evident along the Great Dividing Range stretching from the Highfields area to the north of Crows Nest. This area is also interspersed with plantation communities (VHC 36.1 with a potential fuel load of 26 t/ha).

It is for this reason, being the extent of potential fuel loads coupled with steep topography, that areas east of the New England Highway carry a substantial hazard profile where existing development creates a high risk profile, and which should ideally be considered as part of the settlement policy for the region, to limit further exacerbation of risk in this location.

Thus, future settlement in the Highfields corridor should be considered having regard to the nature of hazard characteristics where more favourable opportunity exists, in terms of limiting potential risk profiles to a tolerable extent, to the south (Mount Kynoch – west of the highway) and immediately west of Highfields within Cawdor and Woolmer and towards Meringandan, with a focus on limiting further growth to the west of the New England Highway or north of Meringandan Road.

The Toowoomba Escarpment presents a solid physical boundary to the east, and as such potential future growth of the city could include land to the west of the city.

Bushland is comparatively fragmented in the western area of the precinct, however its relationship with grassland is also considerable in terms of the potential transition of fire across this area of the landscape.

The majority of bushfire hazard in this area is identified as medium, with smaller and relatively isolated pockets of potentially high and very high hazard.

Whilst bushfire hazard is apparent in this location around Glenvale, Drayton, Westbook and part of Wellcamp, the hazard profile is lower in comparison with other locations of the Toowoomba urban area precinct and this is a relevant consideration in terms of future greenfield growth prospects for the Toowoomba Region. This is considered in virtue of several characteristics of the hazard in this location, including:

- relative fragmentation of bushland and bushfire hazard;
- density of bushland and fuels arrangement avoids large expanses of higher fuel load concentrations. The fuel load profile of vegetation communities is lower in comparison to other locations. VHCs in this location include:
    - VHC 11.2 – most to dry eucalypt woodlands (potential fuel load of 13 t/ha);
    - VHC 30.4 – Mitchell grass or bluegrass tussock grasslands (potential fuel load of 4.8 t/ha); and

  - VHC 38.5 – discontinuous irrigated cropping and horticulture (potential fuel load of 2.0 t/ha).

- ability to cater for existing and new road network connections and upgrades to consider emergency evacuation (which may extend beyond bushfire hazard to contemplate other hazards);
- ability for the implementation of statutory planning controls to mitigate a proportion of residual risk via the formulation of robust planning provisions as part of the new planning scheme, the implementation of those measures through urban design and development assessment processes, construction in accordance with AS3959 and additional bushfire management provisions which are identified at the development assessment stage; and
- ability to forward plan for longer-term water supply and servicing needs.

It is recognised that *ShapingSEQ* identifies a quantum 'consolidation and expansion' policy approach to accommodate growth in the region over the next 25 years. That is to say, a combination of both infill development coupled with greenfield expansion is anticipated.

Where infill development occurs within 100 metres of identified bushfire hazard, a bushfire hazard assessment is required under current planning provisions and this will continue to remain the case under the new planning scheme arrangements, in accordance with State and national policy arrangements.

In this regard and in consideration of the relationship between planning and building instruments, it is necessary to understand the limitations of AS3959:

- AS3959 must be triggered by Section 1.6 of the planning scheme, via the identification of the hazard overlay mapping as the trigger instrument;
- it applies only to Class 1, 2, 3 and selected Class 10a structures in Queensland;
- it is not triggered for rainforest vegetation communities (irrespective of the face these communities exhibit fire behaviour in climate change conditions); and
- the fire weather underpinning AS3959 assessments is FFDI 40, which is substantially lower than that which supports the State-wide bushfire prone areas mapping:
  - this can mean that bushfire attack level assessments undertaken in accordance with AS3959 drastically underestimate potential fireline intensity.

The limitations of AS3959 as a building instrument must be appropriately considered by planning provisions to ensure new development adequately and appropriately contemplates the magnitude of potential bushfire exposure.

6.2.4 Risk of urban fire intrusion

Urban fire intrusion is a growth phenomenon associated with bushfire events across the globe and involves the intrusion of bushfire with suburban locations.

The 2003 Canberra bushfires saw house loss occur 700 metres within suburban Duffy, involving the loss of over 200 dwellings and the loss of four lives, three of which were aged over 60 years. The 2020 Royal Commission noted that over 90 per cent of house losses during the Black Summer bushfires occurred out to a distance of 500 metres from the bushland interface. Some losses occurred beyond 500 metres.

Similar events have continued to occur in California over recent years. In 2017, the Tubbs fire led to the loss of almost 6,000 structures, half of which were dwellings in the single suburb of Santa Rosa, and claiming the lives of 22 people across the entire Sonoma County event. To that date, the Tubbs fire was the most destructive in US history.

In 2018 the Tubbs fire was surpassed by the Camp fire which destroyed over 18,000 structures and claimed 85 lives in the town of Paradise.

Urban fire intrusion, as a growing trend, is driven by several factors. These include:

- increased urban settlement at the bushland interface, with a corresponding settlement pattern and density consistent with urban areas;
- housing stock which is not built to AS3959 standard, and pre-dates current planning provisions to limit risk;
- urban expansion in locations of key fire paths and at the interface of landscape-scale bushfire hazard (i.e. adjacent to large expanses of bushland and highly connected vegetation communities);
- properties which are not maintained in a low fuel condition, and landscaping which does not respond to potential bushfire hazard; and
- timber fencing between properties.

Construction to AS3959 standards in greenfield locations may assist, but this on its own does not provide a fulsome mitigation approach to the risk of potential urban fire intrusion. This is largely associated with the fact that AS3959 does not itself contemplate radiant heat flux and potential flame contact from adjoining dwellings which may catch alight during a bushfire event. The exposure to a dwelling from a burning property next door, in addition to a broader landscape of fire likely to be in progress, is beyond the design assumptions informing AS3959.

Opportunities for policy provisions which respond to urban fire intrusion include (but are not limited to):

- larger allotments at the immediate hazard interface, separating dwellings more so than urban-sized allotments;
- a settlement pattern which provides a perimeter road and other perimeter treatments (for example, open space) between urban residential areas and the bushland interface;
- a road network which facilitates the efficient egress of persons away from the hazard interface, and timely access for emergency services; and
- formulation and implementation of statutory planning provisions which limit urban fire intrusion risk, having regard to the above, as well as provisions in relation to fencing and landscaping, and including limiting the construction of dwellings with built to boundary setbacks in bushfire prone areas.

6.2.5 Rural residential areas west of Millmerran

The existing rural residential communities west of Millmerran are zoned rural under the current Toowoomba Planning Scheme. This effectively limits potential future subdivision in this location, relative to prescribed minimum lot sizes, which is ideal.

From a planning perspective, the range of opportunities for enhanced bushfire resilience in this location is limited, but may include:

- infrastructure enhancements in improve the local and key evacuation route network;
- exploration of opportunities for strategic firebreaks and whole-of-community mitigation measures, facilitated and supported by appropriate zoning; and
- planning-related provisions which support potential opportunities relating to water-supply (i.e. via the local government infrastructure plan or zoning of land to support

shared-supply infrastructure (shared static supply tanks) which could be contemplated).

6.3 Roads and transport (evacuation) risks

Planning for bushfire evacuation is an immensely difficult task. Unlike flood and other events, bushfire events are not a 'known quantity'. There is no surety in when or where an ignition may occur, the direction it may spread, the extent of possible ember attack, etc.

The impact of smoke and limited visibility in emergency situations, coupled with wind impact, can lead to issues on the road network as residents attempt to evacuate. The exposure of motorists to potential flame contact and radiant heat are also key considerations.

Evacuation planning processes can also inadvertently presuppose that the intended location in which one seeks to evacuate to, and the pathway to get there, is safer than from which they came.

The extent of warning time and ability to evacuate to safety (including the aspects of access and egress) represent the most fundamental characteristics which determine risk to life in a land use planning context.

There are three key elements of relevance to land use planning:

1. The extent of warning time available (window of evacuation opportunity);
2. How the settlement pattern supports / enables:
    a. separation from hazard sources;
    b. limits urban penetration of fire by built form;
    c. the act of community evacuation (processes); and
3. Evacuation destinations (designated evacuation centre or Neighbourhood Safer Place [NSP]).

AIDR Handbook 4: Evacuation Planning provides guidelines and considerations for developing community evacuation plans underpinned by an all-hazards approach. It uses the nationally recognised five stages of the evacuation process as a framework for planning an evacuation (AIDR, 2017).

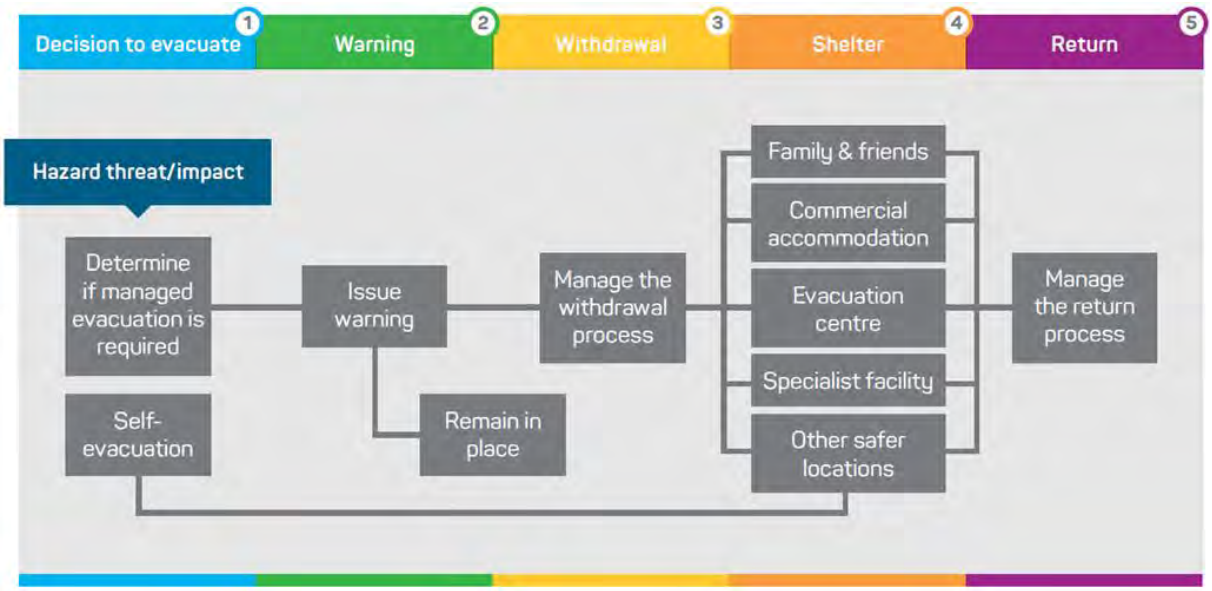


Figure 43 - The five-stage evacuation process (Source: AIDR, 2017)

This risk assessment does not seek to determine specific evacuation windows for any event scenarios. Rather, the focus of this work is to examine the potential exposure of the key evacuation route network to inform potential Council decisions in relation to settlement policy and potential growth locations.

In terms of evacuation destinations, this is likely to be a function of several aspects. Firstly, most evacuees will choose to evacuate to home of family and friends, with a smaller proportion of persons who may choose to evacuate to a dedicated centre, if a centre is stood up. The locations of evacuation centres will depend on the circumstances of the event at the time it occurs.

Thus, establishing these relationships is not within the scope of this risk assessment.

This risk assessment consider evacuation risks in relation to the exposure and performance of the network itself, and the land uses which may experience challenges with emergency evacuation.

This risk assessment further contemplates emergency evacuation, rather than early evacuation. Based on research previously identified by this assessment, only 12 per cent of persons are likely to accept emergency services warnings to leave early. The majority will plan to 'wait and see', attempt to stay and defend, or await an emergency evacuation warning from emergency services. This is further verified by the recent research conducted by the University of Southern Queensland, in relation to preparedness of residents across the Escarpment area of the region.

The road and transport (evacuation risks) identified by this risk assessment include:

- certain parts of the evacuation network may be compromised in a fire event, and may impact the ability to evacuate;
- vulnerable facilities exist in locations subject to bushfire hazard and which may require evacuation;
- ability to evacuate may be complicated by exposure of the road network to bushfire attack, fragmented vegetation, land parcels, zoning, and limited route options;
- evacuation of some townships with limited road connectivity may experience evacuation challenges; and
- rural residential communities to the west of Millmerran are highly exposed to the threat of bushfire.

Evaluation of these risks is expanded upon below.

6.3.1 Compromised evacuation network

This risk assessment has examined the exposure of the following road typologies, in accordance with the following hierarchy of roads:

- Level 1 – Freeways and motorways (there are no identified freeways or motorways within Council boundaries)
- Level 2 – Highways
- Level 3 – Secondary roads
- Level 4 – Local connector roads.

Together, these roads are considered to form the 'key evacuation route network' in the region.

In order to understand the potential impact of bushfire attack on the road network, to an extent where the evacuation network may become compromised, is largely a factor of potential for exposure to flame contact or extreme radiant heat.

Tree fall and road accidents are a separate issue, and these are difficult to model. However, there may be specific locations where risk of tree fall and accidents may present a risk to the broader network.

In terms of exposure of the key evacuation route network, the following table outlines the proportion of exposure. This detail is supplemented by road network exposure mapping included at Appendix F, along with a breakdown of kilometres exposed (as opposed to percentages shown below).

Table 42 - Summary of bushfire attack exposure to key evacuation routes

Precinct	Bushfire attack mechanism	Level 1 Freeways and motorways	Level 2 Highways	Level 3 Secondary roads	Level 4 Local connector roads	Sub-total	Total
	% of length of road						
Toowoomba urban area	Flame contact	N/A	16.82	5.09	3.08	7.52	13.76
	Radiant heat	N/A	9.47	5.86	4.43	6.24	

Precinct	Bushfire attack mechanism	Level 1 Freeways and motorways	Level 2 Highways	Level 3 Secondary roads	Level 4 Local connector roads	Sub-total	Total
	% of length of road						
Crows Nest - Rosalie	Flame contact	N/A	31.70	19.61	26.67	25.43	36.69
	Radiant heat	N/A	19.25	8.53	9.00	11.26	
Clifton - Greenmount	Flame contact	N/A	0.02	14.10	9.58	11.14	15.78
	Radiant heat	N/A	2.49	6.15	2.92	4.64	
Pittsworth	Flame contact	N/A	6.01	7.15	8.11	7.65	13.99
	Radiant heat	N/A	7.34	7.30	5.89	6.34	
Jondaryan	Flame contact	N/A	1.78	2.66	3.58	2.92	7.82
	Radiant heat	N/A	3.53	4.99	5.35	4.90	
Millmerran	Flame contact	N/A	40.46	13.96	13.51	20.12	28.68
	Radiant heat	N/A	7.35	8.08	10.90	8.56	
Total Toowoomba Region	Flame contact	N/A	19.67	11.25	10.46	12.59	19.75
	Radiant heat	N/A	9.92	6.84	6.14	7.15	

NOTE: For the purposes of the above table, 'radiant heat' extends a distance of 50m from potential bushfire hazard sources, irrespective of hazard class. To this end, it is indicative only.

The Crows Nest – Rosalie precinct is identified to comprise the highest percentage of evacuation network exposure, relating to various points along the New England Highway as well as Pierces Creeks Road and Anduramba Road / Bluff Road. Esk Hampton Road is also subject to potential exposure which is critical for the community of Ravensbourne.

West of the highway, exposure along key roads is observed in some locations however, to a considerably lesser extent than those to the east of the highway.

The Millmerran precinct also comprises a relatively high percentage of exposure of the key evacuation route network. This includes lengthy portions of Millmerran Cecil Plains Road and the Gore Highway.

In the Toowoomba urban area, the Toowoomba Connection Road, Bridge Street, Murphys Creek Road and Vayro Road, sections of Rowbotham Street and stretches of the New England Highway are identified as subject to potential exposure to flame contact or radiant heat.

The exposure of part of the key evacuation route network is highly dependant upon the location and progression of fire events, and is generally managed by emergence services during an event. The purpose of this examination however, is to strategically contemplate the exposure of the key evacuation route network in informing the settlement policy for the region into the future. A key aspect of this is the consideration of movement options to and from bushfire prone area within the region.

Generally, rural and agricultural character of the region limits the extent of evacuation route exposure. However, as per above there remain several locations where the key evacuation route network is potentially exposed and these are largely located along the escarpment area, north along the Great Dividing Range and to the north and west of Millmerran.

The above must be considered as part of the settlement policy intent for these areas.

6.3.2 Evacuation of vulnerable facilities

The historical settlement policy of the Toowoomba Region appears to have largely avoided the proliferation of potentially vulnerable facilities within bushfire prone areas.

Those facilities that are within bushfire prone areas are dominated by educational facilities, and includes several nursing home facilities and child care centres. Notable facilities which are potentially exposed or may be necessary to consider from an evacuation perspective include:

- Toowoomba urban area:
  - Anglicare SQ Symes Thorpe Home for the Aged;
  - Toowoomba Anglican School;
  - Fairholme College;
  - Fairview Heights State School;
  - Highfields State School;
  - Koojarewon Youth Camp;
  - Highfields State Secondary College;
  - Amaroo Environmental Education Centre; and
  - Geham State School.
- Crows Nest – Rosalie:
  - Ironbark of St Peter's Lutheran College;
  - Cooyar State School; and
  - Haden State School.
- Clifton – Greenmount:
  - Ramsay State School; and
  - Greenmount State School.
- Millmerran:
  - Cecil Plains State School.

Other facilities may be further identified by Council's detailed QERMF assessment as part of its disaster management activities, including the mitigation treatment measures for the above facilities.

Having regard to the identified facilities above, further development of potentially vulnerable facilities in bushfire prone areas should be a key focus addressed by Council's land use policy moving forward, limiting the location of new facilities within bushfire prone areas.

6.3.3 Performance of the road network

The performance of the road network may be influenced by its capacity (in emergency situations), connectivity and the demand from land uses which rely on specific routes.

Most townships across the region are serviced by multiple road options in different directions, which is highly desirable when considering potential evacuation opportunities. Those locations where specific consideration of context is necessary include:

- Crows Nest;
- Hampton;
- Cooyar;
- rural residential areas west of Millmerran; and
- areas of the Toowoomba urban area.

6.3.3.1 Crows Nest

Crows Nest is flanked to the east by dense bushland vegetation forming part of the Crows Nest National Park. The township is principally accessed via the New England Highway to the south and west. A series of secondary and local collector roads enter the town from the north and east. These routes would primarily be used for evacuation to the Crows Nest township from surrounding rural areas and are unlikely to be used for evacuation from Crows Nest township.

A fire event in proximity to Crows Nest (with the exception of grassfire) would occur from the east, north of south-east, moving towards the township.

The New England Highway is flanked by Pechey State Forest to the south of town, however this is relatively discontinuous from the national park. However, in the event that multiple ignitions occur in the area, egress to the south of town may be impacted.

Routes to the west toward Haden and Goombungee may be appropriate egress routes.

One of two neighbourhood safer places (NSPs) in the region is located in Crows Nest, at the Crows Nest Sports Ground. In the event of inability to evacuate the township, the NSP provides a place of absolute last resort, but it does not guarantee survival. NSPs are discussed further in Section 6.4.

Land use policy formulation should ideally have regard to the factors of both the hazard context and potential evacuation context.

6.3.3.2 Hampton

The landscape context of Hampton is essential to consider given its exposure to potential bushfire hazard, and opportunities for evacuation. Hampton is a small township to the south of Crows Nest and the Pechey State Forest, on the New England Highway.

It is largely rural residential in its context, dispersed with bushland and small-scale agricultural activities.

The connectivity of township bushland with the broader landscape of bushfire hazard is moderate to high, meaning it is conceivable that fire occurring the Pechey State Forest or Crows Nest National Park further to the east could run toward the Hampton Township.

Additional bushland areas occur to the immediate south of the township, beyond which is the Geham State Forest.

West of town the extent of vegetation becomes more fragmented however, connectivity across the landscape remains moderate. This may possibly increase the intensity of potential grassfire in this location.

Hampton is potentially exposed to a series of fire runs which could advance towards the township from almost any direction. Whilst the hazard might be lower to the west of town, the extent of grassland and fragmented bushland continues to present a potential hazard threat.

The New England Highway is the primary route through town, however other routes traverse east – westerly throughout the township including Esk Hampton Road and Hampton Road. From Hampton Road however, the route options are available to the north and south. Both move south towards either Pechey or Geham State Forests on unsealed roads.

Esk Hampton Road provides the primary connection between Hampton and Ravensbourne and is critical route for both communities.

Land use policy formulation should ideally have regard to the factors of both the hazard context and potential evacuation context.

6.3.3.3 Cooyar

Cooyar is a small township in the northern area of the region. Similar to Hampton, it is extensively surrounded by medium potential bushfire hazard within a broader landscape of potential hazard. It is also located on the New England Highway, and connects with Yarraman to the north-east via Palms Road.

Most roads within the area of Cooyar are exposed to potential bushfire hazard however, six egress routes are available. This includes two routes to the south, one to the west, two to the east and one to the north. The performance of the road network is supported by the number of route options which are available.

The second of two NSPs in the region is located in Cooyar, at the Cooyar Show Grounds. In the event of inability to evacuate the township, the NSP provides a place of absolute last resort, but it does not guarantee survival. NSPs are discussed further in Section 6.4.

6.3.3.4 Rural residential areas west of Millmerran

A series of rural residential estates have established over time west of the township of Millmerran, including the communities of Millmerran Woods, Millmerran Downs, Cypress Gardens, Forest Ridge and Wattle Ridge. These communities are flanked to the north by Western Creek State Forest and the south by Bulli State Forest and Wondul Range National Park.

These rural residential communities are immersed within surrounding bushland. Some properties maintain asset protection zones, and many do not. Whilst many dwellings likely satisfy the legislative definition of a 'dwelling', it must be acknowledged that some may experience difficultly where construction in accordance with the Building Code of Australia, and building permits, cannot be verified. This may cascade into insurance challenges in the event of building loss, similar to the consequences of the Deepwater fire in Central Queensland.

These communities were evacuated in 2019 during the Millmerran fires.

The bushfire hazard context and exposure of the key evacuation route network in these rural residential areas yields considerable risk.

This area of the region requires specific land use controls to maintain at the very least, or seek to improve the risk context.

6.3.3.5 Toowoomba urban area

The Toowoomba urban area includes a number of urban residential areas across the Escarpment which may, under specific event circumstances, present challenges in terms of the ability to facilitate evacuation. This may be a function of either potential for bushfire hazard exposure, or the number of properties serviced by specific routes and the demand on these routes.

Research by Cova (2005) provides indicative 'community egress' parameters which identifies the maximum preferred number of dwellings and corresponding minimum number of road exits or egress points to facilitate emergency evacuation in the event of bush fire. It remains a generalised approach which can be used to guide new development, or identify existing pinch points within a community.

Table 43 - Cova's road and dwelling capacity framework for bushfire prone areas (Source: Cova, 2005)

Number of dwellings	Minimum number of exiting roads	Maximum number of dwellings per exit
1-50	1	50
51-300	2	150
301-600	3	200
601+	4	-

Having regard to both exposure and potential road network demand as per Cova, the following routes are identified:

- New England Highway;
- Preston Boundary Road (interface with Lockyer Valley Regional Council);
- Flagstone Creek Road (interface with Lockyer Valley Regional Council);
- Nelson Street;
- Rowbotham Street;
- East Street;
- Dudley Street;
- Bridge Street;
- Prince Henry Drive;
- Harvey Street;
- Weale Street (and connecting streets);
- Murphys Creek Road (interface with Lockyer Valley Regional Council);
- Vayro Road; and
- Perry Road.

These routes act as collectors for other residential streets which are exposed, the above is not intended to reflect all potentially exposed streets, rather those which provide key connections.

In some locations along the Escarpment interface, land is zoned for Limited Development, Open Space and Sport and Recreation, outside of those areas historical development for residential development which is identified largely within the Low Density Residential Zone.

The zoning approach of the current planning scheme may limit potential for future increased urban development in this highly exposed area, though noting recent development application for urban residential activity has included land currently zoned for community facilities.

The policy approach currently adopted by Council along the Escarpment (an area exposed to potential multiple hazards) should be maintained moving forward.

Notwithstanding the above, there is a considerable extent of land in the Middle Ridge area (and discrete lots identified north toward Harlaxton) zoned for rural residential which carries with it a current minimum lot size of 4,000m^2 (unless identified in the 1 or 2 hectare rural residential precinct). Whilst some locations have been previously development within the zones, there continues to remain sizable parcels of land capable of sustaining further residential development within high and very high bushfire prone areas.

This should form a specific area of focus in terms of land use policy approaches as part of the development of the new planning scheme.

6.4 Human and social risks

The highest human and social risk is the loss of life, followed by injury and impacts of physical and mental health. Bushfire poses a particular risk to people's lives from different aspects. A summary of historical observations of life loss from Australian bushfires is included in Part A – Contextual Analysis.

The human and social risks identified by this risk assessment include:

- considerable risk to community facilities, services and infrastructure within the community facilities zone is present;
- vulnerable facilities exist in locations subject to bushfire hazard and which may require evacuation;
- lands zoned for future development growth are highly exposed to potential bushfire hazard, particularly the rural residential and emerging community zones;
- the low density residential zone is relatively exposed, incorporating a high percentage of existing housing stock within the Toowoomba urban area;
- township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion;
- certain parts of the evacuation network may be compromised in a fire event, and may impact the ability to evacuate;
- ability to evacuate may be complicated by exposure of the road network to bushfire attack, fragmented vegetation, land parcels, zoning, and limited route options;
- evacuation of some townships with limited road connectivity may experience evacuation challenges;
- emergency services may face increased burden from expanded development in interface areas; and
- rural residential communities to the west of Millmerran are highly exposed.

Evaluation of these risks is expanded upon below.

6.4.1 Community facilities, service and infrastructure

The human and social risks associated with community facilities zoned land, services and infrastructure are largely a function of cascading, cumulative and / or compounding risk should the infrastructure, networks and services supported by community facilities zoned lands fail.

This includes services and networks such as electricity, telecommunications, water supply and sewerage. The ability to be informed of local fire in predicated on electricity supply to power resources used to communicate emergency warnings (television, radio, internet) and telecommunications networks including land-based telephone infrastructure, mobile phone networks and assets and NBN nodes. Electricity is also critical to aspects of the water supply network, which is critical for offensive and defensive firefighting.

Impacts on water supply and sewerage assets can also prolong community recovery.

The cascading risks of the above can translate to significant impacts on the community, including potential risk to life, and may exacerbate trauma and psychological impacts.

Thus, the resilience of these networks, including the location of assets and their relative exposure to hazard and risk, is necessary to complete in a planning context. Generally, infrastructure providers will go to great lengths to protect their assets and the resilience of infrastructure networks.

Many approvals processes for critical and essential infrastructure do not require Council planning consent. Irrespective of this, many will undertake a voluntary assessment of local

government planning scheme provisions as part of broader approvals process and accordingly, the new planning scheme can proactively integrate infrastructure provisions to expand the ability to mitigate the potential cascading human and social risks associated with infrastructure assets and network resilience.

6.4.2 Neighbourhood safer places

Two NSPs are located within the region, including one at the Crows Nest Sports Ground and another at the Cooyar Show Grounds.

As identified by the Queensland Rural Fire Service (QRFS), the 2009 Victorian Bushfire Royal Commission Interim report recommended that people need a range of options to increase their safety in the event of bushfire. It is intended that the NSP is a place of last resort, where a bushfire survival plan fails and evacuation out of town is not an option.

A NSP is a local open space or building where people may gather, as a last resort, to seek shelter from a bushfire. It is provided for the purposes of contingency and is not meant to be used as a gathering place or evacuation centre. To this end, survival at a NSP cannot be guaranteed.

Firefighters may not be present, in the event that they will be fighting the fire or undertaking defence elsewhere. It is further noted that NSPs do not:

- cater for animals or pets;
- provide meals or amenities; and
- provide shelter from the elements, particularly flying embers.

Following the 2020 Royal Commission, it was identified that communities struggle to understand the intention of NSPs relative to evacuation centres, and their purpose is misunderstood.

Whilst locations which as Hampton and rural residential areas west of Millmerran could benefit from an alternative, this is likely to be challenging to achieve in each location, and ideally a leave early posture should be the absolute preferred approach for residents living in these locations.

6.4.3 Vulnerable facilities and vulnerable persons

Vulnerable persons are typically over-represented by life loss data from bushfire events in Australia. In this regard, it is critical to consider vulnerable facilities across the region due to the characteristics of occupants.

The built environment and evacuation sections above have identified a low level of exposure of existing vulnerable facilities within bushfire prone areas across the region. This position should ideally be maintained through proactive planning policy, embedded within the new planning scheme.

The identification of land to support potential vulnerable facilities within new growth areas should locate these uses outside of bushfire prone areas. This includes nursing homes, aged care facilities, retirement homes, child care centres, hospitals and medical facilities, and educational facilities.

The evacuation of facilities such as those listed above is a highly stressful undertaking which can carry risk to life consequences beyond the impact of fire. The stress of evacuation on vulnerable occupants of vulnerable facilities can yield significant threat to life.

As per the State interest policies, these activities should ideally be avoided in bushfire prone areas. Where this cannot be avoided, the new planning scheme can prescribe provisions and assessment requirements. These, however, should only be deployed in instances where genuine need is evident. Refer to Appendix C for existing vulnerable uses mapping.

6.4.4 Exposure of potential growth areas

The State interest policy of avoidance of hazard and risk in the first instance presents the strongest opportunity to avoid continued increases to risk to life, and the social consequences which follow an event.

Importantly, those events which may not impact upon a community directly can leave profound and lasting psychological impacts such as anxiety, which can manifest in various ways. In this regard, even those events which do not cause damage or loss can have a multitude of social consequences.

Those planning and built environment opportunities to limit risk in potential growth areas also decrease potential risk to life. This largely focusses on ensuring growth areas across the region are not exposed to higher hazard in the first instance, but instead are oriented to locations where hazard is fragmented and of a lower fuel composition and arrangement. This increase the opportunity for the effectiveness of statutory planning and building measures to mitigate risk to life and property.

The ability for efficient evacuation is equally as critical as orienting growth away from highly exposed locations. Both the existing and new road networks required to support growth areas must be evaluated.

Current planning instruments and materials in Queensland do not, at this time, adequately articulate the characteristics of an effective and efficient evacuation network in relation to bushfire hazard. This risk assessment defines it as including the following attributes (as a minimum):

- a network with capacity to support surge demand during evacuation (i.e. many residents leaving at once, with multiple vehicles departing from each household);
- a network which provides and support multiple egress options, in the event that one or more routes become non-trafficable;
- potential bottlenecks and pinch points in an emergency situation are identified via strategic processes and able to be mitigated; and
- roads at the interface are sufficiently wide to enable fire appliances to stand on the pavement and be operational (i.e. doors open and equipment deployed), and continue to allow for passing vehicles which may be leaving the area.

Regard for the above in advance of development growth enables the road network to appropriately support emergency evacuation, and mitigate potential risk to life to a tolerable level.

6.4.5 Exposure of existing residential areas

The exposure of existing urban residential areas across the region, primarily within the Toowoomba urban area is largely a legacy of historical settlement. The housing stock in these locations largely pre-dates the provisions of AS3959 for construction of buildings in bushfire prone areas, and current risk-responsive planning provisions.

It may be the case that incremental and discrete planning opportunities may arise which elevate the resilience of these locations however, at the strategic planning level there is limited breadth for built environment related outcomes to holistically mitigate the risk profile relative to these locations.

For non-residential infill development, the planning scheme should provide sufficient provisions which acknowledge that non-residential land uses do not require construction in accordance with AS3959. This may translate to additional provisions Council may wish to contemplate to protect occupants of these activities, and their ability to evacuate.

As part of infill development, opportunities may exist through encouraging home-owners to retrofit their homes in accordance with the Queensland Government's Bushfire Resilient Homes Guideline.

Over time, it may be assumed that properties within the bushfire prone area along the escarpment may be redeveloped. Whilst design and construction provisions may apply, land use provisions should equally limit considerable population increase in this area, given its risk profile. Whilst it is recognised that infill targets may apply for Toowoomba pursuant to *ShapingSEQ*, the bushfire prone area of the Toowoomba Escarpment is not identified as a location where infill development should be encouraged or supported, where involving potential population increase.

Alternatively, Council may consider integrating the bushfire resilient design provisions into its bushfire hazard code provisions. At present, building design has formed a considerable gap in planning approaches to bushfire hazard and risk reduction. This is in contrast to approaches to flood resilience which incorporate specific design outcomes.

Supplementary to the above are discrete built environment opportunities which may be apparent in existing bushfire prone areas, for example, which additional road connections may enhance opportunities for evacuation, or additional open space opportunities may achieve multi-objective outcomes to provide asset protection to existing communities.

Additionally, community education campaigns and programs to encourage residents to prepare their properties each season and prepare and maintain a bushfire survival plan may assist. Communities which understand their risk and are empowered to take action in relation to those aspects within their control generally contribute to a more resilient community, in ways which extend beyond just responding to a hazard. It can contribute to increase social capital, improved connections between individuals, communities and their interaction with Council and other stakeholders.

The combination of above plays a considerable role in limiting risk to life in existing (and new) residential areas.

6.4.6 Risk of urban fire intrusion

The risk of urban fire intrusion relevant to potential harm to human life is largely associated with the ability for evacuation. The impacts of urban fire intrusion may typically commence ahead of the arrival of the fire front, with ember attack giving rise to spot fires within the urban area. As these fires coalesce and consume landscaping and materials around dwellings, the risk to dwellings increases which is exacerbated upon the arrival of the fire front.

This environment of fire leads to confusion and can challenge those who intend to stay and defend.

As per the CSIRO study into life loss of over 260 fire events in Australia to 2011, life loss of persons passively sheltering in a dwelling (as opposed to actively defending it) is increasing. However, the rates of life loss during active defence are also increasing.

Planning to mitigate risk to life from urban fire intrusion is ostensibly linked to the same provisions identified for built environment mitigation and include (but may not be limited to):

- larger allotments at the immediate hazard interface, separating dwellings more so than urban-sized allotments
- a settlement pattern which provides a perimeter road and other perimeter treatments (for example, open space) between urban residential areas and the bushland interface
- a road network which facilitates the efficient egress of persons away from the hazard interface, and timely access for emergency services

- formulation and implementation of statutory planning provisions which limit urban fire intrusion risk, having regard to the above, as well as provisions in relation to fencing and landscaping, and including limiting the construction of dwellings with built to boundary setbacks in bushfire prone areas.

6.4.7 Increased burden on emergency services

The protection of firefighters through planning provisions is liked to limiting the extent of urban interface which exposed to hazard in the first instance, and then ensure those areas which may be subject to potential bushfire hazard yield a risk profile which is a low as reasonably practicable.

This includes excluding further growth in locations exposed to extensive areas of high and very high hazard and formulating and implementing appropriate statutory planning provisions which support the operation of emergency services before, during and after a fire event.

This includes provisions which enable the operation of firefighters at the interface, where defence of dwellings may be required. Asset protection zones (i.e. defensible space) provides operational space for firefighting, reduce the exposure of potential flame contact and radiant heat during defensive operations, may enable offensive firefighting tactics to occur (such as access for back burning operations, mechanical vegetation removal, etc.) to contain the fire front, and the like. Beyond asset protection and defensible space, the ability for firefighters to fall back immediately away from the bushland interface is paramount. This usually involves direct egress points to locations within the urban area, or to safer ground.

On the basis of the above, the provision of fire trail systems in lieu of perimeter roads is not ideal. In the first instance, they are less effective than a perimeter road system which guarantees defensible space in perpetuity. Fire trails at the rear of developments tend to become compromised over time, as residents encroach on the trail. They also provide a significant ongoing cost and burden on Council resources to maintain.

Fire trails can also lack key design requirements which support firefighter safety including space for vehicles to pass and turn around in forward gear, with linkages back to the road network every 200 metre, or as close as possible.

Often, trail networks are not used for defensive firefighting. Rather, they are used to undertake regular vegetation management and fuel load reduction.

As such, there are significant multi-objective opportunities for the statutory bushfire hazard provisions of the new planning scheme to actively consider and plan for firefighter safety.

6.4.8 Rural residential areas west of Millmerran

This risk assessment has previously considered the planning opportunities which may be considered for this location however, this must be a joint consideration with Council's disaster management team insofar as risk to life is associated.

This includes finding potential common ground where strategic and statutory planning tools might assist to advance bushfire resilience via whole-of-community mitigation measures.

6.5 Economic risks

Over 16,000 registered businesses exist or operate within the Toowoomba Region (Geoscience Australia, 2021). The Toowoomba Region produces an estimated $12.18 billion of Gross Regional Product, which represents 3.46 per cent of Gross State Product, with over 85,000 employed persons (National Institute of Economic and Industry Research (NIEIR), 2021).

Economic productivity is spread across the region, beyond the CBD, with valuable agricultural production lands generating significant economic activity and employment. These areas are not immune to bushfire for grassfire threat, which can lead to crop loss and loss and damage to property, buildings and equipment.

At 2017, the total cost of disasters across Queensland was $11 billion per year representing 60 per cent of the total economic cost of disaster over the preceding ten years. This is forecast to escalate to $18.3 billion per year by 2050 having regard to direct and indirect tangible costs as well as intangible costs (Deloitte Access Economics, 2017). Queensland also receives the highest allocation of Commonwealth resilience funding (2013/14 – 2016/17) at $12 million (Deloitte Access Economics, 2017).

Early estimates of the costs of the 2019-20 Australian bushfires has been estimated at approximately $100 billion, incorporating both tangible and intangible costs (Read & Denniss, 2020).

Deloitte Access Economics (2017) estimated the tangible impact of the Victorian Black Saturday bushfires at $3.1 billion in 2015 dollars, with intangible costs at more than $3.9 billion.

Governments of all levels are increasingly exposed to economic risks stemming from bushfire and other disaster events. Understanding risk exposure and investing in building resilience to reduce disaster risk are key opportunities to reduce the magnitude of potential loss.

The economic risks identified by this risk assessment include:

- recovery and reconstruction may be long and costly;
- a proportion of residents and businesses do not have adequate insurance cover;
- grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact;
- land and fire management activities may face added pressure from expanding development in interface areas; and
- emergency services may face increased burden from expanded development in interface areas.

Evaluation of these risks is expanded upon below.

6.5.1 Recovery and reconstruction

Geoscience Australia (2020) estimates the current potential reconstruction cost of property loss within the local government area at almost $33 billion, with a contents value of approximately $4 billion.

This value is likely to increase substantially over time.

The cost of damage or loss to public assets, critical infrastructure and essential services extends beyond the above amount and can translate into extended recovery timeframes which can also extend beyond bushfire impacts to communities.

Queensland's exposure to bushfire threat is changing over time, as climate change influences fire weather and vegetation characteristics, and development at the urban bushland interface continues to expand.

Millions of dollars in recovery costs have been expended by local, State and Commonwealth governments over recent years in response to the past several fire seasons experienced in Queensland.

In more catastrophic events, recovery and reconstruction processes stretch into years, as housing, business premises and community facilities are rebuilt.

The 2020 Royal Commission identified the role of strategic land use planning in considering the risk posed by natural hazards, and the preparation and implementation of settlement policy which seeks to avoid or otherwise limit continued hazard exposure and increase of risk, as part of a shared responsibility approach to project life and property, invest in resilience, and limit future recovery and reconstruction costs and impacts.

6.5.2 Insurance

The Insurance Council of Australia identifies that approximately 1 in 20 properties across Australia are not insured, approximately 70 per cent of properties are under-insured and about two-thirds of renters do not have contents insurance (Wynne, 2017).

One of the critical issues in this regard is that 'insured value' should not just cover the construction or purchase price, but must take into account current building standards, demolition, potential asbestos removal and site clean-up. The recent 2019-20 New South Wales Bushfire Inquiry identified that costs to re-build to new standards could be as high as an additional $100,000 (Owens & O'Kane, 2020).

In a recent inquiry directed by the Commonwealth Government, the Australian Competition and Consumer Commission (ACCC) (2020) established that as disaster events continue, insurers are using more refined data and sophisticated pricing techniques which can result in insurance affordability for some consumers, over time. It also found that reforms to land use planning and building standards can help reduce risks and costs over the longer term.

6.5.3 Threat of agricultural loss

Agricultural losses from bushfires in Queensland and Australia more broadly is also continuing to grow. These losses come with far-reaching socio-economic impacts which lengthen community recovery timeframes, and can lead to devastating consequences for agricultural businesses which are often family-owned enterprises.

Impact on agricultural enterprises also carries significant cascading economic impacts of associated industries such as transport, logistics and manufacturing. This further extends to other dependant industries.

Pursuant to the Australian Disaster Resilience Index, the precincts of Jondaryan, Pittsworth and Millmerran are most exposed to economic risk as a result of disasters, ostensibly related to limited economic diversity and primacy of agricultural activities.

6.5.4 Increased pressure on land and fire management activities

Expansion of the urban bushland interface is placing growing pressure on land and fire managers to mitigate risks transferred from planning and building. Land managers include Council, State government agencies, major infrastructure providers, Traditional Owners and private landholders.

Often, the impacts on land and fire management as part of planning decision making is not contemplated by strategic or statutory planning processes.

The economic costs of these growing pressures relate to the implementation of mitigation activities such as prescribed burns, mechanical and manual fuel treatments, weed management, vegetation and landscape management, fire break and fire trail maintenance, etc. These costs are escalating as a result of increasing exposure, a changing climate, and also

community expectation. The costs and resources required for land and fire management across the country was a key aspect considered by the 2020 Royal Commission.

For the purposes of local government, planning policy should proactively seek to reduce the impost of burden on land and fire managers. Ostensibly, this should include the provision of adequate asset protection which does not require reliance on the provision of new trail networks and the like, which become an impost on local rate payers to fund, and Council's and other land managers to resource and implement.

6.5.5 Increased burden on emergency services

State interest policy 5 of the SPP identifies that 'development in natural hazard areas supports, and does not hinder, disaster management capacity and capabilities'.

At the statutory level, this involves the formulation of settlement policy and planning scheme provisions which proactively consider the safety of emergency services in an operational capacity. This is achieved through the provision of perimeter roads, connected road networks which enable firefighter fallback to safety, limiting the exposure of dwellings requiring protection, and limiting the establishment of dangerous (hazardous) and vulnerable facilities in bushfire prone areas.

From a strategic perspective, it is clear from the events of the Black Summer bushfires of 2019/20 that emergency service resources face mounting pressures in large-scale and dynamic events. Where the extent of the urban bushland interface can mean a large number of localities are under threat at the same time.

Over time, the escalation of mitigation, response and suppression associated with bushfire hazard will continue to increase costs for emergency services. Resourcing over time may be impacted.

When considering this against the observations and findings of the University of Southern Queensland research report for Council completed in 2020, in relation to bushfire mitigation and preparation on the Escarpment, more than two thirds of surveyed households believed they were at low risk or no risk during a bushfire.

There also remains a widespread perception that fire services will be available to protect every house which is threatened during a bushfire. In reality, fire services do not maintain the resources to achieve this, and QFES actively communicates this message.

A risk-responsive settlement policy will ensure that locations of higher risk are avoided, and those locations where risk can be mitigated, are designed in a manner which considers life and property risk in the first instance, including firefighter protection.

6.6 Environmental risks

The region comprises extensive tracts of native remnant bushland, including vegetation communities and fauna which are identified as matters of local environmental significance (MLES).

Flora MLES communities identified with the Toowoomba Region include:

- Redwood rainforest area (Toowoomba urban area escarpment);
- Rifle range rainforest area (Toowoomba urban area escarpment);
- Broxburn-Pittsworth linear habitat corridor (Pittsworth precinct);
- Basalt hilltops SE Downs (Toowoomba urban area);
- Sandstone wildflower outlier (Crows Nest-Rosalie precinct);
- Cooby woodlands (Crows Nest – Rosalie precinct);
- Wet sclerophyll forests (Toowoomba urban area and Crows Nest – Rosalie precincts escarpment areas);
- Red river gum riparian land zone 3 (Millmerran precinct);
- Muntapa tunnels (Crows Nest – Rosalie precinct);
- Araucarian notophyll/microphyll vine forests and semi-evergreen vine forests (Crows Nest – Rosalie precinct);
- Toowoomba escarpment and Great escarpment corridor (Toowoomba urban area, Crows Nest – Rosalie and Clifton – Greenmount precincts);
- Sandstone belt corridor (Millmerran precinct);
- Bunya Mountains connection (Crows Nest – Rosalie precinct);
- Mountain coolabah open woodland (Pittsworth and Clifton - Greenmount precincts);
- Highfields falls, Spring Bluff (Toowoomba urban area);
- Hirstglen to Pilton and Rockmount – Ramsay (Clifton – Greenmount precinct); and
- Cooya Creek (Crows Nest – Rosalie precinct) (Source: Red Leaf Environmental, 2020).

The environmental risks identified by this risk assessment include:

- hazard exposure may change in certain locations over time to a higher hazard class, as a result of climate change;
- land and fire management activities may face added pressure from expanding development in interface areas. Ecological assets may be impacted; and
- certain land uses within interface locations may inadvertently impact on the ability to implement certain forms of hazard reduction, due to the risk magnitude of mitigation activities.

Evaluation of these risks is expanded upon below.

6.6.1 Increased exposure as a result of climate change

As noted in Part A – Contextual Analysis as well as earlier in this report, the impacts climate change are already being felt across the region. It is manifesting in several ways, including:

- changes to vegetation communities, changes to fuel loads and therefore potential fire behaviour and propensity of ignition, over time;
- increasing FFDI trends as a result of lower levels of precipitation, higher mean temperatures, more frequent hot days and more frequent hot nights – equating to a situation where both vegetation and fire weather prime the landscape to experience more frequent fire; and
- increased higher FFDI days, rising highest daily FFDI values, a longer fire season, and shorter period for hazard reduction.

Changes to vegetation attributes and overall fuel loads across the region is likely, as the landscape responds to climatic and weather changes over time. This may mean that medium potential hazard classes may escalate towards higher potential hazard classes, compared with that currently mapped.

This may result in larger areas of the region being exposed to higher levels of hazard than compared with current conditions, as a result of increased or altered fuel loads, and fire weather characteristics. Monitoring of these conditions will be required.

6.6.2 Increased pressure on land and fire management activities

In addition to the added costs for land and fire management activities, urban expansion at the bushland interface and the need for enhanced mitigation activities can result in negative impacts on environmental assets and values.

Fire regimes provide an important guidance on how frequently certain ecosystems can endure fire without altering its characteristics. Some vegetation communities can and should experience a higher level of fire frequency than others, and some should not be exposed to fire at all.

Cultural burning practices also adopt quasi regime approaches, where the characteristics or hallmarks of changes in vegetation on a seasonal basis are monitored, and provide an indicator of when certain vegetation communities should be burnt. Cultural burning is far more comprehensive in its application than prescribed burning. The primary function of prescribed burning is for hazard reduction, whereas cultural burning provides broad benefits for Country in terms of health of Country, protection and provision of habitat and food sources for animals, as well as hazard reduction.

Irrespective, the conversation about healthy fire and good fire is in its early stages and is not well understood by the community. This places land and fire management at a crossroads of sorts. Whilst community expectations of land and fire management are generally high after an event, over time these sentiments can give way to complaints about smoke and impacts on lifestyle from hazard mitigation.

6.6.3 Inadvertent impacts on ability to mitigate

The consideration of appropriate land uses in interface areas is also critical. The location of vulnerable facilities, housing vulnerable occupants, can inadvertently translate to the inability to implement some land and fire management (mitigation) measures.

For example, the location of a nursing home in a bushfire prone area can limit the ability for prescribed burning to be conducted due to the immediate risk of smoke impact on occupants with cardiac and respiratory illnesses. The cascading impacts of this can increase risk to the surrounding community, where alternative mitigation approaches available may be less effective.

From both a strategic and statutory planning perspective, the application of planning tools to consider the impact of land uses on the potential to inadvertently 'void' mitigation options should be explored.

7 Risk mitigation and treatments

This section considers, supplementary to Section 6, those mitigation and treatment opportunities which are available in response to the identified planning-related bushfire risks outlined by this risk assessment.

A risk register, adapted to align with the QERMF but utilised to inform the fit-for-purpose land use planning risk assessment process, has been prepared and is included at Appendix E.

It is noted that both the LDMP and Operation Cool Burn identify a suite of mitigation measures. This risk assessment does not duplicate or in any way override those measures. The purpose of this risk assessment is to identify a suite of relevant land use planning related measures to mitigate future risk, as well as existing risk insofar as possible.

The risk register informs Part C – Planning Issues and Options Analysis of this Bushfire Risk Analysis. It identifies a range of planning, and non-planning, risk treatments for consideration relative to those risks identified by this risk assessment. It analyses each risk in terms of vulnerability, likelihood and consequence before consideration is provided for the suite of mitigation measures which may apply, and their relative effectiveness.

An assessment of residual risk is also provided. This benchmarked not only against the QERMF risk level for each identified risk, but also its level of acceptability, tolerability or intolerability having regard to the requirements of the State interest policies as well as the 'ALARP' process.

Refer to Appendix E for the risk register.

Further to the detail contained in the risk register, the following sections provide a summary overview of potential future risk relative to each precinct within the Toowoomba Region.

7.1 Toowoomba urban area

Around the Toowoomba CBD area of the precinct, most lands identified for further growth vis existing emerging community zones are located to the west, away from the Escarpment. Whilst this is beneficial in terms of identifying growth away from higher risk locations, hazard also exists to the west, noting the primacy of westerly-driven fire winds. The fuel loads in this location are lower when compared with other fuel loads prevalent across higher hazard areas of the region.

Whilst hazard is present to the west, it is fragmented in nature, and likely to endure further fragmentation as a result of future development. The ability to meet statutory planning and building controls in these locations previously identified for growth via emerging communities zoned land to the west of the city is likely to be achievable. Existing road networks likely offer a range of evacuation options, and future development should further contemplate evacuation opportunities as a key aspects of development assessment.

The further subdivision of rural residential zoned land in the Top Camp area will increase potential hazard exposure and vulnerability, noting this area of the precinct is surrounded by bushland.

North of the CBD area, land to the east of the New England Highway is highly exposed to higher potential hazard and a series of planning options exist in relation to this location. On balance however, this risk assessment identified the area east of the highway to present a significant potential risk hot spot. Hazard is present to the west of the highway however, it transitions to a more fragmented nature. This discontinuous fuel composition limits larger conflagrations. However, fragmented fuels can also propagate spot fires, and these can create challenging evacuation situations in an emergency where confusion as to the direction of the fire front can occur, and fire can travel in many directions as spot fires draw back toward the main fire front.

There is not a large expanse of emerging community or township-zoned land in this area at present, and land zoned for low density residential is continuing to be developed. Thus, existing opportunities for growth are located closer to the Toowoomba CBD under the existing planning

scheme. If growth to the north were contemplated, it is considered that Meringandan Road presents a logical extent, with the magnitude of higher bushfire hazard exposure increasing significantly to the north.

7.1.1 Toowoomba urban area mitigation options

The risk register at Appendix E identifies the following potential planning mitigation measures which will be explored as part of Part C of this Bushfire Risk Analysis, the Planning Issues and Options Analysis:

- growth areas and development is contemplated in locations where hazard exposure is lowest possible.
- infill development opportunities may over time address a portion of existing building risk, however ideally this should avoid increased population exposure via increased density activities (i.e. multi unit dwellings etc.).
- some rural residential zoned land in the Toowoomba urban area is capable of accommodating further development within the bushfire prone area of the Toowoomba Escarpment. The zoning rationale of these allotments should be revisited.
- existing risk will require treatment via continued land and fire management practices, disaster management arrangements, community education and household preparation.
- identification of new road connections to facilitate growth which aid evacuation opportunities, providing increased route options.
- focus future growth expansion in locations where additional road network connections can be facilitated to support development.
- identify potential key existing pinch points in the urban network where opportunities exist to add works into the LGIP to achieved improve evacuation potential.
- growth expansion should consider the impact on adjoining land managers in managing hazard and risk.
- statutory planning measures which provide for asset protection may alleviate demand on emergency services, and enable more time, and provide emergency services with more options during an event. Statutory controls can also mitigate the risk of urban fire intrusion.
- retention of policy position to avoid community facilities and vulnerable facilities in bushfire prone areas (applicable across the region).
- a local law to assist with compliance of bushfire management plans in perpetuity may be a worthwhile consideration (applicable across the region).

7.2 Crows Nest – Rosalie

The New England Highway continues north through this precinct, from the Toowoomba urban area which is located to the south. The highway provides a general distinction between fuel loads to the east and west. Land to the east of the highway comprises dense vegetation which is anchored by a series of state forests. Vegetation to the west of the highway is more fragmented in nature, and whilst still comprising areas of high and very high potential hazard, this dissipates further to the west as land uses transition to rural and agricultural activities.

This generally indicates the potential for more significant fire runs occurring to the east of the highway compared with the west, though significant fire activity may still occur to the west.

North of Meringandan Road, the extent of bushfire prone area is expansive, which correlates with the current extent of low density residential development in the Highfields area south of Meringandan Road.

The townships of Hampton and Crows Nest are highly exposed to high and very high potential bushfire hazard, and Hampton in particularly is largely enveloped by bushland areas. The township of Cooyar is also exposed.

Both Cooyar and Crows Nest maintain Neighbourhood Safer Places (NSP), which are places of last resort. To a degree, this acknowledges the potential for significant fire impacts in these locations. Hampton does not have an identified NSP, largely due to the fact there is no current location in the township which would meet the radiant heat requirements to be designated a NSP. This could be contemplated however, care must be taken that community members do not misinterpret the provision of an NSP which is a significant risk. Early evacuation from Hampton is, and should continue, to be the most appropriate disaster management option.

The exposure of road corridors within the precinct is a critical factor for consideration of any future potential changes to land uses within this precinct. Almost 40 per cent of the key evacuation route network is potentially exposed to flame contact and radiant heat. This may place significant pressure on ensure evacuation occurs early with a potential high probability that portions of the evacuation network will be overrun by fire.

7.2.1 Crows Nest – Rosalie mitigation options

The risk register at Appendix E identifies the following potential planning mitigation measures which will be explored as part of Part C of this Bushfire Risk Analysis, the Planning Issues and Options Analysis:

- road corridor treatments could be considered for key locations to reduce fuel loads along key evacuation route corridors.
- identification of new road connections to facilitate growth which aid evacuation opportunities, providing increased route options.
- use of NSPs in key townships where evacuation may be challenged, and clear messaging on their purpose.
- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.
- clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.

7.3 Clifton – Greenmount

The majority of the Clifton – Greenmount precinct is characterised by rural and agricultural lands and activities.

Areas of high and very high potential hazard are largely associated with state forest land on the Great Dividing Range. This land is currently zoned rural, with very little to no alternative zoning outside of townships which would indicate potential for growth.

Hazard becomes fragmented and patchy further to the west however, agricultural production dominates the landscape, with the majority of the western portion of the precinct being located on the Condamine Plains.

7.3.1 Clifton – Greenmount mitigation options

The risk register at Appendix E identifies the following potential planning mitigation measures which will be explored as part of Part C of this Bushfire Risk Analysis, the Planning Issues and Options Analysis:

- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.
- clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.

7.4 Pittsworth

The Pittsworth precinct is dominated by large expanses of productive agricultural land, giving way to fragmented patches of bushland. The majority of remnant bushland in the area is identified a medium potential bushfire hazard, largely due to the nature of topography in the area which is relatively flat, forming part of the Condamine Plains.

The township of Pittsworth is relatively surrounded by fragmented bushland, as is its road connection with Toowoomba city. Only a minor portion of the township is exposed. The town does incorporate land zoned for rural residential.

7.4.1 Pittsworth mitigation measures

The risk register at Appendix E identifies the following potential planning mitigation measures which will be explored as part of Part C of this Bushfire Risk Analysis, the Planning Issues and Options Analysis:

- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.

7.5 Jondaryan

The Jondaryan precinct is characterised by broad agricultural lands situated on the fertile Condamine Plains. It is one of the least exposed precincts, thought the risk of potential grassfire remains present and this introduces potential economic risk for the area.

The nature of hazard is highly fragmented, more so than other locations in the Toowoomba Region. However, hazard is identified within existing rural residential areas of Oakey, in the south of the township. The largest extent of potential hazard is situated north of the Jondaryan township, with remnant bushland areas remains which is identified as medium potential hazard.

A high incidence of rural residential land is zoned in Oakey, with some vacant allotments remaining. The defence operations within Oakey remain a key employment driver within the precinct, and the region more generally.

7.5.1 Jondaryan mitigation measures

The risk register at Appendix E identifies the following potential planning mitigation measures which will be explored as part of Part C of this Bushfire Risk Analysis, the Planning Issues and Options Analysis:

- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.
- clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.

7.6 Millmerran

The Millmerran precinct is generally characterised by large-scale rural activities and industries, with the majority of its residents living on the eastern side of an expansive area of state forests in the very western portion of the Toowoomba Region. In an area dominated by dry, hot westerly winds, Millmerran endures frequent and sometimes significant fire events.

Rural residential properties are nestled amongst state forest areas. The evacuation route network from these locations to the township of Millmerran area highly exposed. In fact, almost 30 per cent of the evacuation route network (levels 1, 2, 3 and 4 of the road hierarchy) are exposed to potential flame contact and radiant heat, which is particularly significant given the Millmerran precinct is also the largest of all precincts within the Toowoomba Region.

A similar situation can be observed in and around the township of Cecil Plains.

The connectivity of continuous fuels in the area can generate significant fire behaviour, and large-scale conflagrations.

A substantial area of the Millmerran township is currently zoned for rural residential uses, with further capacity for residential development seemingly available.

7.6.1 Millmerran mitigation measures

The risk register at Appendix E identifies the following potential planning mitigation measures which will be explored as part of Part C of this Bushfire Risk Analysis, the Planning Issues and Options Analysis:

- road corridor treatments could be considered for key locations to reduce fuel loads along key evacuation route corridors.
- identification of new road connections to facilitate growth which aid evacuation opportunities, providing increased route options.
- use of NSPs in key townships where evacuation may be challenged, and clear messaging on their purpose.
- statutory planning controls can incorporate provisions for feedlots and intensive animal husbandry activities, and other land uses.
- infrastructure assets may benefit from asset protection zones. Where network vulnerabilities exist, these should be identified and mitigated with infrastructure providers.
- clarity for landholders on what can and cannot be undertaken on property without approach in terms of vegetation management will empower some residents to increase preparedness in existing rural residential and township areas.
- council planning, disaster management, engineering, roads and transport parks and open space should undertake a charrette process to unpack and identify risk issues and opportunities to enhance the existing resilience of rural residential areas west of Millmerran. Possible opportunities to enhance the resilience of these communities, to explore, may include:
    - improved road connections;
    - improved water supply options (including shared static supplies);
    - ongoing investment in early warning infrastructure (including understanding its limitations and challenges);
    - assistance with APZ clearing or incentives;
    - community champions to assist engender behavioural change and preparedness; and
    - liaise with Gladstone Regional Council to share learnings from the Deepwater fire.

8 Determining risk acceptability

The determination of outcomes which represent 'acceptable' or 'tolerable' risk versus 'intolerable' risk, and those measures, treatments and controls which might assist in achieving mitigated residual risk, must be measured against a set of benchmarks, or risk acceptability criteria. This provides clarity and transparency of assessment against key criteria.

The acceptable risk criteria established for this risk assessment are derived from the Bushfire Resilient Communities Technical Reference Guide policies.

As per Section 3.7, risk acceptability is measured by this risk assessment against the risk levels of the QERMF as well as the performance of measures against the ALARP principles. An assessment of each, including against residual risk following risk mitigation, is included in the risk register at Appendix E.

This Bushfire Risk Analysis addresses each relevant State interest, ensuring State interests are appropriately considered, assessed and integrated into the new planning scheme. The tables below outline how this work has specifically integrated the State interests for bushfire (relevant to the risk assessment), and the ten policy positions established by the Bushfire Resilient Communities Technical Reference Guide.

Table 44 - Summary of State interest considerations

State interest	Statement
Natural hazard areas are identified	For the purposes of this risk assessment, the State-wide Bushfire Prone Areas mapping is intended to be adopted as the hazard overlay mapping. This risk assessment identifies that updates to the current mapping is required to ensure small patches and corridors of vegetation are filtered out. Together with improved data inputs such as the 2020 Regional Ecosystem mapping, it is understood QFES is likely to undertake mapping updates prior to the adoption of a new Toowoomba Region Planning Scheme.
A fit-for-purpose risk assessment is undertaken	This fit-for-purpose risk assessment, along with accompanying parts of the broader Bushfire Risk Analysis, satisfies the State interest requirement to identify, analyse, evaluate and mitigate potential bushfire risk. This process is based upon the ANZ ISO 31000 and NERAG risk assessment frameworks, and aligns with the methodologies of the Queensland Emergency Risk Management Framework (QERMF) to the greatest extent possible.
Planning instrument response	The mitigation options identified by this risk assessment are contemplated in finer detail as part of Part C – Planning Issues and Options of this Bushfire Risk Analysis. This body of work will establish the land use planning considerations to guide Council's integration of risk-responsive policy and statutory measures within the new Toowoomba Region Planning Scheme.

In terms of risk acceptability, the policy positions of the Bushfire Resilient Communities Technical Reference Guide provide an opportunity to benchmark the observations and recommendations of this risk assessment in terms of risk tolerability and acceptability.

Specific assessment of risk tolerance / acceptability relative to each identified strategic planning risk identified by this risk assessment is provided in the risk register at Appendix E.

Table 45 - Summary of policy acceptability

BRC Policy	QFES policy approaches which guide acceptable and tolerable risk
Mapping	Mapping is robust and locally relevant.
	TOLERABILITY / ACCEPTABILITY ANALYSIS For the purposes of this risk assessment, the State-wide Bushfire Prone Areas mapping is intended to be adopted as the hazard overlay mapping. This risk assessment identifies that updates to the current mapping is required to ensure small patches and corridors of vegetation are filtered out. Together with improved data inputs such as the 2020 Regional Ecosystem mapping, it is understood QFES is likely to undertake mapping updates prior to the adoption of a new Toowoomba Region Planning Scheme.
Fit-for-purpose risk assessment	A fit-for-purpose risk assessment informs plan-making or amendments to achieve an acceptable or tolerable level of risk to people and property in bushfire prone areas.
	TOLERABILITY / ACCEPTABILITY ANALYSIS This fit-for-purpose risk assessment, along with accompanying parts of the broader Bushfire Risk Analysis, satisfies the State interest requirement to identify, analyse, evaluate and mitigate potential bushfire risk. This process is based upon the ANZ ISO 31000 and NERAG risk assessment frameworks, and aligns with the methodologies of the Queensland Emergency Risk Management Framework (QERMF) to the greatest extent possible.
Avoidance, or mitigate to an acceptable or tolerable level	The planning scheme or amendments following a risk assessment are based on the principle of avoidance as the first priority, and then mitigation of the risk to an acceptable or tolerable level.
	TOLERABILITY / ACCEPTABILITY ANALYSIS This risk assessment has identified a suite of mitigation options which inform Part C – Planning Issues and Options, and which are intended to yield residual risk as low as reasonably practicable. A risk register has been prepared for each strategic planning risk identified by the risk assessment, included at Appendix E. This risk register outlines the analysis of risk, including mitigation and effectiveness of mitigation, to understand likely residual risk. This provides the structure for analysis of tolerable and acceptable risk, as a result of strategic and statutory planning approaches highlighted by this Bushfire Risk Analysis, informing the new Toowoomba Region Planning Scheme.
Disaster management	Disaster management capacity and capabilities are maintained to mitigate the risks to people and property to an acceptable and tolerable level.

BRC Policy	QFES policy approaches which guide acceptable and tolerable risk
	TOLERABILITY / ACCEPTABILITY ANALYSIS A risk register has been prepared for each strategic planning risk identified by the risk assessment, included at Appendix E. This risk register outlines the analysis of risk, including mitigation and effectiveness of mitigation, to understand likely residual risk. This provides the structure for analysis of tolerable and acceptable risk, as a result of strategic and statutory planning approaches highlighted by this Bushfire Risk Analysis, informing the new Toowoomba Region Planning Scheme.
Urban design	Lot and neighbourhood layout and design mitigates the risks to people and property to an acceptable and tolerable level.
	TOLERABILITY / ACCEPTABILITY ANALYSIS This risk assessment discusses in detail the aspects of settlement patterns and associated statutory provisions which minimise risk to people and property. The broader Bushfire Risk Analysis articulates these exact provisions and their applicability as part of the new Toowoomba Region Planning Scheme.
Vulnerable uses	Vulnerable uses are not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service, there is no suitable alternative location and site planning can appropriately mitigate the risk.
	TOLERABILITY / ACCEPTABILITY ANALYSIS The Toowoomba region has long maintained policy provisions which have effectively avoided a proliferation of vulnerable uses from occurring in higher risk bushfire prone areas. This is achieved through implementation of the Limited Development Zone, as well as zoning and statutory planning approaches. This risk assessment recommends that a policy of avoidance of vulnerable facilities in the bushfire prone area across the region is maintained, unless overwhelming community need can be demonstrated. In this instance, strong statutory requirements should be applied to limit risk exposure to occupants, staff and emergency services.
Revegetation, rehabilitation and land management	Revegetation and rehabilitation avoids an increase in the exposure or severity of bushfire hazard.
	TOLERABILITY / ACCEPTABILITY ANALYSIS This risk assessment discusses the balance required between biodiversity and environmental values, and bushfire protection and how this can be achieved via statutory approaches. The broader Bushfire Risk Analysis articulates these exact provisions and their applicability as part of the new Toowoomba Region Planning Scheme.
	Development does not locate buildings or structures used for the storage or manufacture of materials that are hazardous in the context

BRC Policy	QFES policy approaches which guide acceptable and tolerable risk
	of a bushfire within a bushfire prone area unless there is no suitable alternative location.
Hazardous activities and storage	TOLERABILITY / ACCEPTABILITY ANALYSIS This risk assessment discusses incompatible land uses in bushfire prone areas. The broader Bushfire Risk Analysis articulates these exact provisions and their applicability as part of the new Toowoomba Region Planning Scheme.
	The protective function of vegetation arrangements that can mitigate bushfire risk are maintained.
Protective functions	TOLERABILITY / ACCEPTABILITY ANALYSIS This risk assessment discusses the balance required between biodiversity and environmental values, and bushfire protection and how this can be achieved via statutory approaches. The broader Bushfire Risk Analysis articulates these exact provisions and their applicability as part of the new Toowoomba Region Planning Scheme.
	Community infrastructure for essential services is not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service and there is no suitable alternative location, and further, the infrastructure can be demonstrated to function effectively during and immediately after a bushfire event.
Community infrastructure	TOLERABILITY / ACCEPTABILITY ANALYSIS The Toowoomba region has long maintained policy provisions which have effectively avoided a proliferation of community facilities and critical infrastructure assets from occurring in higher risk bushfire prone areas. This is achieved through implementation of the Limited Development Zone, as well as zoning and statutory planning approaches. This risk assessment recommends that a policy of avoidance of such facilities in the bushfire prone area across the region is maintained, unless overwhelming community need can be demonstrated. In this instance, strong statutory requirements should be applied.

9 Observations and recommendations

This section summarises the key observations and recommendations of this strategic land use planning-based risk assessment.

9.1 Risk assessment observations

The key observations drawn from the analysis and evaluation of potential bushfire related risks across the Toowoomba Region are summarised as follows:

- overall, this risk assessment identifies areas of potential overrepresentation of potential bushfire hazard under the current State-wide bushfire prone areas mapping, particularly in relation to small and isolated patches and corridors of vegetation within the Toowoomba urban area. This is likely to be addressed by forthcoming amendments to the mapping, undertaken by the State government.
- irrespective of the above, the Toowoomba Region is a fire-prone landscape, and its characteristics including fire weather and vegetation communities are continuing to evolve, translating to a higher likelihood of fire into the future as a result of climate change factors.
- the role of settlement policy, strategic and statutory land use planning can yield significant opportunities to reduce risk and ensure further growth is oriented to locations where the risk profile is as low as reasonably practicable. This process provides clarity and certainty to subsequent development assessment processes.
- those precincts of the Toowoomba Region identified as subject to a higher bushfire risk profile, pursuant to the QERMF risk analysis matrices, include:
    - Toowoomba urban area
    - Crows Nest – Rosalie
    - Millmerran.
- these locations experience an elevated fire frequency compared with other areas of the region, which experience relatively less fire events – largely due to the fragmentation and limited extent and connectively of vegetation across the Condamine Plains.
- these areas also comprise considerably higher fuel loads, which (in areas) are amongst the highest in Queensland along the Great Dividing Range and Toowoomba Escarpment area, of approximately 35 tonnes per hectare.
- the topography along the Toowoomba Escarpment and Great Dividing Range is steep, which combined with its extensive fuel load, has the potential to derive significant fire intensity and behaviour under certain conditions.
- the majority of fire-driven winds in this region are likely to emanate from the west, from the dry continental interior. This may mean a lower likelihood of fire moving upward on the Escarpment or the Great Dividing Range however, fire frequency mapping indicates that fire in these locations is still relatively high.
- the vulnerability to fire in the above locations is high to extreme. The housing stock in each precinct is relatively aged, on proportion, and the majority are not constructed to AS3959 standard or current planning provisions. Many locations also do not include observable asset protection zones separating dwellings from the source of hazard.

- the consequence of fire in the above locations is moderate to major having regard to the potential risks to life, property, infrastructure, environmental and economic values.
- some townships across the region include lands with the ability to accommodate further residential development, and therefore population increase. This is largely associated with the rural residential zone, of which there appears to be a relative surplus across some communities. These townships include Hampton, Crows Nest and Millmerran. The same is also consistent for Cecil Plains, largely associated with potential for further development in the township zone.
- in these same areas, exposure of the key evacuation route network is also observed.
- the above observations are consistent with the nature of transitional zoning and land use which are typically located at the urban bushland interface. This is part of the function of these zones.
- a spectrum of planning options exist to consider the hazard and risk profile for these locations, to be considered by Council as part of its settlement policy formulation underpinning the preparation of the new planning scheme.
- in relation to primary future growth areas of the region, the Toowoomba Escarpment and Great Dividing Range provides a significant physical constraint to the immediate east of the Toowoomba urban area. It is acknowledged that current and historical strategic planning activities have identified the city to Highfields corridor as a key growth corridor within the region, which is likely to be sustained and expanded into the future.
- land to the east of the New England Highway is subject to significant fuel loads and steep topography. Future growth therefore should seek to avoid any further densification of development and population in this location. It is noted that Council's disaster management efforts already focus extensively on working with communities across the Toowoomba Escarpment.
- having regard to the city to Highfields corridor, lands to the south (Mount Kynoch – west of the highway) and west of Highfields incorporates mostly medium potential bushfire hazard, which presents a pockets or patches of isolated bushland in a highly fragmented manner. Some small, isolated areas of higher hazard exist in the area west of Highfields however, this is significantly limited in comparison with that area east of the New England Highway.
- potential future growth of the Highfields corridor may limit risk by orientating development to the immediate west of Highfields, in Woolmer and Cawdor towards Meringandan, and south of Meringandan Road. In this location, statutory planning measures may be more effective in limiting risk to a tolerable level.
- in relation to the Toowoomba urban area, that area to the west of the city including parts of Glenvale, Drayton, Westbrook and parts of Wellcamp is subject to highly fragmented and isolated pockets of potential bushfire hazard, with a limited incidence of high or very high hazard. The extent of hazard in this location is significantly lower than those areas to the east, along the Toowoomba Escarpment.
- it is acknowledged the escarpment area of the city has been historically developed over time, and is exposed to relatively high hazard. It is also relatively vulnerable, based on the nature of construction and types of land uses.
- *ShapingSEQ* identifies a combination of consolidation (infill) as well as expansion in order to accommodate further growth of the region. Thus over time, it may be assumed that properties within the bushfire prone area along the escarpment may be redeveloped. Whilst design and construction provisions may apply, land use

provisions may equally limit considerable population increase in this area. Whilst it is recognised that infill targets may apply, the bushfire prone area of the Toowoomba Escarpment is not identified as a location where increased density infill development should be encouraged or supported, where involving potential population increase.

- a combination of Council planning, disaster management, engineering, roads and transport parks and open space should collaborate to address the resilience of the existing rural residential communities to the west of Millmerran. Further expansion of rural residential development in this location should not be supported on the basis of the existing bushfire risk profile of this location.

9.2 Risk assessment recommendations

The following table outlines the extent of recommendations identified by this risk assessment for further consideration as part of the Toowoomba Region Futures Program.

Table 46 - Summary of risk assessment recommendations to inform policy, strategy and statutory planning

ID	Recommendation	Responsibility
01	Work with the State government as part of ongoing updates and amendment processes supporting the State-wide BPA mapping to address the patch and corridor mapping issues observed by the risk assessment within the Toowoomba urban area.	Queensland Government Toowoomba Regional Council
02	Consider the quantum of potential for growth in the townships of Hampton, Crows Nest, west of Millmerran and Cecil Plains relative to their hazard and risk profile and exposure of evacuation networks to identify appropriate risk-responsive land use planning controls.	Toowoomba Region Futures Program.
03	Consider a policy of avoidance of vulnerable facilities in the bushfire prone area across the region. Where such uses are necessary, contemplate the strength of statutory controls which acknowledges these uses rarely require a bushfire building response under AS3959.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
04	Explore the opportunity to align the definition of vulnerable uses (defined by the SPP guidance materials) with that which applies to flood under the current planning scheme, to aid in consistency.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
05	Consider the existing exposure and vulnerability elements of this risk assessment, to support and inform Council's broader disaster management risk assessment processes pursuant to the QERMF.	Council's disaster management team.
06	Consider the opportunity to introduce design related aspects into the bushfire hazard overlay code, having regard to the provisions contained in the *Bushfire Resilient Building Guidance for Queensland Homes*, released by the Queensland Government. Design elements currently form a major gap in bushfire resilience planning provisions.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
07	Explore opportunities for statutory planning provisions to appropriately address the bushfire resilience of land uses and activities not subject to AS3959 including short term	Part C – Planning Issues and Options reporting

ID	Recommendation	Responsibility
	accommodation, tourist activities, fuel stations, feed lots, hay storage, industrial activities and vulnerable facilities and critical infrastructure where these cannot be avoided in a bushfire prone area.	of the Bushfire Risk Analysis project.
08	Ensure the new planning scheme appropriately balances the competing planning policy issues of biodiversity and environmental protection with bushfire protection and mitigation.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
09	Consider the need for a bushfire planning scheme policy as part of the new planning scheme. This may provide detail to assist in achieving consistency of bushfire hazard assessments and management plans submitted to Council via the development assessment process. It may deal with standardisation of FFDI inputs, provisions for asset protection zones, evacuation road network guidance and vegetation management information.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
10	Collaborate across Council to determine appropriate pathways for compliance for ongoing compliance of approved bushfire management plans, and options to ensure these are communicated appropriately to property owners in perpetuity. A local law approach may assist.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
11	Upon identification of potential growth areas and urban form framework, addendum bushfire risk analysis should be undertaken to verify the risk-responsiveness of the settlement policy and test the draft planning scheme provisions prior to State interest review.	Bushfire Risk Analysis project.
12	Ensure zoning and other settlement policy decisions are informed by considerations for evacuation, having regard to: • the existing and potential exposure of the road network to bushfire attack • the ability to provide / retain multiple egress route options • the capacity of the road network to support emergency evacuation • road network design and construction • identifying and mitigating potential route bottlenecks during emergency evacuation	New growth areas within the region must have the capacity and capability to conceive a road network which effectively and efficiently conveys traffic out of or immediately away from bushfire interface areas. This should be contemplated as part of the land use implications of the major infrastructure study, and the Toowoomba Region Growth Plan and Urban Form Framework studies.

ID	Recommendation	Responsibility
13	Consider a settlement policy which focusses on expansion of existing growth corridors and urban areas west of city and west of Highfields. Avoid a settlement policy which enables continued expansion east of the New England Highway or north of Meringandan Road, on the western side of the highway.	Toowoomba Region Futures Program.
14	Consider the integration of provisions within the statutory context which focus on mitigating the risk of urban fire intrusion for new settlement at the urban bushland / grassland interface.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
15	Consider the potential development yield of existing rural residential zoned allotments along the escarpment, the intention of the existing zoning rationale, and the tolerability of further development, relative to the risk profile of this location.	Toowoomba Region Futures Program.
16	Develop a suite of criteria to inform ongoing growth and urban form planning, to ensure bushfire resilience is factored in as part of these processes.	Part C – Planning Issues and Options reporting of the Bushfire Risk Analysis project.
17	Consider the development of whole-of-township bushfire management plans, developed via multi-disciplinary input from across Council, for Hampton, Crows Nest and Cooyar.	Council's disaster management team, with support from broader Council teams.
18	On balance of the observations of this risk assessment and having regard to the findings of the 2020 University of Southern Queensland study into community preparedness across the Toowoomba Region Escarpment, consider the development of a bespoke education program to support communities to better understand their risk and prepare for bushfire. This may include support for business continuity planning with an emphasis on the agricultural sector.	Toowoomba Regional Council, QFES and Get Ready Queensland
19	Ensure the new planning scheme provisions are sufficiently robust to avoid further rural residential expansion within bushfire prone areas west of Millmerran.	Toowoomba Region Futures Program.
20	Council planning, disaster management, engineering, roads and transport parks and open space should undertake a charrette process to unpack and identify risk issues and opportunities to enhance the existing resilience of rural residential areas west of Millmerran.	Toowoomba Region Futures Program.

9.3 Bushfire risk-responsive growth opportunities

Having regard the quantum of observations and recommendations outlined above, and noting the future demand for increased urban development likely to occur in Toowoomba into the future, the following locations are identified for Council consideration.

This highlights that potential for growth that is oriented to the west of Highfields, and west of the city towards Westbrook. Whilst hazard is still present in this location, it exists in a more fragmented context and incorporates vegetation communities which comprise a considerably lower fuel load compared with areas on the Escarpment. These areas also offer increased ability for the effectiveness of statutory provides to reduce risk to a tolerable level.

Overall, such an approach orients hazard away from higher hazard locations in the region, which yields dividends from a risk avoidance and mitigation perspective.

This approach has the potential to be supplemented by:

- strategic approaches and statutory provisions to limit increased risk from consolidation (infill) requirements within the Toowoomba urban area precinct; and
- strategic and statutory approaches which seek to mitigate risk increase in townships across the region, as well as for agricultural and other regionally-significant economic activities.

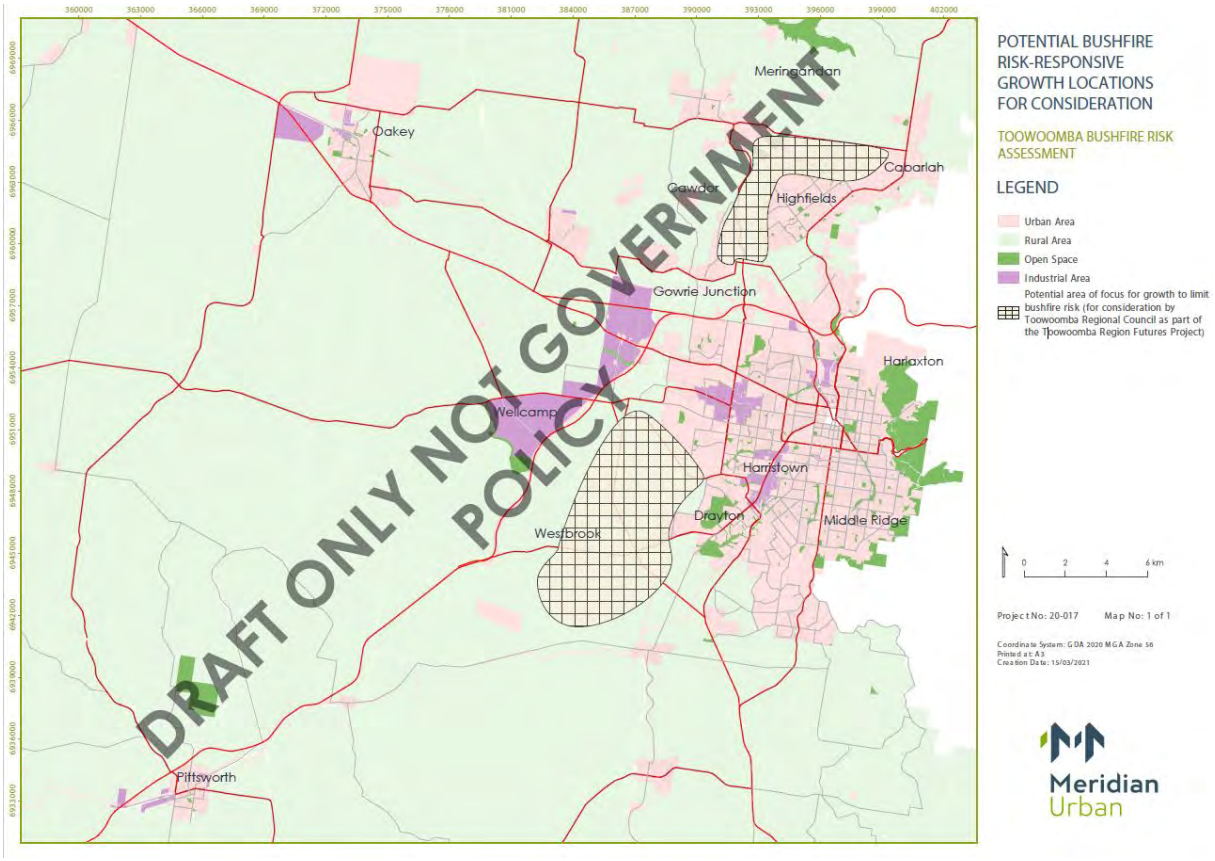


Figure 44 - Potential bushfire risk-responsive growth locations for consideration

9.4 Next steps – planning issues and options

This Part B – Risk Assessment is followed by a detailed body of work which focusses exclusively on the planning issues and options identified by this risk assessment, to inform Council policy direction and the drafting of statutory provisions that are intended to form part of the new Toowoomba Region Planning Scheme. Refer to Part C – Planning Issues and Options Analysis.

BUSHFIRE RISK ANALYSIS

Part C - Issues and options analysis

Meridian Urban

1 Introduction

The intent of this issues and options analysis is to examine the current expectations of the State Planning Policy in relation to how local planning instruments must address bushfire risk, as well as consider the existing bushfire provisions under the Toowoomba Regional Planning Scheme (TRPS) and other associated Council documents. It also contemplates the observations and recommendations of Part B of the Bushfire Risk Analysis which is the risk assessment, and Council feedback through workshopping processes in relation to policy and regulatory pathways for risk-responsive bushfire planning mechanisms.

This issues and options analysis focusses on the interlinkages between policy issues and on-the-ground conditions and outcomes as they relate to land use planning, disaster management, land and open space management, asset management and governance.

This analysis seeks to inform the formulation of Council's proposed new planning scheme as it relates to bushfire hazard and achieving alignment with the current *State Planning Policy July 2017* (SPP 2017), and the State interest guidance materials which are required to be appropriately integrated into local planning instruments. Specifically, the analysis will focus on:

- summarising legislation, best practice guidelines and guidance material relevant to bushfire requirements for planning schemes in Queensland;
- an assessment of the existing bushfire-related provisions under the TRPS;
- commentary in relation to the observations and recommendations articulated by Part B – Risk assessment; and
- providing options in relation to the nature of bushfire protection provisions as part of the preparation of the new planning scheme.

1.1 Objectives

The objectives of this bushfire risk analysis, including the planning issues and options analysis, are:

- to assist risk-informed land use planning policy, strategy and statutory controls to underpin a new planning scheme for the Toowoomba Region; and
- to transfer the quantified risks identified in Part B of the risk analysis to a format for policy and strategy responses across the spectrum of avoid, mitigate, accept and transfer. It considers risk multipliers such as climate change, rainfall trends and settlement patterns, and applies this to the Toowoomba Region and its aspirations as a growing community; and
- to define localised risk levels through benchmarking and principles-based approaches for acceptable or tolerable risk; and
- identification of the relevant strategic and statutory planning provisions which may be considered in response to the above matters.

The objectives will inform the final component of the risk analysis, the drafting of relevant bushfire hazard and risk provisions for the new planning scheme, including a new draft bushfire hazard overlay code and draft planning scheme policy.

2 Issues and options analysis scope

This issues and options analysis forms Part C of a suite of three documents which form the bushfire risk analysis, as set out in the figure below.

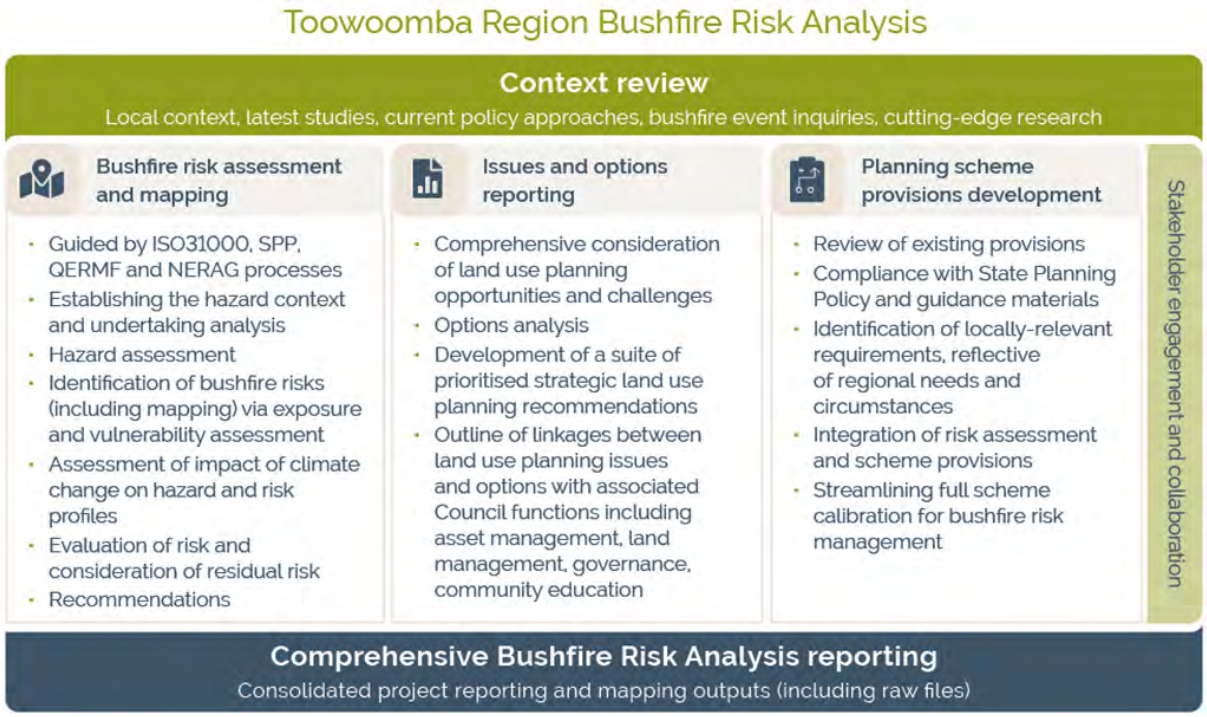


Figure 45 – Toowoomba Region bushfire risk analysis project framework and staging

The scope of this issues and options analysis incorporates the following aspects:

1. a summary of current legislation, regulatory provisions, SPP requirements and guidance material relating to the integration of bushfire hazard provisions within planning schemes which:
    - summarises the key state-level documents including:
        - the *State Planning Policy July 2017* (SPP 2017);
        - '*Integrating state interests into a planning scheme – guidance for local governments*' (SPP bushfire guidance 2021);
            - *including the (now repealed) State Planning Policy – state interest guidance material: Natural hazards, risk and resilience – bushfire, December 2019*; and
        - *Bushfire Resilience Communities – Technical reference guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire', October 2019* ('Bushfire Resilient Communities' technical reference guide).
    - sets out the hierarchy of applicable documents, which set the benchmark against which the planning scheme's provisions will be measured; and
    - summarises the role and function of each relevant document.
2. a review of the current planning scheme provisions related to bushfire hazard including:
    - the strategic framework and strategic intent;

- Part 5.10 – Categories of development and assessment – overlays, and ensuring bushfire requirements are appropriately 'triggered';
- Part 8.2.2 – Bushfire hazard overlay code; and
- other relevant sections of the Planning Scheme.

3. consideration of the range of land use planning opportunities and challenges emerging from Park B – Risk assessment, and an analysis of these options.
4. prioritised land use planning and scheme calibration opportunities for Council to consider to inform statutory drafting of bushfire hazard provisions as part of the new planning scheme.

3 Methodology

Having regard to the scope identified above, the process adopted by this analysis takes an integrated approach to the consideration of the state planning framework and policy environment as it relates to planning for bushfire hazard. The review will also have regard to national disaster management and best practice approaches.

This integrated approach will derive a set of policy benchmarks by calibrating the various aspects of the SPP 2017 alongside the provisions of the SPP Bushfire Guidance 2021 and the 'Bushfire Resilient Communities' Technical Reference Guide while also having regard to the national policy setting and disaster management arrangements. The policy benchmarks will therefore articulate the state interest requirements for natural hazards, risk and resilience with regards to bushfire as well as ensuring an alignment with the national policy setting and disaster management arrangements from a land use planning perspective.

Having regard to the best practice documents and measures, and identified policy benchmarks, a comprehensive review of the TRPS's bushfire provisions has been undertaken. The observations from this current state-of-play are then contemplated in conjunction with the risk observations drawn from the Part B Risk Assessment component of this risk analysis, and the spatial, policy and statutory tools which are available to Council to support the calibration of a bushfire risk-responsive new planning scheme for the Toowoomba Region.

Councillor and Council officer workshopping processes were undertaken as part of this analysis, to explore the existing issues and challenges associated with planning for bushfire hazard and risk in the region, and the desired policy and regulatory pathways preferred by Council.

The methodology which underpins the bushfire risk analysis approach is illustrated in the figure below.

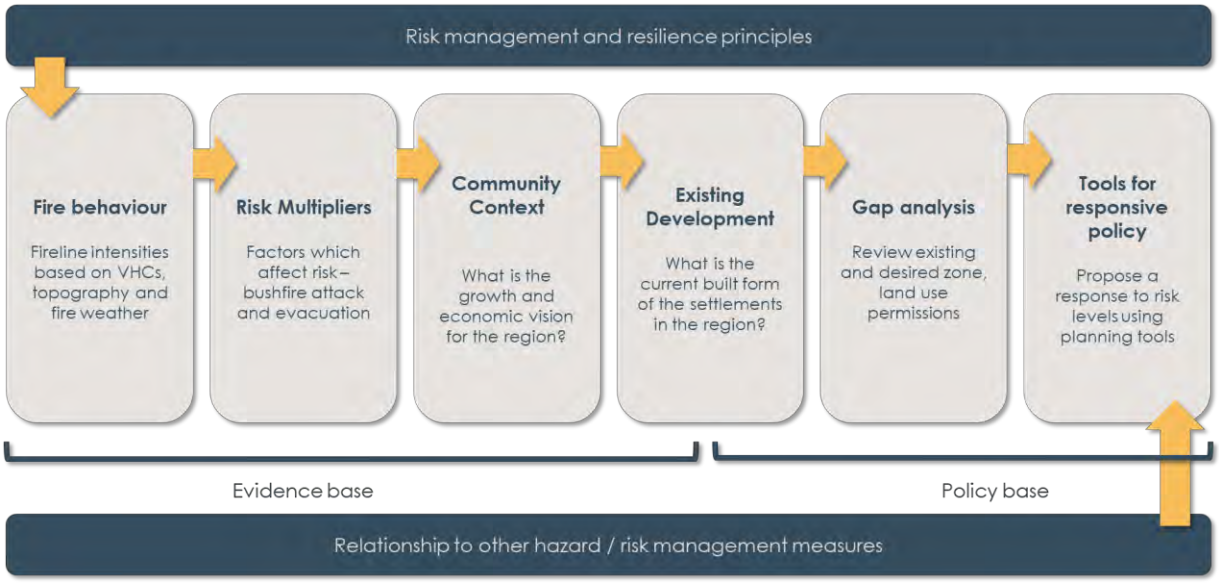


Figure 46 - Risk-based bushfire planning methodology

4 Legislative and regulatory requirements

This section provides an overview of the current policy, regulatory and best practice material relating to the integration of bushfire hazard into land use planning contexts in Queensland. This section should be read in conjunction with Section 4 of Part A – Contextual Review which provides a high-level overview. This section provides greater detail with respect to key documents to inform the issues and options analysis.

The past ten years has seen a dramatic shift in research, knowledge and policy which guides bushfire protection in the land use planning context. One of the key catalysts for this shift were the events of Black Saturday in Victoria on 7 February 2009 which claimed the lives of 173 people and remains Australia's worst bushfire disaster in terms of lives lost.

Importantly, almost 30 per cent of the recommendations made by the Victorian Bushfires Royal Commission in 2010 were focussed on land use planning, representing the single highest proportion of recommendations made. These were not specific to just Victoria, and other state jurisdictions across the country subsequently changed their respective land use policy settings as they related to bushfire protection, following the recommendations handed down. This included Queensland.

Following this event, much scientific and social-science research into bushfire behaviour, human behaviour, building loss, building materials and land use planning has occurred, giving rise to the combination of bushfire protection measures which are in place in Queensland and across Australia today.

Moving forward to 2018 and 2019, following years of drought conditions, bushfire activity across Queensland was extreme with multiple ignitions across the state and extreme bushfire behaviour. The 2019-20 fire season brought extensive fire activity across the Toowoomba Region. The Black Summer events have been a turning point in Queensland and this coincided with the release of guidance material supporting the implementation of the State Planning Policy and the natural hazards (bushfire) state interest.

The following sections summarise the key state planning framework provisions as they relate to bushfire hazard.

4.1 Legislation

4.1.1 Planning Act 2016

The premise for protecting people and property from natural hazards (including bushfire) and enhancing the community's resilience to natural hazards, is established through the purpose of the *Planning Act 2016* (Planning Act) which states '*establish an efficient, effective, transparent, integrated, coordinated, and accountable system of land use planning (planning), development assessment and related matters that facilitates the achievement of ecological sustainability*' (Queensland Government, 2020). More specifically, ecological sustainability is defined as a balance that integrates:

a. *the protection of ecological processes and natural systems at local, regional, state, and wider levels; and*

b. *economic development; and*

c. *the maintenance of the cultural, economic, physical and social wellbeing of people and communities (Queensland Government, 2020).*

Where maintaining the cultural, economic, physical and social wellbeing of people and communities includes, amongst other matters:

- *creating and maintaining well-serviced, healthy, prosperous, liveable and resilient communities with affordable, efficient, safe and sustainable development; and*

- *accounting for potential adverse impacts of development on climate change, and seeking to address the impacts through sustainable development (sustainable settlement patterns or sustainable urban design, for example)* (Queensland Government, 2020).

The Planning Act establishes the system for achieving ecological sustainable development which includes:

- state planning policies, and now the state planning policy (SPP 2017), which expresses the state's interests in land use planning and development. Natural hazards, risk and resilience is identified as a key state interest which seeks that '*the risks associated with natural hazards, including the projected impacts of climate change, are avoided or mitigated to protect people and property and enhance the community's resilience to natural hazards*' (Queensland Government, 2017).

- regional plans, which provide the strategic direction to achieve regional outcomes that align with the state's interests in land use planning and development. More specifically, the Darling Downs Regional Plan (DD Regional Plan), which acknowledges that 'natural hazards create an array of challenges for the Darling Downs region affecting the liveability, productivity and communities of the region' (State of Queensland, 2013).

  The DD Regional Plan does note however, that the achievement of the State Interest in relation to natural hazards is not reliant on 'strategic direction established through a statutory regional plan'.

- planning schemes and planning scheme policies, which set out the local government's plan for the future direction of their local government area, whilst integrating the needs of the state and the region; and

- a development assessment system, for implementing the planning instruments.

4.1.2 Planning Regulation 2017

The Planning Regulation 2017 prescribes instruments and addresses the detail of matters provided for under the Planning Act 2016, providing the mechanics for the operation and implementation of the Act.

Amongst other matters and in particular relation to bushfire, the Regulation provides the following:

- a prohibition on the ability for planning instruments to identify a material change of use for a dwelling house in a residential zone subject to a bushfire hazard overlay on premises less than 2,000m^2 as assessable development;

- provisions for operational work for necessary firebreaks or fire management lines and exempt clearing work as per the provisions outlined in the Vegetation Management Act;

- provisions for development in koala priority areas and habitat areas (noting the Toowoomba Urban Area forms part of the State's identified koala district);

- requirements for cropping involving forestry or wood production, including provisions for firebreaks, fire trails and fuel reduced areas. It also prescribes separation distances for dwellings from cropping involving forestry or wood production for fire protection purposes;

- clearing provisions by fire for land dedicated as road under the Land Act, under the Emergency Services Act to reduce hazardous fuel loads (along road reserves)

- definitions of 'essential management' in relation to fire management.

4.2 State planning instruments

4.2.1 State Planning Policy 2017

The overarching policy intent for the natural hazards, risk and resilience state interest has remained consistent throughout the various iterations of the state planning policy, being that '*the risks associated with natural hazards, including the projected impacts of climate change, are avoided or mitigated to protect people and property and enhance the community's resilience to natural hazards.*'

State Planning Policy 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03) took effect on 1 September 2003. With regards to making or amending a planning scheme, SPP 1/03 required planning schemes to:

- identify natural hazard management areas, with the associated *State Planning Policy Guideline – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide, June 2013* (SPP 1/03 guideline) recommending a comprehensive and detailed natural hazard assessment study be undertaken using a disaster risk management process, with Appendix 3 setting out the principles and methodology for a bushfire natural hazard assessment; and
- include strategies and codes that aim to ensure development is compatible with the nature of the natural hazard, impacts are minimised and development does not increase the severity of the natural hazard, with the SPP 1/03 guideline providing that:
    - there should not be an increase in the number of people living or working in natural hazard management areas;
    - the establishment or intensification of uses or works that are likely to increase the adverse impacts of the natural hazard are avoided;
    - when allocating land uses in natural hazard management areas, planning schemes should give preference to those uses that are less susceptible to the risks posed by the particular hazard;
    - land uses that would increase the extent or severity of bushfire hazard (such as the establishment or expansion of commercial forests) should be encouraged in areas where they would not place existing and planned communities or facilities at greater risk from bushfires; and
    - key factors to be considered include the likely speed and direction of bushfire movement, the provision of adequate on-site firebreaks, fire-fighting and fuel reduction measures and separation distances from susceptible development and incompatible planning scheme designations (Queensland Government (Department of Local Government and Planning and Department of Emergency Services), 2003).

Over the past 10 to 20 years the approach to planning for bushfire hazard in Queensland has evolved considerably. The science which underpins current state-based policy and guidance has advanced on the basis of new research, understanding of bushfire behaviour dynamics and its interface with the built environment. Namely, this includes how bushfire impacts upon communities, infrastructure and dwellings, which has enabled the formulation of enhanced policy and development controls for community bushfire resilience.

In December 2013, the state planning policies were replaced with a single *State Planning Policy, December 2013* (SPP 2013) – bringing together the 16 state interests arranged under five broad themes, including hazards and safety, which included the state interest in natural hazards. With regards to bushfire, planning schemes were required to:

- identify bushfire natural hazard areas;

- include provisions that seek to achieve an acceptable or tolerable level of risk, based on a fit for purpose natural hazards study and risk assessment;
- include provisions that require development to avoid or mitigate the risks, support and not unduly burden disaster management response and recovery, avoid an increase in severity, and maintain and protect natural processes and functions that can mitigate the risks; and
- facilitate the location and design of community infrastructure to maintain the required level of functionality during and after an event (Department of State Development Infrastructure and Planning, 2013).

The State Planning Policy has evolved through a number of iterations since its inception in 2013 including amendments to the state interest relating to natural hazards. Notable amendments include:

- requiring a fit-for-purpose risk assessment consistent with AS/NZS ISO 31000:2009 Risk Management (SPP July 2014);
- improved methodology for state-wide mapping of bushfire prone areas (SPP July 2014);
- the introduction of a state interest guideline for each state interest including the *State Planning Policy – state interest guideline: Natural hazards, risk and resilience, April 2016* (Natural hazards guideline 2016) and compendium guidance material, the *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'*
- development requirements should ensure that development within an area affected by a natural hazard:
    - avoids or mitigates the risks to people, property and infrastructure to an acceptable or tolerable level;
    - does not increase the number of people at risk to an intolerable level;
    - provides safe and efficient access and operation for emergency services;
    - enables safe shelter or self-evacuation of occupants and visitors via safe routes;
    - does not cause or contribute to an increase in the level of risk affecting surrounding areas; and
    - incorporates natural processes, landforms and vegetation that contribute to the mitigation of natural hazards and risks inform development design, location and operation (Department of Infrastructure Local Government and Planning, 2016).

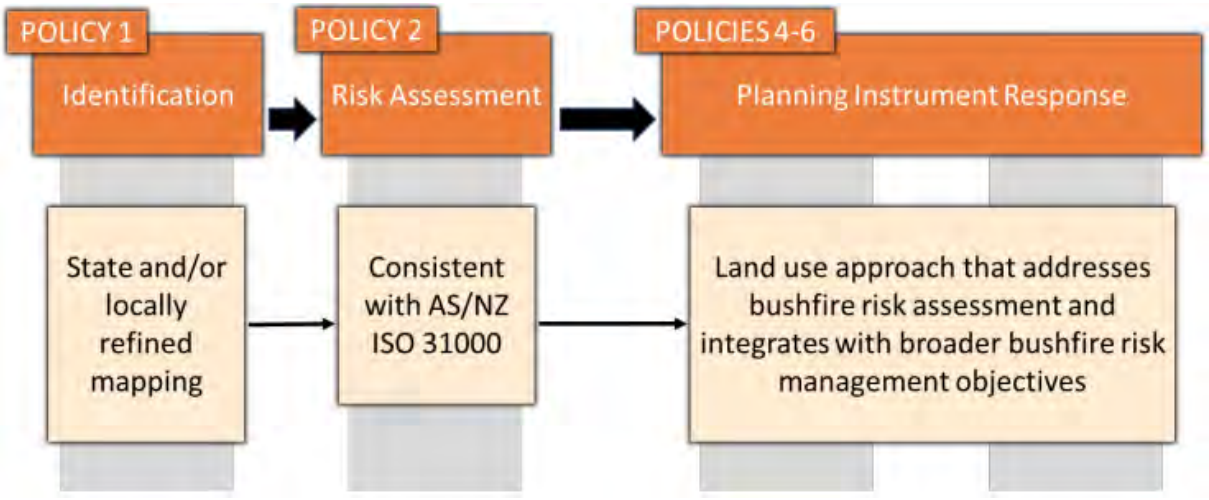


Figure 47 - Process for integration of State interest policy for natural hazard - bushfire prone areas into local planning instruments (Source: Queensland Government, 2019)

The current SPP 2017 saw the most changes to the state interest – natural hazards, risk and resilience. To meet the objectives of SPP 2017 for the state interest – natural hazards, risk and resilience, a local government must first follow the process of hazard identification (Policy 1) and risk assessment (Policy 2) to inform the preparation of planning scheme requirements for bushfire protection (Policies 4 to 6) (Queensland Government, 2017).

4.2.2 Guidance materials

In December 2019, the *State Planning Policy – state interest guidance material: Natural hazards, risk and resilience – bushfire, December 2019* was publicly released after several years of preparation which includes the following key elements of guidance (among other matters):

- a risk assessment be undertaken assessing the risks to proposed development, including people, property and infrastructure, resulting in the identification of land uses that are existing, proposed and should not occur in the natural hazard areas; the risk criteria (exposure, tolerability and vulnerability); any planning provisions used to ensure that the community is not exposed to an unacceptable level of risk; and the hazard and risk information required to achieve the planning provisions; and
- the model code provisions contained in Part D be used and tailored to meet the local needs and circumstances however, the bushfire hazard model code was under review and therefore, it was noted that development requirements in bushfire hazard areas could be limited to appropriate land uses, property access, management of open space (including protection of vegetation) and provision of bushfire management trails, an adequate water supply for fire fighting and adequate evacuation routes.

In May 2021, the 2019 SPP bushfire guidance was superseded by the new *Integrating State Interests in a Planning Scheme* document which combined all guidance documents supporting the SPP into a single, consolidated document.

A compendium document prepared by QFES was also released in 2019 (but remains a separate document to the SPP bushfire guidance 2021), titled *Bushfire Resilient Communities – Technical reference guide, October 2019* (herein referred to as the 'Bushfire Resilient Communities' technical reference guide), which contains further detailed information for planning scheme preparation, consideration of bushfire risk and the preparation of bushfire hazard assessments as part of the development assessment process.

Both documents are non-statutory however, they represent a considerable advancement in bushfire planning for Queensland.

A new methodology for state-wide mapping of bushfire prone areas in Queensland, developed in partnership between the CSIRO and QFES, was used to produce the current state-wide Bush Fire Prone Area map, which improved upon the previous SPP 1/03 bushfire mapping methodology by providing more in-depth consideration of regional differences in fire weather severity and diversity of vegetation types (Queensland Government, 2019, Queensland Fire and Emergency Services, 2019).

Appendix G sets out the current policy requirements and guidance related to bushfire protection through the Queensland land use planning framework, including the identification of policy benchmarks (and associated criteria) required to be met by the new Toowoomba Regional Planning Scheme.

These benchmarks also perform the acceptability criteria against which the assessment of bushfire risk is carried out as part of Part B – Bushfire Risk Assessment.

Whilst not a statutory document and not forming part of the SPP guidance materials for bushfire, the newly-released '*Bushfire Resilient Building Guidance for Queensland Homes*' authored by the Queensland Reconstruction Authority and CSIRO provides suite of better-practice opportunities for bushfire resilient building design which is capable of being incorporated into local planning instruments.

4.2.3 Regional plans

The Toowoomba Region is subject to two Regional Plans. *ShapingSEQ*, which relates only to the Toowoomba Urban Area as well as the Darling Downs Regional Plan which covers the Toowoomba Urban Area and the balance of the Toowoomba Region.

4.2.3.1 ShapingSEQ

The South East Queensland Regional Plan, *ShapingSEQ*, includes the urban areas of Toowoomba with a focus on new regionally important infrastructure such as the Wellcamp Airport and the Western Gateway regional economic cluster which will have implications for the broader regional planning.

The portion of Toowoomba which is incorporated into *ShapingSEQ* is relatively small compared to the balance of region, and is confined to the Toowoomba Urban Area but includes higher hazard bushfire prone areas across the escarpment from the Lockyer Valley up the range to the city.

The SEQRP has six themes of grow, proper, connect, sustain and live in a positive manner which leaves the mapping of detailed planning constraints and natural elements largely to local governments. Toowoomba's role in the SEQRP is connecting and growing through the regional economic cluster. This does have flow on effects for the growth of Toowoomba. The SEQRP supports more detailed planning and SPP positions through inclusion of policy summary statement in the 'strategies' sections of each theme.

The Western Gateway regional economic cluster includes the University of Southern Queensland, Toowoomba public and private hospitals precincts and the TAFE Queensland campus. There is a major enterprise and industrial area targeted for expansion through the enabling infrastructure of the airport, rail network and highway networks focusing on freight. Toowoomba is identified as a regional activity centre in the plan and in the 'grow theme' is described:

> *'Major cities will be located on the Gold Coast and Sunshine Coast along our great coastline, and inland, at Ipswich. Toowoomba, a major gateway city situated on the crest of the Great Dividing Range, will connect SEQ with the west and provide a temperate climate alternative in the region.'*

With specific regard to bushfire and other natural hazards, one of the key opportunities identified by *ShapingSEQ* in addressing trends of increasing exposure, is the adoption of

settlement patterns which focus growth in existing urban areas. Development within Rural Living Areas (RLAs) is also flagged, with a key principle for these locations to avoid unacceptable risk. RLAs within the Toowoomba Urban Area are located around Highfields, Cabarlah and toward Meringandan, as well as several smaller pockets.

Potential hazard in areas around Cabarlah is identified within Part B – Risk Assessment at the upper end of the risk spectrum.

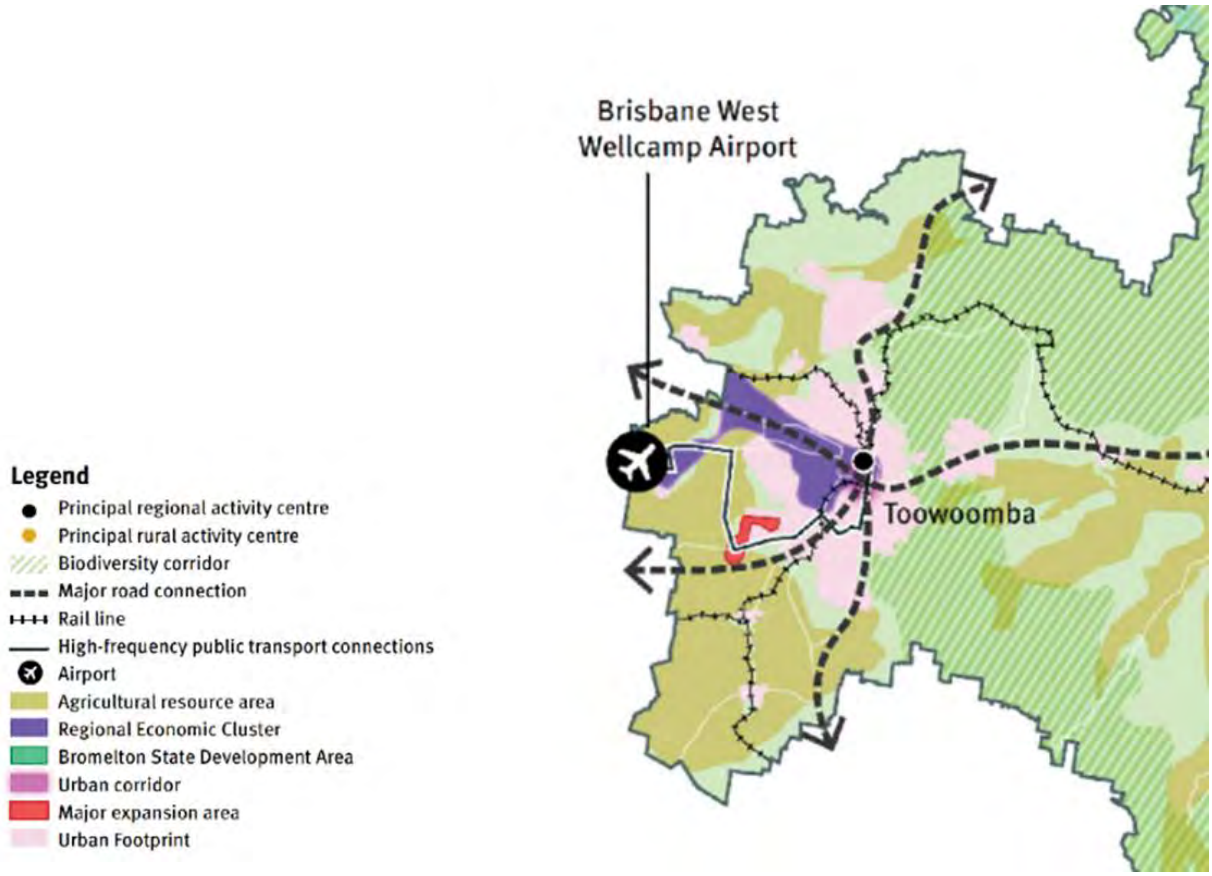


Figure 48 - Extract of the ShapingSEQ western sub-region map (Source: Queensland Government, 2017)

4.2.3.2 Darling Downs Regional Plan

The Darling Downs Regional Plan was prepared in 2013 and includes six local government areas:

- Balonne Shire Council
- Goondiwindi Regional Council
- Maranoa Regional Council
- Southern Downs Regional Council
- Toowoomba Regional Council; and
- Western Downs Regional Council.

This effectively covers the Condamine basin which flows into the Murray Darling. The plan predates the *Planning Act 2016* and the State Planning Policy 2017.

The regional plan was particularly relevant for emerging mining activity further west and attempted to address conflict of state interests through Priority Living Areas (PLAs), Priority Agricultural Areas (PAAs) and Priority Agricultural Land uses (PALUs) in relation to the not yet gazetted *Regional Planning Interest Act* of 2014. The PAAs designation provided the basis of

the regionally-specific policy of providing certainty to the agriculture industry in the face of growing coal seam gas industry. The majority of the PAA is found in Toowoomba, Southern Downs and Western Downs.

In contrast, the PLAs safeguard urban land uses from the same encroachment. Many small settlements and townships have a designated PLA. The region was already noted by the regional plan as being a primary connector in all directions and an important linkage and freight hub.

The issue of bushfire hazard is not emphasised within the regional plan, noting it incorporates an understandable natural hazard focus on flood for the region.

4.3 Statutory instruments

4.3.1 Minister's Guidelines and Rules

The Minister's Guidelines and Rules (MGR) sets out the rules and processes for a range of activities, including local government plan-making, local government infrastructure plans and Ministerial and local government designations.

Chapter 4 outlines the Minister's rules for making a planning change to reduce a risk of serious harm to persons or property on the premises from natural events or processes. This includes the process for preparing a feasible alternatives assessment report, where required. It also prescribes requirements for notifying land owners of the planning change.

The MGR is supported further by a document entitled 'Guidance for the Minister's Guidelines and Rules: Guidance for Plan-Making'. This document provides additional detail in relation to plan-making processes, scheme amendments, provisions for temporary local planning instruments and local government infrastructure plans.

The document outlines the relevant planning changes to reduce risk of serious harm from natural events or processes, including re-zoning (or back-zoning, down-zoning, etc.) land to exclude land uses that would be at intolerable risk from a natural hazard. It also includes changes to hazard overlay mapping, tables of assessment and hazard codes. It details what are considered to be adverse planning changes, which relates to changes to local planning instruments that reduces the value of an interest in premises, for which compensation may be payable by a local government to an affected land owner.

In response to local government concerns that compensation arrangements were hindering plan-making to mitigate natural hazards, the Queensland Floods Commission of Inquiry and the Commonwealth Productivity Commission recommended the removal of compensation provisions from the state's planning legislation in relation to natural hazards planning changes.

Accordingly, section 30(4)(e) of the Act, states that a planning change is not an adverse planning change, and compensation is not payable if the change is made:

- to reduce a material risk of serious harm to persons or property on the premises from natural events or processes (bushfires, coastal erosion, flooding or landslides, for example); and
- following the process set out by the MGR, chapter 4.

4.3.2 Development Assessment Rules

The Development Assessment Rules document is a statutory instrument made under section 68(1) of the *Planning Act 2016*. It sets out the Minister's rules for the development assessment process in Queensland, including the processes and procedural requirements of the planning system. This document is further supported by a detailed guidance document.

4.3.3 State Development Assessment Provisions

The State Development Assessment Provisions (SDAP) provide assessment benchmarks for the assessment of development applications where the chief executive is the assessment manager or a referral agency.

Through the State Assessment and Referral Agency (SARA), the chief executive of the Act (the Director-General of the Department of State Development, Manufacturing, Infrastructure and Planning) is the assessment manager or referral agency for development applications where there is a matter of interest to the state.

Development applications assessed against the SDAP will sometimes involve multiple matters of state interest and trigger assessment against a number of different state codes. These codes relate to a range of issues including but not limited to development on land designated as state controlled roads, native vegetation clearing, hazardous chemical facilities, development in SEQ koala habitat areas and development for wind farms.

4.4 How to draft a local planning scheme

The (former) Treasury Planning issued a revised drafting guidance document in June 2020. Especially relevant in the drafting of overlay codes is the need to ensure vertical and horizontal alignment through the planning scheme from the overarching strategic and to ensure that the intent of the overlay functions in harmony with other parts. This begins with ensuring:

- the strategic outcomes flow consistently through the planning scheme, so where there is specific local policy response it is foreshadowed or captured at the outset;
- the allocation of spatial overlays aligns with and deliver on the strategic outcomes and associated strategic mapping;
- there is clear connection between the intent of the strategic outcomes and the intents of overlay codes and the regulatory response; and
- the assessment levels are appropriate to the intended regulatory response which connect to the assessment benchmarks, noting that only nominated benchmarks are applicable for code assessable development.

There are now limited mandatory components to a planning scheme.

It is assumed that overlays continue to take precedence over other planning considerations and that the tables of assessment will function using similar principles to the current planning scheme. Some of the matters that this project may need to consider include:

- whether the tables of assessment will function in a similar manner or if another style is chosen such as a matrix;
- the consistency of the new scheme drafting style with the current scheme in terms of land use thresholds and descriptors. Some variations include:
    - simple tables of assessment with definitions aligned minimal thresholds; or
    - extended tables of assessment with large thresholds and circumstances for accepted development subject to requirements listed rather than the codes (current style in part); or
    - thresholds for development included with definitions (e.g. 'Utility Installation where owned by the local government' in the left column of the assessment table).
- any policy decision on altering levels of assessment generally across a new scheme;

- any policy or drafting decisions on the hierarchy across the instrument. Currently overlays take precedence over other codes in most planning schemes; and
- any decision to amend default or overriding assessment level circumstances.

The future benchmarks will form a line of sight in policy progression in a logical transition from the levels of assessment within the tables.

4.5 Local planning instruments

Local planning instruments include the range of planning schemes and other associated instruments prepared an administered by local government. This includes planning schemes, temporary local planning instruments and planning scheme policies.

Importantly, Section 8 of the Planning Act 2016 provides that:

> '(5) A local planning instrument must not include a provision about building work, to the extent the building work is regulated under the building assessment provisions, unless allowed under the *Building Act*.
>
> (6) To the extent a local planning instrument does not comply with *subsection (5)*, the local planning instrument is of no effect'.

4.6 Building requirements

The planning system maintains a natural relationship with building provisions, notwithstanding the Planning Act provision identified above.

In specific relation to bushfire hazard, Section 1.6 of local planning instruments are intended to provide the linkage between planning and building provisions, declaring the 'designated bushfire prone area' for the purposes of the Building Code of Australia by citing the bushfire hazard overlay map as the trigger, and specifically the assessment of Australian Standard (AS) 3959 (2018) for Construction of Buildings in Bushfire Prone Areas (herein refer to as 'AS3959'), as the 'deemed to comply' requirements for the bushfire protection provisions of the Building Code of Australia. In addition, the National Association of Steel Framed Housing (NASH) Standard for Steel Framed Construction in Bushfire Areas is an equivalent and may be used in lieu of AS3959.

The '*Integrating building work into planning schemes – guidance for local governments*' document provides specific provisions on how local planning instruments ca designate a bushfire prone area for the purposes of the Building Regulations, as well as other matters which seek to avoid duplication between planning and building.

4.6.1 AS3959 – Construction of Buildings in Bushfire Prone Areas

AS3959 (or alternatively, the NASH Standard) specifies requirements and measures for residential buildings constructed in bushfire prone areas. Bushfire attack levels (BALs), which form the foundation upon which AS3959 is applied, distinguish the level of attack buildings (and occupants) may experience based on a range of factors including fire weather, vegetation class, effective slope and separation distance.

A BAL is defined as 'a means of measuring the severity of a buildings potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire' (Standards Australia, 2019).

The level of attack buildings may experience is based on a range of factors including vegetation typologies (fuel load), effective slope and separation distance, each of which has

a significant bearing on the likely behaviour and intensity of a bushfire and how these factors can combine to impact upon nearby buildings.

The Australian Standard adopts six distinct BAL categories including a 'low' category for areas where bushfire risk is limited. The categories are based upon the level of radiant heat flux which may be experienced during a bushfire event measured at the building façade and generally relates to how close or far a building is from classifiable vegetation. These BAL classifications translate to specific building construction requirements to enhance the ability of building occupants and the building itself to withstand bushfire attack.

From a planning perspective however, there are a range of limitations in relation to the implementation of AS3959 which planning activities must consider. These include:

- AS3959 applies only to Class 1, 2, 3 and selected Class 10a structures in Queensland;
- the above excludes aged care facilities, schools, child care centres, industry and commercial buildings and the like;
- AS3959 regulates construction methodologies and materials. It does not cover:
    - water supply provisions;
    - building design;
    - siting of buildings;
    - access; and
    - landscaping.

Importantly, the Building Code of Australia provisions have been varied for Queensland to exclude bushfire construction provisions where vegetation is classified as rainforest (excluding wet sclerophyll), mangroves and grasslands under 300mm high, refer to Part 3.10.5.0 of Volume 2 of the National Construction Code.

It is understood this provision has proved a challenge in Toowoomba, for development along the Escarpment, where bushfire management plans have argued the vegetation classification is rainforest when indeed, it may actually constitute wet sclerophyll which carries one of the highest fuel loads in Queensland. As a result of climate change, it may be the case that pockets of remnant rainforest along the Escarpment may transition to wet sclerophyll over time as rainfall patterns change.

The SPP and its guidance materials articulate the State's policy position which is to restrict exposure of development where exceeding a radiant heat flux level of 29 kW/m^2 (equivalent to BAL-29) where planning processes are involved.

AS3959 provides building construction requirements which exceed these parameters, providing methodologies for up to BAL-Flame Zone where little separation is provided between hazardous vegetation and the built form. Where planning applications are not triggered (for example, for dwelling houses on pre-existing allotments), land owners can build to BAL-FZ without any planning controls to yield the best possible risk-responsive outcome for sites in such circumstances, whilst recognising potential existing land use rights.

Having regard to the above, it is noted the now repealed MP2.4 of the Queensland Development Code provided additional building provisions for certain forms of development in Queensland however, this mandatory part is now replaced by provisions included in the current version of the National Construction Code.

It is a common misconception that a building constructed to AS3959 standard will withstand bushfire attack. This is not the case. The Australian Standard assumes an approximate 10 per cent failure rate. Thus, construction to bushfire building standards does not guarantee building survival.

It must also be noted the Australian Standard makes no representation in relation to the ability for any occupant to survive a bushfire event, either actively or passively sheltering in place. The Australian Standard does not consider, in any manner, aspects of occupant survival.

Buildings constructed to AS3959 standards have been lost in recent bushfire events. Conversely, brick constructed dwellings have survived bushfire events, whilst occupants sheltering in place in those dwellings have lost their lives.

The NSW Bushfire Inquiry following the devastating 2019/20 Black Summer bushfires specifically cited community misconceptions about building to bushfire protection standards, and the assumption the building is then safe from bushfire attack.

5 The Queensland disaster management context

The Australian Emergency Management Arrangements are formed around three levels of government which include local, state and the federal government.

The Queensland Disaster Management Arrangements (QDMA) acknowledge these three levels of government and also include an additional tier between local and state governments, known as Disaster Districts (Queensland Government, 2018b).

The *Disaster Management Act 2003* (Disaster Management Act) identifies four principles which guide disaster management in Queensland, including:

- a comprehensive approach;
- an all-hazards approach;
- local disaster management capability; and
- support at the local level by district disaster management groups and the state group, the Queensland Disaster Management Committee (Queensland Government, 2018a).

The Disaster Management Act denotes that local governments are primarily responsible for managing events in their local government area and must establish a Local Disaster Management Group (LDMG). Part of an LDMG's function is to improve and foster effective disaster management through regular reviews and assessments of disasters which, in turn, enables local government to develop its Local Disaster Management Plan (LDMP) (Queensland Government, 2018b).

A District Disaster Management Group (DDMG) is established for each Disaster District. Part of a DDMG's function is to develop effective disaster management for the District, including a District Disaster Management Plan (DDMP). This plan is developed through regular review and assessment of the disaster management of the local governments within their District and their LDMPs (Queensland Government, 2018b).

QFES leads the operation of Area Fire Management Groups (AFMGs) in support of a coordinated approach to the planning, implementation and reporting of bushfire mitigation activities, under the authority of section 67 of the *Fire and Emergency Services Act 1990*. The Toowoomba AFMG prepares the annual Bushfire Risk Mitigation Plan (BRMP) for the LGA, as part of Operation Cool Burn.

The *Disaster Management Act* 2003 identifies that managing disasters is a shared responsibility involving government agencies, individual landholders, non-government and private organisations.

AFMGs provide the primary mechanism for the coordinated identification of high-risk areas, the planning of bushfire mitigation activities, and the preparation of a BRMP for applicable Local Government Areas.

AFMGs play a key role in connecting communities, landholders and partners with local level bushfire mitigation planning, the conduct and benefits of mitigation activities, and communicating a broader understanding of the bushfire risks that cannot be addressed by these mitigation activities.

Relevant disaster management plans, strategies an documents which are relevant to the QDMA include:

- Fire and Emergency Services Act 1990;
- Queensland State Disaster Management Plan;

- Queensland Bushfire Plan 2020;
- Queensland Emergency Risk Management Framework; and
- Queensland State Natural Hazard Risk Assessment 2017.

5.1 Toowoomba Disaster Management Plan

The purpose of the *Toowoomba Regional Council Local Disaster Management Plan 2015* (TRC LDMP) is to 'detail the arrangements for the coordination and management of resources, to ensure and maintain safe communities within the region prior to, during and after a disaster' (Toowoomba Regional Council, 2015). The LDMP adopts a comprehensive, all hazards, all agencies approach to disaster management.

The LDMP sets out a range of objectives which are centred upon the Prevention, Preparation, Response and Recovery (PPRR) cycle. The LDMP includes a community profile which articulates the demographic, topographical, climate and weather, economic and social characteristics of the Toowoomba region, as well as key infrastructure assets, community facilities, essential services and major events. The LDMP also articulates the range of existing and ongoing risk assessment and treatment approaches which are adopted by Council, and the roles and responsibilities in preparedness, response and recovery. Sub-plans may be in place however, these do not appear to be available online. These may or may not include hazard-specific local action plans in terms of aspects for protested implementation across the Toowoomba region.

In relation to bushfire hazard specifically, the TRC LDMP identifies the escarpment area of the city as the area most likely subject to bushfire hazard. In addition, a high bushfire threat is acknowledged in the Crows Nest district along the escarpment and also within the communities west of Millmerran. The overall risk rating applied to bushfire within the region is classified as 'significant'.

6 Existing planning scheme review and gap analysis

The TRPS came into effect on 1 July 2012. The TRPS has been through a number of amendments, with the latest version, Version 26, commencing on 22 January 2021. As per Section 2.1 of the TRPS, the Minister has identified that the former SPP 1/03 has been partially integrated into the planning scheme for the parts that relate to bushfire and landslide. The nature of the State Interest relating to natural hazards and in particular bushfire, has evolved substantially since SPP 1/03, which was repealed in 2013. As such, it is the case that the new planning scheme for the Toowoomba Region will require changes from the content contained in the TRPS to ensure alignment with SPP 2017.

This section provides an overview of the TRPS against the identified policy benchmarks established by the current SPP and associated guidelines (refer to Table at Appendix G). The analysis will have particular regard to the Bushfire hazard overlay code and other relevant sections of the TRPS.

The analysis will culminate in the identification of potential opportunities to integrate improved outcomes into a new Toowoomba Region Planning Scheme with regard to bushfire hazard and protection.

6.1 Identification (mapping) of bushfire prone areas

Policy 1 of the state interest in natural hazards, risk and resilience under SPP 2017 requires bushfire prone areas to be identified. The SPP bushfire guidance 2021 goes on to further note that the state-wide bushfire mapping should be used in the first instance, and then locally verified for its accuracy and reliability. Councils may vary the State's methodology but must seek Minister's approval before doing so.

The bushfire hazard overlay mapping contained in the current TRPS is based upon the mapping methodology articulated by SPP1/03 which was released in 2003 and repealed after its ten-year lifespan, in 2013. This mapping is therefore not consistent with the latest state-wide bushfire prone areas mapping for the Toowoomba region. It also does not incorporate the significant advancements in fire science and mapping inputs used to derive the current state-wide bushfire prone areas mapping.

6.1.1 State-wide bushfire prone areas mapping

In 2014, the CSIRO in conjunction with QFES, released the '*New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland*'. This methodology underpins the fire science which is incorporated into the current SPP mapping. This mapping is also regularly updated. In 2017, the CSIRO released addendum methodological information, '*Estimating the Potential Bushfire Hazard of Vegetation Patches and Corridors: An enhancement of Queensland's methodology for State-wide mapping of bushfire prone areas*'.

The State-wide mapping methodology has been subject to peer review processes and has been found to be highly accurate, yielding an estimated 85 per cent level of accuracy based upon recent innovation in fire science and is considered a substantial advancement in bushfire hazard mapping in Queensland. The mapping methodology is based upon potential fire line intensity using the MacArthur Mk 5 Forest Fire Danger Meter and inputs of total fuel load and effective slope to derive a potential rate of fire spread. A 100m 'buffer' area is also applied under the SPP (replicating the approach under AS3959:2018 – Construction of Buildings in Bushfire Prone Areas), being the zone in which ember attack and radiant heat remain most relevant, adjacent to the actual hazard.

6.1.1.1 Updates to the state-wide bushfire prone areas mapping

Based on advice provided by QFES during this risk analysis, it is understood the state-wide bushfire prone areas mapping will be updated within 12 months. The current state-wide bushfire prone areas mapping covering the Toowoomba Region was prepared in 2015. An update was undertaken in 2017 but this related only to SEQ.

Since 2015, an addendum to the state-wide mapping methodology was prepared by the CSIRO relating specifically to small patches and corridors of vegetation where potential rate of spread is constrained by patch size and corridor dimensions. This methodology provides the criteria and process for the removal of these patches and corridors.

For example, Queens Park in the Toowoomba Urban Area is currently mapped as subject to potential bushfire hazard which, in reality, is not the case. The forthcoming update to the state-wide mapping will remove these small pockets of vegetation to streamline the application of the mapping as an overlay for local planning instruments.

It is noted that whilst the risk assessment component of this risk analysis utilised the current state-wide bushfire prone areas mapping, this approach was discussed prior to, during and after the preparation of the risk assessment. Both the Department and QFES confirmed this approach was the best available at the time this work was completed. It is not considered the likely amendments to the state-wide bushfire prone areas mapping will alter the observations of the risk assessment in any meaningful way, with amendments likely to focus on updated vegetation data (including recent clearing and use of the 2020 Regional Ecosystem data), and removal of patch and corridor areas.

It is likely the case that the updated state-wide bushfire prone areas mapping will be available for Council to adopt for the purposes of the bushfire prone areas overlay mapping as part of the new planning scheme, given the timeframes currently associated with the Toowoomba Region Futures program.

6.1.1.2 Reliability assessment

As part of the process of adoption of the state-wide bushfire prone areas mapping for the purposes of a local planning instrument overlay, a reliability assessment is required to locally verify the accuracy of the state-wide mapping. The process for the reliability assessment, and the expectations of the State in its detail, is included at Part 4 of the Bushfire Resilient Communities technical reference guide.

A reliability assessment of the state-wide mapping inputs (being those intended to be used as inputs for the updated mapping, including the 2020 Regional Ecosystem data) has been undertaken as part of the risk assessment process, and the report is attached to the Part B reporting of this risk analysis.

The reliability assessment concluded that seven of 180 (roughly 4 per cent) assessment areas returned a 'not satisfactory' outcome. The methodology set out in the Bushfire Resilience Communities technical reference guide notes that achievement of 90 per cent satisfactory reliability is necessary. The reliability assessment for Toowoomba has returned a result of 96 per cent and is future-proofed, by having regard to the data inputs intended to be used by QFES as part of the forthcoming mapping update. It is noted, this does not account for the current small patches and corridors which will eventually be removed from the mapping.

A review of revised state-wide mapping data will likely be required, against the observations of the Part B – Risk Assessment once it is made available by the State and prior to adoption of the new planning scheme.

6.1.2 Bushfire buffer area

In addition to the adoption of fireline intensity (as an indicator of fire behaviour) as the basis for the mapped hazard categories within the state-wide bushfire prone areas mapping, the mapping also includes a 100 metre 'buffer' area which is also classed as part of the bushfire hazard area. It is noted the current TRPS overlay map does not incorporate a buffer extent, which includes land surrounding hazard areas where flame contact, radiant heat and ember attack is likely.

6.1.3 Planning options associated with mapping of bushfire hazard

The following planning options are identified in relation to the identification (mapping) of bushfire hazard within the Toowoomba Region:

PLANNING OPTION 1: Work with the State government as part of ongoing updates and amendment processes supporting the state-wide bushfire prone areas mapping to address the patch and corridor mapping issues observed by the risk assessment within the Toowoomba urban area, and adopt the revised mapping as the bushfire hazard overlay mapping for the purposes of the new planning scheme.

PLANNING OPTION 2: Section 1.6 of the new planning scheme can / should specifically identify the buffer area as forming part of the designated bushfire prone area to avoid any potential for uncertainty. The designation of the bushfire prone area for the purposes of the Building **Regulation must be undertaken in accordance with the 'Integrating building works into local** planning instruments **–** guideline for **local governments' document.**

PLANNING OPTION 3: Council may consider, as part of any forthcoming amendment for the **current TRPS, to specifically cite the scheme's bushfire hazard overlay mapping as the** designated bushfire prone area for the purposes of section 32(a) of the Building Act 1975 and section 12 of the Building Regulation 2006 in relation to Building Work regulated by the planning scheme.

PLANNING OPTION 4: Council may consider, as part of any forthcoming major amendment for the current TRPS, to adopt the current state-wide bushfire prone areas map to replace the current overlay mapping, and introduction of new code provisions as an interim risk-reduction measure before the new planning scheme is adopted and comes into effect.

6.2 Risk assessment

Policy 2 of the state interest in natural hazards, risk and resilience under SPP 2017 requires a fit for purpose risk assessment to be undertaken. The SPP bushfire guidance 2021 requires that the risk assessment be consistent with *AS/NZS ISO 31000:2018 Risk Management – Principles and Guidelines*, and be undertaken by a suitably qualified person.

It is noted that a fit for purpose risk assessment has been undertaken as part of Part B of this risk analysis.

One of the key objectives of the risk assessment process is to support the implementation, where relevant, of the state policy principle of avoid first, and if it not possible to avoid, then to mitigate.

Policy 4 of the state interest in natural hazards, risk and resilience under SPP 2017, is for development to first avoid natural hazard areas, and where it is not possible to avoid, mitigate the risks to an acceptable or tolerable level. The outputs of the risk assessment are intended to inform the strategic intent and strategic outcomes, as well as assessment requirements based on avoiding outcomes which expose land uses and occupants to high bushfire risk in the first instance, and where it cannot be avoided, achieving an acceptable or tolerable level of risk for both existing and new development in bushfire prone areas.

This section will review the TRPS relative to the observations of the risk assessment, with a focus on the extent to which the existing TRPS embeds the policy principle of avoiding first and then mitigating to an acceptable or tolerable level where it cannot be avoided.

A series of planning options are also identified relative to each component part of the planning scheme, for consideration as part of the formulation of the new planning scheme. These options are summarised later in this report.

6.2.1 Strategic framework

The TRPS's strategic framework includes several components including the overarching strategic intent across seven themes that collectively represent the policy intent of the TRPS, including:

- settlement pattern;
- natural environment;
- community identity and diversity;
- natural resources and landscape;
- access and mobility;
- infrastructure and services; and
- economic development.

6.2.1.1 Strategic intent

The strategic intent (Part 3.2 of the TRPS) establishes the high level policy direction of the TRPS. In relation to natural hazards, the strategic intent establishes that development is to avoid 'areas exposed to natural hazards'.

PLANNING OPTION 5: The strategic intent can / should recognise the potential risk of bushfire to human life and property and that development is required to ensure an acceptable or tolerable level of risk is achieved.

6.2.1.2 Theme – settlement pattern

Part 3.3 of the TRPS sets out the strategic direction for the settlement pattern within the Toowoomba Region. The settlement pattern identifies seven major urban areas and towns as being:

- Toowoomba City;
- Clifton;
- Crows Nest;
- Highfields;
- Oakey;
- Pittsworth; and
- Millmerran.

Broadly, the strategic framework identifies growth areas to occur by way of consolidation of existing areas within proximity to existing town centres. Growth areas are identified within Toowoomba City (Drayton, Glenvale and Darling Heights), Highfields (new urban areas northwest of the town centre and Oakey (new urban area in the southeast of the town). New development, in the form of large rural residential development, in the southwest of Millmerran township is also identified.

The risk assessment does not identify growth within the townships of Clifton, Highfields, Oakey, Pittsworth or Millmerran as a high risk outcome. Whilst bushfire hazard may be present in pockets, the risk profile is such that the likelihood of mitigation measures to reduce risk to a tolerable or even acceptable level, is high.

West of Millmerran, the rural residential areas including Cypress Gardens, Forest Ridge and Wattle Ridge are flanked by potential bushfire hazard, further development in these locations likely represents a high risk undertaking.

Parts of Toowoomba City, along the escarpment, and Crows Nest are also exposed to higher hazard by virtue of the context of vegetation communities and complex topography. Whist growth in these communities remains appropriate, zoning should consider the bushfire exposure profile of the area. For example, in Crows Nest a risk-responsive approach to accommodate future growth may be best achieved via an expansion rationale located to the west of the New England Highway, rather than to the east. This equally applies to the Highfields and Cabarlah area where further development east of the New Engagement Highway is likely to pose a high-risk undertaking, expanding and increasing the risk profile of this location.

For Toowoomba City, development on the escarpment edge is high risk however, this area is also largely developed. It is noted that Low-Medium Density zoning in Middle Ridge and pockets of rural residential zones in the urban area may give rise to increased densities and population within this higher risk area.

PLANNING OPTION 6: Where growth (expansion or infill) is proposed in Toowoomba City, in the Highfields and Cabarlah area, and in Crows Nest, Council may consider bushfire hazard exposure as a key factor as part of any zoning decisions to accommodate future growth.

A principles-based approach to ensuring a risk-responsive settlement pattern (zoning rationale) is discussed in further detail in Section 7 of this report, relevant to the strategic framework.

Strategic outcome 7 of Part 3.3.1 states that '*the settlement pattern and built form of the region's urban areas and towns evolves to respond to the natural hazards affecting them so that people, property and infrastructure are more resilient to natural hazard risks over time*'. It then expands to provide specific examples of areas subject to flood risk.

PLANNING OPTION 7: Council may consider a consolidated review of locations susceptible to multiple hazards (including flood and landslip) and specifically identify within the strategic intent of the new planning scheme, higher risk locations in the region where growth and development should be avoided.

PLANNING OPTION 8: The strategic intent of the new planning scheme would be bolstered and provide a strength of strategic direction where specific higher risk locations, or circumstances / criteria that give rise to elevated risk, are identified.

The circumstances or criteria which could be incorporated to reflect higher risk within the strategic intent may include:

- exposure to high or very high hazard where development cannot be sited to reduce magnitude of potential exposure; and
- locations of limited access which may constrain the ability to evacuate, and where evacuation routes are also exposed in a manner which is likely to give rise to intolerable evacuation risk.

The above is also capable of being adapted to provide combined multi-hazard criteria.

Part 3.3.8 of the settlement pattern theme focuses on aspects of sustainable urban development. The sustainable development narrative in this section does not have regard to the role of disaster risk reduction in achieving sustainable urban development outcomes.

PLANNING OPTION 9: Council could consider the incorporation of disaster risk reduction outcomes as a facet of sustainable urban development, if this objective is retained as part of the new planning scheme.

6.2.1.3 Theme – natural environment

This theme articulates the strategic outcomes and specific outcomes relating to natural environmental values across the region. The narrative within the current TRPS remains silent on Council's policy position in relation to clearing of vegetation for the exclusive purpose of bushfire protection. This is likely to manifest in challenges in the development assessment phase in terms of both clarify of expectation of policy position for the community, development industry and assessment managers.

Should Council wish to pursue a policy position on this matter, content could be incorporated within the strategic intent to provide clarity on Council's expectations in relation to protection of the natural environment.

PLANNING OPTION 10: Council may consider outlining its strategic policy intent with regard to protection of the natural environment from clearing for the exclusive purpose of bushfire protection within the strategic framework of the new planning scheme, where the onus may be placed on the development to be appropriately sited to avoid unnecessary vegetation clearing, on balance.

Part 3.4.5 addresses the climate change element, a number of climate projections are identified to impact the region including an increase in hot days and warm nights as well as increased and longer dry spells. As identified as part of Part A and Part B of this Risk Analysis, future climate projections lend themselves to increased fire weather intensity and frequency across the region.

This is similar reflected by work completed to date as part of Council's Warm Temperate Climate Study which was ongoing at the time of writing.

PLANNING OPTION 11: Council may wish to emphasise the changing fire weather conditions for the region as a result of climate change as part of the strategic framework in the new planning scheme.

6.2.1.4 Theme – community identity and diversity

Item 8 of the strategic outcomes for the community identity and diversity theme identifies *'a community that is planned, designed and managed so that it is sustainable, safe and able to respond to the changing environment and community landscape'*. Disaster risk reduction and protection from natural hazards are integral components of sustainability and safety, and there is opportunity for Council to be more explicit in articulating these linkages – particularly in relation to protection of human life from risk.

PLANNING OPTION 12: Acknowledging the risk from natural hazards posed to the community, including bushfire but not exclusive to, Council may consider refining the linkages between sustainable and safe communities and sustainable urban development and natural hazard risk reduction within the new planning scheme.

Additionally, specific outcome 5 of part 3.5.5.1 within the community facilities and services element identifies that *'community facilities and services that include vulnerable uses avoid locating or expanding in identified flood risk areas or higher risk overland flow path areas'*. Bushfire prone areas are not specified, however can be easily incorporated.

The risk assessment at Part B of this risk analysis includes a recommendation for the avoidance of vulnerable facilities within bushfire prone areas.

Schedule 1 of the current TRPS defines 'vulnerable use' for the purposes of the flood hazard overlay to include one or more of the following:

- child care centre;
- community care centre;
- community residence;
- detention facility;
- educational establishment;
- emergency services;
- hospital;
- residential care facility; and
- retirement facility.

PLANNING OPTION 13: Council may consider a multi-hazard approach to commentary in the strategic framework of the new scheme which avoids vulnerable uses in higher risk hazard areas, not exclusive to just flood hazard.

PLANNING OPTION 14: Council can adapt the vulnerable use definition in the new planning scheme to relate to multiple hazards, and ensure code provisions and references to vulnerable uses in hazard overlay codes align to the same definition, insofar as possible.

In relation to Planning Option 14 above, the Bushfire Guidance 2019 identifies additional land uses which may also be considered as part of the vulnerable use definition, including:

- nature-based tourism;
- relocatable home park;
- rooming accommodation;
- resort complex; and
- tourist park.

PLANNING OPTION 15: Council may consider expanding the range of land uses considered to **be 'vulnerable uses' where there are shared across multiple hazard**s.

6.2.1.5 Theme – access and mobility

The theme identifies the importance of the road network within the region.

As identified in the risk assessment contained within Part B, parts of the road network are subject to bushfire hazard. The road network plays a vital role before, during and after a bushfire event for emergency access and evacuation.

The ability to evacuate is also a key factor which multiplies bushfire risk. This is relevant both in terms of strategic planning for growth and calibration of the settlement pattern, but also from a development assessment perspective.

A principles-based approach to ensuring a risk-responsive zoning rationale takes account of emergency evacuation is discussed in further detail in Section 7 of this report.

PLANNING OPTION 16: Council may consider specifically citing emergency evacuation during a natural hazard event as a key aspect of access and mobility narratives within the new planning scheme.

6.2.1.6 Theme – infrastructure and services

Strategic outcome 1 of Part 3.8.4 states that '*infrastructure and services (d) are resilient to, and are designed to operate during or recover quickly from, natural hazard events*'. This is continued via the specific outcomes at 3.8.2.1.

PLANNING OPTION 17: Council may consider specifically citing the need to support emergency access and evacuation processes during a natural hazard event as a key aspect of infrastructure and servicing narratives within the new planning scheme.

Water supply is likewise critical during a bushfire event, whether by reticulated supply or via static (tank) water supplies. Having regard to the size of the region, reticulated water supply is available for only a small portion of the area, but services the majority of the Toowoomba Region population.

Sufficient water supply to service development in terms of exclusive bushfire protection needs can often be a challenging issue in the development assessment context where local planning instruments lack suitable clarity on expectations. The strategic framework offers the opportunity to provide strategic-level indicators as to the need for adequate water supply to service development in bushfire prone areas.

PLANNING OPTION 18: Opportunity exists to incorporate strategic statements into strategic framework narratives on infrastructure and servicing into the new planning scheme. A strategic outcome may include that bushfire protection is supplemented through adequate water supply provision.

6.2.1.7 Theme – economic development

Strategic outcome 10 of Part 3.9.1 identifies that '*economic development opportunities are promoted in the parts of the Region (including Cooyar, Oakey, Maclagan, Quinalow, Yarraman and Jondaryan) that are impacted by natural hazards to assist these communities to orient away from identified risk areas over time*'. Some of these hazards are more related to flood hazard and include the relocation of commercial activities off the floodplain. However, it does present a relevant consideration also from a bushfire hazard perspective, which township commercial precincts are located within exposed locations.

PLANNING OPTION 19: Council may consider revised commentary from an economic development perspective within the strategic framework which focuses on ensuring economic development opportunities achieve an acceptable or tolerable level of risk.

6.3 Planning instrument development requirements

The third pillar of the SPP requirements for natural hazards includes the incorporation of land use approaches within the planning instrument response that addresses the risk assessment and integrates with broader bushfire risk management objectives.

The planning instrument elements of relevance in this context are:

- tables of assessment;
- the Bushfire hazard overlay code; and
- zone, local plan and development codes.

The specific development requirement benchmarks (see Appendix G) enshrined in the current SPP 2017 for bushfire hazard relate to:

- Ensuring planning function to ensure disaster management capacity and capabilities are maintained;
- Development does not increase the risk of bushfire attack, to either new or existing communities;
- Avoiding sensitive land uses in bushfire prone areas; and
- The protective function of vegetation and environmental systems are maintained and enhanced.

These benchmarks represent those elements against which the TRPS will be assessed at the state level, in consideration of the 2019 bushfire guidance material.

The SPP bushfire guidance 2021 refers to example planning scheme assessment benchmarks in the form of an example table of assessment for bushfire hazard, as well as an example bushfire overlay code for contemplation by local governments for integration into planning schemes. Whilst this content is not intended to be seen as 'the only' way to reflect the state interest for bushfire, it does set a benchmark in itself noting that it has been drafted to already reflect the state-level benchmarks, including SPP 2017, the SPP bushfire guidance 2021 and 'Bushfire Resilient Communities' technical reference guide.

As such, a review of the TRPS bushfire hazard overlay code against the example planning scheme provisions contained within the SPP Bushfire Guidance 2019 is provided in a later section of this report.

6.3.1 Building work regulated under a planning scheme

Section 1.6 of the TRPS identifies building work regulated under the Planning Scheme, and is required to formally designate the bushfire prone area (citing the overlay map) for the purposes of the Building Regulation. The manner in which Section 1.6 is currently drafted, specifically item (4)(a), does not explicitly cite the Bushfire Hazard Overlay Map as the trigger for assessment of AS3959. Therefore, the designation of the 'bushfire prone area', in accordance with section 32(a) of the *Building Act 1975* and section 12 of the *Building Regulation 2006* for the purposes of triggering assessment against AS3959, is questionable from a legal perspective.

6.3.2 Tables of assessment

The existing table of assessment contained within the TRPS, as it relates to bushfire, identifies no change to the category of assessment for already assessable development that also happens to be subject to the Bushfire Hazard Overlay mapping. The tables of assessment do make assessable (code assessment) a range of otherwise accepted development activities in the Principal or Major Centre Zone including Community Care Centre, Community Use and Educational Establishment. Telecommunication Facilities are also subject to code assessment.

The tables of assessment identify that 'all accepted development not listed elsewhere in this table' is subject to Accepted Development Subject to Requirements (ADSR).

The tables of assessment do not appear to trigger any building work categories. They also do not distinguish between the level of hazard (i.e. medium or high) however, this is not unusual across Queensland schemes.

Under the current circumstances and for example, an application for an aged care facility (defined as a Residential Care Facility) on land within the Low-medium density residential zone would be subject to code assessment irrespective of the level of bushfire hazard.

It is noted that under the section 60(2) of the *Planning Act 2016*, where an application is subject to code assessment, the assessment manager must decide to approve an application unless compliance with assessment benchmarks cannot be achieved by imposing development conditions. That is to say, applications subject to code assessment are weighted in favour of approval.

It may be the case that some uses in higher bushfire hazard exposed or higher risk areas may not be considered by Council to be acceptable, in which case this should ideally be reflected via levels of assessment for those instances warranting such an approach. This may include vulnerable uses, for example. It also may not only relate to certain uses in certain bushfire prone areas, but specific localities which may be considered at higher risk to bushfire. In conjunction with a precinct-based approach attached to zoning, levels of assessment may be varied for specific localities where higher existing or future potential risk may exist.

The current approach to the categories of assessment for development subject to bushfire hazard, of any level, within the TRPS appears to lack the benefit of a risk-informed approach. This potentially inadvertently infers that bushfire hazard and risk can be addressed satisfactorily through design mitigation which is not always the case and does not address the policy position of SPP 2017 in relation to avoidance of higher instances of risk through a calibrated approach to planning scheme controls.

PLANNING OPTION 20: Council should consider a risk-responsive approach to levels of assessment for certain land uses / higher risk locations in bushfire prone areas as part of the new planning scheme, in line with the expectation of plan-drafting under the SPP 2017.

6.3.3 Bushfire hazard overlay code

Council's bushfire hazard overlay code (the code) incorporates three components including its application, purpose (including overall outcomes) and assessment benchmarks.

6.3.3.1 Application

The code is identified to only apply to assessable development that is:

- identified by the Bushfire Hazard Overlay map; and
- identified as an assessment requirement in the tables of assessment.

The application of the code to only 'assessable development' conflicts with the tables of assessment which identify some development as ADSR (note, 'accepted development subject to requirements' is not assessable development).

6.3.3.2 Purpose and overall outcomes

The purpose of the code includes:

1. *The purpose of the Bushfire Hazard Overlay Code is to protect the safety of people and property in bushfire risk areas.*
2. *The purpose of the code will be achieved through the following overall outcomes:*
    i. development does not increase the exposure of people and property to an unacceptable bushfire hazard risk;
    ii. development located in a bushfire risk area is designed to mitigate the bushfire risk through siting, design and management measures;
    iii. development provides access and evacuation routes for both private and emergency service vehicles which are appropriate to the nature of the development and the level of bushfire risk;
    iv. development for essential community infrastructure is able to function effectively during and immediately after a bushfire event;
    v. public health and safety and the environment are not put at risk by development involving the manufacture and/or storage of hazardous goods in a bushfire hazard area;
    vi. the reconfiguration of land appropriately responds to bushfire hazard having regard to the appropriate siting of future development and access for evacuation; and
    vii. development provides access to an adequate water supply for fire fighting purposes.

In terms of the purpose of the code, the following observations are noted:

- the purpose (and application) remains silent on a position of avoidance, similar to the strategic framework and strategic intent – it is however, later identified in the assessment benchmarks but is then overridden by the ability to provide and comply with a bushfire management plan.
- the overall outcomes identify that exposure is not increased where 'unacceptable risk' is present however, how unacceptable risk is defined or determined is not articulated by the scheme, the land use associated with this, as well as locations or circumstances.
- evacuation is identified, which is a strength of the existing overall outcomes.

- A position on vulnerable uses is not identified however, the resilience and operation of essential community infrastructure is noted.

PLANNING OPTION 21: Council may consider the draft purpose provisions contained within the draft assessment benchmarks under the SPP bushfire guidance 2021 to solidify a position on avoidance of intolerable risk outcomes, as well as aspects involving vulnerable uses, **vegetation removal, and rehabilitation and demand on emergency services. Council's existing** policy position in relation to the consideration of evacuation should be retained.

6.3.3.3 Assessment benchmarks

The SPP Bushfire Guidance 2021 cites example bushfire assessment benchmarks for Council to consider for integration into planning instruments, varied to reflect local circumstances.

While this content is not intended to be seen as 'the only' way to reflect the state interest for bushfire, it does set a benchmark in itself noting that it has been drafted to already reflect the state-level benchmarks, including SPP 2017, the SPP Bushfire Guidance 2021 and the 'Bushfire Resilient Communities' technical reference guide.

A review of the code against the example assessment benchmarks (overlay code provisions) cited in the SPP Bushfire Guidance 2021, has been undertaken for Council's consideration. In summary, the review identifies the following:

- the code does not apply to uses within 100 metres of identified bushfire hazard due to the current mapping methodology, which remains a significant shortcoming in the knowledge that approximately 85 per cent of fatalities and buildings lost to bushfire are lost within 100 metres of the bushland interface;
- the current overlay code is highly focused on residential dwelling and RaL development, almost to the exclusion of other land uses which may be proposed in a bushfire prone area, including rural activities and tourism activities;
- the current code does not differential material changes of use requirements from RaL requirements, however the needs are very different;
- the current overlay code does not reflect the requirements of the *Planning Regulation 2017* which provides specific requirements for dwelling houses on lots of 2,000sqm or less. The example assessment benchmarks are framed in response to these regulatory requirements;
- the code refers to a several-times outdated version of AS3959;
    - this includes reference to AS3959 requirements for shielding of water tanks and pumps, which AS3959 does not (or no longer) includes;
- the separation distances identified within the code do not align with current best practice or fire science and should instead provide a radiant heat threshold to inform building siting as opposed to a blanket 10m or 1.5 times canopy height expectation;
- the code enables fire trails in lieu of a perimeter road within new subdivisions which increases management burden on Council and rate payers, and is less effective than the provision of perimeter roads;
- the existing code does not discuss vulnerable or hazardous uses;
- some road design provisions for internal road networks are identified for new RaL however, these do not necessarily align with current approaches encouraged under the Bushfire Resilient Communities technical reference guide document;
- whilst a small number of road design provisions are included in the existing code, the acceptable outcomes which align to the performance outcomes for evacuation do not necessarily ensure the safe ability to evacuate would be achieved;

- the existing code does not address siting in response to bushfire hazard (referring to Council's policy position on clearing), nor does it address potential inadvertent increased risk driven by rehabilitation and revegetation associated with development applications; and
- the current code does not respond to different scales of development. The example assessment benchmarks prepared by the state offer different options for large versus small-scale RaL's for example, where expectations of compliance with certain mitigation measures may differ.

PLANNING OPTION 22: Council may consider the example assessment benchmark provisions as a based upon which a new overlay code is constructed for the Toowoomba Region, noting it requires significant variation to ensure it is locally fit-for-**purpose to meet Council's and the community's needs.**

6.3.4 Zone, local plan and development codes

Some zone, local plan and development code provisions incorporate overall outcomes and other assessment benchmarks associated with bushfire hazard including, in particular, the Low medium density residential zone. The overall outcomes of the zone code seeks to ensure development responds to land constraints, including but not limited to topography, bushfire and flooding constraints.

The limited development zone code is, by its nature, geared towards the regulation of highly constrained lands within the region, where risk from natural processes and events is heightened.

The Charlton Wellcamp Enterprise Area Local Plan Code also has regard to siting of development in response to potential bushfire risk.

Council's Environmental Significance Overlay Code is silent on any policy position or assessment benchmarks which relate to clearing for bushfire protection purposes, or rehabilitation / revegetation activities and the potential for inadvertent introduction of or increases to fuel loads and hazard through such works.

PLANNING OPTION 23: Council may consider matters associated with bushfire hazard beyond the Bushfire Hazard Overlay Code, particularly with regard to environmental significance / biodiversity overlays and specific zone and development codes.

6.3.5 Bushfire planning scheme policy

The TRPS does not currently include a Bushfire Hazard Planning Scheme Policy (PSP). However, as articulated later in this report, the opportunity for further guidance, instruction and communication of Council's expectations for assessment and management measures in bushfire prone areas across the region is apparent. Selected matters which may be addressed by a PSP include (but are not limited to):

- a defined framework for vegetation assessments;
- Council expectations for the design and construction of perimeter roads;
- asset protection zone design options;
- landscaping treatments which can be considered;
- how evacuation may be considered; and
- requirements to be addressed for the purposes of bushfire management plans and any emergency or evacuation plans which may be prepared to support development applications.

PLANNING OPTION 24: Council may consider the value and benefit of a Bushfire Hazard Planning Scheme Policy to communicate its expectations on various aspects of bushfire mitigation measures which may be employed to comply with the overlay code.

7 Bushfire risk observations and recommendations analysis

The bushfire risk assessment carried out as Part B of this risk analysis identifies 16 strategic land use planning risks for the Toowoomba Region, which can be addressed in multiple ways – both through strategic and statutory planning but also via other Council and related activities.

Table 47 - Summary of identified strategic land use planning risks relating to bushfire hazard in the Toowoomba Region

No.	Identified risk
1	Hazard exposure may change in certain locations over time to a higher hazard class, as a result of climate change.
2	Certain parts of the evacuation network may be compromised in a fire event, and may impact the ability to evacuate.
3	Grassfire hazard in cropping and grazing lands exists, presenting a risk for agricultural losses and economic impact.
4	Considerable risk to community facilities, services and infrastructure within the community facilities zone is present.
5	Recovery and reconstruction may be long and costly.
6	A proportion of residents and businesses do not have adequate insurance cover.
7	Certain land uses within interface locations may inadvertently impact on the ability to implement certain forms of hazard reduction, due to the risk magnitude of mitigation activities.
8	Land and fire management activities may face added pressure from expanding development in interface areas. Ecological assets may be impacted.
9	Emergency services may face increased burden from expanded development in interface areas.
10	Lands zoned for future development growth are highly exposed to potential bushfire hazard, particularly the rural residential and emerging community zones.
11	The low density residential zone is relatively exposed, incorporating a high percentage of existing housing stock within the Toowoomba Region.
12	Vulnerable facilities exist in locations subject to bushfire hazard and which may require evacuation.
13	Ability to evacuate may be complicated by exposure of the road network to bushfire attack, fragmented vegetation, land parcels, zoning, and limited route options.
14	Township zoned land, and urban interface land, is exposed to potential urban/township fire intrusion.
15	Evacuation of some townships with limited road connectivity may experience evacuation challenges.

A number of these risks can and should be addressed via strategic planning approaches, spatial tools and the formulation of statutory or regulatory controls as part of the development of the new Toowoomba Region Planning Scheme.

The following sections discuss those risks which are relevant from this perspective, unpacking the issues and providing relevant options for Council consideration moving forward, ensuring an appropriately calibrated and risk-responsive approach is established by the new planning scheme.

7.1 Land use and settlement policy

The implementation of spatial controls, such as zoning, is a key opportunity to strategically respond to identified risks, particularly where they may be specific to certain locations. The settlement pattern of the Toowoomba Region has a long history of such approaches, where a considerable scale of high risk flood and steep slope areas, as well as bushfire prone lands, have been deliberately zoned to avoid incompatible development through spatial approaches such as the allocations of the Limited Development Zone, Open Space Zone and other compatible zones which limit built form.

The majority of the Toowoomba Region is zoned Rural, which to an extent limits the nature and density of activities which can occur across large swathes of the region. Where bushfire risk (as opposed to hazard) is most pronounced is around the periphery of townships and urban areas, where development and people interface with bushfire hazard.

The majority of the Toowoomba Region is zoned Rural, which to an extent limits the nature and density of activities which can occur across large areas of the region.

Where bushfire risk (as opposed to hazard) is most pronounced is around the periphery of townships and urban areas, where development and people interface with bushfire hazard.

Rural and industry activities outside of townships across the region can also be exposed, however the risk profile of these individual activities is usually mitigated by surrounding land uses where grazing and cropping may reduce bushfire risk but increase grassfire hazard, larger allotments which comprise asset protection zones, or are capable of doing so, surrounding access roads, etc.

Thus, the focus of spatial controls relative to bushfire risk is focused at the urban bushland interface.

The Part B Bushfire Risk Assessment identifies several locations across the region where the bushfire risk profile is higher compared with other parts of the region. To understand the quantum of potential risk, it is first important to contemplate risk benchmarking, to establish the principles which drive and multiply bushfire risk factors.

7.1.1 Risk benchmarking

One of the primary objectives of the SPP 2017 is to identify the circumstances (including locations) where intolerable risk is present or may eventuate into the future as a result of strategic and statutory planning processes, and set in place regulatory frameworks to avoid, or mitigate where avoidance cannot be achieved, the potential for new or increased intolerable bushfire risk.

The definitions of intolerable, tolerable and acceptable risk are outlined at the table below, as per the SPP 2017.

Table 48 - Risk acceptance / tolerability benchmark assessment system

Risk benchmark	Description as per SPP 2017
Acceptable	A risk that, following an understanding of the likelihood and consequences, is sufficiently low to require no new treatments or actions to reduce risk of the natural hazard further. Individuals and society can live with this risk without feeling the necessity to reduce the risk any further.
Tolerable, subject to treatment	A risk that, following an understanding of the likelihood and consequences, is low enough to allow the exposure to the natural hazard to continue, and at the same time high enough to require new treatments or actions to reduce risk. Society can live with this risk but believes that as much as is reasonably practical should be done to reduce the risks further.
Intolerable	A risk that, following an understanding of the likelihood and consequences, is so high that it requires actions to avoid or reduce the risk. Individuals and society will not accept this risk, and measures are to be put in place to reduce the risk to at least a tolerable level.

The above system of risk quantification aligns with that of the 'ALARP' principle relating to risk tolerance, set out by both the Australian Institute of Disaster Resilience (AIDR) 2020 *Land Use Planning for Disaster Resilient Communities Handbook*, and the 2016 Planning Institute of Australia (PIA) publication, the *National Land Use Planning Guidelines for Disaster Resilient Communities*.

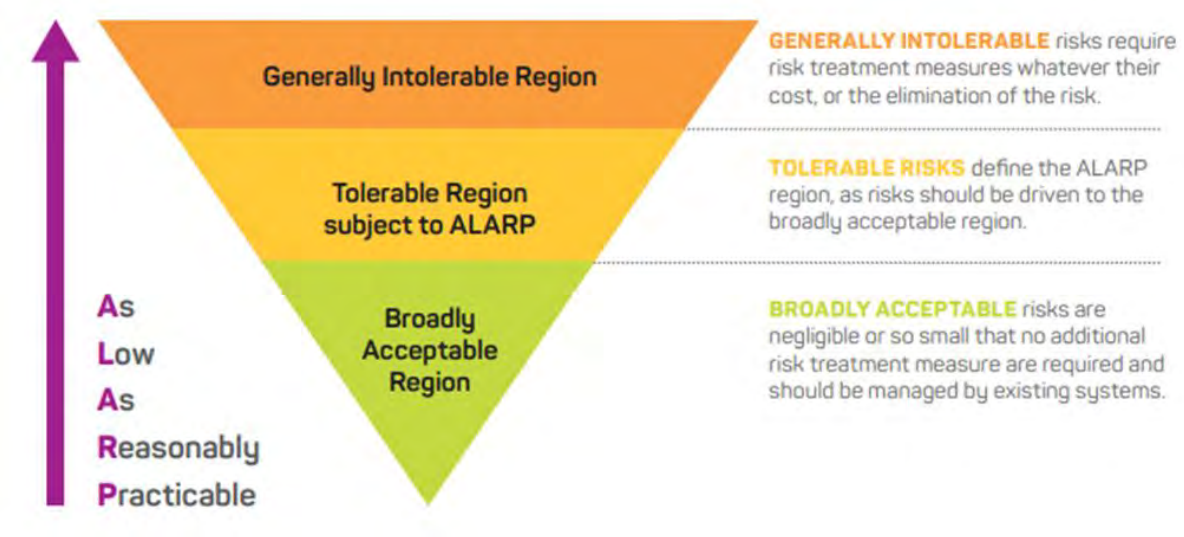


Figure 49 - The 'ALARP' principle for risk tolerance (Source: AIDR, 2020)

The above sets the framework against which risk can be defined in a land use planning context.

Four (4) types of risk treatment categories are consequently associated with the above. As per the AIDR Handbook and PIA Guideline, these are as follows:

Table 49 - Risk treatment options available as part of the risk management process (Based on AIDR, 2020)

Risk treatment	Description
Risk avoidance	Measures taken to avoid risks from natural hazards. These measures could include avoiding development in hazardous areas, relocating people or assets away from hazardous areas, or developing buffer zones to the hazard. Example options may include orienting growth to lower risk / hazard exposure areas.
Risk reduction / mitigation	Measures undertaken to reduce the risks from natural hazards, such as strengthening buildings against ground shaking from earthquakes. Development controls for new development can be seen as a way of reducing the growth of risks from natural hazards due to new development. In addition, while often limited, there may be opportunities to reduce risk over time as redevelopment occurs through, for example, the implementation of new development standards that consider the impacts of the hazard or the relocation of development to less hazardous locations. Example options may include the adoption of risk-responsive zoning provisions and zoning precincts for land use allocation and / or minimum settlement pattern densities.
Risk transfer	Measures taken to transfer the risk from a natural hazard from one party to another, such as property insurance. Example options may include the mitigation of tolerable risks through planning and building provisions, which reduces but does not remove risk. Residual risk is passed on to landholders, residents, emergency managers and insurers.
Risk acceptance	The acceptance of risk from a natural hazard; any realised losses will be borne by those parties exposed to the hazard. This is not specifically a treatment option as no action is taken, but it is an option for addressing risk. **Example options include potential 'accepted development subject to requirements' provisions to improve site**-based outcomes whilst acknowledging existing land use rights.

7.1.2 Bushfire risk drivers and multipliers

It is important to note that mere exposure to bushfire hazard does not necessarily give rise to intolerable risk. In fact, the current land use policy position of all state and territory governments across Australia allows development in bushfire prone areas where sufficient separation can be achieved, limited radiant heat exposure to a maximum of 29 kW/m^2. This threshold applies to planning processes, not necessarily building processes, which is an important distinction to be aware of.

This being the case, it then becomes necessary to identify locations where, despite this separation to limit radiant heat flux (and flame contact) exposure, other risk factors mean certain locations may still give rise to potentially intolerable risk.

To this end, intolerable bushfire risk may be defined by the following drivers and risk multipliers:

Table 50 - Risk drivers and risk multipliers, as indicators of potential intolerable risk

Intolerable risk driver / multiplier	Description
Existing or future exposure to Very High Potential Bushfire Hazard (fireline intensities exceeding 40,000 kW/m)	Hazard mapping does not indicate risk, however Very High Potential Bushfire Hazard areas are susceptible to erratic, intense and fast-moving fire behaviour. Development within 100m of Very High Potential Bushfire Hazard is likely to be subject to significant risk of impact from bushfire attack.
Existing or future potential constrained ability to evacuate to safety	Constrained ability potential (under some circumstances) to evacuate either by virtue of potential challenges with: • extreme traffic volumes on the road network, or a high volume of vehicles reliant on limited road network options; or • the need to travel through bushfire prone areas to reach safety; or • ability to navigate the road network due to impaired visibility from smoke and ember attack; or • potential high risk tree fall areas where debris over the road may create entrapment issue where alternative routes are not available; or • limited network route options; • exposure of the road network to potential flame contact and extreme radiant heat flux; or • limiting or creating an adverse impact on the ability for existing communities to evacuate.

Other factors such as access to water supply can increase potential risk however, given water supply is a fundamental aspect of ordinary development (either reticulated supply or static supply) it is considered a mitigation measure rather than a risk driver or multiplier, ensuring adequate pressure or exclusive fire-fighting supply is available. This same situation applies to electricity supply.

In circumstances where water (or electricity) supply fails (which is common even for reticulated services during bushfire events as mass water is drawn from the network for suppression purposes), the ability to evacuate to safety can overcome the failure of this mitigation measure.

7.1.2.1 Spatially-specific risks and place-based analysis

If Council should consider a spatially-specific approach, that is to say, pursuing a policy of avoidance in part through strategic planning processes and zoning rationale, it is necessary to consider those areas of the region where potential for intolerable risk may occur (either existing or potential future risk if development continues in the absence of consideration of bushfire risk).

Having regard to the two (2) risk multipliers above, as indicators of potential for intolerable risk, the risk assessment identifies a small number of locations across the region where these factors

may apply. The following table summarises these locations and their respective context, relative to the risk multipliers that apply. In some cases, both risk multipliers are observed in certain locations.

This reflects a principles-based approach to identifying areas of potential heightened bushfire risk, where spatially-based planning controls may be worthy of consideration to limit continued risk growth.

Table 51 - Summary of location-specific risk multiplier factors

Risk driver / multiplier	General locality of exposure (informed by risk assessment)	Discussion
Existing or future exposure to Very High Potential Bushfire Hazard (fireline intensities exceeding 40,000 kW/m)	Toowoomba Escarpment	Areas of exposure include parts of Harlaxton, Mount Lofty, Prince Henry Heights, Redwood, Rangeville, Middle Ridge and Top Camp. These suburbs are largely developed with limited opportunity for further development with the exception of several isolated pockets of rural residential and low density residential zoned land which could be further developed.
	Blue Mountain Heights, Highfields, Spring Bluff to Cabarlah (east of New England Highway)	East of the New England Highway, these areas are exposed to steep topography and high fuel loads. Land use planning approaches cannot take into account or rely upon the implementation of fuel management activities, which are likely to be challenging to implement in this area due to complex terrain and proximity of existing development. Meringandan Road north of Highfields provides another discernible boundary, north of which the connectivity of bushland is significant.
	Hampton and Ravensbourne	The existing risk profile of Hampton and Ravensbourne is being managed via disaster management processes under the QDMA. The vegetation profile within the township itself is considerable, noting the town is also surrounded / adjoined by expansive bushland, as well as nearby forestry.
	Crows Nest (east)	A fire event in proximity to Crows Nest (with the exception of grassfire) would occur from the east, north or south-east, moving towards the township. Land to the east of the highway is exposed to Very High Potential Bushfire Hazard. A risk-responsive approach to growth in Crows Nest would need to also consider exposure to flood risk, but would likely be best considered to the west of the New England Highway. Several rural residential zoned allotments to the east of the New England Highway exist which

Risk driver / multiplier	General locality of exposure (informed by risk assessment)	Discussion
		could accommodate a small level of further development.
	Toowoomba Range (Great Dividing Range)	Outside of existing populated centres and townships, the bulk of the region along the range is zoned for rural purposes.
Existing or future potential constrained ability to evacuate to safety	Crows Nest (east)	The township is principally accessed via the New England Highway to the south and west. A series of secondary and local collector roads enter the town from the north and east. These routes would primarily be used for evacuation to the Crows Nest township from surrounding rural areas, but not from Crows Nest. The New England Highway is flanked by Pechey State Forest to the south of town, however this is relatively discontinuous from the national park. In the event that multiple ignitions occur in the area, egress to the south of town may be impacted. Routes to the west toward Haden and Goombungee may be appropriate egress routes. One of two neighbourhood safer places (NSPs) in the region is located in Crows Nest, at the Crows Nest Sports Ground. In the event of inability to evacuate the township, the NSP provides a place of absolute last resort, but it does not guarantee survival. Immediate opportunities for evacuation are located west of the town. Properties to the east must first attempt evacuation to the Crows Nest township, in and through an area highly exposed to Very High Potential Bushfire Hazard.
	Hampton	Hampton is potentially exposed to a series of fire runs which could advance towards the township from almost any direction. Whilst the hazard might be lower to the west of town, the extent of grassland and fragmented bushland continues to present a potential hazard threat. The New England Highway is the primary route through town, however other routes traverse east – westerly throughout the township including Esk Hampton Road and Hampton Road. From Hampton Road however, the route options are available to the north and south. Both move south towards either Pechey or Geham State Forests on unsealed roads.

Risk driver / multiplier	General locality of exposure (informed by risk assessment)	Discussion
	Blue Mountain Heights, Highfields, Spring Bluff to Cabarlah	East of the New England Highway, existing areas serviced by routes which are one way in and out service a volume of properties and which may be impacted by flame contact, extreme radiant heat, smoke impacts and poor visibility or tree fall. Such locations include: • Weale Street (and connecting streets); • Murphys Creek Road (interface with Lockyer Valley Regional Council); • Vayro Road; and • Perry Road. It is understood vegetation along Vayro Road has been recently cleared, however this area remains subject to Very High Potential Bushfire Hazard and future development in this location could limit the ability for existing residents on Vayro Road to evacuate to the New England Highway.
	Toowoomba Urban Area	Along the Escarpment, several areas are identified as potentially subject to emergency evacuation challenges during a bushfire event due to exposure to bushfire attack and limited route options. These include: • New England Highway; • Preston Boundary Road (interface with Lockyer Valley Regional Council); • Flagstone Creek Road (interface with Lockyer Valley Regional Council); • Nelson Street; • parts of Rowbotham Street; • East Street; • Dudley Street; • Bridge Street; • Prince Henry Drive; and • Harvey Street and surrounds.
	Rural residential areas west of Millmerran	These rural residential areas include the communities of Millmerran Woods, Millmerran Downs, Cypress Gardens, Forest Ridge and Wattle Ridge. These communities are exposed to Medium Potential Bushfire Hazard, however the cumulative density of properties, the construction of the road network (quantum of unsealed roads), exposure of the road network to bushfire

Risk driver / multiplier	General locality of exposure (informed by risk assessment)	Discussion
		attack and including vast stretches of the Gore Highway create a compounding risk issue in terms of the ability for evacuation. A number of existing allotments are capable of accommodating further development in an area exposed to potentially significant evacuation risks. Whilst emergency management policy is for evacuees to leave early, in reality, only 12 per cent will likely do so.

The risk drivers / indicators of potentially intolerable risk described from a place-based perspective above may attract a number of potential planning measures which collectively avoid growing risk, or where this is not feasible, mitigate existing and potential future risk to a tolerable level. That is to say, where planning measures are sufficiently effectively to arrest (maintain) or alleviate the risk profile of a location.

PLANNING OPTION 25: The options for Council consideration in relation to responding to potentially intolerable risk locations in the region comprise a suite of the following:

- back-zoning of existing urban or residential zoned land;
    - specific allotments across the region would need to be identified, the options weighed, and a Feasible Alternatives Assessment Report prepared in satisfaction of the MGR;
- use of zoning controls to establish appropriate land use intent, and drive a desired settlement pattern;
- use of zone-based precincts which establish specific bushfire resilient provisions for certain locations which use planning controls to limit increased risk (i.e. minimum lot size provisions, siting and design controls, access and evacuation requirements, etc.); and
- utilisation of levels of assessment for specific land uses and development in specific locations (i.e. zone-based precincts) which can ensure that non-desirable land uses trigger higher levels of assessment with the ability for Council to use all relevant part of the planning scheme, beyond just the overlay code, as the assessment benchmarks, and also ensure the best possible outcomes for other uses where existing use rights may exist but which will benefit from being subject to requirements.

The avoidance of new emerging community and rural residential zoned land in higher risk locations is also a key opportunity, explored in the growth management opportunities section which follows.

Addressing intolerable locations need not, and largely cannot, be the function of simply one tool or approach, but must be the function of a range of planning tools working collectively. Back-zoning, being one of the strongest risk management tools, requires specific analysis.

Criteria to direct zoning, to drive a desired settlement pattern, could be utilised to also highlight existing allotments which do not meet the criteria and therefore may be candidates for back-zoning, from which a detailed analysis could be performed. Notwithstanding, back-zoning for the exclusive purpose of only bushfire hazard is, at present, not a widely used tools but remains an option for consideration of specific allotments.

The land use policy table which follows provides criteria which may be used to guide a zoning approach as part of Council's broader settlement strategy, and may highlight existing zoning which does not meet the criteria, and therefore may attract considerations for alterative planning tools, including back-zoning.

7.1.2.1.1 Growth management opportunities

Council's growth management activities provide a pathway to facilitate lower risk settlement pattern and development outcomes in a manner which orients the region's future growth deliberately away from high risk locations.

It is noted that Council's core growth areas may include areas to the immediate west of Highfields, as well as the Westbrook corridor.

Part of the bushfire risk assessment identified not only locations of potential higher risk across the region, but also those locations where growth expansion may be considered, having regard only to bushfire risk factors. This does not take into consideration other planning matters which must also be contemplated, but does provide a clear articulation of where growth in a lower-risk context can occur, particularly focussed on the Toowoomba Urban Area. Whilst hazard is still present, it is relatively fragmented, of reduced scale and with lower fuel loads and topographical influences than other locations.

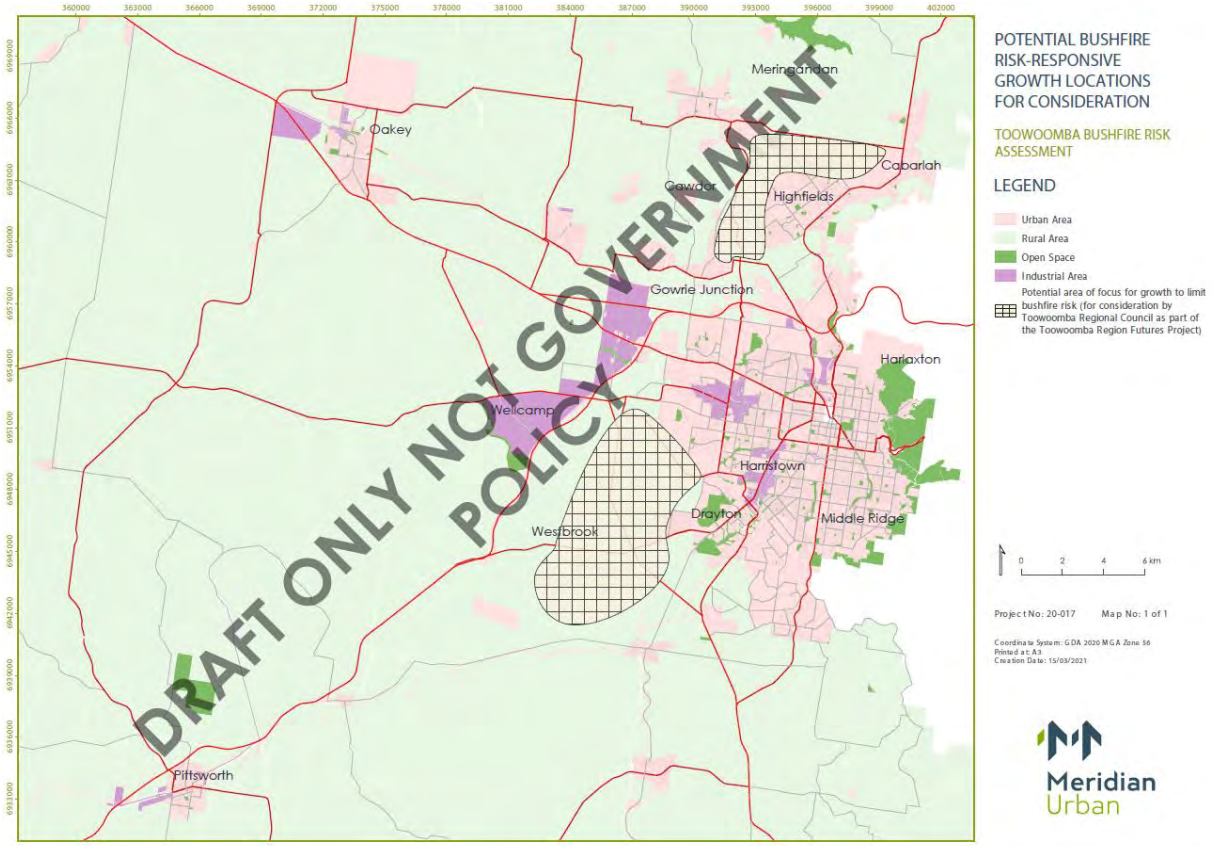


Figure 50 - Potential bushfire risk-responsive growth locations for consideration

PLANNING OPTION 26: Council may consider the above potential bushfire risk-responsive growth locations as part of its broader settlement strategy.

7.1.2.2 Land use-related risks

The preceding section relates to zoning-based approaches to reconcile land use risks, which this section and the following section expands upon.

The SPP and its guidance materials make clear the State's interest that vulnerable and incompatible uses are not located in bushfire prone areas.

To a degree, this position is not one which Council's policy can necessarily differentiate from however, there are aspects for consideration in terms of how this State interest may be satisfied.

Vulnerable uses are not appropriate in hazard prone areas due to the nature of occupants. This may include the aged, the ill or the very young. It can also extend to persons who are visiting and unfamiliar with the landscape. Limiting vulnerable uses in hazard exposed locations is a widely accepted planning approach to risk management. This ensures that those persons who are least capable of enduring natural hazard emergencies are not unnecessarily exposed, and development growth avoids placing further, avoidable demand on emergency services. Section 6.2.1.4 outlines the specific land uses considered to be 'vulnerable uses'.

At this stage, it is not considered to be the case that Council would seek a different policy position in relation to vulnerable uses in bushfire prone areas to that of the State interest, particularly noting a similar policy position has been previously adopted by Council for the purposes of flood hazard.

Based upon the spatial analytics performed by the risk assessment, Council maintains an excellent track record in ensuring vulnerable uses are located largely outside hazard prone locations.

Perhaps the most simple and streamlined opportunity is to utilise Council's existing 'vulnerable use' definition embedded within the TRPS (expected to be carried across into the new scheme) which was established as part of Council's significant flood risk response. The current guidance materials expand the range of uses slightly beyond Council's definition however, these additional uses may be considered by Council for inclusion as they likely represent vulnerability to flood hazard.

A planning option in relation to this is identified previously in this report.

If this approach to a consolidated, multi-purpose definition is not desirable then Council may consider adopting a specific definition for 'bushfire vulnerable uses'.

PLANNING OPTION 27: Council could consider the adoption of **a special definition for 'bushfire vulnerable uses' or the like. Alternatively, a table can be embedded at the end of the bushfire** hazard overlay code which outlines the nature of vulnerable uses relevant for the Toowoomba Region however this may raise complexities for development assessment.

For other uses including hazardous facilities, such land uses are also best avoided in bushfire prone areas due to the potential ignition source they may serve, or increased vulnerability and risk if fire in the surrounding landscape were to occur. These uses should ideally attract the same policy position as vulnerable uses.

PLANNING OPTION 28: Council may consider a similar policy position for hazardous facilities as it does for vulnerable uses.

In instances where it may be argued that 'overriding' or 'overwhelming' need exists to warrant a vulnerable use or hazardous facility in a bushfire prone area, firstly Council's position on its acceptance of such representations is the first consideration and this stems beyond bushfire hazard to any planning matter. The second requires the contemplation of how the 'door is left open' to enable certain merits-based consideration, whilst maintaining a policy position which avoids these uses generally.

Should Council wish to maintain some flexibility in relation to potential vulnerable uses and/or hazardous facilities to undertake a merits-based assessment, whilst maintaining a general policy position of avoidance for these uses, the planning scheme provisions can be drafted accordingly.

PLANNING OPTION 29: Council is to decide its policy position in relation to avoidance in the first instance of vulnerable uses and hazardous facilities in bushfire prone areas, and the desired approach in terms of the strength of scheme provisions to enable a merits-based assessment **for specific circumstances, and what they may entail, or not at all. Council's existing policy for** vulnerable uses in flood prone areas may provide the opportunity to ensure consistency in terms of how multiple hazards are considered by the local planning instrument.

7.1.3 Land use policy table

Having regard to the policy positions available to Council for consideration in relation to intolerable, tolerable and acceptable risk, the table over-page sets out a suggested policy framework, which includes some options, noting that no single measure in isolation will satisfactorily address risk. Thus, multiple options exist and can be utilised throughout the formulation of the new planning scheme.

PLANNING OPTION 30: Council may consider the policy positions relative to varying bushfire risk profiles to inform its policy settings both in terms of settlement strategy as well as statutory instrument formulation.

Table 52 - Bushfire risk-driven land use policy table

Primary risk multiplier	General level of risk	Reason for level of risk	Broad land use policy position	Integration with settlement policy							Key Development Control Parameters *Consistent with Land Use Principles*	Other risk treatment & supporting governance measures
				Existing Residential zones *incl. Rural Residential*	Existing Commercial Zones	Existing Industrial Zones	Existing Emerging Community Zone	Existing Community Facilities Zone	Existing Open Space / Recreation Zones	Existing Rural Zone		
Existing or future exposure to Very High Potential Bushfire Hazard (fireline intensities exceeding 40,000 kW/m)	Intolerable	Very High Potential Bushfire Hazard areas (including 100m buffer area) are susceptible to erratic, intense and fast-moving fire behaviour.	Avoid greenfield expansion Support built form change in existing areas over time Support bushfire resilient land uses in non-urban areas Responsive land use permissibility: - no greenfield expansion - rural industry appropriate where code compliant - no vulnerable uses - strong focus on built form controls	Create a bushfire resilient precinct within existing residential zones (particularly rural residential) to denote limited future potential (including RaL) but retain some opportunity for residential development if an improvement of risk profile can be achieved No secondary dwellings (unless above can be achieved) No multiple dwellings Consider application of back-zoning in severe circumstances to limit further development / population increase	Create a bushfire resilient precinct within existing commercial zones to denote limited future potential (including RaL) but retain some opportunity for residential development if an improvement of risk profile can be achieved Tenancy change acceptable (subject to vulnerable use provisions) No caretaker residences or other mixed uses involving residential activities Avoid new vulnerable uses (but may allow repair and extensions up to 100sqm for	Create a bushfire resilient precinct within existing industrial zones to denote limited future potential (including RaL) but retain some opportunity for residential development if an improvement of risk profile can be achieved Tenancy change acceptable (subject to hazardous facility provisions) No caretaker residences or other mixed uses involving residential activities Avoid new hazardous facilities (but may allow repair and extensions up to 100sqm for	Consider split zoning with Limited Development Zone, Environmental Management or Sport and Recreation) but acknowledging associated land use responsibilities for Council Consider a bushfire resilient precinct which limits minimum allotment sizes to ensure on-site asset protection can be achieved and reduces extent of population increase Consider application of back-zoning in severe circumstances to limit further development / population increase	No zoning change No new vulnerable uses Infrastructure assets avoid bushfire prone areas generally, otherwise application of overlay code provisions which should include asset protection provisions	No zoning change Promote structures outside of bushfire prone areas (equipment is not covered under the DRFA)	No zoning change Promote development outside of bushfire prone areas, or with limited radiant heat exposure profile	Strong reliance of policy provisions of the full planning scheme Application of full overlay code	Other governance actions / incentives including: Consideration of risk as part of bushfire management plan practices Ongoing Operation Cool Burn activities Encourage amalgamation Transferrable development rights Limit future sale (Council as first right of refusal) for residential zoned lots Strategic buy back policies
Existing or future constrained ability to evacuate to safety	Intolerable	Where bushfire behaviour means limited time to evacuate or road network is subject to impact.										

Primary risk multiplier	General level of risk	Reason for level of risk	Broad land use policy position	Integration with settlement policy							Key Development Control Parameters *Consistent with Land Use Principles*	Other risk treatment & supporting governance measures
				Existing Residential zones *incl. Rural Residential*	Existing Commercial Zones	Existing Industrial Zones	Existing Emerging Community Zone	Existing Community Facilities Zone	Existing Open Space / Recreation Zones	Existing Rural Zone		
					existing premises)	existing premises)						
Exposure to bushfire hazard	Tolerable	Where exposure to High or Medium Potential Bushfire Hazard is present and ability to evacuate is reasonable.	High land use permissibility: - No vulnerable uses - Overlay code drives land use outcomes	No zoning change	No zoning change	No zoning change	No zoning change	No zoning change	No zoning change	No zoning change	Application of full overlay code	As per existing processes (LDMP, bushfire hazard management plans, etc.)
Nil planning-related matters	Acceptable	Where land is exposed but existing use rights prevail, or development is unable to be deemed 'assessable' development (i.e. dwelling houses on allotments measuring 2,000sqm or less)	Development is dealt with primarily under the Building Code, though the opportunity for 'accepted development subject to requirements' may be an option to regulate water supply, access and siting of dwellings	No zoning change	No zoning change	No zoning change	No zoning change	No zoning change	No zoning change	No zoning change	Potential ADSR code provisions for dwelling houses on lots 2,000sqm or higher.	As per existing processes (LDMP, bushfire hazard management plans, etc.)

7.2 Zoning and levels of assessment

Pursuant to the land use policy table above, no zoning changes are require where tolerable and acceptable risk profiles are currently presently. That is to say, where land is not subject to exposure to Very High Potential Bushfire Hazard (fireline intensities exceeding 40,000 kW/m), or existing constrained ability to evacuate to safety.

PLANNING OPTION 31: Any new zoning rationale considered as part of the growth management process must consider the two intolerable risk multipliers before any changes (for example, from rural to low density residential or emerging community) are made to the current settlement pattern within the region.

In terms of existing zoning which relates to either or both of these risk multipliers, it is acknowledged some parcels in the region are zoned for uses other than rural or open space. In the vast majority of these instances, the land has been previously developed and the potential for further, increased development is limited due to a variety of factors.

In the Toowoomba Urban Area, existing Rural residential zoned land along the Escarpment may have the potential to accommodate increased development, particularly for allotments which are larger than the minimum allotment size requirements. This area is exposed to Very High Potential Bushfire Hazard as well as discrete areas of potentially constrained ability to evacuate in some circumstances (i.e. reliance on one point of access and egress).

A high number of Rural residential zoned land on the Toowoomba Escarpment from Preston, extending north to Harlaxton. The Escarpment Rural residential zone may be a specific focus for the consideration of a 'bushfire resilient precinct' or similar precinct which acknowledges the extent of bushfire risk exposure and sets in place settlement policies which limit further development potential to a defined threshold. For example, minimum allotment sizes could be a specific focus, ensuring appropriate siting and defensible space for dwellings can be achieved whilst also limiting cumulative population increase across this zone, in this location.

PLANNING OPTION 32: Consider the settlement policy approach for Rural residential zoned lands on the Toowoomba Escarpment between Preston in the south and Harlaxton in the north, including the viability of a bushfire resilient precinct which places a limit on future increased development density and population growth in location which is exposed to Very High Potential Bushfire Hazard. The level of assessment for certain forms of development in this location, within this zone, may also be augmented to reflect its risk profile.

A similar situation is prevalent to the east of the New England Highway from Blue Mountain Heights to Crows Nest. This area comprises a more diverse range of existing land uses, dominated largely by rural and residential activities but with some vulnerable uses also apparent. Further densification of existing zoned Rural residential land is possible.

PLANNING OPTION 33: Consider the relevance of a bushfire resilient precinct as part of the Rural residential zone (which can apply to different parts of the region) with specific bushfire resilience provisions (i.e. such as minimum allotment size requirements) as a measure to place a limit on future increased development density and population growth in location which is exposed to Very High Potential Bushfire Hazard. The level of assessment for certain forms of development in this location, within this zone, may also be augmented to reflect its risk profile.

Prince Henry Heights is exposed to Very High Potential Bushfire Hazard, which surrounds the entire suburb, the evacuation of which relies on one access and egress point which is also exposed to potential flame contact and radiant heat. Further development at Prince Henry Heights requires a specific policy position from Council having regard to the intolerable bushfire risk profile currently present, ensuring the existing situation is not further exacerbated by additional exposure of persons or property. This area is also identified as subject to potential landslide hazard, which is a further consideration.

From a response perspective, protection of Prince Henry Heights is challenging for fire services due to the potential fire runs, the steep terrain of the area, the vegetation which completely

surrounds Prince Henry Heights, and emergency access and egress. Further development in this location will directly increase the burden on emergency services with regard to life and property protection. Burden on emergency services is a key State interest which Council is required to considered under the SPP 2017.

PLANNING OPTION 34: Consider a settlement policy for Prince Henry Heights, including consideration given to the need to limit the opportunity for existing risk to be further exacerbated by additional exposure of persons and property.

The rural residential areas to the south-west of Millmerran are already zoned Rural, despite the allotment sizes, which clearly signals the potential for growth in this location is limited. Beyond planning, other mitigation measures could be considered from a built form and asset perspective to support and mitigate disaster management in this location.

With specific regard to levels of assessment within the new planning scheme, Council's current approach to levels of assessment for development in bushfire prone areas does not make full use of this tool to respond to bushfire risk however, this is largely to be expected given Queensland's historic planning approach to bushfire hazard more generally and the relatively recent requirement for bushfire risk assessments to be undertaken.

For example, development within the bushfire resilient precinct may trigger impact assessment, requiring a merits-based consideration of proposed development against the entire scheme, which provides the Council the flexibility to consider the multitude of mitigation measures applicable to respond to risk, or whether the development remains of an intolerable risk profile. Likewise, vulnerable facilities in bushfire prone areas may become impact assessable.

7.3 Assessment benchmarks

For the most part, the assessment benchmarks have been covered at Section 6.3.3.3 of this report which includes a summary of existing assessment benchmarks of the TRPS against that matters covered by the example assessment benchmarks cited by the SPP guidance material 2021.

However, there is further ability to utilise research to inform settlement pattern outcomes in tolerable and acceptable risk locations.

Given that evacuation is a key aspect of planning for bushfire protection, opportunity exists to have regard to the service catchment of allotments / dwelling houses serviced by new and existing road networks.

Research by Cova (2005) provides indicative 'community egress' parameters which identifies the maximum preferred number of dwellings and corresponding minimum number of road exits or egress points to facilitate emergency evacuation in the event of bush fire. It remains a generalised approach which can be used to guide new development, or identify existing pinch points within a community.

Table 53 - Cova's road and dwelling capacity framework for bushfire prone areas (Source: Cova, 2005)

Number of dwellings	Minimum number of exiting roads	Maximum number of dwellings per exit
1-50	1	50
51-300	2	150
301-600	3	200
601+	4	-

It is the case, particularly in Queensland, that planning triggers for secondary and multiple road access requirements for new subdivisions continues to remain a significant policy gap. Not only would the introduction of such provisions help to guide resilient settlement pattern outcomes, it can also be used to guide strategic planning activities as part of Council's growth management process.

PLANNING OPTION 35: Consider the introduction of planning triggers for secondary and multiple road access / egress requirements as part of the RaL assessment benchmarks within the new Bushfire Hazard Overlay Code.

PLANNING OPTION 36: Consider using the Cova framework as a tool to analyse the ability to **evacuate for potential growth areas, as part of Council's growth** management activities under the Toowoomba Region Futures Program.

8 Stakeholder engagement

To inform this issues and options analysis and consider on-the-ground operation of the bushfire planning scheme provisions as they are currently applied under the TRPS, three forms of stakeholder feedback and engagement have been undertaken:

1. Review and feedback provided on the draft risk assessment and draft issues and options report, from officers across various Council departments;
2. Council officer workshop held on 28 April 2021; and
3. Councillor workshop held on 26 May 2021.

8.1 Review feedback

The draft risk assessment report was provided to officers from across different Council departments for preliminary review and feedback. Relevant comments provided by Council through this process included:

- *the current bushfire hazard overlay mapping and code does not have regard to development and occupants which may seek to locate immediately adjacent to mapped bushfire hazard under the current TRPS. The current mapping does not trigger the overall, and thus a bushfire management plan is not required and the building does not need to address any building requirements.*

  Response: The author of the above observation goes on to note the adoption of the state-wide bushfire prone areas mapping will overcome this issue, and this is correct. Planning Option 2 outlines how Council may ensure the buffer is appropriately identified as part of the designated bushfire prone area for the purposes of triggering planning and building provisions.

- *the current TRPS does not provide clarity in relation to the assessment of fuel loads as part of bushfire management plans submitted to Council as part of development assessment processes.*

  Response: Council may consider the benefit of a Planning Scheme Policy which provides detail and communicates Council's expectations with regard to how vegetation classification assessments area carried out.

- *Council lacks certainty in relation to ongoing and future land uses which do not form part of development applications (but may adjoin these sites) where fuel loads may change and increase in the future as properties change hands.*

  Response: This matter remains a key challenge for assessment managers, where revegetation activities on both public and private land can inadvertently change the fuel load profile, and this the hazard profile of an area over time. This issue largely manifests outside of the development assessment process. Other instruments such as provisions under the Fire and Emergency Services Act, a local law, Council operational policy and educational programs can assist to avoid these situations, or ensure they occur in a fire-wise manner.

- *changes in fuel loads (i.e. rainforest to wet sclerophyll) may occur over time as a result of climate change, producing higher fuel loads.*

  Response: The risk assessment at Part B identifies this as a particular risk across the region and in particular, across the escarpment. A longitudinal study of these pockets of vegetation may assist to provide Council with a strength of evidence base over time to understand the impact of climate change in this regard. On a separate but related note, these two vegetation classifications are a particular challenge in development assessment processes where wet sclerophyll vegetation,

one of the highest fuel load communities in Queensland, is routinely mistaken for and argued to be rainforest vegetation – a community where fire should be excluded. Rainforest vegetation is also excluded from requiring bushfire building requirements in Queensland, subject to a state-specific variation to the Building Code of Australia. This can give rise to the potential for development to occur without any planning or building mitigations in place in immediate proximity to high fuel loads, where vegetation communities have been mistakenly identified. A bushfire hazard planning scheme policy may assist to provide clarity on the differences between these communities, as they exist in the Toowoomba Region.

- *adequate water supply and access requirements for fire appliances are needed.*

  Response: as part of the SPP bushfire guidance 2021, example assessment benchmark provisions are outlined by the state, with the ability to be locally refined to account for local conditions and needs. The draft code provisions identify the role of water supply and access provisions however, these provisions can be drafted to be more specific, to guide water supply requirements for different types of land uses.

- *there is a conflict in intent between the TRPS bushfire hazard overlay code and the current Environmental Significance Overlay. Aspects of revegetation should be contemplated as part of the bushfire management plan process required through development assessment.*

  Response: as part of the SPP bushfire guidance 2021, example assessment benchmark provisions are outlined by the state, with the ability to be locally refined to account for local conditions and needs. The draft code provisions identify specific requirements where revegetation and rehabilitation is proposed, providing a potential linkage with Council's environmental and biodiversity codes, ensuring a calibrated approach across the planning scheme provisions.

- *it is desirable to remove the minimum setback and maximum vegetation heights within AO3.1 and AO5.1 and instead, reply on the fireline intensity and radiant heat flux assessment undertaken as part of a bushfire management plan to determine if separation is reasonable, and only include maximum tree heights for land within asset protection zones.*

  Response: maximum vegetation canopy heights to determine separation distances is a generalised and non-specific approach which does not take any account of fire science related to the understorey fuel load, its arrangement and connectivity, or effective slope. These attributes determine potential bushfire behaviour and intensity. These generic provisions should be removed as part of revised bushfire hazard overlay code drafting.

- *mandate perimeter roads between new development and bushfire prone vegetation, and clearly articulate in the code the purpose of access arrangements is to provide safe carriage for evacuation.*

  Response: as part of the SPP bushfire guidance 2021, example assessment benchmark provisions are outlined by the state, with the ability to be locally refined to account for local conditions and needs. The draft code provisions identify specific requirements for perimeter roads which also limit the acceptability of fire trails and firebreaks as an alternative. Fire trails and breaks are generally handed to local government to manage in perpetuity, attracting significant maintenance costs, occupying significant resources, and also tend to produce poorer protection outcomes over time. It is a common misconception that perimeter roads result in compromised yield outcomes for development however, urban design approaches are capable of maintaining yield and facilitating perimeter roads.

8.2 Officer workshop

A workshop with Council officers was held on 28 April 2021. As part of this workshop, an online survey was conducted, focused on determining potential policy and regulatory responses. They survey involved eight questions and 13 responses were received. The questions related to four key themes:

3. the current TRPS;
4. desired outcomes;
5. risk tolerance; and
6. the regulatory response.

8.2.1 The current TRPS

The first survey question related to how the current planning scheme is dealing with assessment of bushfire hazard. The majority of responses indicate that a general tightening of provisions would be useful, followed by almost 40 per cent of responses identifying it is operating to a minimum level and would benefit from multiple improvements to achieve SPP compliance.

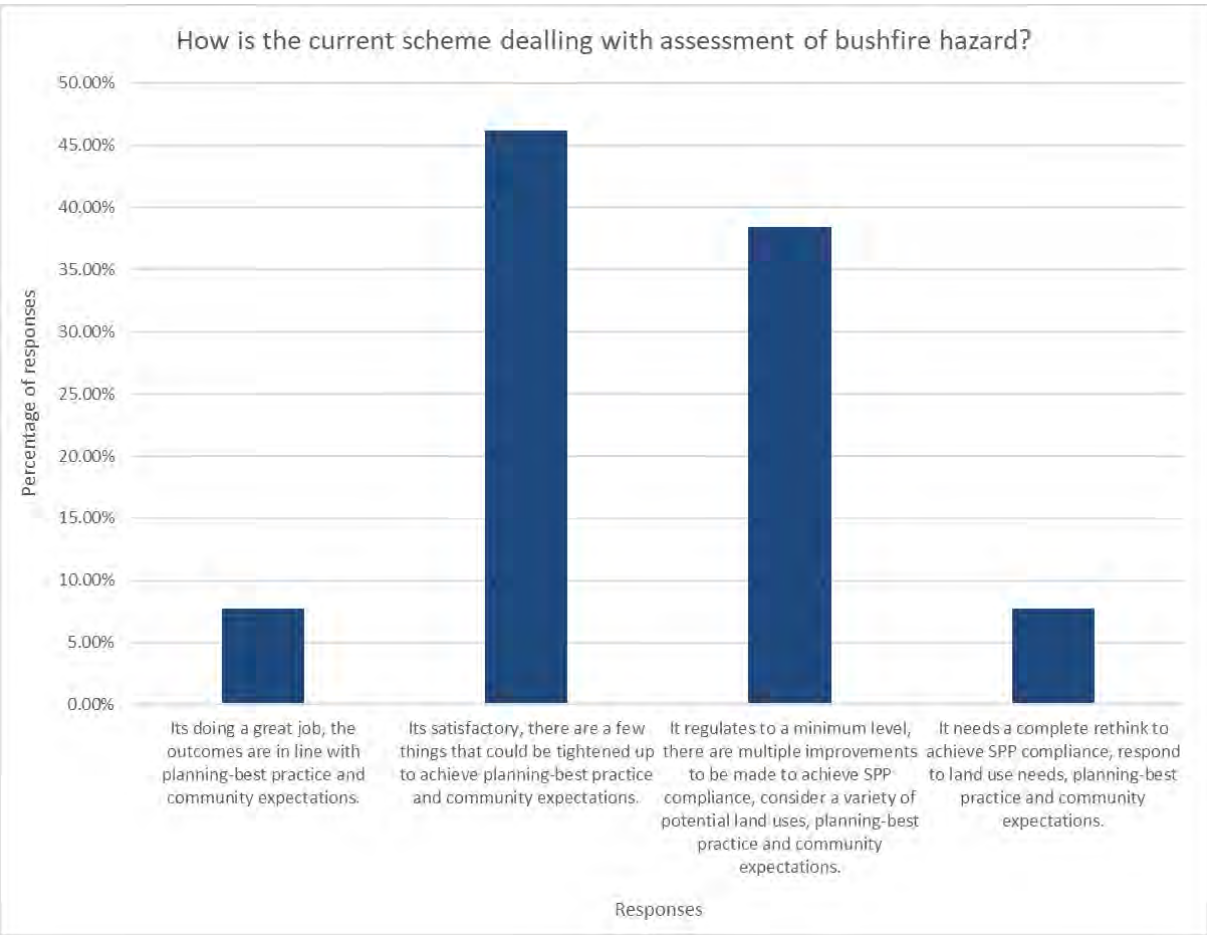


Figure 51 - Response graph for how well the current scheme is dealing with assessment of bushfire hazard

8.2.2 Desired outcomes

The second group of questions focused on the types of land uses considered appropriate and inappropriate in bushfire prone areas in the Toowoomba Region. Council officers provided the following feedback.

In Toowoomba, land uses that are suitable in bushfire prone areas include:

- low and very low density rural living;
- temporary accommodation (including eco tourism);
- recreational activities and open space;
- anything except residential and industry;
- development where protection of life, property and the environment at a reasonable cost, can be achieved;
- those which can be adequately separated from hazard without clearing, and with appropriate access and egress;
- existing land uses;
- any use or structure assessed against AS3959 and confirms that treatments, access and water supply are suitable;
- any development where design and management measures can be properly implemented;
- those that do not involve vulnerable persons (no uses as per current scheme provisions); and
- development should be limited due to increasing threat of climate change.

In Toowoomba, land uses that are not suitable in bushfire prone areas include:

- critical community infrastructure;
- permanent residential accommodation where density does not allow for buffers;
- sensitive and vulnerable uses;
- hazardous industry and commercial activities increasing population working in BPA;
- high density development;
- uses that do not have the resources for the correct protection of assets;
- non-residential uses on lots that cannot achieve the adjacent (with some tolerance for dwelling houses on terminating roads where accompanied by well-maintained all-weather fire trails established for the purposes of emergency evacuation); and
- new dwellings where significant clearing is required for bushfire protection.

The above generally aligns with the list of potentially vulnerable uses identified earlier in this report, with a small number of exceptions. As previously outlines, the regulation of non-compatible land uses in bushfire prone areas can be implemented via the Levels of Assessment component of the new planning scheme.

It is significant to note that ability to evacuate was not highlighted in the feedback above. This may be for a range of reasons:

- the concept of ability to evacuate and how it is contemplated in strategic planning activities is a relatively emergent arena in Australia;
- there is an underlying view that separation and building construction, which increases the ability for a building to withstand bushfire attack, means that occupants could shelter-in-place;
- evacuation (beyond simply site-based access provisions) have not featured within development assessment processes, largely due to the fact the evacuation network

extends far beyond the site boundary which limits its ability to be contemplated by development assessment.

The above aspects each underpin the need for the consideration of ability to evacuate as part of the risk assessment and this issues and options analysis, to appropriately inform strategic planning approaches.

The above was follow by a question in relation to the balance between bushfire protection and vegetation clearing, from a policy perspective.

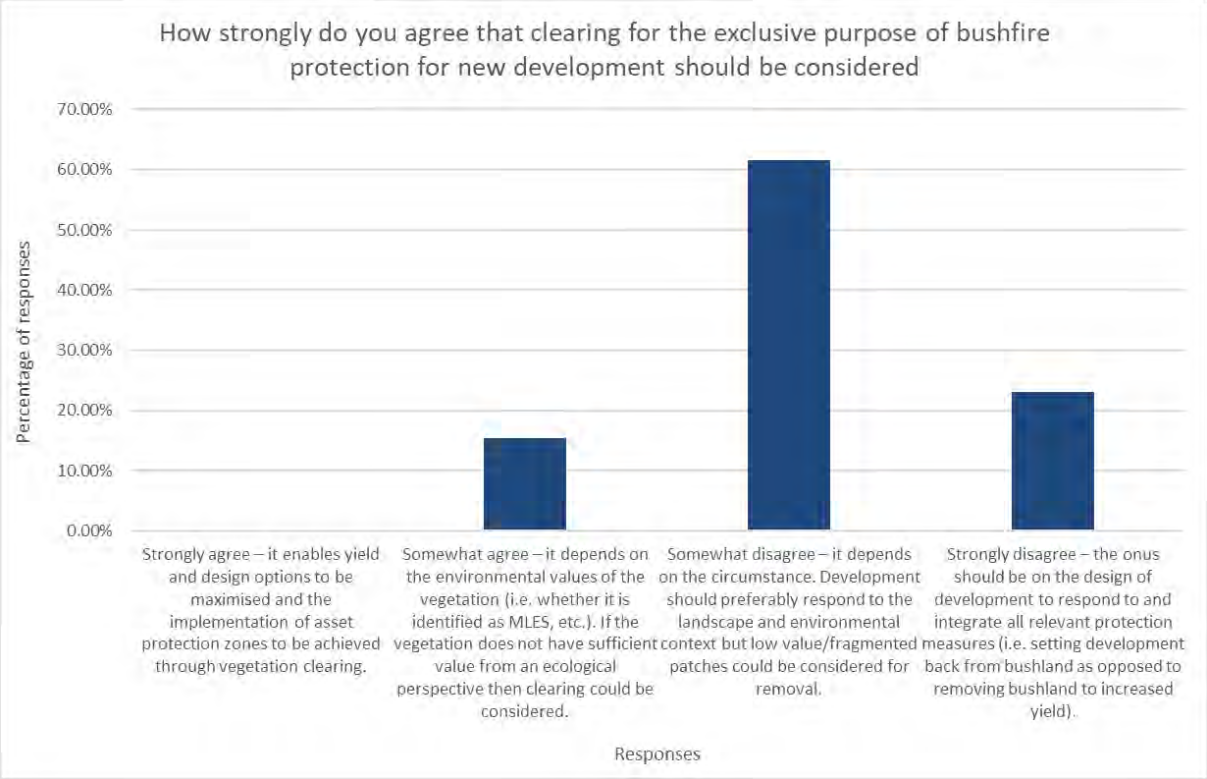


Figure 52 - Response graph relating to the balance between bushfire protection and vegetation clearing

The above graph demonstrates that most respondents do not believe vegetation clearing for the exclusive purpose to site development in bushfire prone areas is appropriate, and that development should instead respond to the surrounding landscape, acknowledging that exceptions may also arise and thus the need for flexibility is critical.

8.2.3 Risk tolerance

The survey sought Council officer feedback in relation to the level of risk tolerance the new planning scheme may consider.

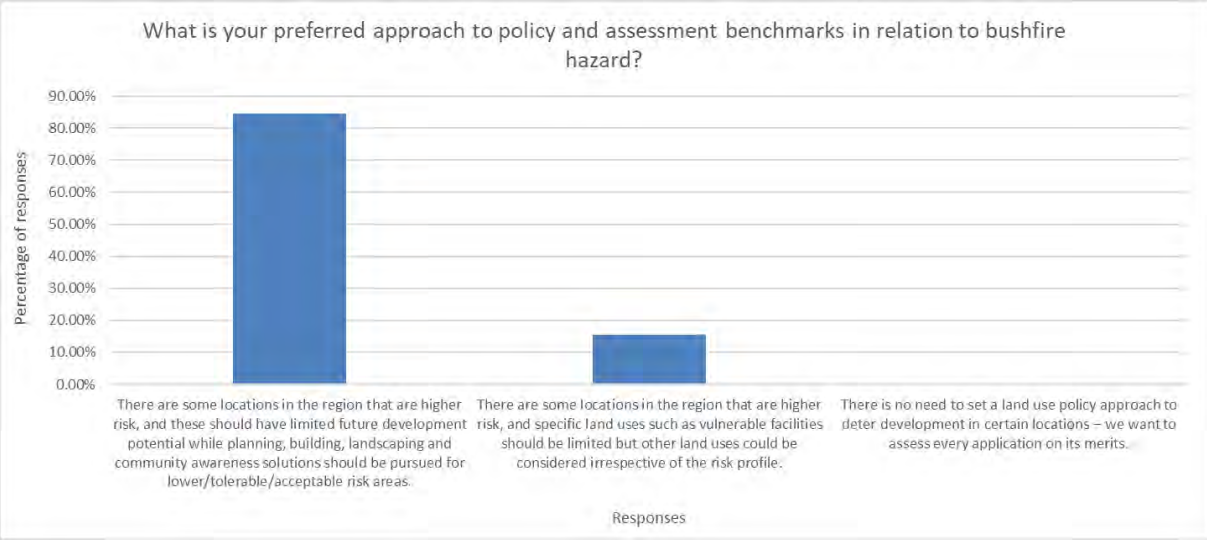


Figure 53 - Response graph relating to the preferred approach to policy and assessment benchmarks

Additional comments provided by Council officers associated with this question included:

- we should be avoiding population increase in high risk / hazard areas;
- consideration of what is causing the higher risk in needed;
- option 2 is better where requirements are unambiguous and integrated into assessment benchmarks;
- the code should enable development to be considered on merits, within reason;
- our approach to bushfire should reflect out stance on how the scheme deals with flood hazard.

The feedback above demonstrates some considerable conflicts in views.

The majority of respondents are of the view that higher risk locations across the region should be contemplated as part of the strategic planning process and application of spatial controls to limit potential future risk, whilst enabling flexibility for tolerable risk locations and land uses to occur with appropriate risk mitigation to protect people and property.

A small number of respondents wish to see a greater level of flexibility applied, potentially deferring consideration of hazard and risk to the development assessment stage. The ultimate challenge with this approach is the ability to avoid potentially inappropriate and intolerable risk activities from occurring, relying fulsomely on the strength of the code and where levels of assessment may inadvertently indicate assessment in favour of approval, where development is code assessable.

8.2.4 Regulatory response

A series of statements were provided for respondents to consider, and either agree or disagree in relation to the regulatory opportunities for planning for bushfire prone areas. These are set out in the table below.

Table 54 - Regulatory responses provided

Question	Agree	Disagree
The overlay code should be confined to SPP matters and risk to life and property through the bushfire risk assessment	4	9

Question	Agree	Disagree
The overlay code should be specific about water supply requirements for different land uses, and include servicing requirements for RaL	12	1
The overlay code should include specific requirements for bushfire resilient building design	9	4
The overlay code should include specific requirements for RaL design / layout	11	2
The overlay code should include requirements for land uses beyond residential dwellings and RaL	12	None of the above - 1
The overlay code should include requirements for landscaping or biodiversity	11	2
The overlay code should include requirements for vulnerable and sensitive uses where they cannot be avoided in bushfire prone areas	10	3
Development with 'acceptable risk' is regulated as accepted development subject to requirements	10	3
Development with 'tolerable risk' can be regulated in all cases	7	6
Levels of assessment should be utilised to signal magnitude of risk for certain land uses and / or locations	11	2
Development with 'intolerable risk' is avoided via policy and regulatory provisions (with provisions which can enable assessment where overwhelming community need is demonstrated	8	5
Development with 'intolerable risk' is considered from a zoning-based perspective, or limited to low impact land uses and limited built form	10	3

The views of Council officers are strong in relation to the need to expand the current focus of the bushfire hazard overlay code within the TRPS to contemplate a broader range of land uses, providing Council officers with the tools to assess non-residential and non-RaL related developments.

Respondents also felt strongly in favour of the introduction of specific requirements for water supply, building design (which has to date, remained a large gap in planning for bushfire protection in Queensland), improved provisions for subdivision layout and urban design, vulnerable uses and the use of levels of assessment to signal magnitude of risk relative to land uses or for certain locations.

One of the key regulatory requirements which must be followed is the need for assessment benchmarks to avoid duplication of building provisions. Despite views of the State government, AS3959 does not have any regard to building design. It is merely a construction and materials methodology which is limit to Class 1, 2, 3 and selected 10a structures, however building design is identified as building control despite the absence of any design controls for bushfire hazard in Queensland.

Despite the above, one opportunity exists to strengthen the relationship by citing the State's *Bushfire Resilient Building Guidance for Queensland Homes* document as part of the non-statutory notes within the Bushfire Hazard Overlay Code.

The final question of the survey sought to understand regulatory pathways for the new planning scheme in response to bushfire hazard and risk.

Table 55 - Responses provided on the future pathways for regulation

In your view, what do you feel are the most challenging issues currently facing Council in relation to development in bushfire prone areas?	% agree
Expansion of low density residential and rural residential areas at the urban bushland interface which is increasing cumulative exposure	76.9
Infill development in bushfire prone areas	15.3
Growth pressure on the Escarpment as a highly desirable place to live	93.3
Clarity of planning controls to guide bushfire resilient outcomes in tolerable risk locations	23
Ability of current policy and scheme provisions to provide a clear framework for assessment in high risk locations, or specific provisions to avoid inappropriate development which could result in a high risk situation	53.8
Clarity and consistency of bushfire hazard assessments and management plans which are assessed by Council	46.1

The most significant issue identified as a challenge by Council officers relates to continued growth pressure on the Escarpment as a highly desirable place to live. It is understood development applications in this location, being a higher risk location, can be sensitive, complex and divisive. This is largely associated with the balance of competing planning issues in these locations, noting these locations are also subject to multiple hazards, not just bushfire.

Land available for infill development, or small-scale expansion of residual rural residential allotments on the escarpment within the Toowoomba Urban Area are often on steep land, adjoining existing urban development or immediately adjacent to, and pushing further into bushland areas. Whilst incremental in nature, this new development is not only highly exposed to quite high levels of potential radiant heat flux, potential for flame contact and extensive ember attack, these developments also place pressure on existing road networks which broader existing communities in the area rely upon for emergency access and evacuation.

The second challenge is the expansion of low density and rural residential areas at the urban bushland interface which is increasing cumulative exposure, which is coupled in with the ability of current policy and scheme provisions to provide a clear framework for assessment in high risk locations, or specific provisions to avoid inappropriate development which could result in a high risk situation.

The speculative nature of planning schemes, which must consider and account for a range of both probable and unlikely land uses places pressure on development assessment processes, particularly for development which is unforeseen by the planning scheme. The ability to the scheme provisions to clearly indicate, through assessment benchmarks, activities which may translate to a high risk proposition must be a key focus. This will provide assessment managers with the strength of regulatory provisions to differentiate between tolerable risk land use outcomes, and those where high risk circumstances or situations could emerge. The new planning scheme must therefore be sufficiently robust and flexible to enable tolerable risk activities to occur, whilst provisioning the strength of statutory regulation to identify and prevent intolerable risk outcomes.

Assessment of development against the code should make this distinction clear to communities, the development industry, and for Council.

Another key challenge is the quality, consistency, robustness and accuracy of bushfire management plans submitted to Council in support of development applications. This presents key difficulties for assessment managers to adequately assess applications. A bushfire hazard planning scheme policy may assist to improve overall quality, consistency and appropriateness of assessment process and management or mitigation measures presented to Council.

8.3 Council Special Meeting

A Special Meeting of Council was called on 26 May 2021 where a briefing was provided to the full Council on the draft risk assessment and policy options available in response, pursuant to the requirements of the SPP and guidance materials.

The Special Meeting was a discussion-based arrangement and Councillors provided questions, statements and reflections throughout the session. A livestream recording of the briefing is available online at https://www.tr.qld.gov.au/about-council/councillors-meetings/special-meetings/12978-special-meetings-of-council

In summary, the following matters were queried by Councillors during the session:

- the nature of fuel loads and existing fire breaks, etc utilised to inform the risk assessment, which relies on potential maximum fuel load as required by the Bushfire Resilient Communities technical reference guide;
- accuracy of the state-wide bushfire prone areas mapping including the patch and corridor remnants and areas east of Clifton where Council estimates that hazard may be higher than that which is illustrated, and whether climate change factors have been included;
- impacts of the mapping on land owners, and for insurance purposes;
- definitions for acceptable, tolerable and intolerable are required; and
- potential for compensation for changes to existing zoning.

A recommendation was presented to Council for consideration, ahead of the planning scheme provisions drafting process, intended to gain steering from Council in terms of its policy position, at a high level.

Subsequent to the proceedings of the Special Meeting, the recommendation was adjusted, as follows:

> *'That proposed bushfire policy and provisions in the new planning scheme be further considered by Council after a draft is prepared based on the following principles:*
>
> *a. Development is supported in areas of bushfire risk where the risk is tolerable or where the risk can be reduced to a tolerable level;*
>
> *b. Development is avoided in areas of bushfire risk where the risk cannot be reduced to a tolerable level; and*
>
> *c. Development involving vulnerable uses is avoided in all areas of bushfire risk.'*

Having regard to the matters raised by Council, further discussions with QFES on the state-wide BPA mapping were held. Summary points which clarify the mapping matter are as follows:

- it is acknowledged the current state-wide bushfire prone areas mapping for the region includes patches and corridors for which an addendum mapping methodology (released after the introduction of the current mapping) addresses,

which provides clarity in relation to how these instances can be and will be removed from the mapping;

- QFES is currently underway with updates to the state-wide bushfire prone areas mapping. Key aspects of the updates include:
    - removal of small patches and corridors as per the mapping methodology addendum; and
    - updated inputs, including the 2020 Regional Ecosystem data set which replaces the Regional Ecosystem data used to inform the current mapping.
- the mapping update will likely be available for Council to consider for adoption as its new Bushfire Hazard Overlay Mapping before the draft planning scheme is prepared, during the ongoing work involved as part of the Toowoomba Region Futures program;
- Council has the option to undertake its own mapping however, at this stage it does not appear that more accurate data is available to inform such an approach that is not otherwise being used by QFES. Such an undertaking would largely be a duplication of effort;
- a reliability assessment (as required by the SPP) of inputs that will be utilised by QFES as part of the updated state-wide BPA mapping has been undertaken, demonstrating the data is satisfactorily reliable in accordance with the reliability requirements of the Bushfire Resilient Communities technical reference guide;
- the use of the existing state-wide BPA mapping to inform the risk assessment is considered entirely acceptable on the basis of landscape-scale risk which this work focusses on, as opposed to fragmented pockets of small patches and corridors. This approach was discussed with the Department and QFES prior to and following the risk assessment process where use of the current mapping to inform the risk assessment processes was deemed appropriate by all parties.

The above may require a brief addendum review towards the end of the Toowoomba Region Futures Program to ensure the mapping, risk assessment and draft planning provisions remain in alignment, and having regard to any state-level changes which may arise during the course of the Program, after the bushfire risk analysis is completed.

9 Summary of risk-responsive planning options

The following table provides a summary of the planning options identified by this report, for Council's consideration, with regard to the manner in which bushfire hazard and risk can and should be addressed by the new planning scheme for the region.

This is followed by a summary of which planning options respond to the relevant approaches to plan-drafting for bushfire hazard, as set out by the *Integrating state interests in a planning scheme – guidance for local* governments document prepared by the State government.

Table 56 - Summary of bushfire risk-responsive planning options for Council consideration

Option No.	Planning aspect	Planning options for Council consideration
1	Mapping and hazard identification	Work with the State government as part of ongoing updates and amendment processes supporting the state-wide bushfire prone areas mapping to address the patch and corridor mapping issues observed by the risk assessment within the Toowoomba urban area, and adopt the revised mapping as the bushfire hazard overlay mapping for the purposes of the new planning scheme.
2	Regulatory linkages	Section 1.6 of the new planning scheme can / should specifically identify the buffer area as forming part of the designated bushfire prone area to avoid any potential for uncertainty. The designation of the bushfire prone area for the purposes of the Building Regulation must be undertaken in accordance with the 'Integrating building works into local planning instruments – guideline for local governments' document.
3	Regulatory linkages	Council may consider, as part of any forthcoming amendment for the current TRPS, to specifically cite the scheme's bushfire hazard overlay mapping as the designated bushfire prone area for the purposes of section 32(a) of the Building Act 1975 and section 12 of the Building Regulation 2006 in relation to Building Work regulated by the planning scheme.
4	Regulatory linkages	Council may consider, as part of any forthcoming major amendment for the current TRPS, to adopt the current state-wide bushfire prone areas map to replace the current overlay mapping, and introduction of new code provisions as an interim risk-reduction measure before the new planning scheme is adopted and comes into effect.
5	Policy	The strategic intent can / should recognise the potential risk of bushfire to human life and property and that development is required to ensure an acceptable or tolerable level of risk is achieved.

Option No.	Planning aspect	Planning options for Council consideration
6	Strategic planning and zoning	Where growth (expansion or infill) is proposed in Toowoomba City, in the Highfields and Cabarlah area, and in Crows Nest, Council may consider bushfire hazard exposure as a key factor as part of any zoning decisions to accommodate future growth.
7	Policy and statutory drafting	Council may consider a consolidated review of locations susceptible to multiple hazards (including flood and landslip) and specifically identify within the strategic intent of the new planning scheme, higher risk locations in the region where growth and development should be avoided.
8	Policy and statutory drafting	The strategic intent of the new planning scheme could be bolstered and provide a strength of strategic direction where specific higher risk locations, or circumstances / criteria that give rise to elevated risk, are identified.
9	Policy and statutory drafting	Council could consider the incorporation of disaster risk reduction outcomes as a facet of sustainable urban development, if this objective is retained as part of the new planning scheme.
10	Policy and statutory drafting	Council may consider outlining its strategic policy intent with regard to the protection of the natural environment from clearing for the exclusive purpose of bushfire protection within the strategic framework of the new planning scheme. On balance, the onus may be placed on the development to be appropriately sited to avoid unnecessary vegetation clearing.
11	Policy and statutory drafting	Council may wish to emphasise the changing fire weather conditions for the region as a result of climate change as part of the strategic framework in the new planning scheme.
12	Policy and statutory drafting	Acknowledging the risk from natural hazards posed to the community including, but not exclusive to bushfire, Council may consider refining the linkages between sustainable and safe communities, sustainable urban development and natural hazard risk reduction within the new planning scheme.

Option No.	Planning aspect	Planning options for Council consideration
13	Policy and statutory drafting	Council may consider a multi-hazard approach to commentary in the strategic framework of the new scheme which avoids vulnerable uses in higher risk hazard areas, not exclusive to just flood hazard.
14	Policy and statutory drafting	Council can adapt the vulnerable use definition in the new planning scheme to relate to multiple hazards, and ensure code provisions and references to vulnerable uses in hazard overlay codes align to the same definition, insofar as possible.
15	Policy and statutory drafting	Council may consider expanding the range of land uses considered to be 'vulnerable uses' where there are shared vulnerabilities across multiple hazards.
16	Policy and statutory drafting	Council may consider specifically citing emergency evacuation during a natural hazard event as a key aspect of access and mobility narratives within the new planning scheme.
17	Policy and statutory drafting	Council may consider specifically citing the need to support emergency access and evacuation processes during a natural hazard event as a key aspect of infrastructure and servicing narratives within the new planning scheme.
18	Policy and statutory drafting	Opportunity exists to incorporate strategic statements into strategic framework narratives on infrastructure and servicing into the new planning scheme. A strategic outcome may include that bushfire protection is supplemented through adequate water supply provision.
19	Policy and statutory drafting	Council may consider revised commentary from an economic development perspective within the strategic framework which focuses on ensuring economic development opportunities achieve an acceptable or tolerable level of risk.

Option No.	Planning aspect	Planning options for Council consideration
20	Policy and statutory drafting	Council should consider a risk-responsive approach to levels of assessment for certain land uses / higher risk locations in bushfire prone areas as part of the new planning scheme, in line with the expectation of plan-drafting under the SPP 2017.
21	Policy and statutory drafting	Council may consider the draft purpose provisions contained within the draft assessment benchmarks under the SPP bushfire guidance 2021 to solidify a position on avoidance of intolerable risk outcomes, as well as aspects involving vulnerable uses, vegetation removal and rehabilitation, and demand on emergency services. Council's existing policy position in relation to the consideration of evacuation should be retained.
22	Policy and statutory drafting	Council may consider the example assessment benchmark provisions under the SPP bushfire guidance 2021 as a base upon which a new overlay code is constructed for the Toowoomba Region, noting it requires significant variation to ensure it is locally fit-for-purpose to meet Council's and the community's needs.
23	Policy and statutory drafting	Council may consider matters associated with bushfire hazard beyond the Bushfire Hazard Overlay Code, particularly with regard to environmental significance / biodiversity overlays and specific zone and development codes.
24	Policy and statutory drafting	Council may consider the value and benefit of a Bushfire Hazard Planning Scheme Policy to communicate its expectations on various aspects of bushfire mitigation measures which may be employed to comply with the overlay code.
25	Policy and strategic planning	The options for Council consideration in relation to responding to potentially intolerable risk locations in the region comprise a suite of the following: • back-zoning of existing urban or residential zoned land; ○ specific allotments across the region would need to be identified, the options weighed, and a Feasible Alternatives Assessment Report prepared in satisfaction of the Ministers Guidelines and Rules (MGR); • use of zoning controls to establish appropriate land use intent, and drive a desired settlement pattern;

Option No.	Planning aspect	Planning options for Council consideration
		• use of zone-based precincts which establish specific bushfire resilient provisions for certain locations which use planning controls to limit increased risk (i.e. minimum lot size provisions, siting and design controls, access and evacuation requirements, etc.); and • utilisation of categories of development and assessment for specific land uses and development in specific locations (i.e. zone-based precincts) which can ensure that non-desirable land uses trigger higher levels of assessment with the ability for Council to use all relevant parts of the planning scheme, beyond just the overlay code, as the assessment benchmarks, and also ensure the best possible outcomes for other uses where existing use rights may exist but which will benefit from being subject to requirements.
26	Policy and statutory drafting	Council may consider identifying potential bushfire risk-responsive growth locations as part of its broader settlement strategy.
27	Policy and statutory drafting	If Options 14 and 15 are not possible, Council could consider the adoption of a special definition for 'bushfire vulnerable uses' or the like. Alternatively, a table can be embedded at the end of the bushfire hazard overlay code which outlines the nature of vulnerable uses relevant for the Toowoomba Region however this may raise complexities for development assessment.
28	Policy and statutory drafting	Council may consider a similar policy position for hazardous facilities as it does for vulnerable uses.
29	Policy	Council is to decide its policy position in relation to avoidance of vulnerable uses and hazardous facilities in bushfire prone areas in the first instance. The desired approach in terms of the strength of scheme provisions to enable a merits-based assessment for specific circumstances, and what they may entail, or not at all would also form part of these considerations. Council's existing policy for vulnerable uses in flood prone areas may provide the opportunity to ensure consistency in terms of how multiple hazards are considered by the local planning instrument.

Option No.	Planning aspect	Planning options for Council consideration
30	Policy	Council may consider the policy positions relative to varying bushfire risk profiles to inform its policy settings both in terms of settlement strategy as well as statutory instrument formulation.
31	Strategic planning and zoning	Any new zoning rationale considered as part of the growth management process must consider the two intolerable risk multipliers (exposure to very high fireline intensity and potentially constrained ability to evacuate) before any changes (for example, from rural to low density residential or emerging community) are made to the current settlement pattern within the region.
32	Strategic planning and zoning Statutory drafting	Consider the settlement policy approach for Rural residential zoned lands on the Toowoomba Escarpment between Preston in the south and Harlaxton in the north, including the viability of a bushfire resilient precinct which places a limit on future increased development density and population growth in location which is exposed to Very High Potential Bushfire Hazard. The level of assessment for certain forms of development in this location, within this zone, may also be augmented to reflect its risk profile.
33	Strategic planning and zoning Statutory drafting	Consider the relevance of a bushfire resilient precinct as part of the Rural residential zone (which can apply to different parts of the region) with specific bushfire resilience provisions (i.e. such as minimum allotment size requirements) as a measure to place a limit on future increased development density and population growth in location which is exposed to Very High Potential Bushfire Hazard. The level of assessment for certain forms of development in this location, within this zone, may also be augmented to reflect its risk profile.
34	Policy and strategic planning	Consider a settlement policy for Prince Henry Heights, including consideration given to the need to limit the opportunity for existing risk to be further exacerbated by additional exposure of persons and property.
35	Statutory drafting	Consider the introduction of planning triggers for secondary and multiple road access / egress requirements as part of the RaL assessment benchmarks within the new Bushfire Hazard Overlay Code.

Option No.	Planning aspect	Planning options for Council consideration
36	Strategic planning and zoning	Consider using the Cova framework as a tool to analyse the ability to evacuate for potential growth areas, as part of Council's growth management activities under the Toowoomba Region Futures Program.

The following table identifies which planning options identified above respond to the relevant approaches to plan-drafting for bushfire hazard, as set out by the *Integrating state interests in a planning scheme – guidance for local* governments document prepared by the State government.

This provides a roadmap for Council on the options available to integrate the bushfire hazard State interests into the new planning scheme.

Table 57 - Planning options available to respond to the State interest approaches for plan-drafting

Approach	Establish strategic outcomes that align with the state interest and inform provisions through the balance of the planning scheme		
The strategic outcomes provide the planning scheme intent for delivering the state interest. The level of detail contained in the strategic outcomes will be informed by the local government context. In preparing strategic outcomes, address the following:		Relevant to state interest policies:	SPP plan-draft compliance options
1	Do strategic outcomes acknowledge the presence of bushfire prone areas in the planning scheme area and recognise and acknowledge the potential risk to human life and property and the environment of bushfire in the local government area?	1 and 4	Options 5, 6, 7 and 8
2	Do strategic outcomes promote a risk-responsive settlement pattern that minimises and does not worsen the impacts of bushfire on existing and new development, through in the first instance, avoiding the hazard as the highest priority and otherwise mitigating the risk through neighbourhood layout and management measures? Including: 1. Avoids allocating growth or more intense forms of development and inappropriate development in bushfire hazard areas?	4 and 5	Options 25, 30, 31, 32, 33 and 34

	2. Where appropriate development may occur in bushfire areas, mitigates risks associated with that development to an acceptable or tolerable level, to protect the safety of people, property and the environment? 3. Ensuring the risk does not worsen over time, for example through the rehabilitation and ongoing management of vegetation which may contribute to the risk?		
3	To reduce community exposure to and vulnerability to bushfire impact and enhance community resilience, do strategic outcomes specifically discourage development in the bushfire prone area where this may: 1. Place additional burdens on disaster management capacity, the community and government? 2. Risk disruption to the effective functioning of essential community infrastructure or vulnerable uses during and immediately after a hazard event? Identify the use terms that constitute community infrastructure for essential services in the local context and the function this infrastructure serves during or immediately after a bushfire event. This could include educational establishment, emergency services and hospital, for example. Do strategic outcomes also recognise that location of community infrastructure and vulnerable uses within a bushfire prone area may be justifiable where there is an overriding need in the public interest for the new or expanded service the development provides and there is no suitable alternative location?	5 and 6	Options 13, 14, 15, 16, 17, 18, 25, 27, 28, 29, 30, 31, 32, 33 and 34
4	To avoid risks to public safety and the environment from the location of hazardous materials and the release of these materials, do strategic outcomes specifically discourage development in the bushfire prone area where involving the manufacture or storage of materials that may exacerbate the risks from bushfire when located within bushfire prone areas?	5	Options 28 and 29
Approach	Prepare state interest specific mapping		

Mapping helps users understand and interpret where and how state interest policies apply in the local government area. Note – Where content is to be identified on a map, consider where this is best located within the planning scheme (such as the strategic framework or an overlay or local plan map). Note – The SPP identifies the mapping that a planning scheme must appropriately integrate – this is discussed in the 'Mapping' section below.		Relevant to state interest policies	SPP plan-draft compliance options
5	Does planning scheme mapping identify the location of and (where appropriate) refine bushfire prone areas in the planning scheme area? These are mapped in the SPP IMS. Note – The SPP identifies when layers may be locally refined.	1	Option 1
Approach	Articulate outcomes for areas by allocating zones and locally specific provisions (such as overlays and local plans)		
Land should be able to be used for the purpose it is zoned. In allocating a zone to land, or in applying locally specific provisions (such as a zone precinct, overlay or local plan), address the following:		Relevant to state interest policies:	SPP plan-draft compliance options
6	When updating a settlement pattern or changing a land use intent: Does the choice of zone/locally specific provisions avoid allocating land for new urban development in areas of unacceptable bushfire hazard and discourage expansion and intensification of inappropriate urban settlement in existing areas of bushfire hazard? For example: 1. Identify new urban areas for expansion or intensification in new or existing areas with acceptable or tolerable bushfire risks and safe evacuation routes. 2. In areas of bushfire hazard, ideally zone land for uses which typically result in low levels of population and economic investment.	4	Options 25, 26, 30 and 31
7	Where land is included in a bushfire prone area:	4, 5 and 6	

	Does the choice of zone/locally specific provisions consider the uses envisaged by each zone and whether the risks associated with bushfire can be mitigated to acceptable or tolerable levels for those uses? The zone and/or locally specific mapping intent may then be adjusted to reflect recent changes to the bushfire hazard area due to approved clearing and provide guidance on the compatibility of different uses, considering: 1. The consequences of and community tolerance to loss of a community service during and immediately after a bushfire hazard event. 2. Whether the use will place additional burden on government disaster management operations or on recovery capacity. For example, intents should avoid the following vulnerable uses from establishing in bushfire hazard areas. 1. Uses catering to vulnerable persons requiring unique evacuation requirements (such as hospitals, education establishments, child care facilities, residential care facilities and retirement facilities, and high security correctional centres). 4. Uses where the nature of the structure is vulnerable to bushfire attack because of the dwelling design (such as relocatable home park and tourist park). 5. Tourism and non-permanent residential uses, where occupants are less familiar with their surroundings (such as nature-based tourism, resort complex, rooming accommodation, short-term accommodation and tourist park). 6. Expansion of existing vulnerable uses in these areas, unless evacuation solutions and resilient design can be achieved – refer assessment benchmarks below. 7. Community infrastructure that will perform an important role and be required to function during and immediately after a bushfire hazard event. Note – Other uses may need to perform a role during or after a bushfire event. For example, showgrounds and sports facilities can perform an active role in bushfire response and recovery, serving as emergency services response staging		Options 20, 25 and 26 Options 13, 14, 15, 16, 17, 18, 25, 27, 28, 29, 30, 31, 32, 33 and 34

	points and emergency evacuation centres). These uses may be acceptable where sited and designed to enable this functionality. 8. To avoid risks to public safety and the environment from the location of hazardous materials and the release of these materials, hazardous industries and uses that involve the storage of significant amounts of hazardous material.		
Approach	Set categories of development and categories of assessment		
The categories of development and categories of assessment support the achievement of the spatial outcomes (zones, overlays, local plans). In setting the categories of development and categories of assessment for development, address the following:		Relevant to state interest policies:	SPP plan-draft compliance options
8	Do the categories of development and categories of assessment reflect the level of risk identified through the risk assessment and vulnerability of the use? A lower level of risk should translate into a lower category of assessment. The category of development and assessment may vary throughout Queensland depending on the level of tolerability (as determined by the local government based on the local context) and the information available to make an assessment. Are the following vulnerable uses assessable when locating or expanding within the bushfire prone area – childcare centre, community care centre, detention facility, educational establishment, hospital, nature-based tourism, relocatable home park, residential care facility, resort complex, retirement facility short-term accommodation and tourist park? This will enable assessment benchmarks to apply so that impacts can be fully considered.	5	Options 20, 25 and 29
9	Do the categories of development and categories of assessment reflect the function of the use?	5 and 6	Options 14, 15, 20 and 27 As above

	Are the following community infrastructure uses providing essential services assessable when locating or expanding within the bushfire prone area – educational establishment, emergency services and hospital? Are other uses that, because of their location and context, may need to perform a role during or after a bushfire event, also assessable? For example, indoor sport and recreation and outdoor sport and recreation? This will enable assessment benchmarks to apply so that impacts can be fully considered.		Options 20 and 25
10	Are aspects of development that may impact on, or be impacted by, bushfire hazard assessable? Including: 1. Reconfiguring a lot where creating additional lots within the bushfire prone area. 2. Material changes of use (where involving new premises or a substantive increase in development footprint) in the bushfire prone area for: a. industry or commercial purposes b. residential uses – multiple dwellings, non-resident workforce accommodation, rooming accommodation and rural workers' accommodation. This will enable assessment benchmarks to apply so that impacts can be fully considered.	5	Options 20, 25, 32, 33 and 34
11	Where for development involving the storage or manufacture of significant amounts of hazardous material in a bushfire prone area: Is development assessable where involving: 1. Hazardous chemicals that are present at the levels or in the quantities that would constitute the use being a hazardous chemical facility? 2. Hazardous materials that are present in the quantities identified in the Work Health and Safety Regulation, schedule 15?	5	Options 28 and 29

	This will enable assessment benchmarks to apply so that impacts can be fully considered.		
Approach	Prepare assessment benchmarks that deliver the outcomes		
Assessment benchmarks measure the extent to which a development achieves the intended outcome, in this case, the intent of the state interest policy. In preparing assessment benchmarks, address the following: Note – Refer to the Natural hazards, risk and resilience - Bushfire state interest - Example planning scheme assessment benchmarks document for example assessment benchmarks that a local government may choose to adopt or otherwise adapt when making or amending a planning scheme.		Relevant to state interest policies:	SPP plan-draft compliance options
12	Where land is included in a bushfire prone area: Does structure planning consider: 1. The location of the new road network, open spaces, and revegetation and rehabilitation areas, so that the remainder of the development area can be planned to minimise exposure to the bushfire hazard? 2. Whether sites within the potential impact buffer are separated from areas with a medium, high or very high potential bushfire intensity by a road or by spaces where vegetation is highly managed in perpetuity?	4 and 5	Options 8, 16, 17, 21, 22, 30, 35 and 36
13	Where land is included in a bushfire prone area: Do assessment benchmarks contain siting, design and transport infrastructure requirements that: 1. The neighbourhood layout separates development from hazardous vegetation and new subdivision design minimises the interface with hazardous vegetation within the bushfire prone areas? 2. The neighbourhood layout facilitates connections to safe evacuation routes, including alternative safe access and evacuation routes should access in one direction be blocked in the event of a bushfire, that provide easy and safe movement away from any encroaching bushfire for both	4 and 5	Options 8, 16, 17, 21, 22, 30, 35 and 36

	occupants and emergency services? Are the proposed evacuation routes of the same or lower potential bushfire intensity? 3. Landscape design and management does not increase the level of bushfire risk or mechanisms of bushfire attack by avoiding or minimising opportunities for ignition of landscaping features. Note – In addition, local government may seek to alert their community to the Bushfire Resilient Building Guidance for Queensland Homes non-statutory guidance document that contains considerations for improving the bushfire resilience of homes.		
14	Where land is included in a bushfire prone area: Do assessment benchmarks consider the effect of development on emergency response capabilities and maintain opportunities for emergency access and operational space for firefighters before the arrival of a bushfire? For example, contain provisions for: 1. Safe access and egress routes within and from each lot. 2. Identification of a separation area (asset protection zones) between development and hazardous vegetation via subdivision layout and, for large lots, the identification of development footprint plans. 3. Fire trail and working areas to facilitate fuel load management[21]. 4. Opportunities to establish control lines from which to conduct hazard reduction or back-burning operations. 5. Easy access for emergency services to a safe working area close to dwellings and water supply to suppress fires. 6. Water supply in both reticulated and non-reticulated areas.	5	Options 21, 22, 30 and 35
15	Where land is included in a bushfire prone area: Do assessment benchmarks manage the growth of vegetation that may increase risk of bushfire hazard above acceptable or tolerable levels?	5	Options 21, 22 and 23

	For example, include provisions for bushfire management plans for maintenance of any asset protection zones, including through vegetation and landscape management to ensure the fuel load can be practically maintained at or below an acceptable level.		
16	Where land is included in a bushfire prone area: Do assessment benchmarks consider that landscape design may create additional bushfire prone areas or exacerbate the impacts of a bushfire? For example, include provisions describing acceptable protective landscape treatments within any asset protection zones.	5	Options 21, 22 and 24
17	Where for development in a bushfire prone area involving vulnerable uses or essential community infrastructure that must continue operating during or after a bushfire event: If community infrastructure or vulnerable uses may be justified (where there is an overriding need in the public interest for the new or expanded service and there is no suitable alternative location), do assessment benchmarks mitigate the risk to an acceptable or tolerable level, including requiring the proposal to demonstrate that site planning can appropriately mitigate the risk and that community infrastructure can function effectively during and immediately after a bushfire event?	5 and 6	Options 21, 22 and 29
18	Where for development involving the storage of significant amounts of hazardous material in a bushfire hazard area: Do assessment benchmarks include requirements for the siting of facilities involving the manufacture or storage of hazardous materials, that will mitigate risks and impacts during and after a bushfire event to an acceptable or tolerable level?	5	Options 21, 22 and 28
19	Where planning scheme provisions designate areas for revegetation and rehabilitation:	5	Options 21, 22 and 23

	Do assessment benchmarks consider whether that revegetation / rehabilitation may result in an expansion of a bushfire prone area or increase in bushfire intensity levels? For example, include requirements for the location, dimensions and configuration of revegetation and rehabilitation areas to ensure they do not: 1. Comprise a higher bushfire intensity level in the future if assessed in accordance with the methodology used to generate the SPP IMS mapping. 2. Increase the exposure or severity of the hazard in a manner that creates an unacceptable level of risk. Note – Where relating to the possible expansion of a bushfire prone area (rather than the increase in bushfire intensity levels) these provisions will not be triggered by the bushfire mapping or be located within say a bushfire overlay code as they will be a consideration in areas that are currently not bushfire prone. Rather the provisions will sit with the provisions that required the revegetation or rehabilitation, such as a waterway or biodiversity code.		

10 Conclusions and next steps

This issues and options analysis (Part C of the Bushfire Risk Analysis) considers the range of potential options available for Council consideration, in terms of the policy strength, policy outcomes, strategic and spatial planning responses, and statutory provisions associated with addressing bushfire hazard in the new Toowoomba Region Planning Scheme.

This report is provided for Council's consideration, to inform the formulation of draft planning scheme provisions for Council to take forward as part of the broader Toowoomba Region Futures Program. It is further intended the narratives in relation to the issues regarding how bushfire is addressed through the local planning framework is considered by the growth management process.

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