Te Hiku Intensification Research

Prepared for Fire and Emergency New Zealand
Prepared by Beca Limited

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Contents

Appendices

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https://fireandemergency.nz/research-and-reports/te-hiku-intensification-research

Revision History

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Document Acceptance

Action	Name	Signed	Date
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on behalf of	Beca Limited		

1 Introduction and Context

National growth predictions suggest that over the coming decades Aotearoa New Zealand will see increased intensification in urban centres, coupled with stagnant or decreased populations in rural areas. Over the next 30 years Tāmaki Makaurau is anticipated to grow and change most significantly, absorbing half of New Zealand's expected growth. The population is projected to grow by approximately 520,000 to reach a total of 2,230,800 people. To accommodate this growth Auckland Council is seeking a focus on intensification within existing urban areas, continuing the shift toward more intensive forms of housing, such as town houses, units and apartments[1].

With the backdrop of growth, increasing housing unaffordability and housing demand, central government has enacted changes over recent years through the National Policy Statement on Urban Development to require local councils of key urban centres across New Zealand to increase urban density and housing choice. Of most relevance to Fire and Emergency this includes:

- Removal of minimum parking requirements on sites allowing developers to choose how much onsite parking to provide. This is aimed at encouraging a more compact city and reducing the private supply of parking so as to incentivise travelling by more space efficient modes (public transport (PT), walking and cycle and micro-mobility). With no need for vehicle access to on-site parking, this can allow for pedestrian only access developments and can create the potential for parking to spill out onto surrounding streets.
- Allowing for buildings of six storeys or more within walkable distances to city centres, large metropolitan centres, train stations and rapid busway stations.
- Introduction of Medium Density Residential Standards (MDRS) – more permissive standards applying to most residential sites allowing three homes of up to three storeys to be built as a permitted activity[2].

In the 2021/2022 year, 78% of consented dwellings in the existing urban area were more intensive housing types (apartments, townhouses etc.) which is 10% more than the previous year[3] and it is expected that these types of changes will continue with an increasing need to respond to the growing city's needs and urgency of reducing emissions. These changes in building type are likely to have an operational impact on Fire and Emergency. Further reforms (including resource management and water) will also further change the urban landscape of Tāmaki Makaurau over the next decade.

At the same time, to respond to congestion and safety, provide for greater transport choice, and reduce emissions, Auckland Transport are making changes to the street and road transport network in Tāmaki Makaurau. This includes the removal of some on-street parking, speed reductions in specific locations, traffic calming measures and reprioritisation of street space towards non-private vehicle modes.

On average Fire and Emergency respond to 24,544[4] incidents across Tāmaki Makaurau per year. In 2022, Fire and Emergency responded to 26,634[5] incidents in Tāmaki Makaurau, representing just over a third of all incidents across New Zealand.

In addition to increasing need for services, Fire and Emergency also faces broad challenges, such as the increasing frequency and severity of extreme weather event associated with climate change. Across Aotearoa New Zealand, states of emergency are being declared with increasing frequency, close to three

[1] Consultation draft: Auckland Future Development Strategy 2023-2053

[2] Fire and Emergency are currently involved in the hearing process for Auckland Council's Plan Change 78 – 80 for the implementation of MDRS

[3] Auckland Plan 2050: Development Strategy – Monitoring Report, December 2020. https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/about-the-auckland-plan/Documents/ap-ds-monitoring-report.pdf

[4] Four-year rolling average 2017/18-2020/22

[5] Total incidents 1 January 2022 – 31 December 2022

times more frequently in the last decade compared to the previous ten years. Medical response is also increasing and is likely to continue this trend as the population ages and health inequities grow.

While a more compact urban form focused on walkability and intensification around public transport (and subsequent mode shift) can reduce congestion and subsequently emergency response times, intensification and infill housing in Auckland are challenging access to properties for fire and other emergencies. This includes both vehicle access to the source as well as physical access by Fire and Emergency personnel to perform rescues and duties, where obstructions and site layout can inhibit the use of lifesaving appliances such as ladders, hoses and stretchers.

Fire and Emergency commissioned Beca to undertake a desktop study of recent redevelopment proposals for residential sites in Tāmaki Makaurau. The rational being:

- There is minimal research or analysis on the potential impact of intensification on emergency response in New Zealand to allow Fire and Emergency to consider this within long-term planning and strategy.
- There are very few case studies which highlight the risk of fire spread and challenges to access and response in intensified areas in New Zealand cities to allow Fire and Emergency to engage with partners and stakeholders on potential risks and response challenges and opportunities.
- There is a limited evidence base to support the hearing process for the intensification plan changes across New Zealand and influence a positive outcome for Fire and Emergency Service Delivery.

The purpose of this desktop study is to assess how changes to urban form may have unintended compounding impacts on typical Fire and Emergency operations, including fire, medical and rescues and assists associated with extreme weather events. It seeks to identify and assess potential impacts and provide future considerations to how Fire and Emergency might address the impacts.

At a wider scale, while this research relates specifically to developments in Tāmaki Makaurau, this type of intensification is occurring in other regions of Aotearoa New Zealand (albeit to varying extents) and is expected to continue to grow.

2 Methodology

This desktop research has selected six medium density residential properties that have been granted resource consent. They are being assessed from a Fire and Emergency operational analysis perspective to understand strategies for risk reduction, mitigation and response to these environments. The following four were assessed by Auckland Council as part of notifying the MDRS plan changes[6] and have been selected for this research to allow for easy-cross referencing for use in Auckland Council Plan Change 78-80 hearing processes:

- 102 Millbrook Road, Henderson
- 32 Takanini Road, Takanini
- 17 Panama Road, Mt Wellington
- 8 James Laurie Street, Henderson

The remaining two were directly identified by Fire and Emergency as examples of where there is a misalignment between resource consenting and building code requirements when sent through to the engineering team by Auckland Council during the Building Consent process:

- 48 Kapuka Road, Māngere Bridge
- 21 Tennessee Avenue, Māngere East

This report aims to analyse the sites across the following matters through the use of a matrix to aid identification of likely constraints and potential mitigations:

1. Impact of the wider street environment on emergency response times and travel to an emergency (e.g. more traffic on roads, parking on streets, raised pedestrian crossings on main roads).
2. Impact of access to emergency response infrastructure (e.g. roading and hydrant access) and timing at the location of the development.
3. Impact of onsite access (e.g. location of the incident on site, legibility of site access, unit setback from road or hydrants, fire spread, emergency egress of residents vs access for personnel) on emergency response activities and times.

For the purpose of grounding this study in a real-life example of a residential fire, 19 Derrimore Heights has been included as a seventh case study. While not a medium density development, by applying the same assessment methodology it identifies the differences between the hypothetical risks and an actual emergency response. An introduction to the Derrimore Heights fire, including Fire and Emergency reports, has been included in Appendix G.

The assessment has been limited to reviewing the following information:

- Plan Change 79 supporting information in relation to access case studies
- Fire and Emergency New Zealand Feedback to Auckland Council on Access to Pedestrian Only Developments (Attachment to Plan Change 79)
- Fire and Emergency submission to Plan Change 79
- Designers' guide to firefighting operations: emergency vehicle access F5-02 GD
- New Zealand Fire Service Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008)
- Auckland Council property files (identifying approved resource and building consent plans)
- Google maps (street view and aerials) as well as analysis of indicative travel times to each site
- Watercare Services Limited GIS Viewer (showing water supply network and hydrant locations)
- Auckland Unitary Plan (Operative in Part) – medium density residential zone

[6] Plan Change 79: Amendments to transport provisions, Attachment 4 – Pedestrian Access Routes to Dwellings, Appendix E: Pedestrian Access Route Case Studies: https://www.aucklandcouncil.govt.nz/UnitaryPlanDocuments/pc-79-attachment-4-pedestrian-access-routes-appendices-part-one.pdf

- Statistics New Zealand vehicle ownership data
- Auckland Transport vehicle and travel data

2.1 Assessment Criteria

This analysis of case studies for emergency considerations have been visualised through the annotated diagrams set out in the appendices. Following the initial analysis, a workshop was held with Fire and Emergency executive operational personnel and engineers to gather additional feedback and commentary on operational and logistical matters for the sites. This was incorporated into the findings.

These findings have culminated in an assessment matrix with a colour rating system as explained in Table 2-1. For a more comprehensive understanding of the factors that impact fire and emergency response across the wider environment, street environment and on site, these have been spelt out in Table 2-2.

Table 2-1: Rating system for assessment matrix

Rating	Description
Optimal	Likely to support effective and efficient emergency response
Neutral	Not likely to be positively or negatively impactful in a reasonable way
Disruptive	Likely to disrupt emergency response (something that is disruptive may have a moderate negative impact but can be worked around but may slow or otherwise hinder an effective response)
Critical	Likely to hinder or prevent effective and efficient emergency response - that cannot effectively be worked around

Table 2-2: Description of matters included in the assessment matrix

Assessment element		Assumptions/assessment considerations
Wider Environment	Closest stations and distance	From Google Maps routing. This assumes that appliances are responding from the station, rather than direct from previous incidents or other stations/routings.
	Incident trends of station (and neighbouring stations)	Data has been provided by Fire and Emergency for incident response areas from 2018 - 2022. Incident counts used to estimate trends include multiple exposures (single callout to an incident could be tagged as more than one incident).
	Likely travel time	To contextualise the case studies and contribute to a qualitative picture of environmental factors approximate travel time to the site (with no form of obstruction or delay) has been provided using Google Maps suggested driving timings at 12pm and 5.30pm. This only considers the first appliance to reach the site, with the assumption that it is travelling from the nearest station. A report[7] commissioned by Fire and Emergency has also been incorporated to highlight the station callout response trends since 2016. This information has been included with the acknowledgement that the operating environment of Tāmaki Makaurau is dynamic and multiple factors can affect travel time to an emergency. It is further acknowledged that many things can affect the outcome (positive or negative) of an emergency and that time-based response is only one factor.
	Any other identified barriers	Considers elements such as any roads that are inaccessible for Fire and Emergency, speed reduction areas, and other barriers as identified by Fire and Emergency personnel at workshops as possibly delaying response.

[7] M R Cagney (2022). Traffic calming and effective response speeds

Assessment element		Assumptions/assessment considerations
	Hazards mapping	As was evident during the extreme weather events of early 2023 in Tāmaki Makaurau, natural hazards impact Fire and Emergency response in two ways. Firstly, hazards on route to incidents (e.g. flooding, land slips etc) can delay Fire and Emergency arrival at site. Secondly, under Fire and Emergency's additional functions under the Fire and Emergency New Zealand Act 2017[8], personnel respond to medical emergencies, rescues, transport accidents, severe weather-related events and more. As a result, natural hazards noted in Auckland Council's Geomaps[9] mapping could result in greater risk.
	Demographics / socio economic	During the workshop, Fire and Emergency identified that more socio-economically disadvantaged communities and different demographic groups are at greater risk from fire and other emergencies. In Tāmaki Makaurau we have an aging population base, and 1 in 5 Aucklanders are identified as disabled. Those aged over 65 are most likely to experience some form of disability; these rates are higher than average amongst our Māori and Pasifika communities[10]. Maori are disproportionately represented in Fire and Emergency fire statistics.[11] To contextualise the case studies, the 2018 NZ Index of Deprivation[12] decile of each case study's area has been included in the appendices with 1 representing areas with the least deprived scores and 10 representing areas with the most deprived scores. Environmental Health Intelligence New Zealand notes that higher levels of socioeconomic deprivation is associated with worse health and greater environmental risk.
Street Environment	Road width	Ability for fire appliances to move to the site, including likely parking position.
	Distance from hydrants to likely appliance parking	The distance from the fire appliance to the nearest fire hydrant should not exceed 135m and 270m to the second fire hydrant as per SNZ 4509:2008. It may still be that these hydrants provide insufficient water supply if they are connected to smaller mains or other water supply network management actions have been taken that reduce pressure.
	On street parking / barriers	This includes carparking reducing the useable width of the street and other street design features that limit fire appliance access.
	Set up space	Fire hydrants should not be less than 6m from any building structure to maintain a clear working space as per SNZ PAS 4509:2008. While initial assessments are based off the setting up of the first fire appliance to the site, it is expected that many of these case studies would require multiple fire appliances to respond to an incident, alongside potential other emergency services attending too. Depending on the size and scale of the building, the standard Fire and Emergency response requires two appliances with a further two appliances and an operational support vehicle if the fire is well developed. Larger buildings could also need an aerial appliance and command unit. In addition, if persons are reported missing or injured this will also likely see 1 – 2 ambulances attend. If evacuation is required Police may also be in attendance. Sufficient space is needed around a fire appliance for firefighters to move around it to connect hoses and safely access equipment.

[8] https://www.legislation.govt.nz/act/public/2017/0017/latest/DLM6712701.html#DLM6678625

[9] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

[10] Statistics New Zealand 2013 disability survey

[11] Unintentional domestic fire-related fatal injury in New Zealand, Otago University 2018, Understanding non-fatal fire related injuries in New Zealand, May 2019.

[12] https://www.ehinz.ac.nz/indicators/population-vulnerability/socioeconomic-deprivation-profile/#nzdep-for-2018-nzdep2018

Assessment element		Assumptions/assessment considerations
On-site	Potential fire spread beyond site	Considers proximity to site boundaries and structures on neighbouring sites in terms of heat radiation and fire spread causing damage beyond the property and increasing the fire risk.
	Distance from appliance to furthest unit	The maximum fire hose run distance allowed under the Building Code is 75m, which is on average three lengths of fire hose. It is noted that the hose run distances should be measured from a suitable hardstand, as specified in Compliance Documents such as C/AS1, C/AS2 etc, and the Designers' Guide to Firefighting Operations: Emergency Vehicle Access F5-02 GD. However, it should be noted that accessways to the developments may not meet the necessary clear width or load-bearing capacity requirements. As a result, fire appliances may have to park on the public road serving the site. Distances beyond the 75m limitation must consider time delays and inefficiencies from connecting hose lengths and reduced water pressure. Based on the data from AFAC Fire Brigade Intervention Model[13], the process of setting up additional hose length would require extra time and resources, which could potentially cause an additional delay of 3 minutes at least.
	Accessway adequacy	This includes widths, heights, obstacles, corners and angles for both appliances (where a vehicle can enter the site) and individual personnel (where there is only pedestrian access). It's important to consider that access is not just for personnel accessing the site, but also potential evacuation of residents and/or other emergency personnel responses for example – St John and stretchers.
	Presence of other barriers	This includes gates or locked access or delays from stairs and corners on site.
	Space available for equipment use	For two storey units, Fire and Emergency rely on manual ladders and so have basic needs to carry these to the emergency site and extend them. Ideally there would be greater than 4m of workable space around buildings to allow for ground ladder operations as pedestrian accessed developments cannot use vehicle appliance ladders (none of the sites achieve the 4m workable space). Where units are three storeys or more Fire and Emergency use the Angus 464 3 section ladder to reach upper floors. To transport this into place, access needs to be 3m wide for two firefighters to carry it. It requires a minimum setback from base of buildings of 4.5m and a turning/manoeuvring area of 6.2m to turn corners.
	Exits and entries	Similar to the accessway adequacy, this relates to the provision for personnel responding to an incident alongside potential evacuation or rescue of residents, and personnel from St John or NZ Police.
	Potential car usage	With the overall policy direction towards reduced car ownership – developments are being constructed with less parking than previously. There is limited data available on likely car usage from these new developments. In practice, 2018 census data[14] indicates that car ownership per household in Tāmaki Makaurau remains at approximately 1.9 cars per household. This will likely decrease over time, where carparking is not provided onsite and/or in close proximity to public transport/cycling infrastructure. It likely also differs for dwelling types with the case studies on the smaller end of the spectrum predominately

[13] Australian Fire Authorities Council – Fire Brigade Intervention Model Manual: https://www.afac.com.au/docs/default-source/doctrine/afac_fbim-manual_v3-0123ea391b1e86477b58fff00006709da.pdf?sfvrsn=2&download=true

[14] https://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE8430&fbclid=IwAR0WAxJH9APjVwMqE5fQ2_VzOlQzYSd2R10gnQCC7YBji9ptAF0uQmstCog#

Assessment element		Assumptions/assessment considerations
		made up of a mix of studios to 2 bedroom units. Given this, while the 1.9 cars/unit is being used as a proxy for potential car usage, please note that this a high scenario of how many cars might use the case study sites.
	Risk reduction elements	This could include on site hydrants, CPTED, sprinklers, neighbourhood watch.
	Hazards mapping	Hazards on the site that could increase risks such as overland flow paths.

3 Case Studies

The case studies are distributed across the west and south of Tāmaki Makaurau and are typical of intensification proposals being seen in Tāmaki Makaurau recently. These do not represent extreme or particularly unusual interpretations of Auckland Unitary Plan provisions. Introductory details of the sites proposals have been included in Table 3-1.

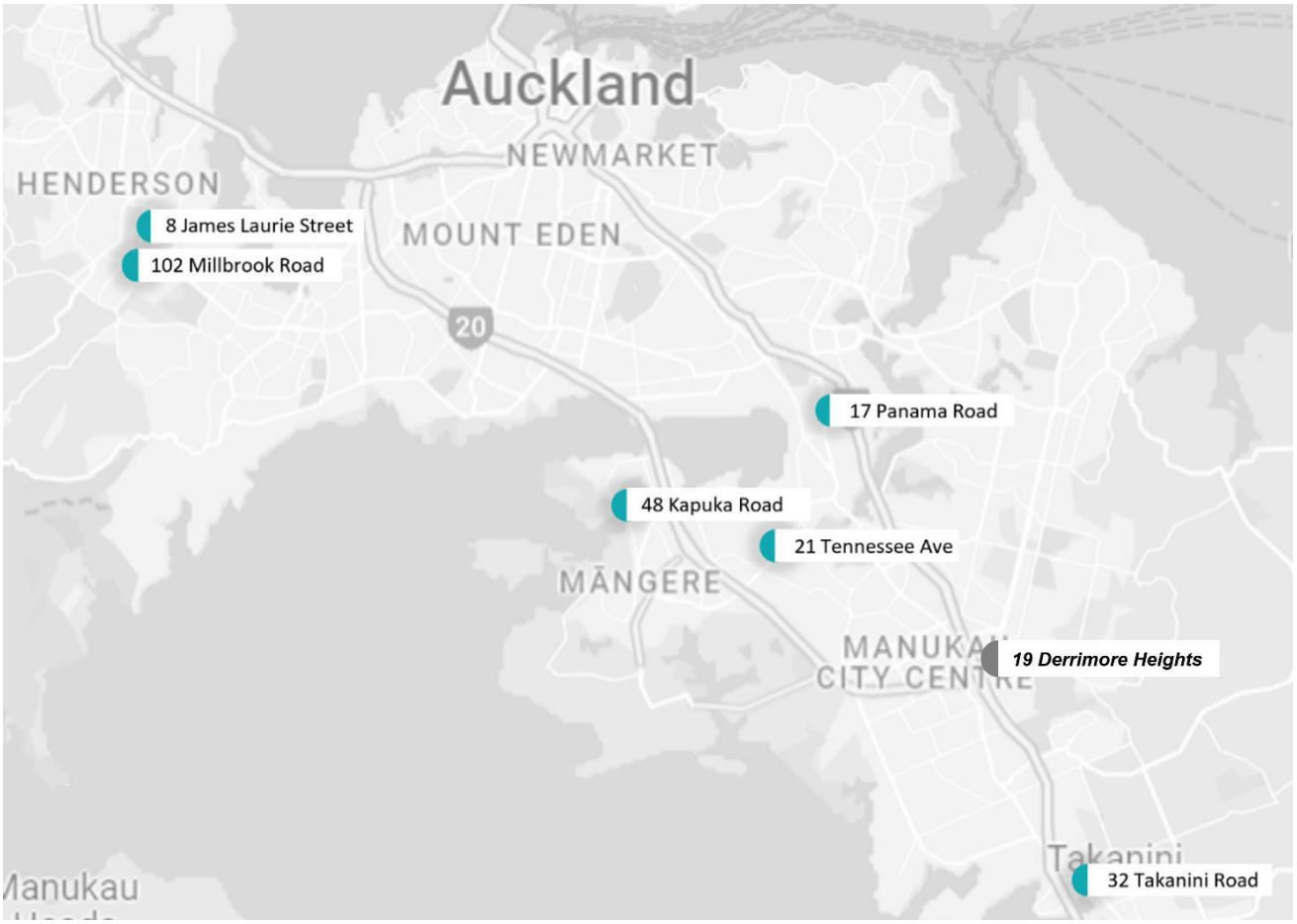

Figure 3-1: Location of case studies across Auckland (Google maps basemap)

The detailed assessments for each site are provided in the appendices to this report. They include the following information:

- Site overview
- Matters which triggered the need for resource consent
- Whether notified
- Any commentary on Watercare or Fire and Emergency considerations included in property file
- Site plans/graphics provided as part of resource/building consent applications
- Locations of site in relation to Fire Stations
- Flood mapping
- Annotated diagrams of Fire and Emergency considerations
- Assessment against proposed criteria (summarised in Table 4-1)

Table 3-1: Introduction to the case study sites

Address	Description	No. of units	No. of parks	No. of storeys	Total site area	Auckland Unitary Plan Zone
32 Takanini Road, Takanini	32 Takanini Road has now been built and is made up of 20 1-bedroom apartment units over two 2-storey buildings. Four units in the front building can be accessed directly by the roadside while the remaining 16 are accessed by a pedestrian walkway with vegetation along one side. A floodplain runs along the road outside the site.	20	2 (car) 20 (bike)	2	1044m^2	Mixed Housing Urban
102 Millbrook Road, Henderson	102 Millbrook Road has now been built and has been designed to have nine one-bedroom, two-storey dwellings across three separate buildings. Millbrook Road outside the site is in a floodplain/overland flow path.	9	0	2	809m^2	
8 James Laurie Street, Henderson	8 James Laurie Street has now been built and involved the construction of 13 2-bedroom residential units – two terraced blocks of five units each (with 2m between the two blocks) at the rear of the site accessed by a 1m wide pedestrian walkway and three units (one duplex and the other detached) facing the street front. The driveway to the carparking area is 5.5m wide.	13	13	2	1473m^2	
17 Panama Road, Mt Wellington	17 Panama Road is a corner site at the junction of Panama Road and Ryburn Road, it has been developed into five blocks of terraced housing made up of a mix of two-bed and three-bedroom units. Each unit has one carpark provided across two communal parking areas. The vehicle crossing along Ryburn Road will be 5.5m while the vehicle crossing along Panama Road will be 3.2m wide.	25	25	2 - 3	2833m^2	Terraced Housing and Apartment Buildings
48 Kapuka Road, Māngere Bridge	48 Kapuka Road is a rear site accessed down a 3.6m wide driveway. On the site will be parking for 9 carparks in a communal parking space, with the nine two-storey terraced dwellings accessed by a pedestrian walkway.	9	9	2	1375m^2	Mixed Housing Suburban
21 Tennessee Ave, Māngere	21 Tennessee Avenue will be a 14-unit development with two street facing units and the rest accessed along a pedestrian accessway running parallel to the site. Council mapping shows a flood prone area on a small portion of the rear of the site	14	8	2	1533m^2	
19 Derrimore Heights, Clover Park	Derrimore Heights is a cul-de-sac with intensification occurring in the surrounding lots. 19 Derrimore Heights is a rear site accessed by a driveway that was being developed with three new standalone, two storey dwellings at the time of the fire.	3	3 (garages)	2	933m^2	

4 Assessment Summary

Table 4-1: Assessment matrix outcomes across the case study sites. For further detail and individual justification per case study please click on site to be taken to appendix.

		32 Takanini Road	102 Millbrook Road	8 James Laurie Street	17 Panama Road	48 Kapuka Road	21 Tennessee Avenue	19 Derrimore Heights
Wider Environment	Closest stations and distance							
	Incident trends of station (and neighbouring stations)							
	Likely travel time	*No rating given, see notes in appendices.*						
	Any other identified barriers							
	Hazards mapping							
	Demographics / socio economic	*No rating given, see notes in appendices.*						
Street Environment	Road width							
	On street parking / barriers							
	Distance from hydrants to likely appliance parking							
	Set up space							
On-site	Potential fire spread beyond site							
	Distance from appliance to furthest unit							
	Accessway adequacy							
	Presence of on-site barriers							
	Space for equipment use							
	Exits and entries							
	Potential car usage							
	Risk reduction elements							
	Hazards mapping							

5 Overview of Findings

The matrix in Table 4-1 and further detail provided in the appendices show that all the developments have significant levels of at least some disruptive elements for Fire and Emergency to contend with. Without risk reduction or mitigation will likely make emergency service responses less effective and efficient.

5.1 Wider Environment

Being in existing urban environments, the case studies are all in relatively close proximity to fire stations. Travel time assessment to sites appear to align with Fire and Emergency's performance expectations (with the possible exception of 21 Tennessee Avenue). An independent report commissioned by Fire and Emergency[15], analysed response from 29 urban stations across Tāmaki Makaurau and showed that 14 of the 29 stations (including 8 of the 10 busiest stations) showed statistically slower call out speed from 2016. At the same time, most of the stations servicing the case study areas are seeing growth in the number of call-outs each year, increasing the likelihood of a fire appliance responding directly from another incident or location.

Workshop attendees identified several factors that they considered would impact travel time to the case study sites including schools (like for 48 Kapuka Road and 102 Millbrook Road), motorway on ramps (such as for 17 Panama Road), rail level crossings, and other traffic calming measures. The independent report noted above was inconclusive on the impact traffic calming measures have on speed of response more than the general slowing of response times being seen across Tāmaki Makaurau. The report also concluded that there is no definitive correlation between the fire stations with slower call out speeds and areas experiencing more rapid growth. There are a myriad of factors that could contribute to slower response due to the dynamic nature of the urban environment. This may be an area for further investigation.

Most of the sites had some level of hazards mapping between fire station locations and the site. Recent events have reinforced that this can pose significant risks to Fire and Emergency operations for responses during extreme weather events.

5.2 Street Environment

The effectiveness of the on-site response is also impacted by the street environment. 17 Panama Road was considered easier to respond to because it is a corner site with streets along two boundaries. On the flipside, 32 Takanini Road faces limitations due to the railway preventing any rear access from other sites.

Given the setup of the case studies, fire appliances would likely park on the street rather than enter driveways or accessways. This is primarily due to the fact that the driveways or accessways may not meet the necessary requirements, such as the clear width, load-bearing capacity, turning circle, or other critical features as specified in compliance documentation, e.g., C/AS1, C/AS2, and the Designers' Guide to Firefighting Operations: Emergency Vehicle Access F5-02 GD. Street trees must be maintained to ensure there is a 4m height clearance for fire appliances. Fire appliances require both space to park and space to set up around the vehicle, for example to roll out hose lengths and unload equipment. While all case studies could accommodate this for the first appliance to scene, on the narrower streets like 32 Takanini Road and 48 Kapuka Road, this could block the entire street, impeding both typical street traffic and the ability for secondary appliances and other emergency services to get to the site. When considered in the context that a fire like at Derrimore Heights required 15 appliances, access can become logistically difficult and require much longer hose lengths to the site, thereby further reducing water pressure and delaying response. For other types of emergencies, such as medical response, a fire appliance, ambulance and police vehicles may

[15] MRCagney (2022). Traffic calming and effective response speeds

be in attendance. Should the ambulance arrive after the fire appliance, it may need locate some distance from incident than is optimal.

While Fire and Emergency support measures to reduce congestion and improve road safety, with the removal of parking requirements on site, there may be resulting additional cars parking on the street. If not managed successfully the overspill of cars may result in reducing traffic flow, and narrowing roadways, both of which is likely to reduce response and access for emergency vehicles on residential streets. There will need to be significant changes in travel behaviours from the current Tāmaki Makaurau average for these developments to not impede access.

All case studies have fire hydrants within close proximity to their street fronts which is important for effective and efficient emergency response. Where possible we have noted the size of the hydrant as this indicates the volume/pressure that Fire and Emergency may be able to use across the different hydrants. However sufficiently-sized hydrants do not ensure suitable water supply and pressure. This was apparent for the Derrimore Heights fire where, despite the consent application stating there was sufficient water supply, it had not been validated by Watercare. During the fire, Fire and Emergency could only create a maximum flow rate of 900L/min by connecting three hydrants compared to the minimum requirement for a fire of this size of 2000L/min. A Watercare audit after the fire showed two valves in the water network connecting to the hydrants were nearly closed to avoid leaking.

5.3 On-site Environment

Feedback was received during the workshop that the largest delays to effective firefighting operations come not from traversing to the site but from the on-site set up.

The most significant concern with the case studies' design choices primarily relates to the use of long, narrow pedestrian accessways as the sole access to most units and backyards only accessed through the units themselves. The length of these accessways (for example 100m for 21 Tennessee Ave or 48 Kapuka Road) would cause delays in accessing rear units and require extra personnel to lay out hose lengths around corners and support with the extra weight of hoses. This in turn would impact water pressure available at the delivery to the fire site.

The narrowness of accessways (e.g. only 1m in the case of 8 James Laurie Street) can cause conflict between emergency personnel reaching an emergency, residents attempting to evacuate, and other emergency personnel needs (e.g. St John transporting patients). In the case of 19 Derrimore Heights, 50 firefighters attended the incident. This scale of response would prove very difficult to accommodate with 1m accessways. In terms of resident safety this can mean impeded or delayed evacuation. In many cases if a fire or emergency (such as hazardous substance) were to occur in a middle unit, this would trap all units further to the rear from being evacuated without removing fences and infrastructure to get individuals out through neighbouring sites. Depending on individual site maintenance arrangements, it is possible that communal areas like pedestrian accessways have locked gates added or are neglected and planting and other barriers or outdoor furniture further obstruct the usable width of the accessway.

This change in risk profile may require a change in tactics at incidents. Responding to these more complex situations may require tactics for more confined spaces, tools and equipment that can be used, or limit the nature of response.

With most of the case studies being limited to two stories (with the exception of 17 Panama Road), a regular ladder rather than the larger 464 ladder can be used for upper floor evacuations and so reduces the need for larger equipment needing to be carried down accessways. However, the standard ground mounted ladders still require area to be extended safely. This is impeded by the narrow accessways between unit and boundary. The proximity of neighbouring units across site boundaries also raises the potential for greater fire spread and heat radiation damaging structures beyond the site boundary.

5.4 Real Life Comparisons

It is apparent from Table 4-1 that 19 Derrimore Heights raises fewer hypothetical risks than the other case studies. When considering the severity of the fire that occurred at Derrimore Heights it highlights the additional risks and complications posed by the other case studies over the already significant risk of the standalone houses at Derrimore Heights. For example, access was raised in the Derrimore Heights fire incident reports as a key barrier for response, and yet the matrix highlights it has the least disruptive access arrangements of the case studies. Similarly, the site had some of the greatest separation distances between units, but heat radiation caused three other properties to be severely damaged beyond the original house being destroyed. This indicates that the matrix rating system sets a high (but realistic) bar for hypothetical risks and that there could be further unexpected complications/challenges to responding to these case studies beyond what can be identified based solely off design plans.

6 Wider Implications

When the public call Fire and Emergency they expect emergency service personnel to be on site and responding to the emergency in a timely manner, to protect and preserve life and prevent or limit damage to property and the environment. The ability to achieve fast and effective response is under increasing pressure. While this assessment has been limited to considering these case studies at an individual site level, they provide an indication of wider issues that one could expect to be replicated across the city into the future. We note that the examples considered are presently surrounded by less intensive development which may not be the case if the proposed Future Development Strategy and provisions of the MDRS intensification are confirmed across all residential zones, or in areas when council is encouraging development, such as along rapid transit corridors.

6.1 The resource consenting process

None of these case studies were notified[16] or provided to Fire and Emergency for input during the resource consenting process. Only three of the case studies had resource consent triggers related to access and manoeuvring, and these considered general access rather than emergency services access. While 48 Kapuka Road and 21 Tennessee Avenue were picked up by Fire and Emergency when sent to their engineering team for building consent, it shows that designs lacking in emergency response provisions are slipping through our resource management system at odds with Part 2 of the Resource Management Act 1991[17]. As such, we can expect increasing examples like these case studies across the city. It also adds to the growing tension with the building consent process, where developments should not be being granted building consent but have had the site design and layout approved by resource consent.

6.2 Replication at a street and city level

As noted in Section 3, these case studies represent typical intensification, and so amid developments like these we can also expect more risky/hazardous sites as well. With increased infill and no need for vehicle access on sites, there are particular concerns that more rear sites like 48 Kapuka Road and narrow sites like 21 Tennessee Ave (that previously would have only been able to hold minimal units) will be developed with very limited provision for emergency access.

Intensification of neighbouring sites to existing developments is already evident in many of the cases, such as for 17 Panama Road, and this is expected to continue. For many of the case studies, workshop attendees identified alternative accesses to the site through neighbouring or rear properties that would likely be used during an emergency to try resolve on-site access limitations. This was also apparent for the real fire at 19 Derrimore Heights where firefighters also responded on foot from Rochas Place and Redoubt Road. While this may be an option currently, ongoing intensification may see these neighbouring sites also intensify to the same extent (or more) as the case studies, thereby dramatically reducing the overall ability for Fire and Emergency to respond across neighbourhoods. With this increased intensification, Fire and Emergency's concerns relating to on-street barriers and fire spreading across boundaries to neighbouring property structures is also likely to be further exacerbated. This increases the risk of harm to people, community and property, through death, serious injury or destruction of property.

[16] Per information provided in Auckland Council property files

[17] Part 2 of the Resource Management Act 1991 sets out the purpose and principles of the Act. In particular it includes enabling people and communities to provide for their social, economic, and cultural well-being and for their health and safety.

6.3 Increasing natural hazards

Climate change will increase the frequency and severity of extreme weather events such as flooding, winds and droughts. Across Aotearoa New Zealand, states of emergency are being declared with increasing frequency, close to three times more frequently in the last decade compared to the previous ten years. 30% of those states of emergency were the result of extreme weather, with 48% the result of flooding. The possible delays getting from station to site due to flooding and other hazards (as noted for the likes of 102 Millbrook Road and 32 Takanini Road) or responding to direct flooding emergencies may grow to be a larger proportion of Fire and Emergency's incident response.

6.4 Changing risk profile

With emergency personnel possibly responding to increasingly different and complex risk profiles, there is need for Fire and Emergency personnel to continue to grow understanding of different environment types and strategies/tactics to mitigate risk.

6.5 Tāmaki Makaurau pre-empting the rest of Aotearoa New Zealand

At a wider scale, while this research relates specifically to developments in Tāmaki Makaurau, these unintended consequences of intensification are occurring in other regions of Aotearoa New Zealand (albeit to varying extents) and this is expected to continue to grow, further straining Fire and Emergency's operations and resources nationally.

6.5.1 National direction

The primary policy driver for intensification across Aotearoa New Zealand over the past three years has been the National Policy Statement on Urban Development 2020 (NPS-UD). For the 15 Tier 1 Councils[18], the primary focus is implementing the NPS-UD and the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act (HSAA).

Within their respective 'plan changes' each Council has identified new and amended rules and provisions to address these statutory obligations. In some cases, the 'intensification' plan changes are being introduced alongside other plan changes or as part of full plan reviews. While there are similarities (due to the requirements and thresholds of the national directions), there are also differences between each Council's plan changes, which are generally based on their existing urban setting and policy context, willingness to reasonably enable MDRS, along with existing plan structure. For MDRS, these differences are focused on the 'qualifying matters' identified for the particular area and the extent that these limit (in part or in full) the development activity.

6.5.2 Pedestrian only access developments

Councils are no longer allowed to require a minimum number of parking spaces for developments. This has enabled potential pedestrian-access developments to become more common. Councils and developers have taken varying approaches on these developments. Some Councils like Auckland have addressed it directly through policies relating to pedestrian access, while others have remained silent on the matter and therefore left it open for interpretation. For example, Waipa District Council did not support MDRS and has not included any policies confirming how Council will manage a resource consent application that is proposed to be pedestrian only. By contrast Christchurch City Council who have recently notified Plan Change 14 to implement the MDRS, appear to anticipate pedestrian only access developments based on the introduction

[18] The objectives and high-level policies of the NPS-UD apply to all councils that have all or part of an urban environment within their district or region. However, some policies apply only to tier 1 or tier 2 councils. Tier 1 territorial authorities include Auckland Council, Hamilton City Council, Waikato District Council, Waipā District Council, Tauranga City Council, Western Bay of Plenty District Council, Wellington City Council, Porirua City Council, Hutt City Council, Upper Hutt City Council, Kāpiti Coast District Council, Christchurch City Council, Selwyn District Council and Waimakariri District Council. Rotorua Lakes Council, identified as a Tier 2 urban environment through the NPS-UD joined the Tier 1 major urban centres covered by the MDRS to significantly increase housing supply in the Rotorua Lakes District.

of new policy around pedestrian access design and a performance standard whereby developments of three or more residential units shall be accessed by *either* a combined vehicle-pedestrian access *or* a dedicated pedestrian access with subsequent minimum form dimensions. Where other Council approaches remain unclear, this is expected to be teased out through the upcoming hearing processes.

In Auckland the uptake of pedestrian only access developments is being demonstrated in new developments and it can be assumed that uptake will follow in other districts in the future. It is however widely anticipated that the uptake of pedestrian only access developments across Tier 1 Councils will be driven largely by the market[19] and this is expected to differ between urban environments across the country[20].

While there are a number of uncertainties, there are opportunities beyond the current plan changes for Fire and Emergency to engage with the Ministry of Housing and Urban Development, Kainga Ora and developers who specialise in residential developments (i.e. Fletcher Residential, G J Gardner Homes and Pragma Homes (Hamilton)) to advocate for best practice emergency access design for residential developments. Where developers work nationally it is likely that the increasing use of pedestrian-access site plans in Auckland could be 'copy-pasted' onto other sites across Aotearoa New Zealand. Working with developers may avoid developments such as the case studies within this report being replicated across the rest of the country.

6.5.3 A shift in the permitted baseline

For a large number of these Councils, these MDRS changes represent a significant paradigm shift with respect to the enabled density of residential development with implications for both developers, communities as well as emergency services. For some Councils however, particularly the larger cities of Auckland, Hamilton, Tauranga, Wellington and Christchurch, residential intensification is not new, and they have a few decades of experience in enabling and managing intensive residential development[21]. For example, Hamilton City saw the emergence of higher density forms of living and in-fill redevelopment as early as 2001 which introduced residential intensification zones, leading to in-fill duplex housing typologies across the residential zones. On average, 55% of Hamilton's residential growth occurs in brownfield locations as apartments or duplexes[22]. Similarly, in Wellington, there has been a marked increase in apartment and townhouse living in the city centre and incremental backyard infill throughout the city, as there has been elsewhere in New Zealand over the last 30 years. Notwithstanding this, the application of MDRS is expected to result in a significant shift for these Councils, as with the other Tier 1 Councils.

There are a number of market and economic factors that are expected to drive the uptake of higher density residential development across the country going forward, i.e. the location, amenities and size of the urban environment, projected growth, existing housing stock, market demand and feasibility of supply. However additional factors such as three waters infrastructure capacity/constraints and areas of natural hazards will also significantly influence how, when and if, development can go ahead. In most Tier 1 environments three waters infrastructure is expected to result in the staging of development over the next 10+ years where infrastructure capacity constraints are realised. Auckland Council, Hamilton City Council, Waipa District Council and Waikato District Council taken a proactive approach to including water supply as a 'qualifying matter' in the implementation of MDRS.

This changing urban landscape will have impacts beyond the design life of the residential development occurring in the next few years. The approach of MDRS making it more permissive to build three homes of up to three storeys, accompanied by the style of terraced housing seen in these case studies, will likely

[19] This has been observed by recent private plan changes in Hamilton where the plan change proponent has indicated that onsite parking will be determined by the developer and that this will be guided by market demand.
[20] Other factors may be quality and quantity of public transport options, land affordability and availability within walkable catchments, the management of the transport network and the ability for the transport network to facilitate a significant increase in on-street parking etc.
[21] This intensification is understood to be influenced by a number of drivers such as regional level growth strategies, changing urban lifestyles, demographic shifts, environmental conditions and market demand and housing supply (among other matters).
[22] Proposed Plan Change 12 to the Operative Hamilton City District Plan - Statement of Evidence of Dr Mark Nairn Davey Dated 20 December 2022 - Link here

result in a more fragmented street block pattern across cities with greater subdivision and split ownership. Any future attempt to take a more holistic master planned approach to intensification at a street block level (including to allow for better emergency access) would require significant amalgamation of parcels/lots over several owners. Given this, it is likely that, without government intervention, subdivision of the case studies and similar developments will 'lock in' this style of development and its corresponding Fire and Emergency risks into the longer-term future beyond the existing structures.

6.5.4 Summary

In terms of built form, most Councils have introduced new policies through their plan changes to strengthen urban design outcomes with a greater focus on design considerations. It is however apparent that the current approach to providing compact housing does not take into account existing Fire and Emergency operational requirements in emergency response scenarios, and as such, a significant shift is required to either strike a balance between how council implement NPS-UD, MDRS and Fire and Emergency's minimum operational requirements, or look to other risk reduction solutions or mitigations.

While most Tier 1 Councils appear to be steering towards clearly defined zoning where intensification can occur, under a highly permissive planning framework, where there is an abundance of market opportunities, the type and location of where development opportunities are realised will be uncertain. This may make it more difficult to predict potential emergency response needs from a resourcing and demand point of view. While no research has been undertaken in other Tier 1 environments, the case study findings in Tāmaki Makaurau represent the likely anticipated outcomes nationally whereby intensified residential developments are enabled through existing legislative processes (such as the RMA and the Building Code). These processes result in unintended consequences for Fire and Emergency due to poorly considered design controls and disconnected legislation. The specific findings of this report are nonetheless expected to strengthen Fire and Emergency's position across the country which has stressed the significant risk to communities if that this balance is not struck. This is particularly important for Councils with limited previous experience in enabling residential intensification.

7 Future Considerations

This report raises several growing issues impacting upon Fire and Emergency's ability to respond effectively to emergencies across Tāmaki Makaurau in emerging urban environment land-use design. Noting that multiple smaller delays compound into increased risks to life, property, the environment as well as reduced ability to achieve performance expectations, Fire and Emergency matters should be included in decision-making across the built environment. Many of the factors identified in the matrix assessment are linked to planning decisions and the Auckland Unitary Plan. Given this, a number of considerations for further action/investigation have been suggested below:

Council training material

Using these case studies as a basis, work with Council to create guidance documents and training material for processing planners and development engineers to consider Fire and Emergency needs in resource consent application decisions. This could involve checklists, inclusion/reminders in notification and decision report templates, updated standard resource consent conditions and triggers for where resource consent applications should be provided for Fire and Emergency comments/input. This would likely reduce the number of situations where developments have critical emergency response flaws but have been granted resource consent and so then seek building consent based off the fact that their resource consent was approved.

Presenting Fire and Emergency concerns to the Auckland Council Hearing Panel for intensification changes

The previous recommendation requires effort on a site-by-site basis to influence development outcomes. It also could only be used where the intensification requires resource consent for a relevant infringement. By influencing the outcomes of Plan Change 78 and Plan Change 79 to the Auckland Unitary Plan, these matters could begin to be addressed at the district-level by way of further development controls, matters for assessment, advice notes for guidance, or other means. If successful it would see more developers design out many of these concerns prior to applying for resource consent and give more of a basis for it to be considered during assessing applications.

Influence wider resource management reform

With resource management reform underway, the planning system will change over the next decade. This provides an opportunity for Fire and Emergency to influence its shape through ensuring that these resource management emergency response factors (across both servicing and access) are included in the National Planning Framework under the Natural and Built Environments Bill for national consistency in application.

Responding to greater demand and risk

With response call outs increasing across Tāmaki Makaurau, and intensification likely resulting in greater concentrations of risk, Fire and Emergency may need to review their longer-term strategies across the four Rs (of reduction, readiness, response and recovery). Fire and Emergency is anticipated to gain requiring authority status through the resource management reform this creates an opportunity for Fire and Emergency to identify locations for potential future stations if required. Equally important will be strategies for risk reduction and community readiness, and engaging communities who live in the emerging developments on how to keep themselves and their neighbours safe.

Other considerations:

Beyond strictly resource management matters, the following considerations could also be investigated further, noting that some of these may be underway:

- *Continuing to work with Auckland Transport on the changing street environment.* Collaborate with Auckland Transport to collate data on the impacts of street redesign measures on response times and

use this to inform the creation of design guides for people-friendly streets that provide effective emergency access. As part of this, Fire and Emergency could consider encouraging Auckland Transport to liaise with Stats NZ for a cross tabulation from the 2023 Census to determine rates of car ownership for multi-unit developments constructed in the previous 5 years compared to Tāmaki Makaurau households at large.

- *Advocate to Auckland Transport for greater enforcement of on street parking and improved public transport.* Greater parking enforcement would reduce development car parking (or lack thereof) spilling out onto streets and improved public transport would improve congestion, thereby both helping to reduce obstacles Fire and Emergency face when responding to an incident.

- *Consider the future roading network in fleet strategies*. Auckland has experienced and is likely to continue to experience the highest level of urban intensification in Aotearoa New Zealand. However, the fire appliances used within the three Auckland Districts are some of the largest in Fire and Emergency's fleet. Fire and Emergency's fleet strategy should consider the requirement to operate in increasingly compact built environments including navigating narrow roads, driving between parked cars, and reduced space for set-up. This may require appliance options of smaller size, enhanced manoeuvrability, lower weight, and adjustment to the location of doors, compartments and pumps. Future strategies should also consider changes in the risk profile and emergency service needs of communities such as medical emergencies and extreme weather events.

- *Support climate change mitigation and adaptation measures in Tāmaki Makaurau.* With Fire and Emergency's likely growing response to extreme weather events as a result of climate change, and the implications on accessing incidents, there are clear benefits to Fire and Emergency to support climate action and being part of adaptation decision making to avoid the flow-on impacts to their operations. There is also an opportunity for Fire and Emergency to support the updating or development of community resilience plans.

- *Adapting to change in risk through changes in operational procedures and risk reduction strategies*. Further research could review international best practice on processes, technology, equipment, policies and/or other measures or approaches that are used in densely populated urban areas (particularly retrospectively intensified areas) overseas to reduce the greater risk from urban areas. It is recommended that this is undertaken holistically across all emergency providers (Fire and Emergency, St John and NZ Police) as policy settings and other matters are likely to be applicable to multiple providers. This could inform updated Fire and Emergency practices and provide evidence for influencing policy and regulatory environments to better support emergency responses.

- *Research intensification approaches/medium density housing designs that provide for effective fire and emergency access*. There may be an opportunity for Fire and Emergency to work with Council, particularly the Auckland Urban Design Panel, and other developers to feed into medium density residential urban design guides and advocate for Council to promote intensification approaches that consider access. For example, it may be that further research shows that perimeter blocks (that have all units accessible from the street) are a form of medium density housing that better supports Fire and Emergency operations. Showing support for specific forms of intensification over a variety of scales would highlight that there are solutions for Tāmaki Makaurau to consider and reinforce that Fire and Emergency are not opposed to intensification itself but focused on managing its unintended consequences.

- *Request urgent Building Code amendments to provide measures to reduce risk from existing intensification.* Investigate whether specific risk reduction measures could be retrospectively added to

existing intensive developments to reduce risk and advocate for this with central/local government as applicable – for example installing interconnected smoke alarm systems for units beyond a certain distance from the nearest fire appliance hardstand requiring sprinklers so as to delay/control fires where they are more difficult for personnel to access; and designing additional separation distances or fire rated constructions to reduce the likelihood of external fire spread and multiple fire exposure.

- *Seek changes to the fire and emergency considerations in Building Code and create clear distinction between emergency matters under the Building Act and the Resource Management Act (and flowing into the reforms)*. Fire and Emergency are aware of several limitations to the existing provisions of the Building Code and for which types of development these are applicable. Updating these matters would feed into greater understanding of the distinction between responsibilities under the Building Act and the Resource Management Act (and the upcoming drafting of the National Planning Framework under the resource management reforms) to provide for emergency response, and, in turn, decrease gaps in current provisions between the two Acts.

- *Advocate to large-scale developers to provide for Fire and Emergency needs.* As noted in Section 6, there is an opportunity for Fire and Emergency to engage with Kainga Ora and large-scale residential developers to advocate for best practice emergency access design. Particularly where developers operate nationally this could help mitigate similar designs to these case studies becoming more common outside Tāmaki Makaurau.

- *Incorporate intensification considerations in public awareness campaigns.* Consider expanding current public awareness campaigns to cover the different risks associated with different housing typologies and what residents can do to ensure Fire and Emergency can respond as efficiently and effectively as possible. This may include measures individuals can take like ensuring access paths are maintained and how to approach locked gates to properties.

To view the appendices for this report,
visit Fire and Emergency New Zealand website