

# PLAYING WITH FIRE | PORT HILLS: CHRISTCHURCH

REDUCING THE HARM CAUSED BY WILDFIRE IN THE PERI-URBAN LANDSCAPE

REGIONAL PLAN

## WHY SHOULD WE BE PLANNING FOR WILDFIRE?

As climate change produces hotter temperatures and reduced precipitation in many regions of the world an increase in the prevalence of wildfire is inevitable. This, combined with ever increasing urban population growth into wildland fire hazard landscapes has the potential to cause catastrophic harm to people, property, and vulnerable ecosystems. In New Zealand 99.9% of wildfires are caused either accidentally or intentionally by human activity, therefore it's an issue we have the ability to do something about.

## WILDFIRE IN THE PORT HILLS

The complex mosaic of social, environmental, and economic values is what makes the Port Hills such an important asset for the people of Christchurch and Canterbury, yet it is these, often competing, values which contribute to the threat of wildfire. Clearance of indigenous vegetation for farming and access, along with the introduction of highly flammable exotic species such as gorse has created a landscape which, combined with the right climatic conditions, will readily ignite. Large pine plantations provide substantial sources of fuel for a raging wildfire and surrounding social and environmental values are easily threatened.

## VISION

The peri-urban landscape of Christchurch's Port Hills will become an intelligently functioning system which reduces the risk of a wildfire igniting and reduces the harm caused should wildfire occur. The landscape will also function as an educational tool, providing immersive experiences which engage users with the dangers of wildfire and precautionary measures they can take at the community and individual level.

## OVERALL GOALS

- Reduce the chance of a wildfire igniting
  - Separate common sources of ignition (i.e. rural burn-offs/land clearance, roads, and powerlines) from highly flammable vegetation types
  - Enhance public awareness of the environmental factors which contribute to wildfire risk and encourage people to take more care to reduce accidental ignition
- Mitigate environmental conditions which contribute to the intensity, spread, and rate of movement of a wildfire
  - Disperse high fuel land uses (i.e. exotic forestry plantations) in small pockets throughout the landscape to reduce the spread of wildfire
  - Provide sufficient water reservoirs throughout the landscape to assist in the firefighting process
  - Utilise low flammability plant species to create green fuelbreaks throughout the landscape to reduce the intensity, spread, and rate of movement of a wildfire
- Reduce the amount of people, property, and natural resources that would be threatened should a wildfire occur
  - Limit residential encroachment into wildfire hazard areas
  - Create additional emergency access routes near existing residential areas to provide improved wildfire defence
  - Promote the planting of low flammability native species throughout the landscape to improve ecosystem resilience to wildfire

## SOCIAL VALUES

Suburban Living, Lifestyle Living, Recreation

## ECONOMIC VALUES

Pine Forestry, Farming, Christchurch Adventure Park

## ENVIRONMENTAL VALUES

Remnant & Revegetated Native Forest, Water Catchment

### PRE-HUMAN LANDSCAPE

- Volcanic activity led to the formation of the Port Hills approximately 12 million years ago<sup>1</sup>
- Landscape covered with mature podocarp forest<sup>2</sup>
- Very few wildfires and vegetation did not evolve to recover quickly from wildfire disturbance<sup>2</sup>

### EUROPEAN SETTLEMENT

- Extensive deforestation for logging timber<sup>2</sup>
- Fire used to clear land for farming<sup>2</sup>
- Introduction of highly flammable exotic plant species (e.g. Gorse)<sup>2</sup>
- Suburban expansion on northern slopes of the Port Hills<sup>2</sup>
- Pine forestry plantations established<sup>2</sup>

### MĀORI SETTLEMENT

- Fire used as a tool to clear forest for moa hunting, access, and cropland<sup>2</sup>
- After moa became extinct and fire use lessened, successional vegetation developed with increased flammability characteristics<sup>2</sup>

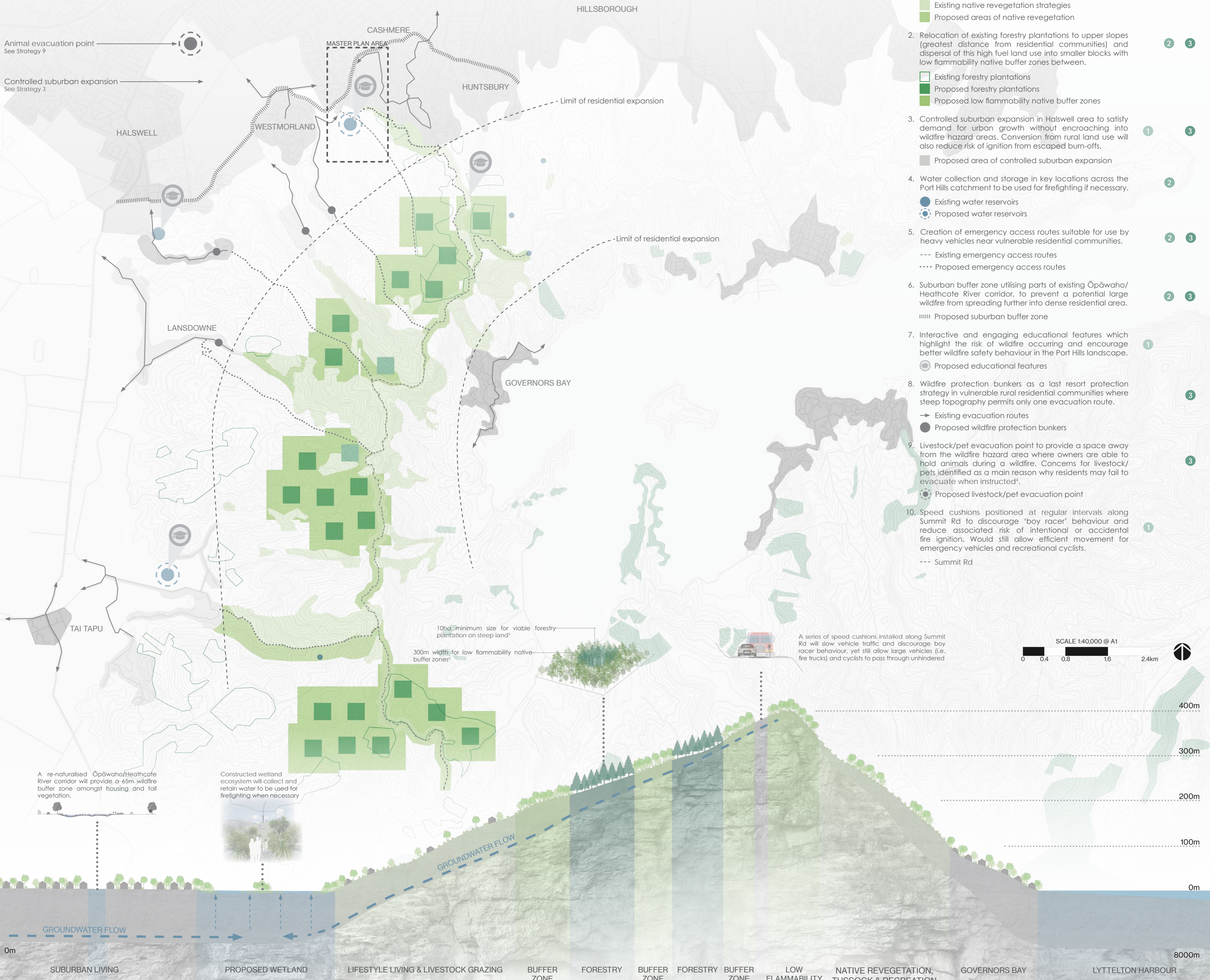
### PORT HILLS WILDFIRE

- Hot, dry summer with little rainfall led to high fire risk<sup>2</sup>
- Two ignition points, causes undetermined but deemed suspicious<sup>1</sup>
- Helicopter pilot killed, nine homes destroyed, five homes damaged<sup>1</sup>
- 1,600ha of land burnt, mature indigenous forest relatively unburnt<sup>1</sup>

## STRATEGIES

## GOALS MET

- Native revegetation with low flammability species along Summit Rd (high ignition risk) and throughout valleys with sufficient shade and moisture to enable establishment.
  - Existing native revegetation strategies
  - Proposed areas of native revegetation
- Relocation of existing forestry plantations to upper slopes (greatest distance from residential communities) and dispersal of this high fuel land use into smaller blocks with low flammability native buffer zones between.
  - Existing forestry plantations
  - Proposed forestry plantations
  - Proposed low flammability native buffer zones
- Controlled suburban expansion in Halswell area to satisfy demand for urban growth without encroaching into wildfire hazard areas. Conversion from rural land use will also reduce risk of ignition from escaped burn-offs.
  - Proposed area of controlled suburban expansion
- Water collection and storage in key locations across the Port Hills catchment to be used for firefighting if necessary.
  - Existing water reservoirs
  - Proposed water reservoirs
- Creation of emergency access routes suitable for use by heavy vehicles near vulnerable residential communities.
  - Existing emergency access routes
  - Proposed emergency access routes
- Suburban buffer zone utilising parts of existing Ōpāwaha/Heathcote River corridor, to prevent a potential large wildfire from spreading further into dense residential area.
  - Proposed suburban buffer zone
- Interactive and engaging educational features which highlight the risk of wildfire occurring and encourage better wildfire safety behaviour in the Port Hills landscape.
  - Proposed educational features
- Wildfire protection bunkers as a last resort protection strategy in vulnerable rural residential communities where steep topography permits only one evacuation route.
  - Existing evacuation routes
  - Proposed wildfire protection bunkers
- Livestock/pet evacuation point to provide a space away from the wildfire hazard area where owners are able to hold animals during a wildfire. Concerns for livestock/pets identified as a main reason why residents may fail to evacuate when instructed<sup>4</sup>.
  - Proposed livestock/pet evacuation point
- Speed cushions positioned at regular intervals along Summit Rd to discourage 'boy racer' behaviour and reduce associated risk of intentional or accidental fire ignition. Would still allow efficient movement for emergency vehicles and recreational cyclists.
  - Summit Rd



<sup>1</sup> SOCHN. (2009). Rural Fire Research Update. Retrieved 25 February, 2019 from [https://publicworks.govt.nz/wp-content/uploads/2014/04/RURAL\\_FIRE\\_RESEARCH\\_UPDATE\\_Issue-3.pdf](https://publicworks.govt.nz/wp-content/uploads/2014/04/RURAL_FIRE_RESEARCH_UPDATE_Issue-3.pdf)

<sup>2</sup> Trindler, S. (2018). A case for spatial planning to manage the growing threat of wildfire in New Zealand's peri-urban landscapes. Lincoln University, Lincoln, New Zealand.

<sup>3</sup> Fire & Emergency New Zealand. (n.d.). Port Hills Operational Review. Retrieved 3 September, 2019 from <https://fireandemergency.govt.nz/research-and-reports/port-hills-operational-review/>

<sup>4</sup> Spangler, H., Johnston, D., M., Stewart, C., & Riley, C. B. (2018). An integrative review of the 2017 Port Hills fires: Impact on animals, their owners and first responders' encounters with the human-animal interface. *Australian Journal of Disaster and Trauma Studies*, 22(1), 97-108.

<sup>5</sup> Ministry of Forestry. (1998). Establishing a Small Forest. Retrieved 9 September, 2019 from <https://www.mps.govt.nz/dmsdocument/15736-establishing-a-small-forest-small-forest-management-5>

<sup>6</sup> Agnew, J. K., Rango, S., Finney, M. A., Oml, P. N., Scobie, D. B., Silmer, C. N., van Wageningen, J. W., & Weatherston, C. P. (2003). The use of shaded fuelbreaks in landscape fire management. *Forest Ecology and Management*, 127(1), 55-66.

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REDUCING THE HARM CAUSED BY WILDFIRE IN THE PERI-URBAN LANDSCAPE

MASTER PLAN

## DESIGN RATIONALE

There is currently a need for additional large water reservoirs throughout the Port Hills peri-urban landscape that are suitable to be used for the filling of helicopter buckets and water tankers during wildfire events. An area of low lying land in the Cashmere/Worsleys Valley, which frequently floods during winter, provides one opportunity to provide this.

Whilst water will not inundate the entire area over summer, the creation of deeper basins and a wetland ecosystem will help to retain enough water to be used for firefighting. Shallower, floodable basins will provide capacity to hold and slowly release stormwater during periods of heavy rainfall, reducing flooding along the Opāwaho/ Heathcote River corridor.

Nearby walking and cycling tracks, a playground, and an iconic sculpture will attract numerous visitors to the site. A series of engaging environmental indicators will reveal the often unobserved environmental factors which contribute to wildfire risk, therefore encouraging visitors to take more care in the Port Hills landscape during times of high wildfire danger.

### 1 RE-NATURALISED OPĀWAHO/HEATHCOTE RIVER CORRIDOR

A re-naturalised river corridor will provide a number of ecological benefits, reduce frequent flooding downstream, and provide a buffer zone within the suburban landscape which will reduce the chance of a wildfire spreading further throughout the residential area.

### 2 PLAYGROUND & BARBECUE/PICNIC AREA

This area will attract a number of visitors to the site who are then engaged with the environmental factors which contribute to wildfire risk through the site's four environmental indicators. This space also provides a critique of suburban expansion into the wildland landscape.

### 3 EMERGENCY ACCESS TRACK

There is a need for an emergency access route along the eastern edge of the Cashmere/Worsleys Valley in order to better protect adjacent residential property in the event of a wildfire. An eight metre wide track will provide access for large emergency vehicles, whilst functioning as a walking, running, and mountain biking track during everyday use.

### 4 VIEWING PLATFORMS

Two viewing platforms situated along the walking, running, and cycling track provide expansive views across the Cashmere/Worsleys Valley and out over the city of Christchurch. Orientated directly towards the Remnant Reminder sculpture, this experience will provide a visual reminder of the threat of wildfire as users continue into the Port Hills landscape.

### 5 LOW FLAMMABILITY NATIVE REVEGETATION

The establishment of native vegetation utilising low flammability species along the eastern edge of the Cashmere/Worsleys Valley will provide a barrier to wildfire movement, further protecting adjacent residential property.

### 6 GREEN FUELBREAK

Smaller pockets of low flammability native revegetation will help to prevent wildfire spread, whilst land dedicated to sheep grazing will help to keep grass short and reduce the available fuel for a wildfire.

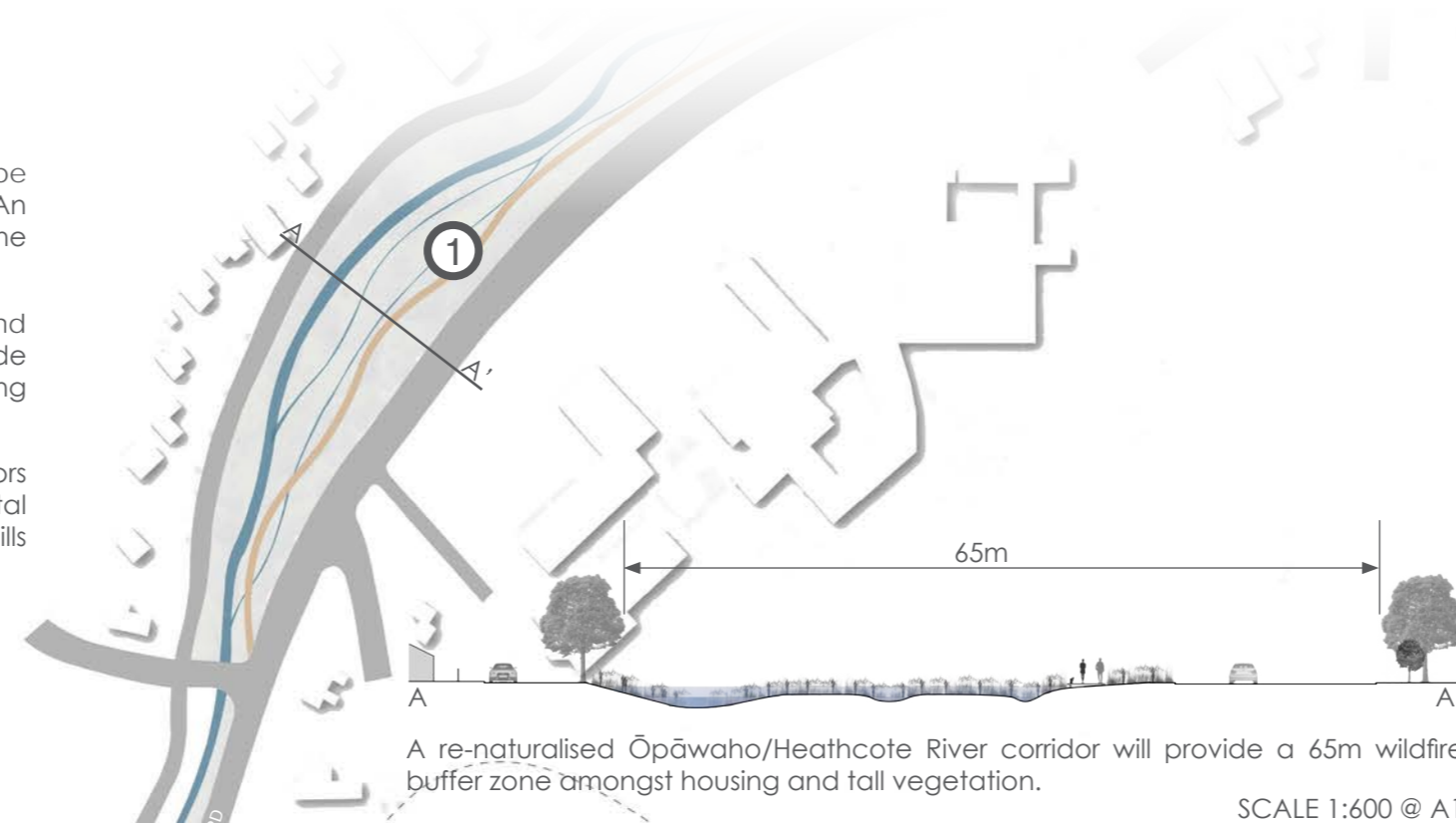
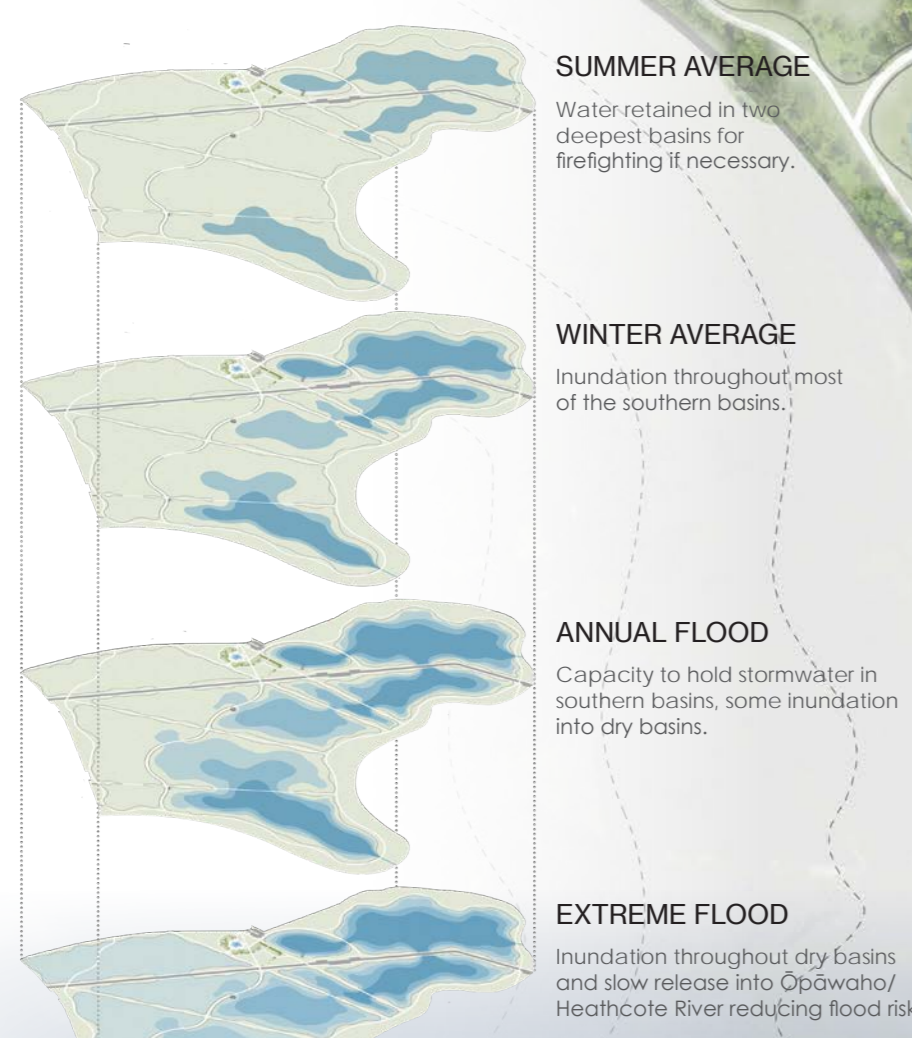
### 7 WASTELAND WALK

The track leading up the hill to The Remnant Reminder sculpture will be lined with a grove of black fibreglass poles which reveal wind speed and direction at an immersive scale. At night orange lighting at the base of each pole will help to create the impression of moving through a wildfire affected landscape.

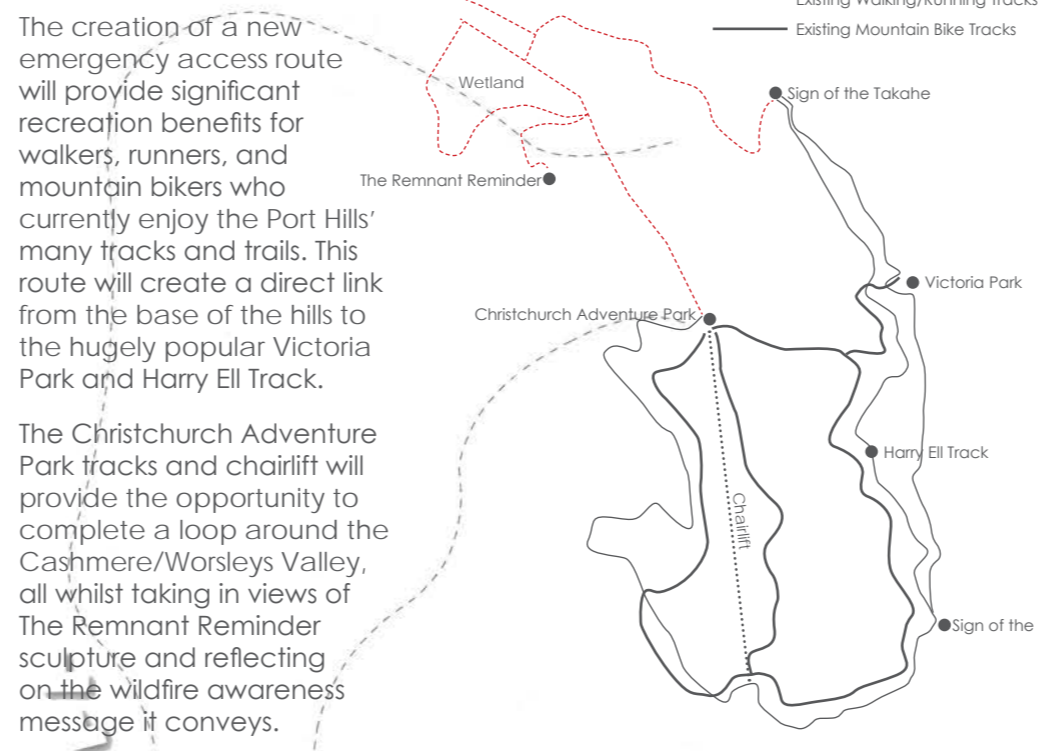
### 8 THE REMNANT REMINDER SCULPTURE

The anchor point and icon for the site, this 60 metre tall sculpture, reminiscent of a lone burnt tree, is the largest of the site's four environmental indicators. Tall fibreglass 'branches' which bend and sway will reveal wind strength and direction, whilst lighting at night will reflect the current level of wildfire risk in the landscape.

## WETLAND WATER LEVELS



## RECREATION NETWORK

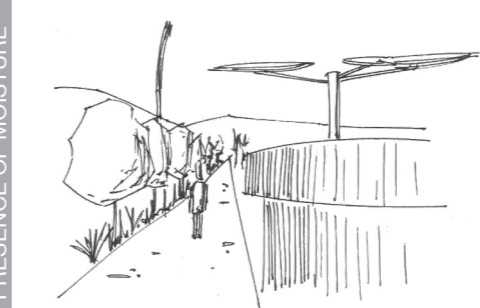


## ENVIRONMENTAL INDICATOR JOURNEY

At present the wildfire danger awareness system in New Zealand consists solely of signs with an arrow pointing towards the current level of fire danger in the landscape. Whilst these signs clearly convey the necessary message, they do little to engage viewers and ensure that people actually take notice.

A series of environmental indicators situated along one of the most highly trafficked routes through the site will provide a unique experience which engages users not only with the current level of fire danger, but also with the environmental cues which show when the risk of wildfire is increased.

### WATER TREES ENGAGING THROUGH PLAY



- Large shade structures collect rainwater and provide visitors with the opportunity to release it.
- Colour coded transparent plastic panels show the current water level and therefore the amount of moisture present in the environment (see sheet six for more detail).

### WATER TERRACES UNDERSTANDING WATER



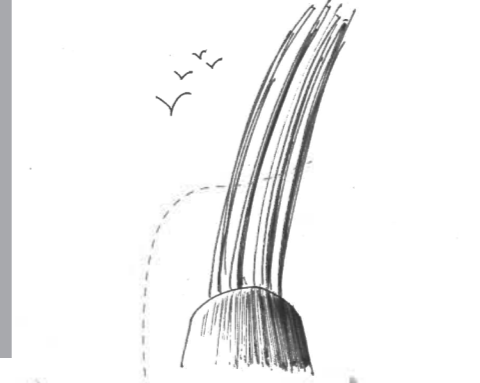
- As water levels in the wetland basin rise and fall different levels of terrace are exposed. These levels are colour coded to represent the current level of wildfire danger (see sheet three for more detail).
- Regular visitors, such as local residents or those who frequently recreate in the Port Hills, will soon develop an understanding for the connection between the presence of moisture and wildfire danger.

### WASTELAND WALK IMMERSED IN A POST-FIRE LANDSCAPE



- At this point in the journey the mood drastically changes. The consequence of ignoring environmental cues is illustrated with a grove of black fibreglass poles creating the experience of walking through a charred landscape.
- Orange lighting at night helps to exaggerate this experience by mimicking flames which spread further down the slope as the level of wildfire danger increases.

### THE REMNANT REMINDER AN UNMISSABLE INDICATOR



- The base of The Remnant Reminder sculpture is the final stage in the journey, however the majority of the sculpture will be highly visible from all points along the route.
- Swaying fibreglass 'branches' illustrate wind strength and direction, whilst colour coded lighting at night expresses the overall level of wildfire danger. The enormous scale of the sculpture makes it impossible to ignore.

## A MULTI-FUNCTIONAL LANDSCAPE

EVERYDAY RECREATIONAL USE



# PLAYING WITH FIRE

REDUCING THE HARM CAUSED BY WILDFIRE IN THE PERI-URBAN LANDSCAPE

# PORT HILLS: CHRISTCHURCH

INTERMEDIATE PLAN

## DESIGN RATIONALE

The desire for continued suburban growth into the wildland landscape of the Port Hills is resulting in significantly more harm caused when wildfire occurs. Increasing the number of people and property in areas where wildfire is known to occur is nonsensical; yet only two years on from the devastating 2017 Port Hills Fires a new subdivision in the Cashmere/Worsleys Valley is being built less than two kilometres from where homes were destroyed.

The playground and barbecue/picnic area will be one of the main attractions for visitors to the site and therefore provides the opportunity to capture their attention with a critique of suburban expansion. The natural, flowing forms and textures of the playground space contrast distinctly with the straight, controlled, and manicured barbecue/picnic area. The continuous mound form provides a link between the two spaces highlighting how the suburban and wildland landscapes are connected; yet the distinct contrast, in combination with the site's environmental indicators, will prompt users to consider the appropriateness of building residential property in a wildfire hazard area.

### 1 PORT HILLS PLAYGROUND

The most active and exciting space within the Cashmere-Worsleys Wetland, this playground will quickly become a popular destination for families from across Christchurch. The high number of visitors this space will attract provides the perfect opportunity for engaging users, both young and old, with the precious Port Hills landscape and the environmental elements which convey wildfire risk. A stark contrast to the bland and unexciting area on the other side of the mound, the key features of the Port Hills are celebrated; whilst large "Water Trees" provide an effective way for children to gauge the level of moisture present in the landscape.

### 2 BARBECUE & PICNIC AREA

A series of three alcoves cut into a grass mound represent the ways in which new residential development is cutting into the Port Hills. White plaster walls and concrete block paving both feature heavily in nearby newly developed subdivisions and also provide a fireproof space to prevent any wayward sparks from spreading. Whilst these alcoves are functional and sheltered, the outward view is largely bland and uninteresting; the real excitement happens in the playground space (i.e. the Port Hills). This experience encourages people to appreciate the value of our wildland areas and to appreciate the benefits provided by preserving them.

### 3 WATER TERRACES

One of the site's four environmental indicators these grass and concrete terraces encourage wetland visitors to engage with the water that is such an important part of the Port Hills landscape. The level of water in the wetland basins correlates directly with the level of moisture in the surrounding environment and is therefore one aspect which contributes to wildfire risk. Five levels of coloured concrete provide a visual translation of this risk and frequent visitors, such as nearby residents, will soon develop an appreciation for when wildfire risk is at its highest.

### 4 MINI MOUNDS

As the mound form tapers off into the wetland a series of four small grass mounds, 0.5m in height, protrude from the earth. These provide a feature for visitors to sit or lie against, gazing directly towards The Remnant Reminder sculpture on the hill 600m away. At night when the sculpture is lit up, visitors from across Christchurch will flock with blankets and sleeping bags to view the swaying branches glowing against the night sky.

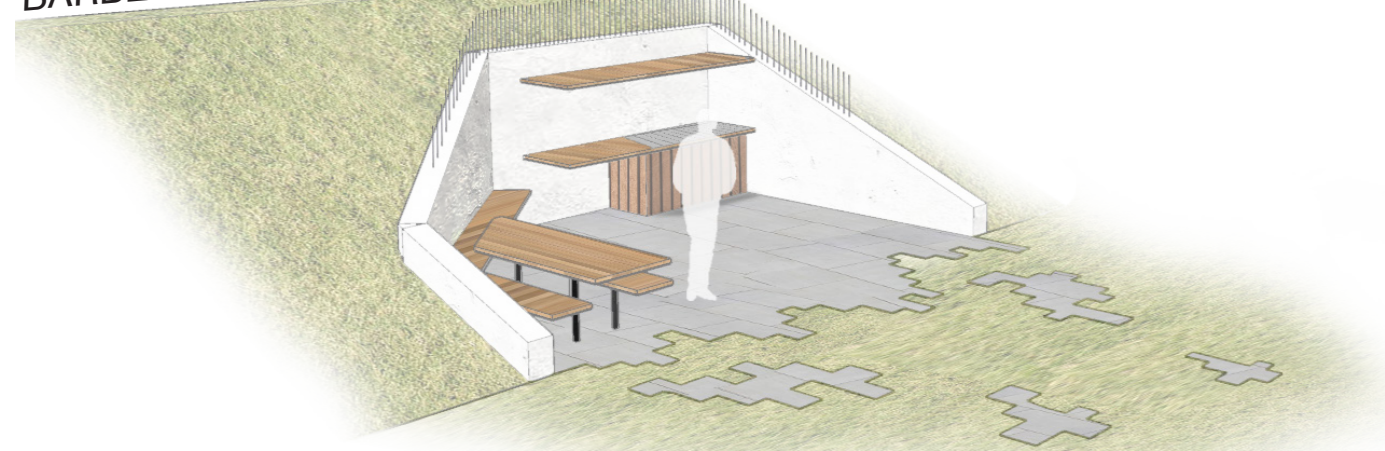
## DESIGN MEANING



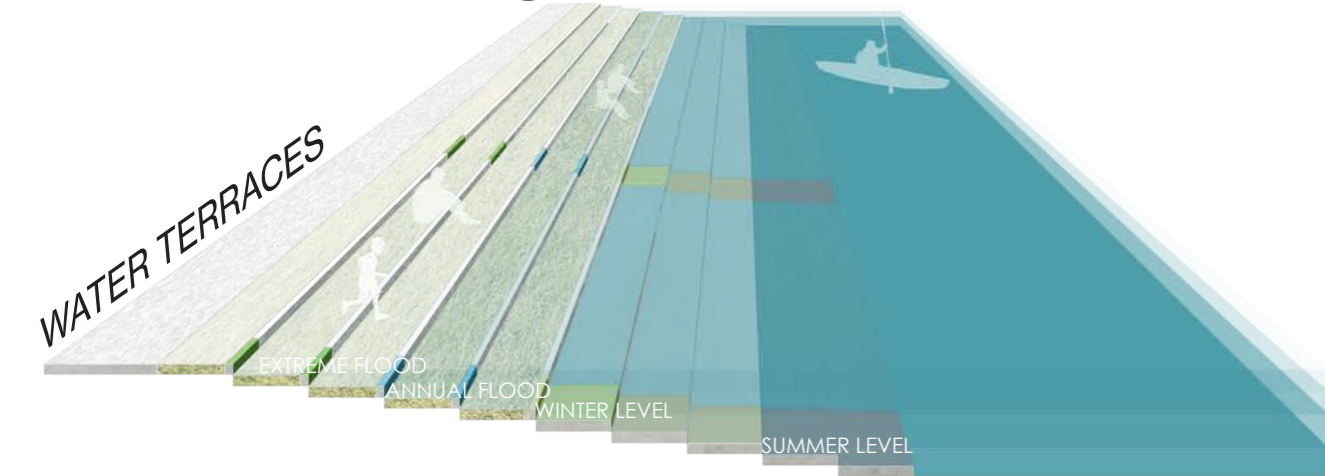
The form of the playground and barbecue/picnic area is largely inspired by the form of Banks Peninsula, with two harbours (the water play area and the barbecue alcoves) nestled amongst steep hills (continuous mound form) providing shelter and refuge from the elements.

Continuous suburban expansion into the Port Hills wildland landscape is one of the main factors increasing the harm caused when wildfire occurs. The intention for this part of the site is to create a gateway to the Port Hills which marks the threshold between suburban and wildland and encourages people to consider what is appropriate in each landscape, both in terms of land use and wildfire safety behaviour.

### BARBECUE ALCOVE

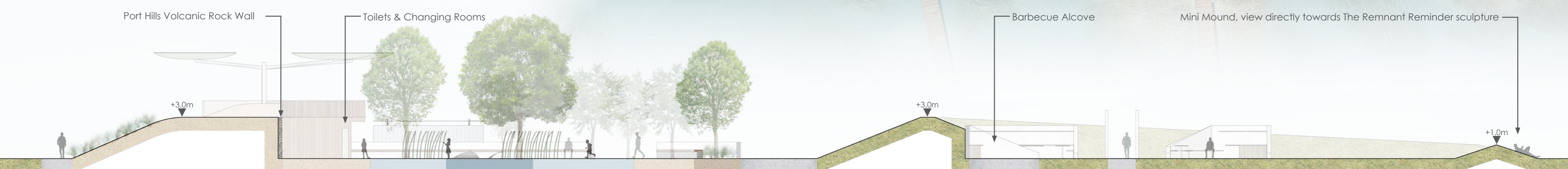


### WATER TERRACES



COLOURS VISIBLE	WATER LEVEL	WILDFIRE RISK
High (Red, Orange, Yellow, Green)	EXTREME DROUGHT	High
Medium (Yellow, Green, Blue)	SUMMER AVERAGE	Medium
Low (Green, Blue)	WINTER AVERAGE	Low
Very Low (Blue)	ANNUAL FLOOD	Very Low
None (Water)	EXTREME FLOOD	None

- More colour levels visible as water level drops
- Concrete terraces for regularly inundated levels, grass for infrequently inundated levels



SECTION ELEVATION SCALE 1:200 @ A1

PORT HILLS PLAYGROUND: Natural, active, exciting; highlighting the value of our wildland landscapes

SUBURBAN BARBECUE & PICNIC AREA: Structured, controlled, manicured; illustrating the blandness of our suburban landscapes

# PLAYING WITH FIRE | PORT HILLS: CHRISTCHURCH

REDUCING THE HARM CAUSED BY WILDFIRE IN THE PERI-URBAN LANDSCAPE

PLANTING STRATEGY

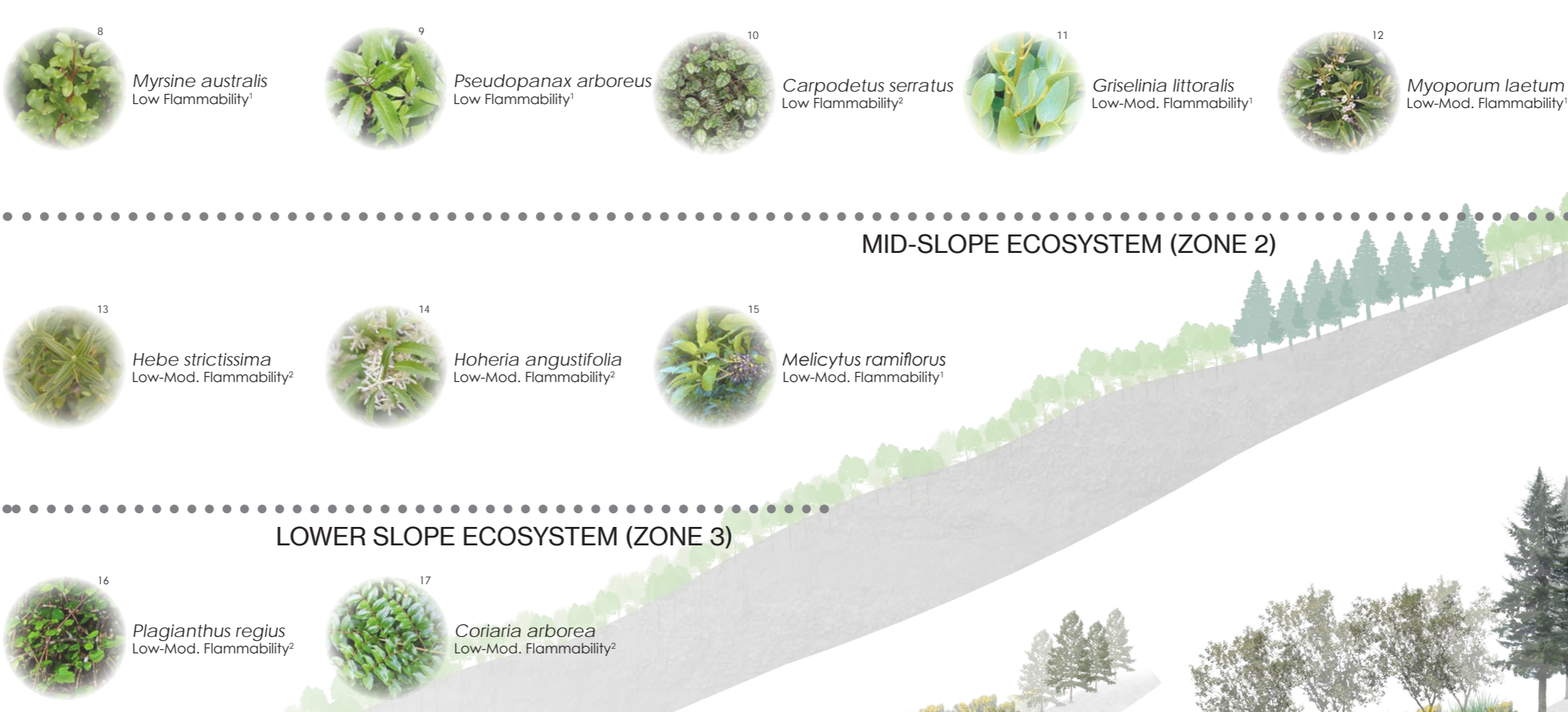
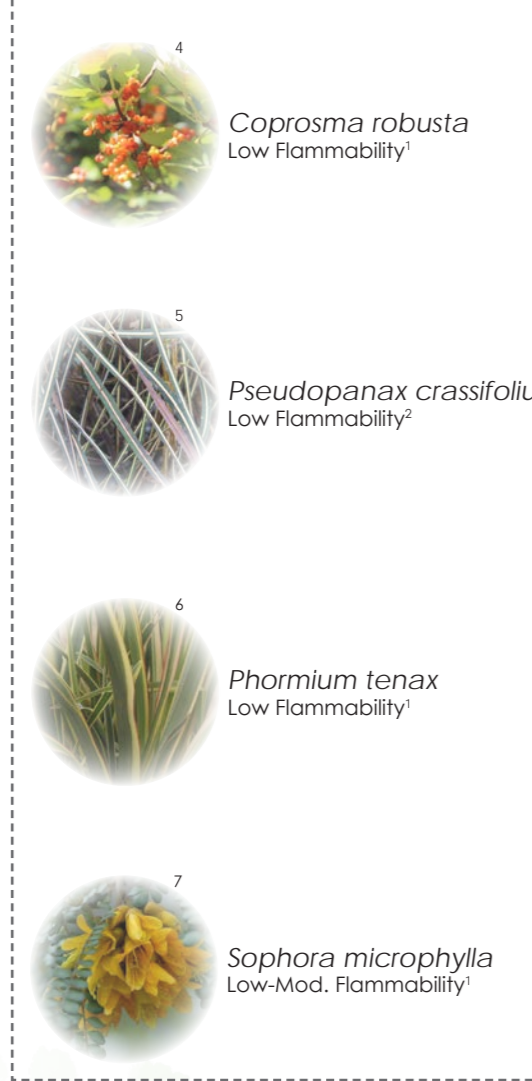
## PREVENTING THE IGNITION AND SPREAD OF WILDFIRE - LOW FLAMMABILITY NATIVE REVEGETATION STRATEGY

The current mix of vegetation found across the Port Hills landscape contributes significantly to the area's high level of wildfire hazard. Vast expanses of gorse provide a highly flammable fuel source and large pine forestry plantations provide an enormous volume of combustible material for a raging wildfire to feed off.

Revegetation of the entire Port Hills landscape is not currently a viable option; therefore revegetation will be implemented in targeted areas where it will have the greatest impact. These areas include the Summit Road corridor (high ignition risk from vehicles and recreational users), 300m wide buffer zones around reduced size forestry plantations, and "Green Fingers" extending down four key valleys where moisture and shade is most prevalent resulting in the best plant establishment conditions.

In order for planting across such large areas to establish and thrive without continued human intervention, species need to be well suited to the distinct ecosystems and climatic conditions found at the various elevations of the Port Hills landscape.

### SUITABLE ACROSS ALL ZONES



### SUMMIT RIDGE ECOSYSTEM (ZONE 1)

### MID-SLOPE ECOSYSTEM (ZONE 2)

### LOWER SLOPE ECOSYSTEM (ZONE 3)

### ESTABLISHMENT OVER TIME

5 YEARS

25 YEARS

50 YEARS

Low flammability native species planted amongst existing Gorse which will function as a nurse crop, providing shelter. Juvenile pines planted in relocated forestry plantations.

Native forest beginning to mature and grow over existing Gorse, creating shade and killing it off. Pine trees matured and ready for harvesting in patches.

Native forest matured providing a resilient ecosystem which creates shade and retains moisture. Wildfire protection now most effective.

## COLLECTING AND RETAINING WATER - WETLAND ECOSYSTEM STRATEGY

A constructed wetland in the Cashmere/Worsleys Valley will provide a number of ecological, recreational, and flood prevention benefits; in addition to providing a nearby water source for the filling of helicopter buckets and water tankers during wildfire events.

Wildfire in the Port Hills primarily occurs over the summer months when water levels in the wetland will be at their lowest; therefore a healthy wetland ecosystem is necessary to provide shade and prevent valuable water from evaporating from the deepest basins.

One common challenge in wetlands with fluctuating water levels is the presence of mosquitoes. With a popular playground space, barbecue/picnic area, and residential property all within the vicinity of the wetland it is of utmost importance to manage this potential problem. Planting in the 'Submerged Zone' has been selected to provide habitat for Canterbury Mudfish which prey on mosquito larvae<sup>1</sup>.

### PERMANENTLY DRY



Low flammability species of high importance

### DRY BASINS



Low flammability species of high importance

### INFREQUENTLY INUNDATED



### MARGIN



### SUBMERGED



### SUBMERGED

## ENGAGING AND EDUCATING THROUGH PLAY - PLAYGROUND PLANTING STRATEGY

Planting in the Port Hills Playground space serves to strengthen visitors' understanding and appreciation for the unique ecosystems found throughout the local area. The largest and most dominant zone is the Port Hills play mound, with swathes of tussock creating a clearly understandable link to this iconic feature of the current Port Hills landscape.

Planting in the Lyttelton Harbour Zone is sparser with two planting beds providing enough space to showcase some of the species found throughout the numerous harbour basin ecosystems. Three shade trees will create an atmosphere of shelter and protection, as is experienced by crews sailing into the harbour. These shade trees will also provide a comfortable space for parents to sit and keep an eye on children using the water play area.

In stark contrast to the windswept tussock of the play mound, an 'ancient forest' is found in the Canterbury Plains Zone. This miniature forest ecosystem will simulate the experience of being immersed in a dense Kahikatea forest, as would have covered the valley floor prior to human settlement.

### CANTERBURY PLAINS ZONE - SLIDE THROUGH ANCIENT FOREST CANOPY

Planting characteristic of poorly drained valley floor ecosystem



### PORT HILLS ZONE - BOUND THROUGH WINDSWEPT TUSSOCK

Planting characteristic of the Port Hills tussock landscape



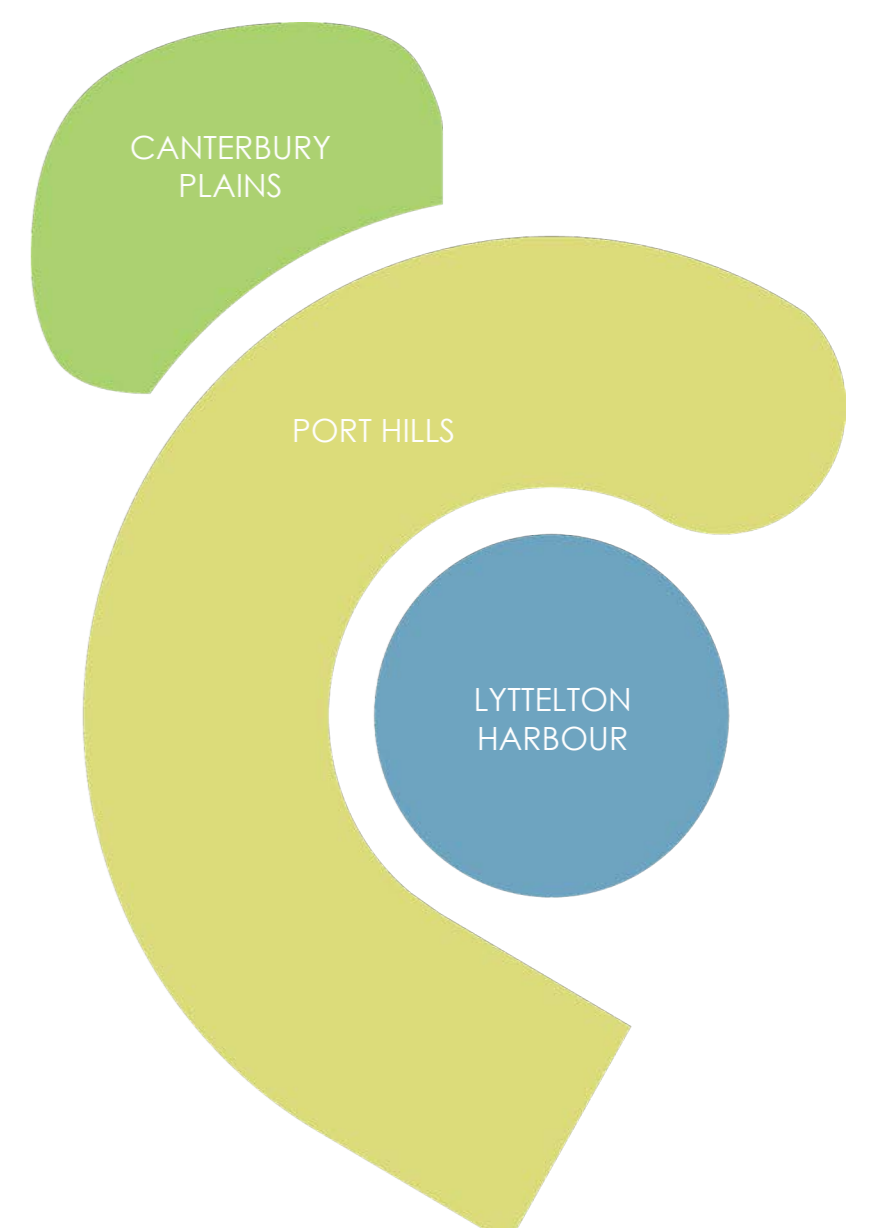
### LYTTELTON HARBOUR ZONE - A SHELTERED SPACE TO SIT AND OBSERVE

Planting characteristic of the many Lyttelton Harbour Basin ecosystems



N.B. Image size denotes visual dominance of species amongst plant grouping

## PLAYGROUND PLANTING ZONES



REGIONAL PLAN

MASTER PLAN

DETAIL PLAN

<sup>1</sup>Wyse, S., Perry, G., O'Connell, D., Holland, P., Wight, M., Hosted, C., Curran, I. (2016). A quantitative assessment of shoot flammability for 60 tree and shrub species supports rankings based on expert opinion. International Journal of Wildland Fire, 25 (1), 466-477.  
<sup>2</sup>Fire and Emergency New Zealand, (n.d.). Retrieved from <https://fireandemergency.nz/our-home/flammability-of-plant-species/>  
<sup>3</sup>Christchurch City Council, (2003). Waterways, Wetlands and Drainage Guide. Retrieved from <https://www.ccc.govt.nz/environment/water/water-policy-and-strategy/waterways-wetlands-and-drainage-guide>  
<sup>4</sup>Please see image references on rear of sheet

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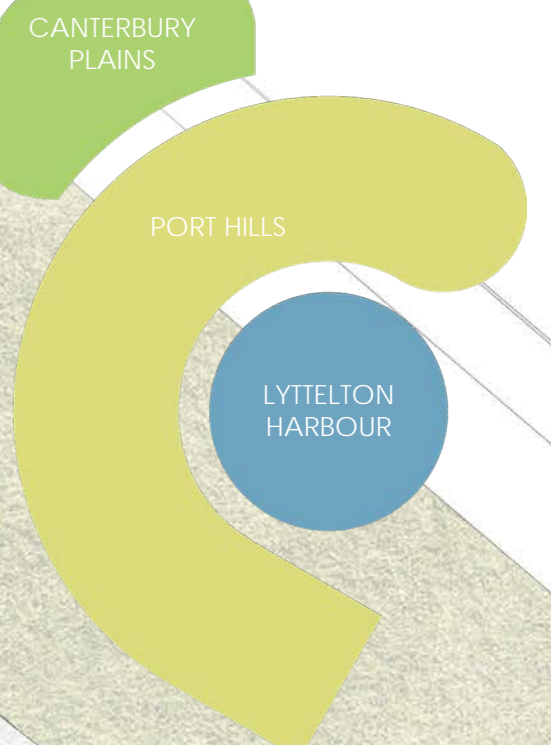
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DETAIL PLAN

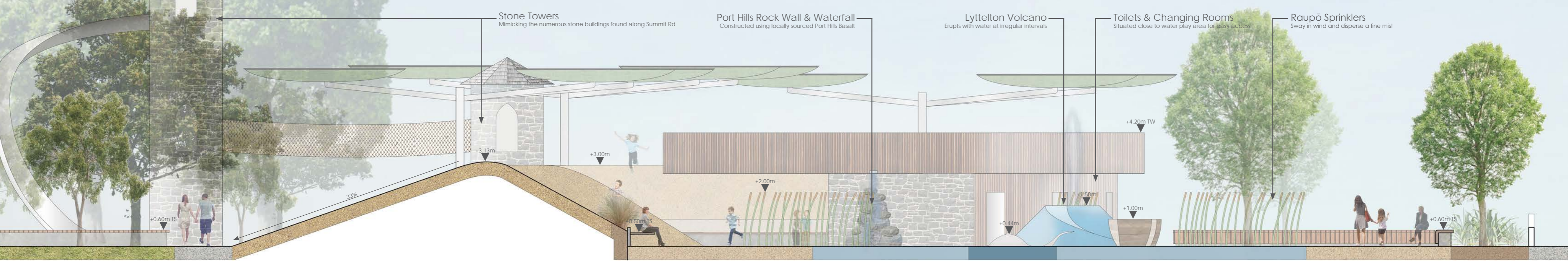
## DESIGN RATIONALE

The Port Hills Playground space will function as both a destination for families and a gateway for other users visiting the wider wetland and Port Hills landscape. In order to build an appreciation and an understanding for the environmental processes that shape this landscape, particularly those related to wildfire risk, the Port Hills region has been constructed in miniature, at a scale easily comprehensible for children.

The central space forms the Lyttelton Harbour Splash Zone, a permanently wet water play area which is fed by a pump and tank system. Encircling the harbour is the Port Hills Play Mound, featuring four "Water Trees" which provide shade and collect rainwater. This water can then be released down the slopes where it flows through "Green Fingers", mimicking the revegetation strategy at the Regional Scale which sustains life and provides wildfire protection. Thirdly, a densely vegetated area surrounding the sandpit and slide forms an "Ancient Forest", representing the pre-settlement land-cover of both the Cashmere/Worsley Valley and much of the wider Canterbury Plains landscape.



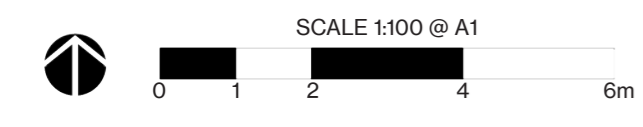
- TW Top of Wall
- TS Top of Seat
- TSL Top of Slide
- BSL Bottom of Slide
- BV Bottom of Volcano
- + Proposed Spot Heights



A CANTERBURY PLAINS 'ANCIENT FOREST'

PORT HILLS PLAY MOUND

LYTTELTON HARBOUR SPLASH ZONE



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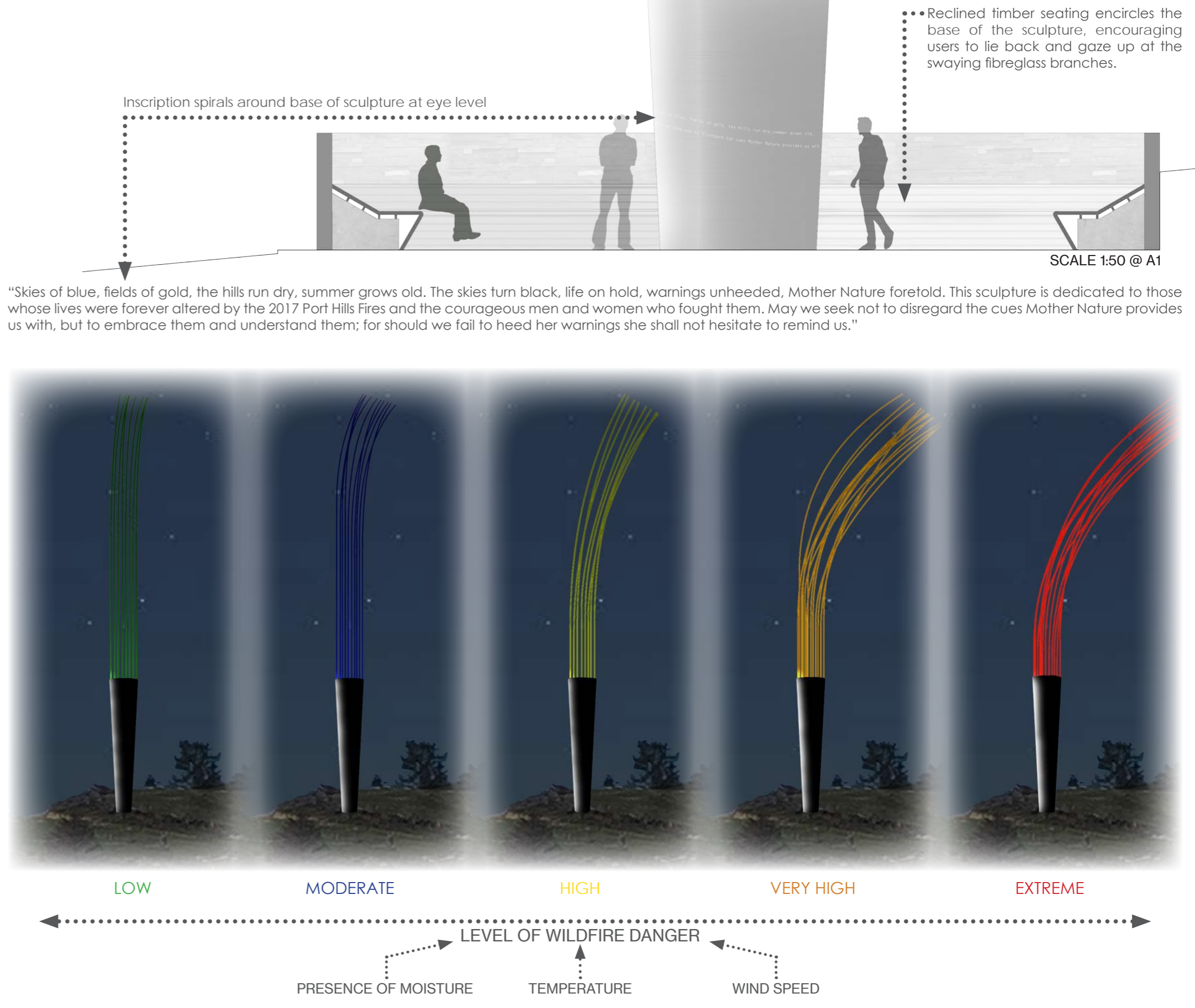
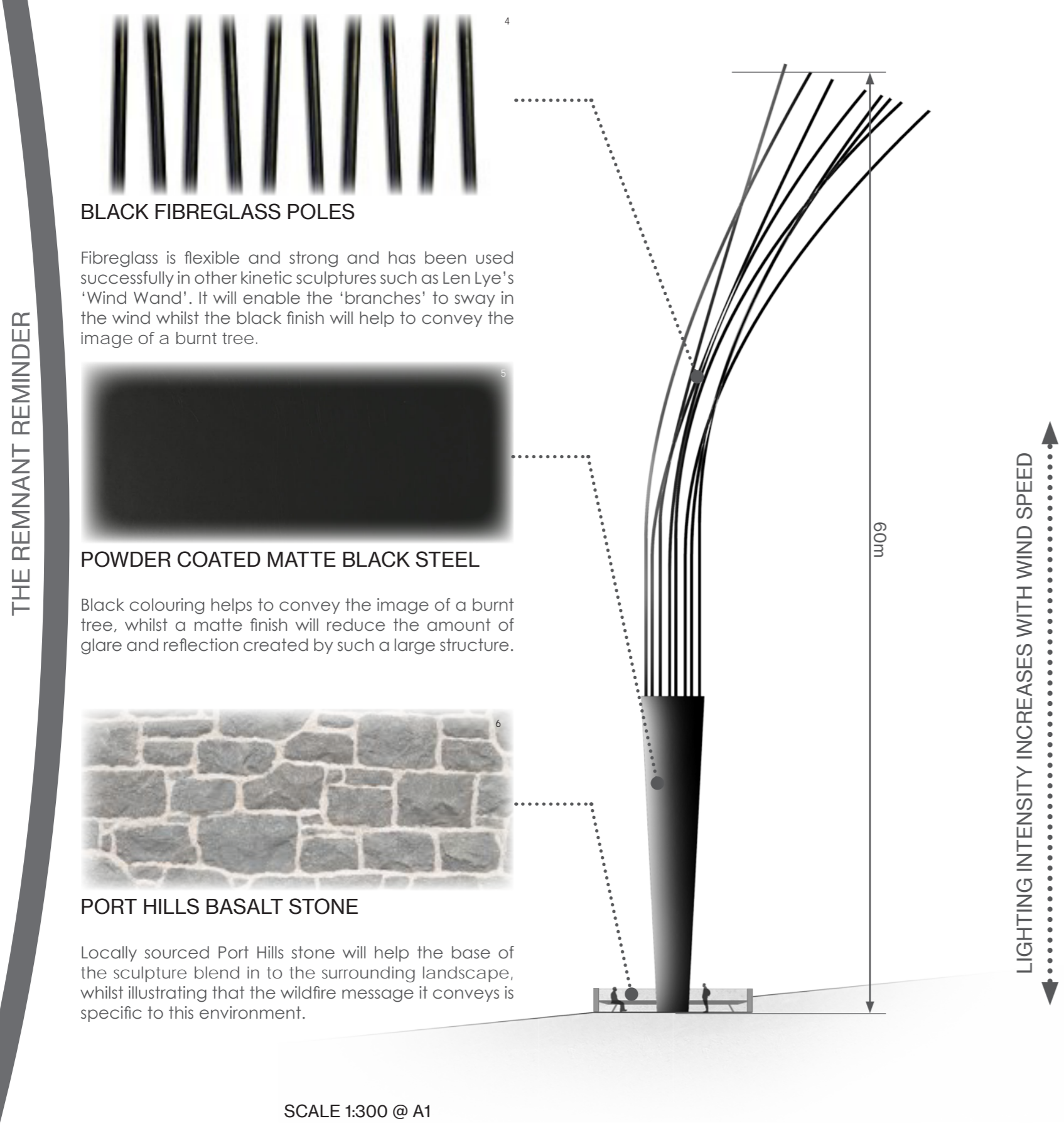
REDUCING THE HARM CAUSED BY WILDFIRE IN THE PERI-URBAN LANDSCAPE

FORM AND MATERIALS STRATEGY

## THE REMNANT REMINDER

In 2017 the devastating Port Hills Fires burnt a vast expanse of the Port Hills, including much of the Cashmere/Worsleys Valley. Immediately post-fire highly visible black scars could be seen across the landscape, yet this image of charred vegetation has already begun to disappear, being replaced with healthy new green regrowth.

Whilst blackened hills are unappealing to look at, they provide an important reminder of the devastation that occurs when we fail to take adequate care in volatile landscapes. A lone "Remnant Reminder" situated on the peak of the hill above the Cashmere/Worsleys Wetland will provide this reminder. With slender fibreglass "branches" which sway in the wind and LED lighting strips which convey the current level of wildfire danger, visitors to the site, especially those passing through on their way further into the Port Hills, will be given an unmistakable reminder of the care needed to prevent accidental ignition and avoid future wildfire disaster.



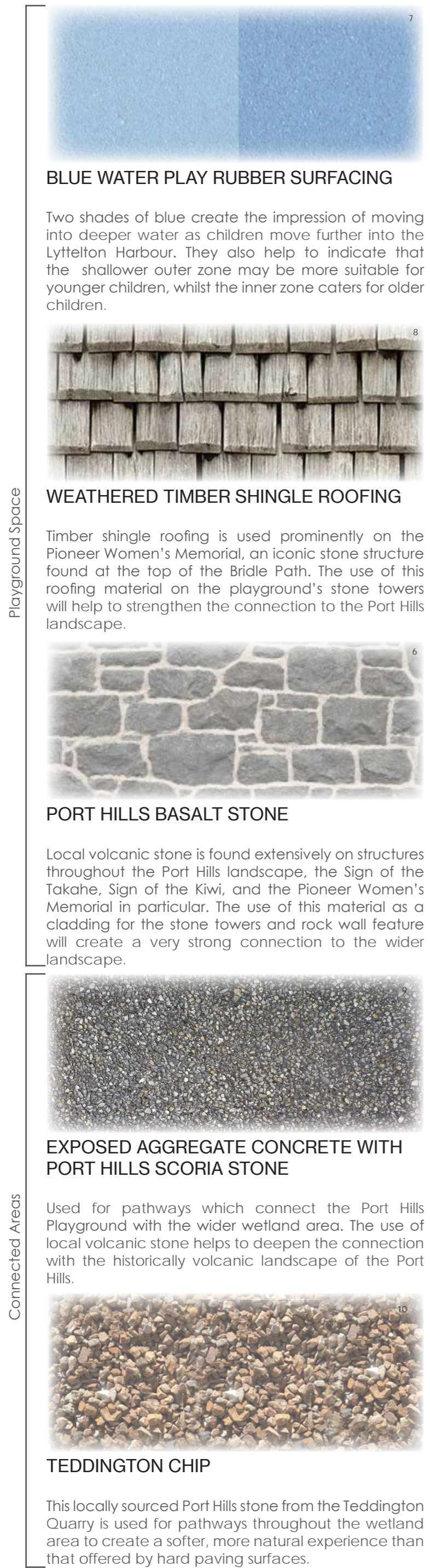
## PORT HILLS PLAYGROUND

The intention of the Port Hills Playground is to build an appreciation and an understanding for the wider Port Hills landscape and for the environmental processes which help to shape it. In order to convey this to users the materials and forms found within this space are of paramount importance.

The playground is arranged in three zones, with each zone representing a key part of the local landscape. In the Port Hills zone the most dominant features are the large "Water Trees" which, in addition to providing shade, collect and allow children to release rainwater. This process helps to illustrate at a simplistic level the journey of water through the Port Hills catchment and promotes the value of water, particularly in regards to wildfire prevention and protection.

The Lyttelton Harbour zone is characterised by four key water play features, each telling a part of the harbour's story. Whilst educational, these features will also be incredibly fun and will help to make the playground a popular destination for families during hot Christchurch summer days.

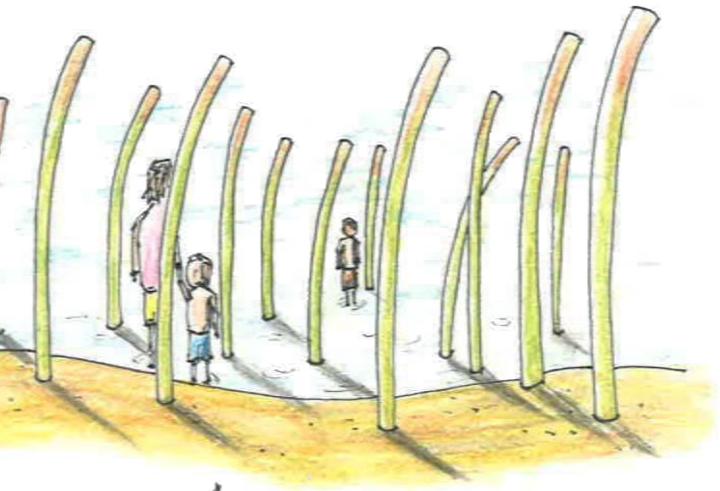
PORT HILLS PLAYGROUND



### DANCE AMONG THE RAUPŌ REEDS

Te Whakaraupō is the Māori name for Lyttelton Harbour, meaning "Harbour of the Raupō Reed" and was named such for the large numbers of Raupō once found at the head of the harbour! Raupō will also be found extensively throughout the margins of the Cashmere/Worsleys Wetland.

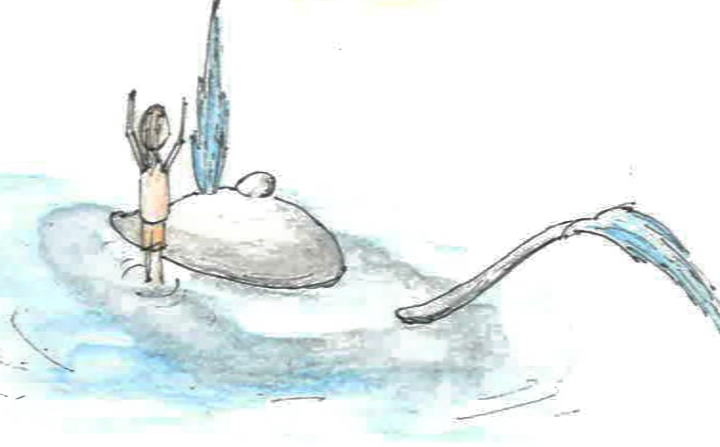
In the playground space Raupō Sprinklers will help to signify the transition from hills to harbour with swaying fibreglass poles dispersing a fine mist. This will provide an immersive experience along the perimeter of the water play area suitable for all ages.



### FROLIC WITH THE HECTOR'S DOLPHINS

The endangered Hector's Dolphin is an iconic species of Lyttelton Harbour, with Banks Peninsula being home to the highest concentration of the species in the South Island\*. Their naturally playful characteristics make them well suited for a playground space.

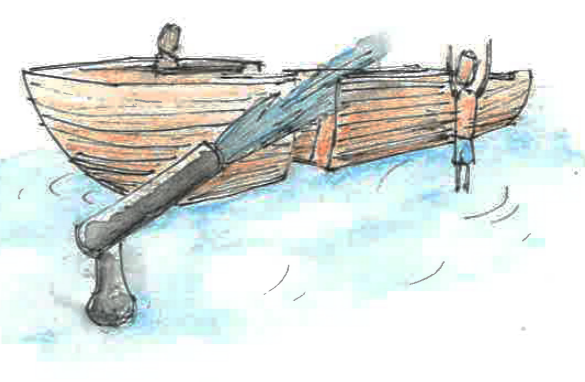
Their distinctive black and white markings and round dorsal fin\* are integrated within the play feature, whilst a bubble up blowhole and sprinklers in the tail provide a fun and refreshing water play experience.



### CLAMBER ABOARD THE FOUR SHIPS

In 1850 four ships operated by the Canterbury Association brought the first group of European settlers into Lyttelton Harbour<sup>1</sup>. In more recent times ships and the maritime industry have remained a key feature of the harbour as a result of the Lyttelton Port.

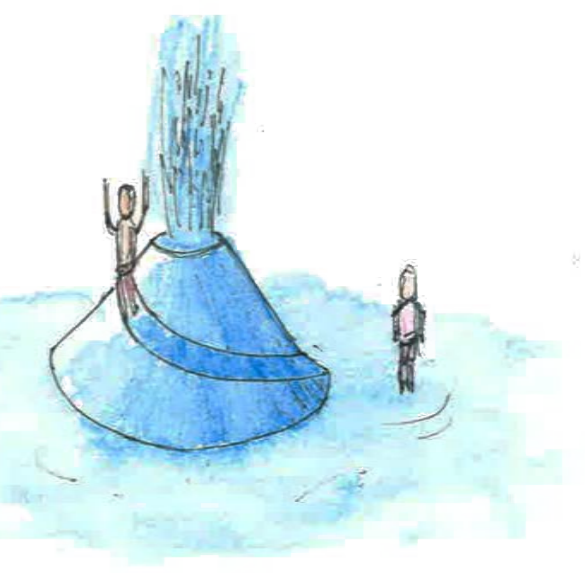
Four "ships" are situated throughout the water play area with water cannons attached and situated nearby to enable playful water fights.



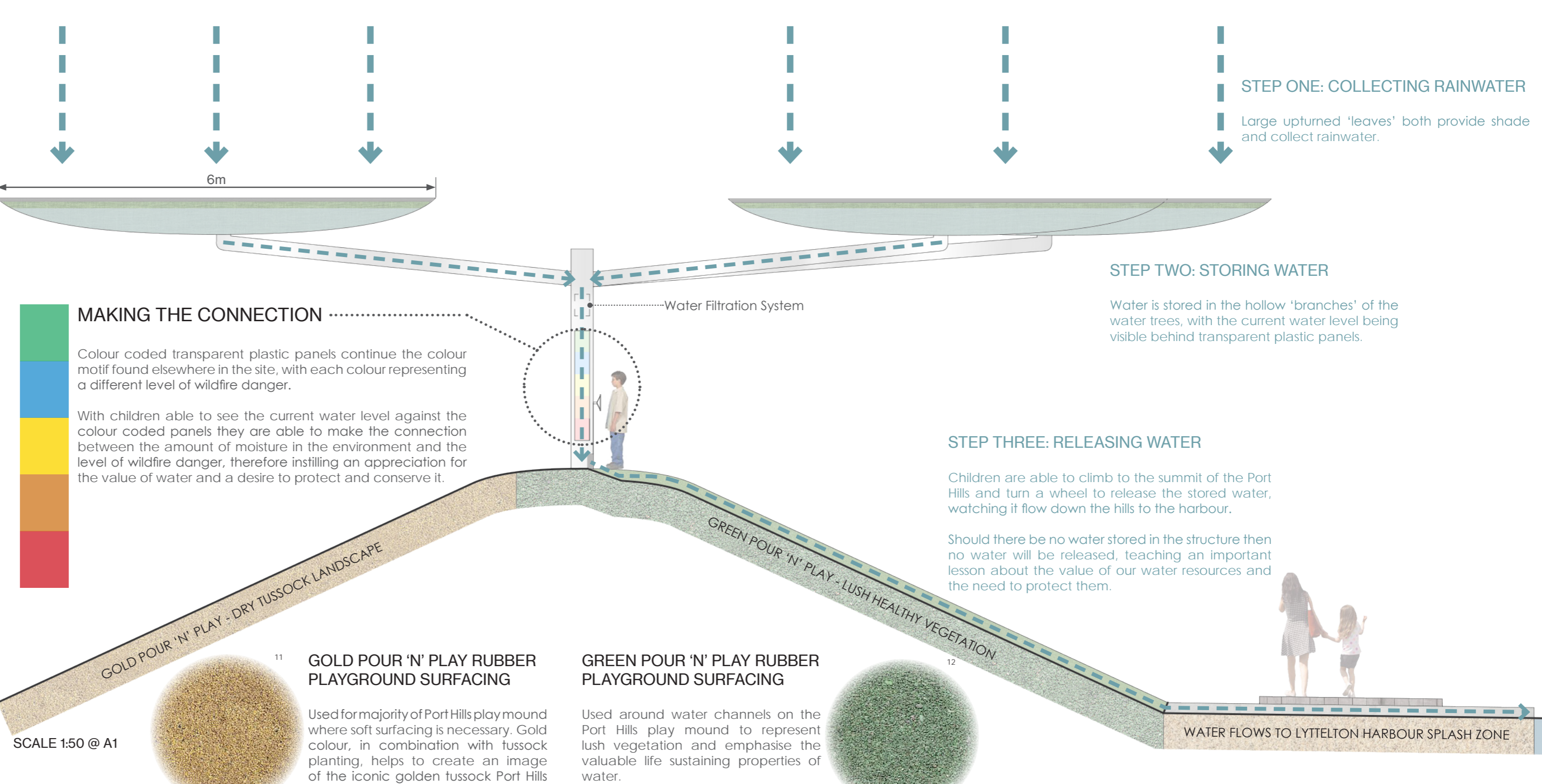
### CLIMB THE ERUPTING VOLCANO

Lyttelton Harbour and the wider Banks Peninsula landscape are a product of historic volcanic activity. Many of the iconic features of the Port Hills and harbour basin have come to be through volcanic eruption millions of years ago.

The centrepiece of the Lyttelton Harbour Splash Zone is the Lyttelton Volcano, a 1.5m high plastic cone with climbing holds on one side. A slide built into the volcano offers a slippery route down. Be wary though, as the volcano erupts with water at irregular intervals.



### WATER TREES - THE JOURNEY OF WATER THROUGH THE PORT HILLS LANDSCAPE



<sup>1</sup> Christchurch City Libraries, (n.d.). Te Whakaraupō - Lyttelton Harbour. Retrieved from https://my.christchurchcitylibraries.com/te-whakaraupō/

<sup>2</sup> Lyttelton Port Company, (n.d.). New research on Hector's dolphins in Lyttelton Harbour. Retrieved from https://www.lpc.co.nz/new-research-on-hectors-dolphins-in-lyttelton-harbour/

<sup>3</sup> Christchurch City Libraries, (n.d.). The first four ships. Retrieved from https://my.christchurchcitylibraries.com/the-first-four-ships/

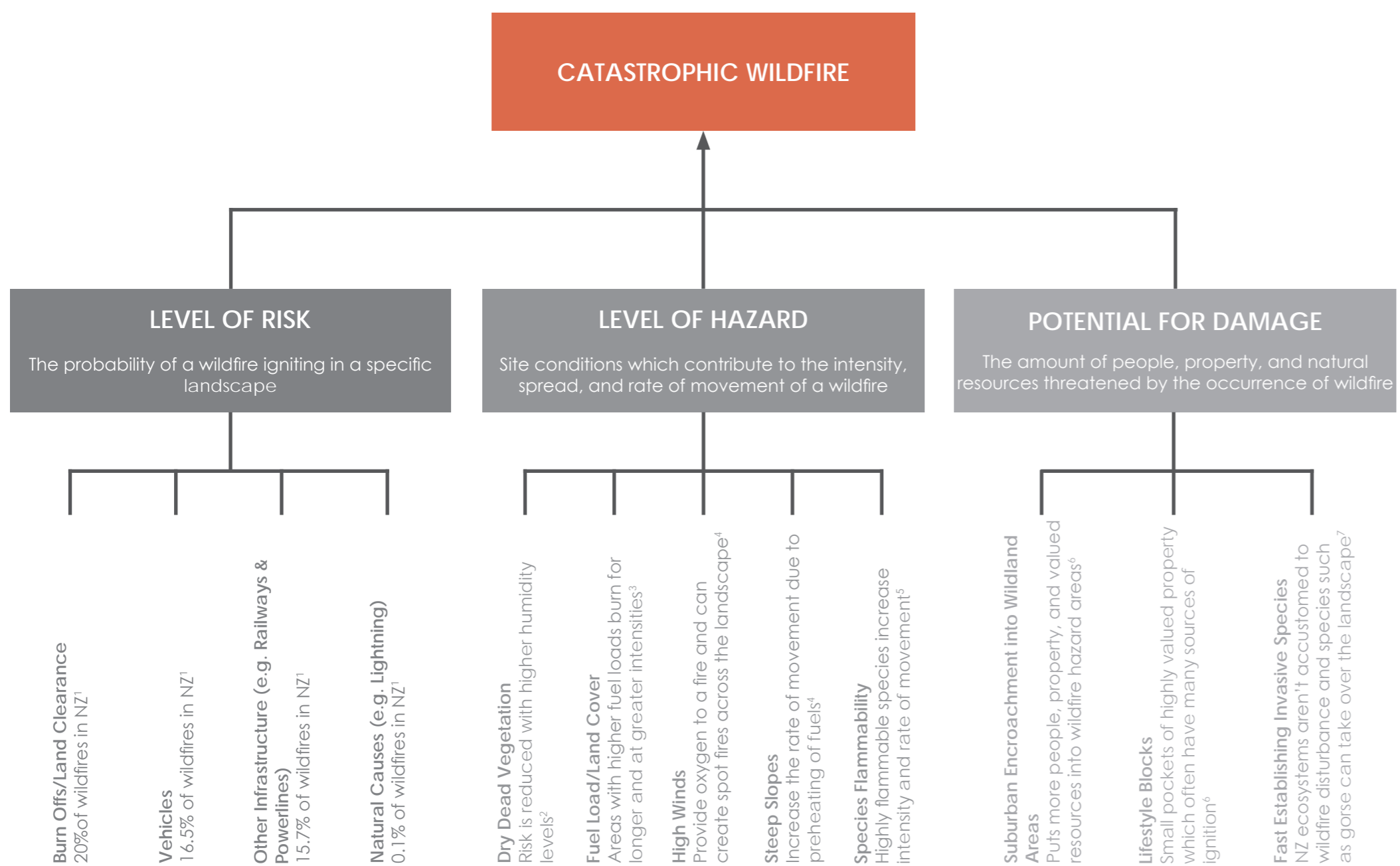
\* Please see image references on rear of sheet

# WILDFIRE IN THE PERI-URBAN LANDSCAPE

## [INVENTORY AND ANALYSIS]

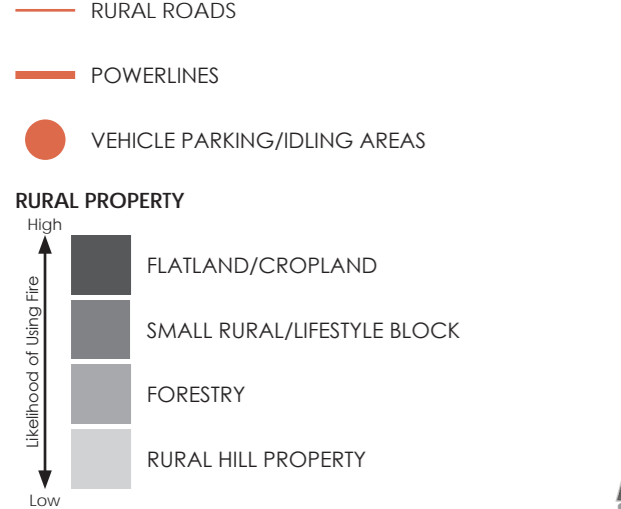
### PROBLEM STATEMENT:

As climate change produces hotter temperatures and reduced precipitation in many regions of the world an increase in the prevalence of wildfire is inevitable. This, combined with ever increasing urban population growth into wildland fire hazard landscapes has the potential to cause catastrophic harm to people, property, and vulnerable ecosystems. In New Zealand 99.9% of wildfires are caused either accidentally or intentionally by human activity, therefore it's an issue we have the ability to do something about.



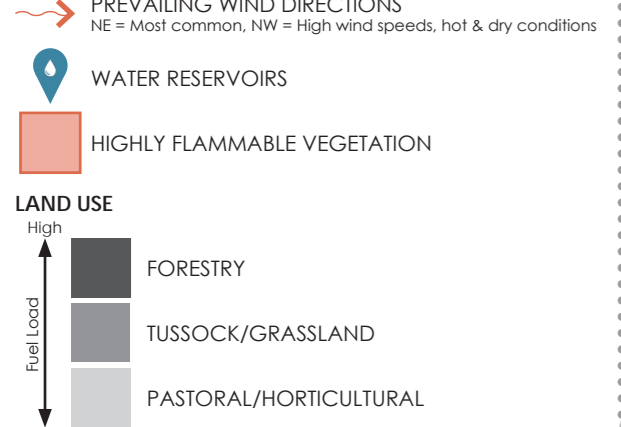
There are a number of factors which contribute to the probability of a wildfire igniting in the Port Hills, including areas where vehicles may go, the location of powerlines, and areas of land where fire may be used for burn offs and land clearing purposes (i.e. rural property).

However, not all rural property is the same; certain types of land use are more likely to use fire than others and therefore pose a greater risk of accidentally igniting a wildfire.

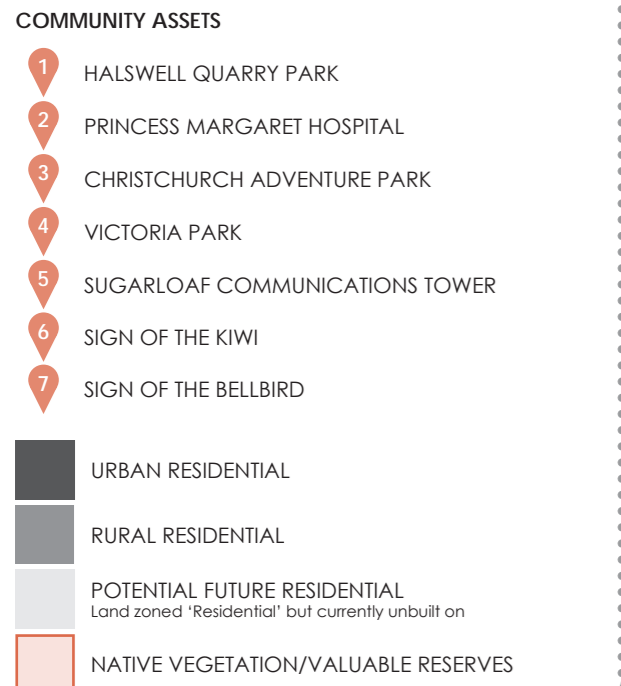


The fuel load associated with various land uses plays a large role in determining how rapidly a wildfire will spread and in which direction. Forestry, with tall woody vegetation, has the highest fuel load and is therefore a significant hazard.

This area of the Port Hills has a number of large forestry plantations, the largest being situated between Dyers Pass Rd and Worsleys Rd, adjacent to multiple residential communities. This large area of forestry is likely to accelerate a wildfire and drive it towards residential areas.



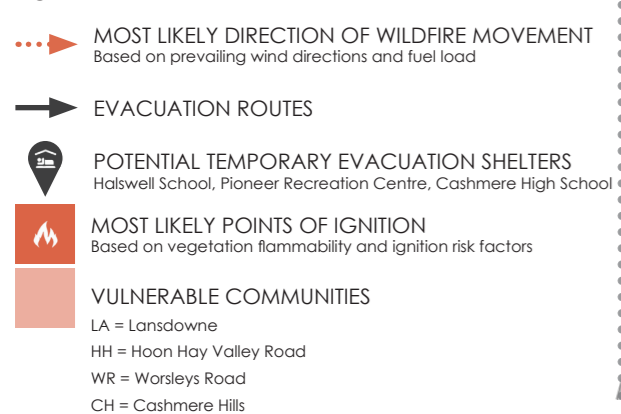
There are a number of existing residential communities and valuable community assets spread throughout the Port Hills peri-urban landscape which would be directly threatened should a wildfire ignite.



Analysis of the three elements of catastrophic wildfire within the Port Hills landscape reveals four key locations where significant ignition risk factors and highly flammable vegetation combine to create the most likely points of ignition.

Hazard factors such as prevailing wind directions and fuel load reveal the direction in which a wildfire is most likely to move from these points.

It can therefore be determined that there are five residential communities which are significantly vulnerable to wildfire.



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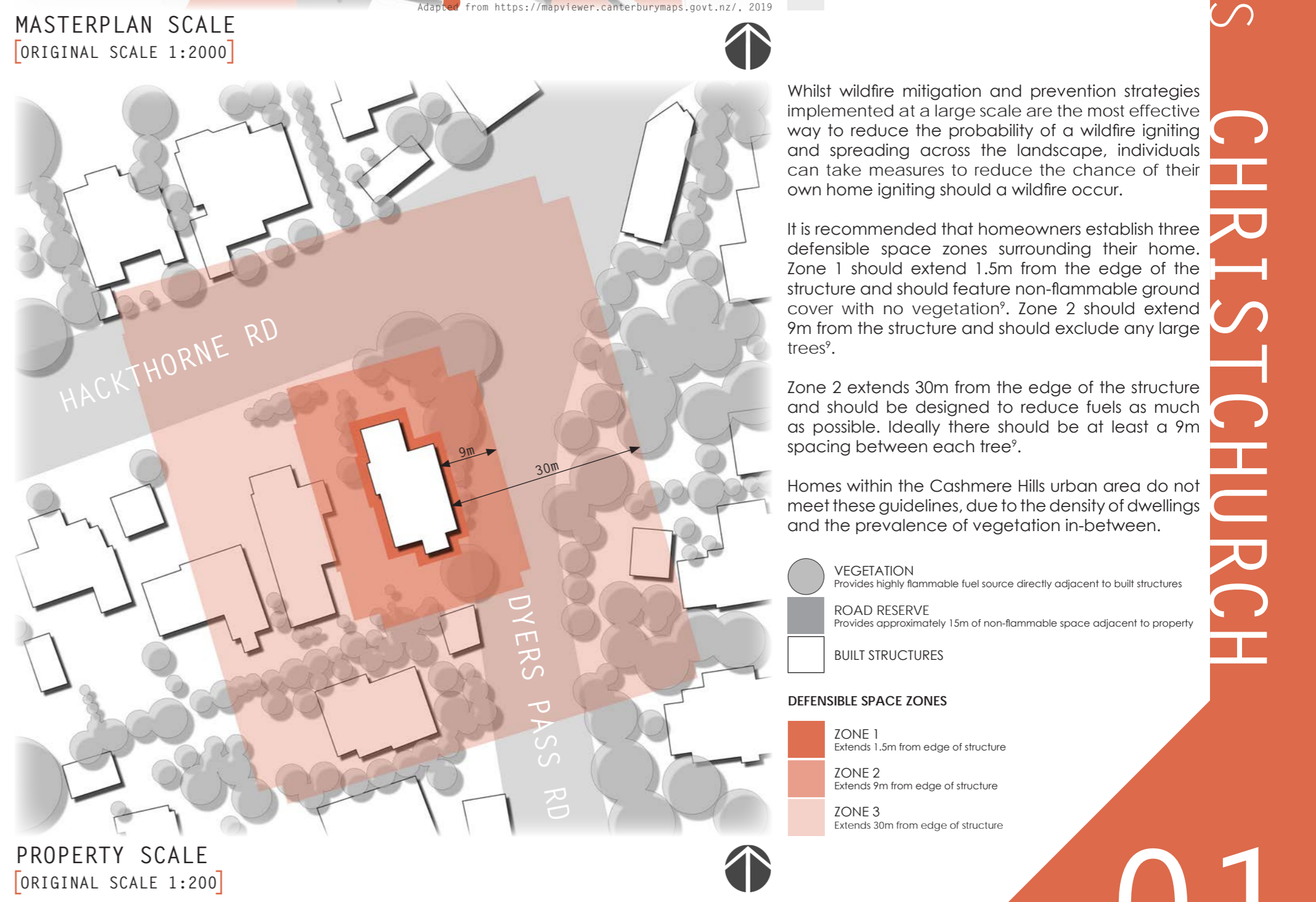
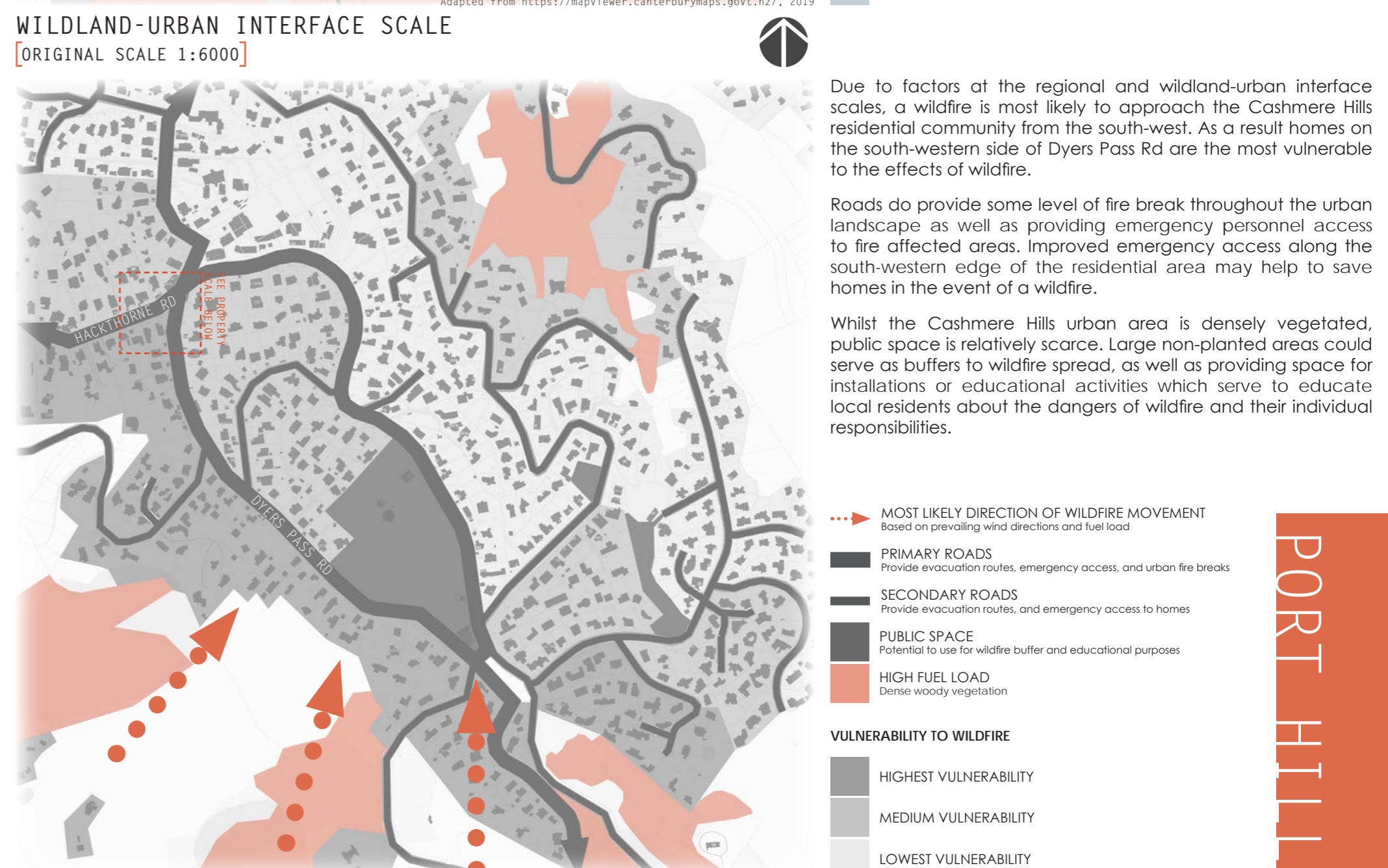
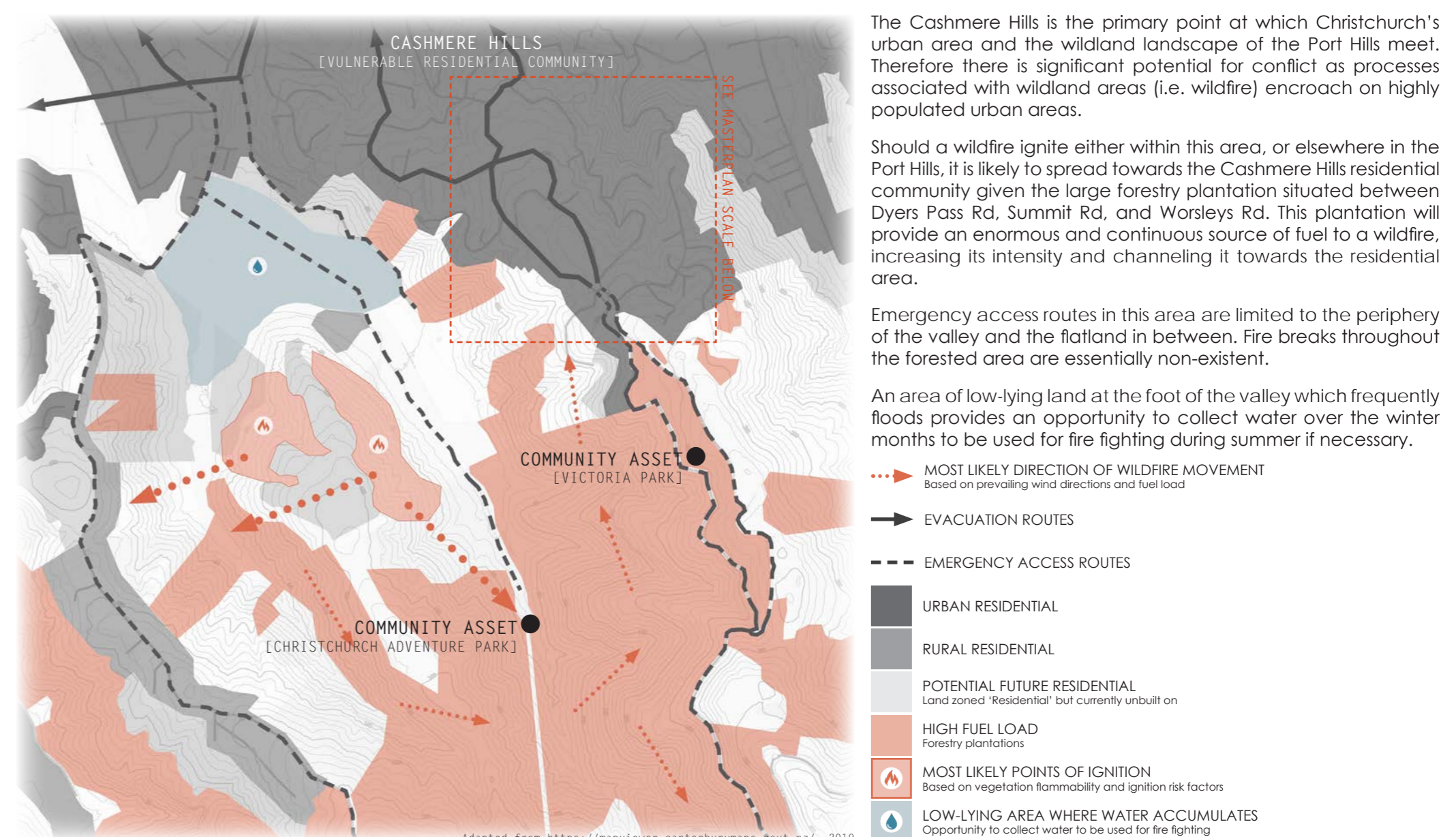
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GOAL	OBJECTIVES	SUB-OBJECTIVES	KEY FINDINGS	SCALE	
Reduce the harm caused by wildfire in the peri-urban landscape	1 [Reduce the risk of a wildfire igniting]	1.1	Enhance public engagement with the dangers of wildfire and outline steps individuals can take to reduce the chance of ignition	There are currently no landscape features which address this issue. Written information is the sole method of communicating the dangers of wildfire and how to reduce the chance of ignition	N/A
		1.2	Separate common sources of ignition (e.g. rural burn offs/land clearance, roads, and powerlines) and highly flammable vegetation types	There are four main areas which are most likely to ignite based on the proximity of highly flammable vegetation (primarily Gorse) to common ignition sources	Regional Scale
	2 [Mitigate site conditions which contribute to the intensity, spread, and rate of movement of a wildfire]	2.1	Disperse high fuel land uses (e.g. forestry plantations) in small pockets throughout the landscape to reduce rate of wildfire spread	At present there is one major forestry plantation situated in the valley bordered by Dyers Pass Rd, Summit Rd, and Worsleys Rd. Smaller forestry plantations are scattered throughout the landscape	Regional Scale WUI Scale
		2.2	Provide regular fire breaks throughout areas of high fuel load which also serve as access routes for emergency personnel	Dyers Pass Rd and Worsleys Rd currently function reasonably well as fire breaks in addition to providing emergency access. The Christchurch Adventure Park access road also provides emergency access. An additional emergency access route along the south-western edge of the Cashmere Hills residential area would be valuable	WUI Scale Masterplan Scale
		2.3	Provide sufficient water reservoirs throughout the peri-urban landscape to assist in the fire fighting process	At present there are seven water reservoirs throughout the peri-urban landscape which could be used for fire fighting, however most of them are relatively small. Water from nearby Lyttelton Harbour could be used if necessary, but saltwater is less preferable as it will inhibit the regrowth of vegetation and increase corrosion in fire fighting equipment	Regional Scale WUI Scale
	3 [Reduce the amount of people, property, and valuable resources in the wildfire hazard zone]	3.1	Limit urban encroachment into wildfire hazard areas	There are areas of land zoned 'Residential' but unbuilt on in the Worsleys Rd and Cashmere Hills area which are likely to be threatened by a wildfire in the Port Hills should one occur. It would be inadvisable to build more residential property in these already vulnerable areas	Regional Scale WUI Scale
3.2		Enhance public awareness of the steps individuals can take to protect their property from wildfire (e.g. defensible space, low flammability planting)	Defensible space guidelines are not currently met in any of the urban residential communities. Due to the density of dwellings it will not be feasible to implement 30m of defensible space surrounding each structure, so alternative protection measures will need to be considered	Masterplan Scale Property Scale	
3.3		Promote the planting of low flammability native species throughout the peri-urban landscape to improve ecosystem resilience to wildfire	There are some small pockets of native vegetation throughout the Port Hills peri-urban landscape as well as multiple native revegetation projects following the 2017 fires. There is potential to increase the planting of low flammability native species in targeted areas	Regional Scale	



PORT HILLS CHRISTCHURCH

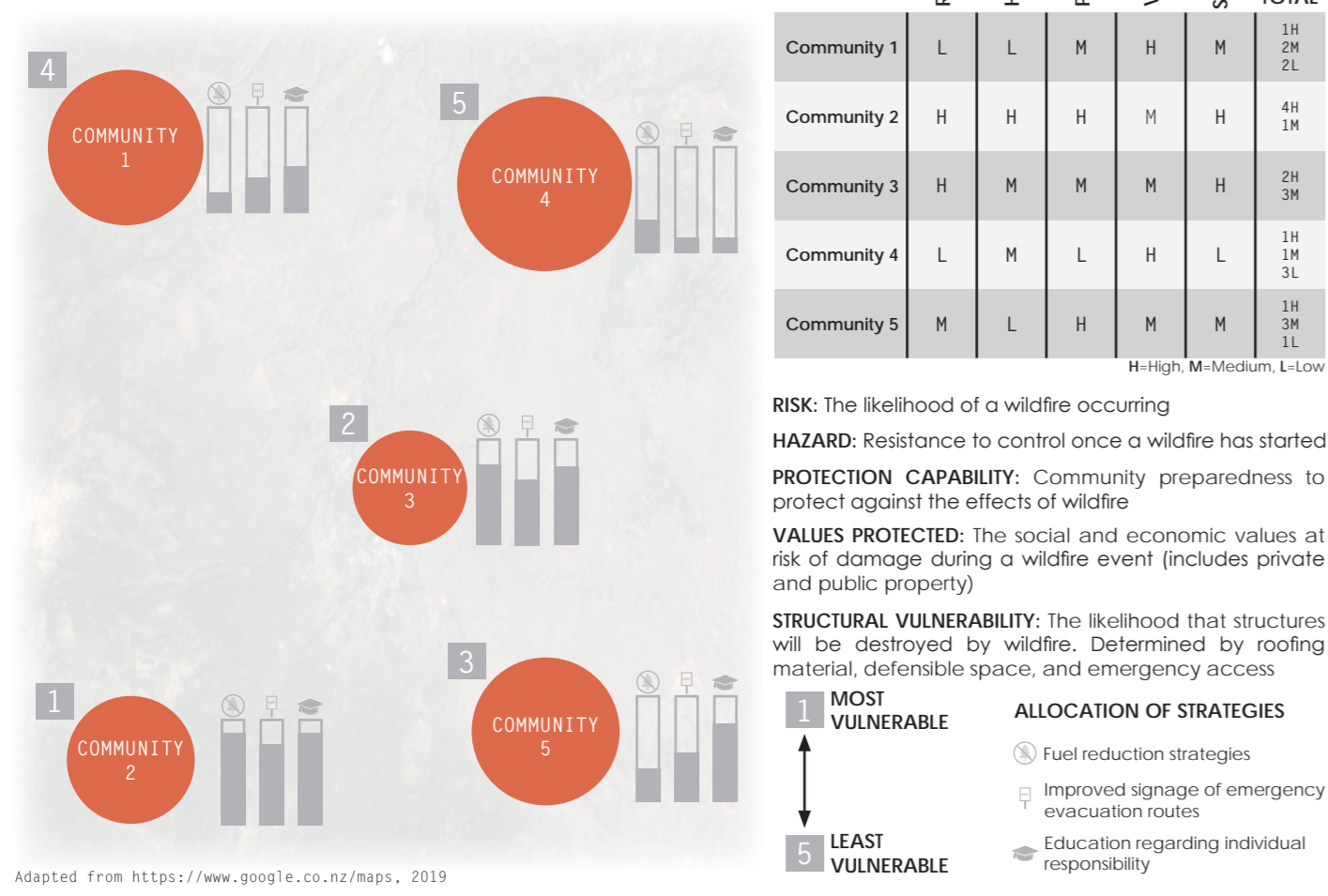
# WILDFIRE IN THE PERI-URBAN LANDSCAPE

## [CONCEPTUAL STRATEGY]

### EVALUATION OF DESIGN PRECEDENTS

#### BEND, OREGON, USA

Greater Bend Community Wildfire Protection Plan  
REGIONAL SCALE

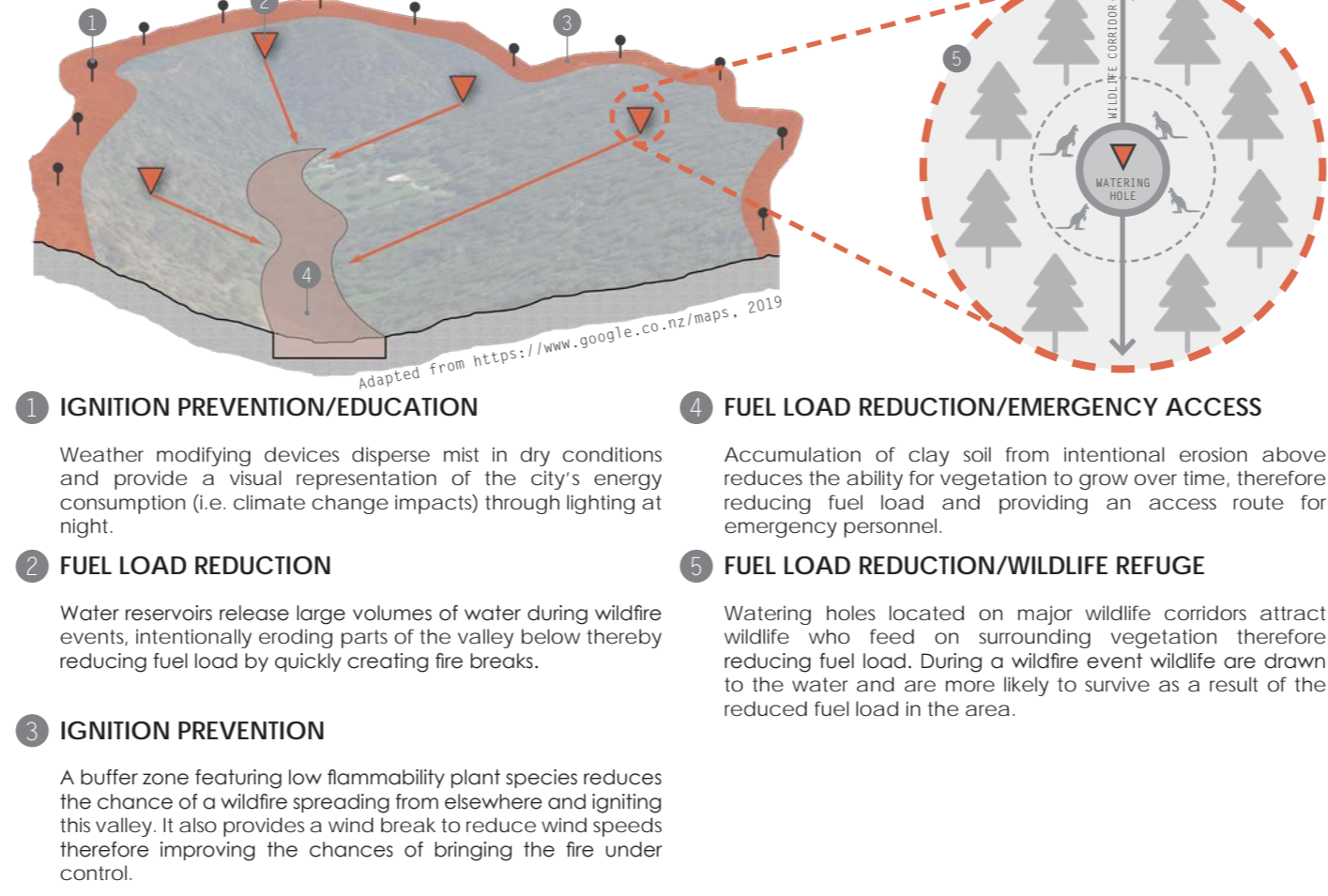


This wildfire protection plan utilises a three step process to identify communities which are vulnerable to wildfire and to allocate protective strategies accordingly.

PROS ✓	CONS ✗
<ul style="list-style-type: none"> <li>Provides an intelligent system for evaluating and ranking communities at a regional scale based on their vulnerability to wildfire</li> <li>Ensures efficient distribution of wildfire protection resources and allows for targeted strategies</li> </ul>	<ul style="list-style-type: none"> <li>Focuses predominantly on residential communities with less emphasis on the value of natural resources threatened by wildfire</li> <li>Applies to a larger scale than the Port Hills context, however basic principles do remain largely the same</li> </ul>

#### ADELAIDE HILLS, AUSTRALIA

The Digital and the Wild: Mitigating Wildfire Risk Through Landscape Adaptations?  
CATCHMENT SCALE

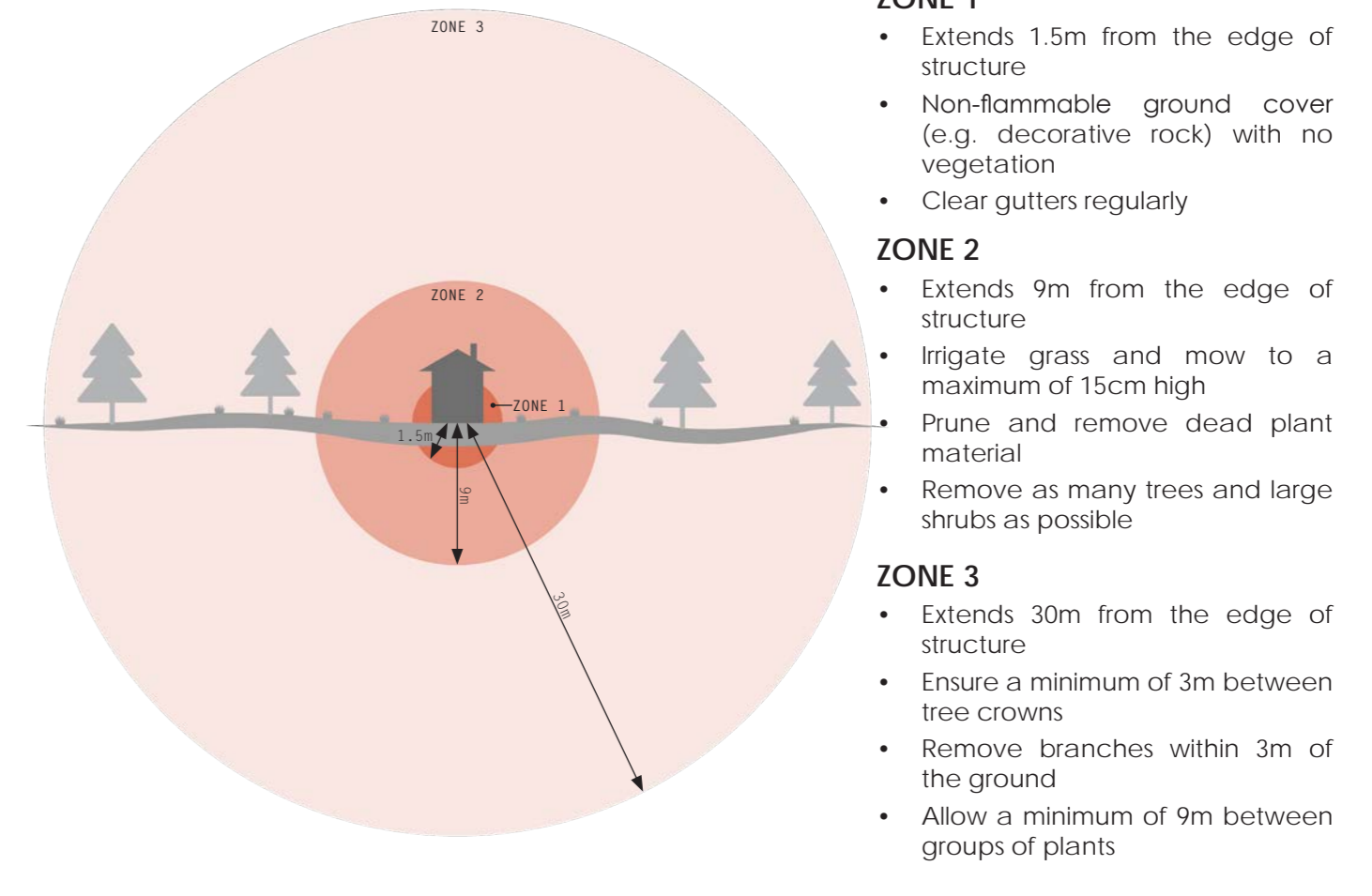


This student design project by Jordan Duke from the University of Toronto utilises five key wildfire protection strategies to reduce the adverse effects of wildfire at the catchment scale.

PROS ✓	CONS ✗
<ul style="list-style-type: none"> <li>The scale of this design is similar to the Port Hills context and therefore there is potential to utilise similar strategies at the catchment scale here</li> <li>Innovative and forward thinking ideas with an emphasis on landscape design as opposed to the more commonly found land use zoning approaches to wildfire mitigation</li> <li>Incorporates strategies which educate residents about their role in reducing wildfire risk, rather than relying solely on local authorities</li> </ul>	<ul style="list-style-type: none"> <li>Is a student design project so has not been implemented, therefore no evidence to prove the effectiveness of this concept</li> </ul>

#### COLORADO, USA

Protecting Your Home from Wildfire: Creating Wildfire-Defensible Zones?  
PROPERTY SCALE



These guidelines provided by the Colorado State Forest Service illustrate to individual homeowners in wildfire hazard areas how to design and maintain their properties to create a sufficient defensible space around their homes.

PROS ✓	CONS ✗
<ul style="list-style-type: none"> <li>Provides a guideline for how individual property owners can take responsibility for protecting their homes against wildfire</li> <li>Provides clear and measurable distances for each zone which can be used to evaluate and improve existing defensible spaces in the Port Hills</li> </ul>	<ul style="list-style-type: none"> <li>Guidelines have been developed for singular properties with over 30 metres between homes. In most Port Hills residential communities homes are grouped much closer together</li> </ul>

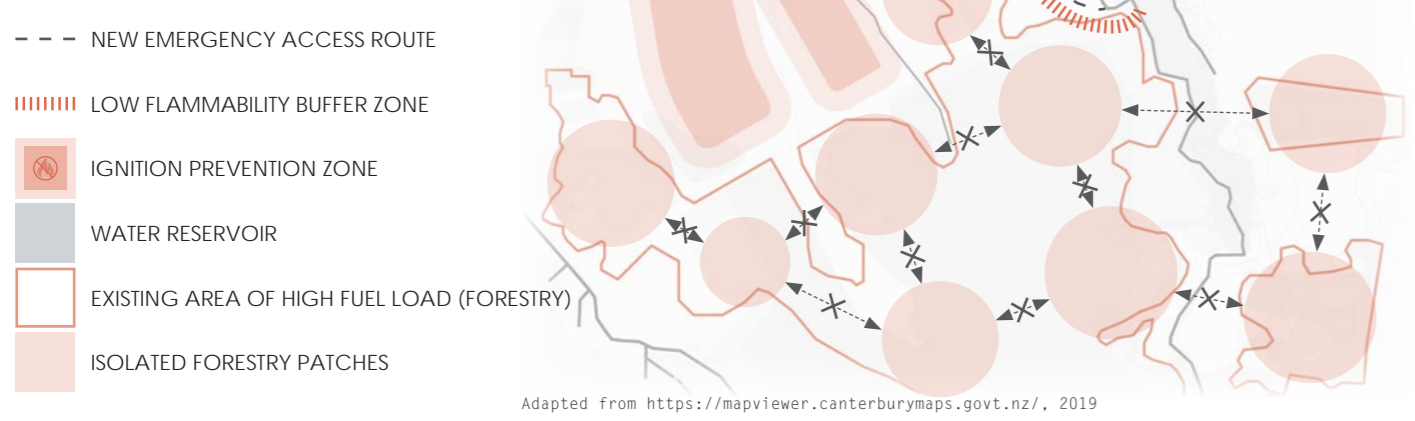
### DESIGN VISION

The peri-urban landscape of Christchurch's Port Hills will become an intelligently functioning system which reduces the risk of a wildfire igniting and reduces the harm caused should wildfire occur. The landscape will also function as an educational tool, providing immersive experiences which engage users with the dangers of wildfire and precautionary measures they can take at the community and individual level.

The wildland-urban boundary scale is crucial for developing a strategy which will reduce the chance of a wildfire spreading into the Cashmere Hills urban area.

Dramstad et al's 'isolated patch theory' can be applied to break up the currently large area of forestry which carries a very high fuel load. Permitting smaller forestry blocks amongst a matrix of low flammability native species will make a potential fire easier to control and extinguish.

An area of low lying land to the west of the Cashmere Hills urban area frequently floods during the winter months. This provides an opportunity to collect this water to be used as both a fire-fighting resource and an additional buffer zone should a wildfire occur over the summer months.



This strategy at the community scale is essential for reducing the number of properties and lives harmed by wildfire should it pass through the low flammability buffer zones and reach the Cashmere Hills urban area.

Public reserves which provide space for recreation would also serve as fire breaks through the urban area during a wildfire event. By removing structures from these areas and limiting any planting to species with low flammability characteristics it would provide a barrier to fire movement and increase the chances of saving life and property.

These public reserves would also provide an educational opportunity, whereby local residents, through participation in planting days, could gain an understanding of the types of low flammability species they should be planting around their own homes.

A defensible space showhome located on the corner of the two main roads through the area, opposite two popular cafes, would provide a highly visible example for how property owners may improve the defensible space surrounding their home.



Due to the density of homes throughout the Cashmere Hills urban area it would not be practical to implement 30 metres of defensible space around every home as recommended by the Colorado State Forest Service. However, it may be possible for local government to purchase four properties on the corner of Hackthorne Rd and Dyers Pass Rd to construct a defensible space showhome.

Situated in a high traffic area this defensible space showhome would serve as a model for how new residential developments in the Port Hills should be constructed, as well as illustrating how owners of existing homes may retrofit their properties to better meet the requirements for defensible space zones one and two.

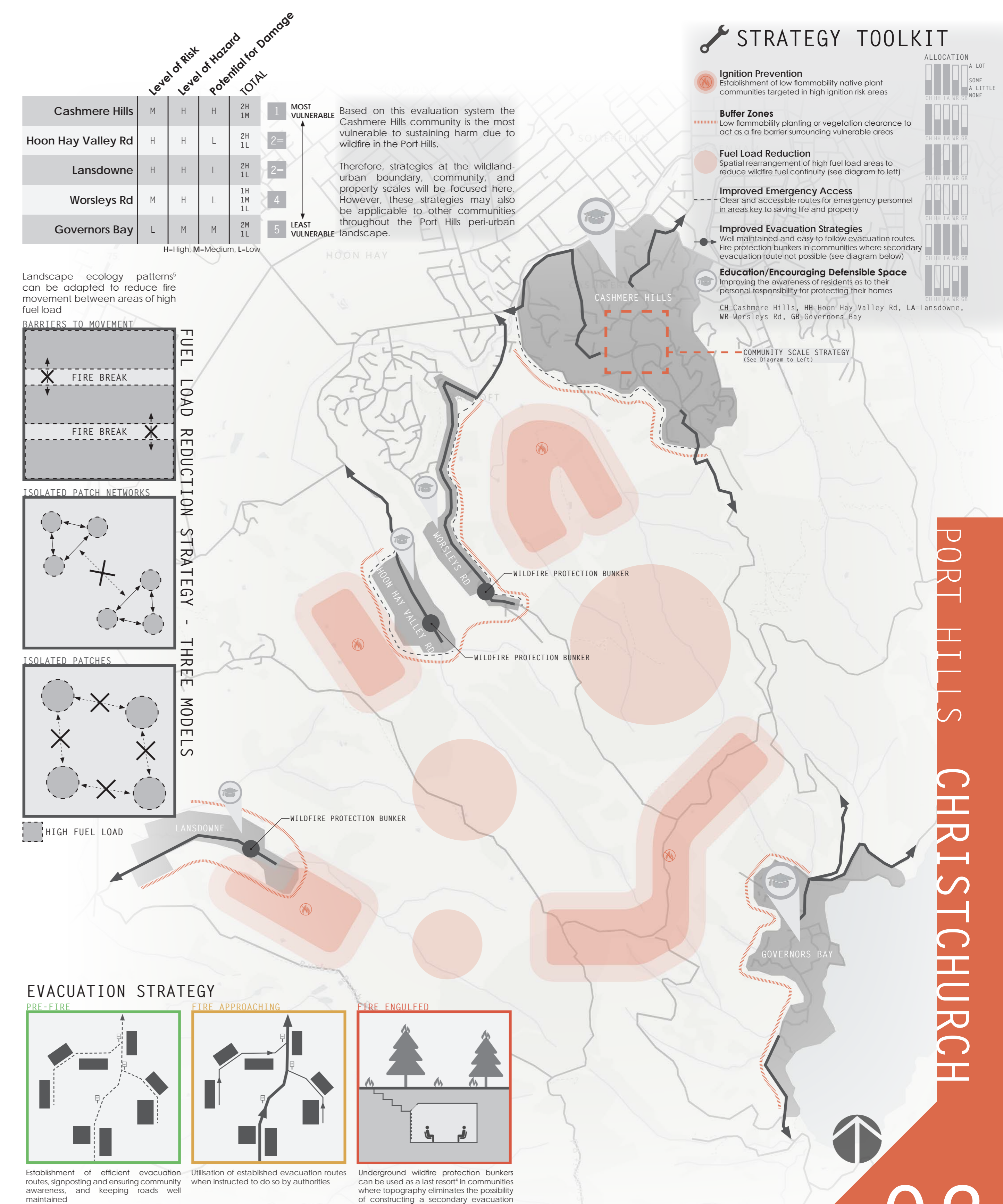
This could serve as an exemplar for both the Cashmere Hills and Governors Bay communities, both of which currently rank poorly in defensible space, as Dyers Pass Rd is frequently used by residents commuting from Governors Bay.

This defensible space showhome would be constructed following the guidelines set out in the design precedent from the Colorado State Forest Service.



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### PORT HILLS WILDFIRE PROTECTION STRATEGY



- <sup>4</sup> [http://www.nzpcn.org.nz/flora\\_details.aspx?ID=1605](http://www.nzpcn.org.nz/flora_details.aspx?ID=1605) <https://corpus.nz/out-of-the-garden/karamu-with-berries/>
- <sup>5</sup> <https://www.southernwoods.co.nz/shop/pseudopanax-crassifolius/>
- <sup>6</sup> [https://www.bigplantnursery.co.uk/plants/phormium-tenax-variegata\\_variegated-zealand-flax\\_599.html](https://www.bigplantnursery.co.uk/plants/phormium-tenax-variegata_variegated-zealand-flax_599.html)
- <sup>7</sup> <http://www.treesandmore.co.nz/cs/prodView.asp?idproduct=238>
- <sup>8</sup> <https://greenleafnurseries.co.nz/product/myrsine-australis-pb6-5-60-80/>
- <sup>9</sup> <http://www.nzplants.auckland.ac.nz/en/about/seed-plants-flowering/araliaceae/pseudopanax-arboreus.html>
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- <sup>11</sup> <https://www.rhs.org.uk/plants/search-results?query=Griselinia+littoralis>
- <sup>12</sup> <https://greenleafnurseries.co.nz/product/myoporum-laetum-pb6-5-60-80/>
- <sup>13</sup> <https://www.southernwoods.co.nz/shop/hebe-strictissima/>
- <sup>14</sup> <https://www.southernwoods.co.nz/shop/hoheria-angustifolia/>
- <sup>15</sup> <https://www.southernwoods.co.nz/shop/melicytus-ramiflorus/>
- <sup>16</sup> <http://www.nzplants.auckland.ac.nz/en/about/seed-plants-flowering/malvaceae/plagianthus-regius.html>
- <sup>17</sup> <http://www.nzplants.auckland.ac.nz/en/about/seed-plants-flowering/coriariaceae/coriaria-arborea.html>
- <sup>18</sup> <http://www.terrain.net.nz/friends-of-te-henui-group/table-1/tree-fuschia.html>
- <sup>19</sup> <https://www.southernwoods.co.nz/shop/aristotelia-makomako-wineberry/>
- <sup>20</sup> <http://www.terrain.net.nz/friends-of-te-henui-group/hebes/hebe-salicifolia-koromiko-south-island.html>
- <sup>21</sup> [https://www.bigplantnursery.co.uk/plants/cordyline-australis-cabbage-palm\\_32.html](https://www.bigplantnursery.co.uk/plants/cordyline-australis-cabbage-palm_32.html)
- <sup>22</sup> [http://www.exclusiveplants.co.uk/product\\_page.php?id=96](http://www.exclusiveplants.co.uk/product_page.php?id=96)
- <sup>23</sup> <https://www.kauriparknurseries.co.nz/plants/juncus-gregiflorus-wiwi/>
- <sup>24</sup> <http://noosasnativeplants.com.au/plants/191/empodisma-minus>
- <sup>25</sup> <https://www.flickr.com/photos/berniedup/98745708330/>
- <sup>26</sup> <http://www.planthawkesbay.co.nz/product/carex-secta/>
- <sup>27</sup> <http://www.terrain.net.nz/friends-of-te-henui-group/plants-native-botanical-names-m-to-q/myriophyllum-propinquum-water-milford.html>
- <sup>28</sup> <http://www.terrain.net.nz/friends-of-te-henui-group/plants-native-botanical-names-m-to-q/potamogeton-cheesemania-pondweed.html>
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- <sup>33</sup> <https://textureplants.co.nz/products/poa-cita>
- <sup>34</sup> <https://www.theplantstore.co.nz/products/grasses-and-strappy-plants/festuca-actae-rootrainer-x-50/>
- <sup>35</sup> <https://floralens.com/2015/06/24/hard-tussock/>
- <sup>36</sup> <https://teara.govt.nz/en/photograph/13353/narrow-leaved-snow-tussock>
- <sup>37</sup> [https://en.wikipedia.org/wiki/Plagianthus\\_regius](https://en.wikipedia.org/wiki/Plagianthus_regius)
- <sup>38</sup> <https://www.southernwoods.co.nz/shop/dodoniaea-viscosa/>
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<sup>4</sup> <https://www.amazon.co.uk/Icarus-600-Fibreglass-Replacement-2010-2012/dp/B01GQ2ERZO>

<sup>5</sup> <https://vivarailings.com/finishing-options/powder-coat-ss-finish/>

<sup>6</sup> <https://jooinn.com/stone-wall-texture-2.html>

<sup>7</sup> <https://www.gymrubberfloor.com/playground-flooring/sterling-playground-tiles.php>

<sup>8</sup> <https://www.textures.com/category/roofing/108>

<sup>9</sup> <https://www.pinterest.nz/pin/424816177322925706/>

<sup>10</sup> <https://gardenmakers.co.nz/product/teddington-chip-large/>

<sup>11</sup> <https://www.pentagonplay.co.uk/products/surfacing-and-landscaping/wetpour/yellow-wetpour-playground-surfacing>

<sup>12</sup> <https://www.gymrubberfloor.com/playground-flooring/sterling-playground-tiles-225-green.php>