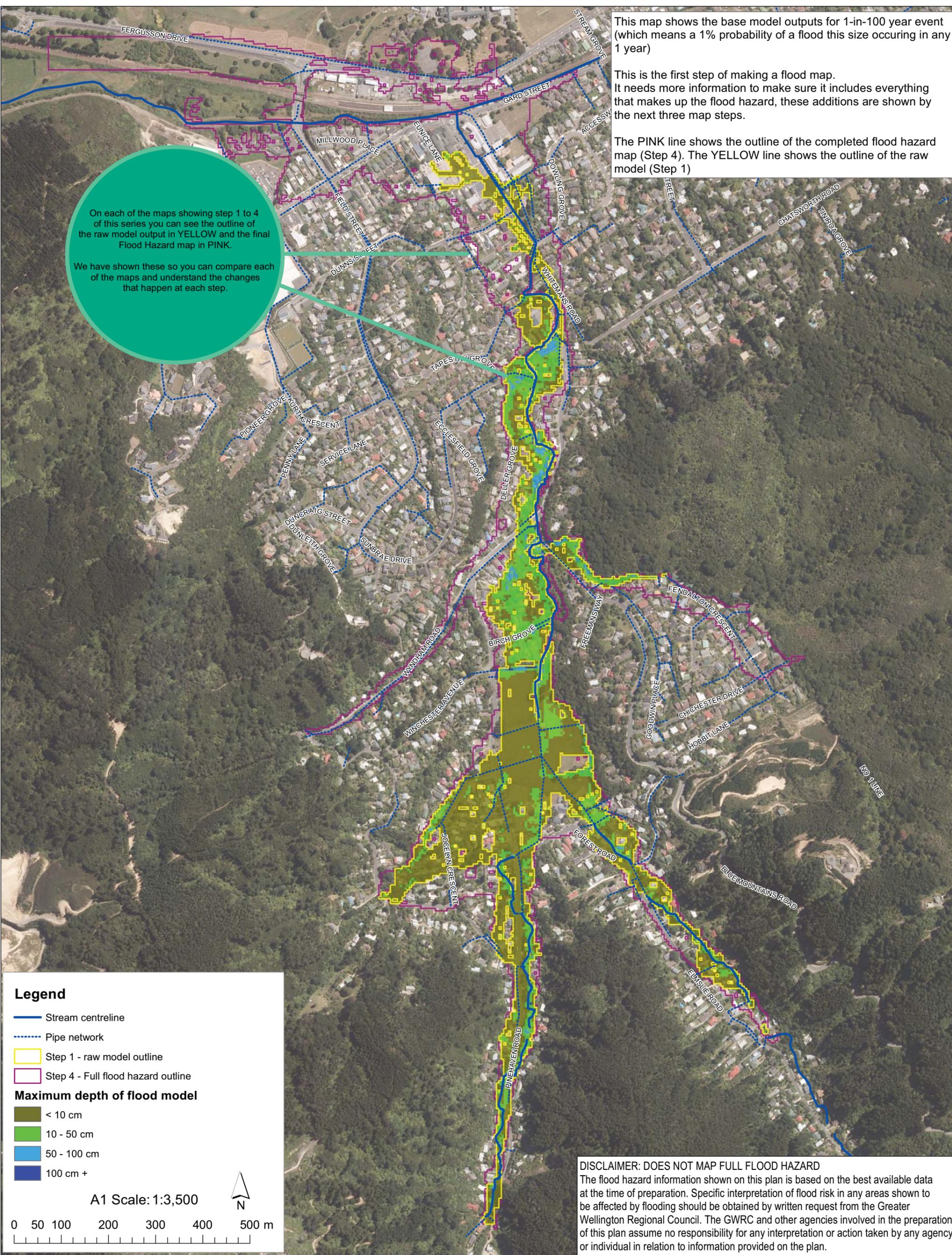


# Map 1a - PINEHAVEN STREAM - Building a flood map

## Step 1 of 4: The raw model stage

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Topographic and Cadastral data is copyright LINZ



This map shows the base model outputs for 1-in-100 year event (which means a 1% probability of a flood this size occurring in any 1 year)

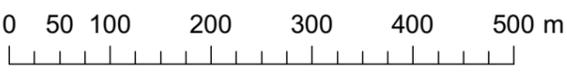
This is the first step of making a flood map. It needs more information to make sure it includes everything that makes up the flood hazard, these additions are shown by the next three map steps.

The PINK line shows the outline of the completed flood hazard map (Step 4). The YELLOW line shows the outline of the raw model (Step 1)

On each of the maps showing step 1 to 4 of this series you can see the outline of the raw model output in YELLOW and the final Flood Hazard map in PINK.  
We have shown these so you can compare each of the maps and understand the changes that happen at each step.

- Legend**
- Stream centreline
  - - - Pipe network
  - Step 1 - raw model outline
  - Step 4 - Full flood hazard outline
- Maximum depth of flood model**
- < 10 cm
  - 10 - 50 cm
  - 50 - 100 cm
  - 100 cm +

A1 Scale: 1:3,500



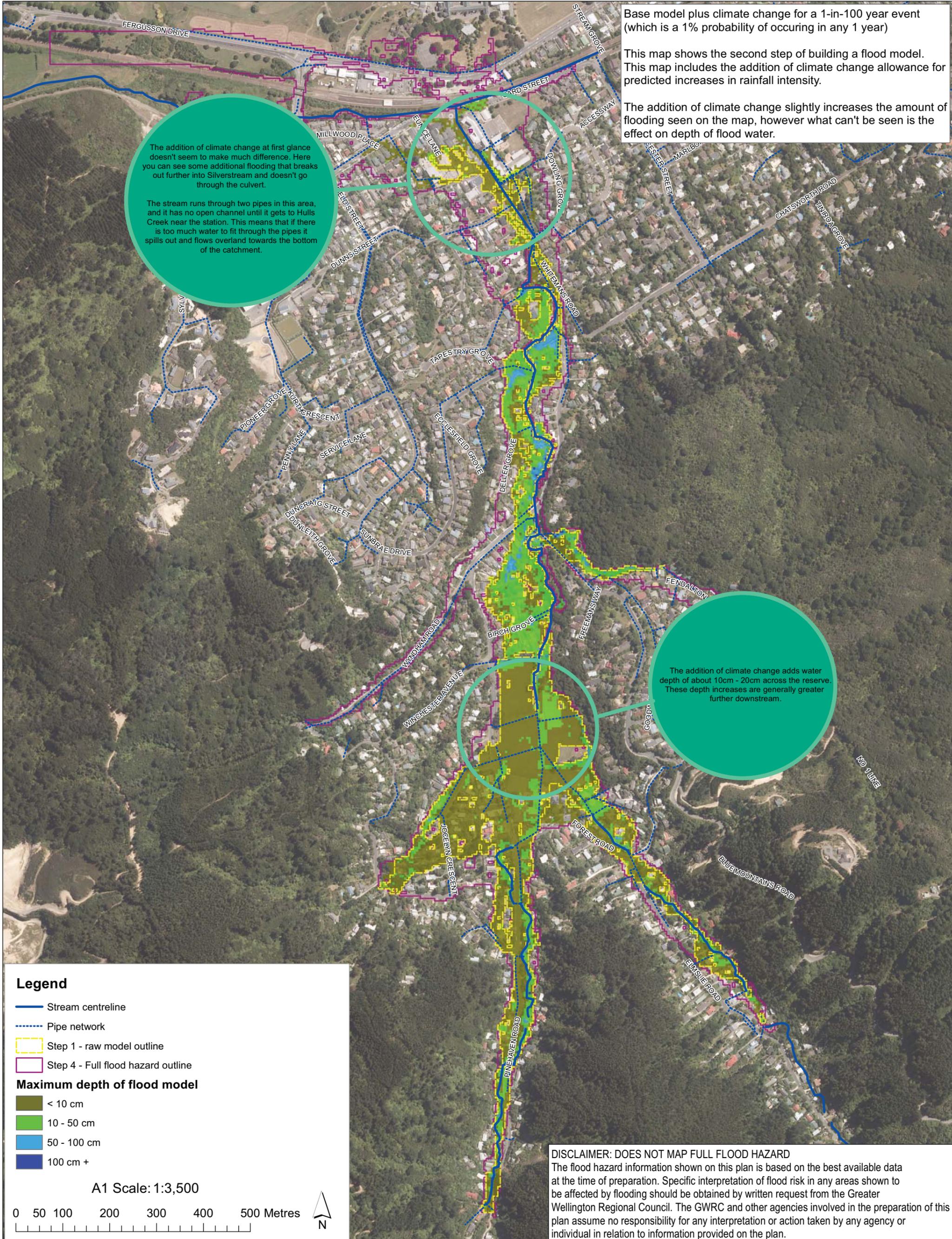
**DISCLAIMER: DOES NOT MAP FULL FLOOD HAZARD**  
The flood hazard information shown on this plan is based on the best available data at the time of preparation. Specific interpretation of flood risk in any areas shown to be affected by flooding should be obtained by written request from the Greater Wellington Regional Council. The GWRC and other agencies involved in the preparation of this plan assume no responsibility for any interpretation or action taken by any agency or individual in relation to information provided on the plan.

Date Plotted : 2:45:39 p.m., 3/06/2016

# Map 1b - PINEHAVEN STREAM - Building a flood map

## Step 2 of 4: Adding climate change

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Base model plus climate change for a 1-in-100 year event (which is a 1% probability of occurring in any 1 year)

This map shows the second step of building a flood model. This map includes the addition of climate change allowance for predicted increases in rainfall intensity.

The addition of climate change slightly increases the amount of flooding seen on the map, however what can't be seen is the effect on depth of flood water.

The addition of climate change at first glance doesn't seem to make much difference. Here you can see some additional flooding that breaks out further into Silverstream and doesn't go through the culvert.

The stream runs through two pipes in this area, and it has no open channel until it gets to Hulls Creek near the station. This means that if there is too much water to fit through the pipes it spills out and flows overland towards the bottom of the catchment.

The addition of climate change adds water depth of about 10cm - 20cm across the reserve. These depth increases are generally greater further downstream.

**Legend**

- Stream centreline
- ..... Pipe network
- Step 1 - raw model outline
- Step 4 - Full flood hazard outline

**Maximum depth of flood model**

- < 10 cm
- 10 - 50 cm
- 50 - 100 cm
- 100 cm +

A1 Scale: 1:3,500

0 50 100 200 300 400 500 Metres

**DISCLAIMER: DOES NOT MAP FULL FLOOD HAZARD**

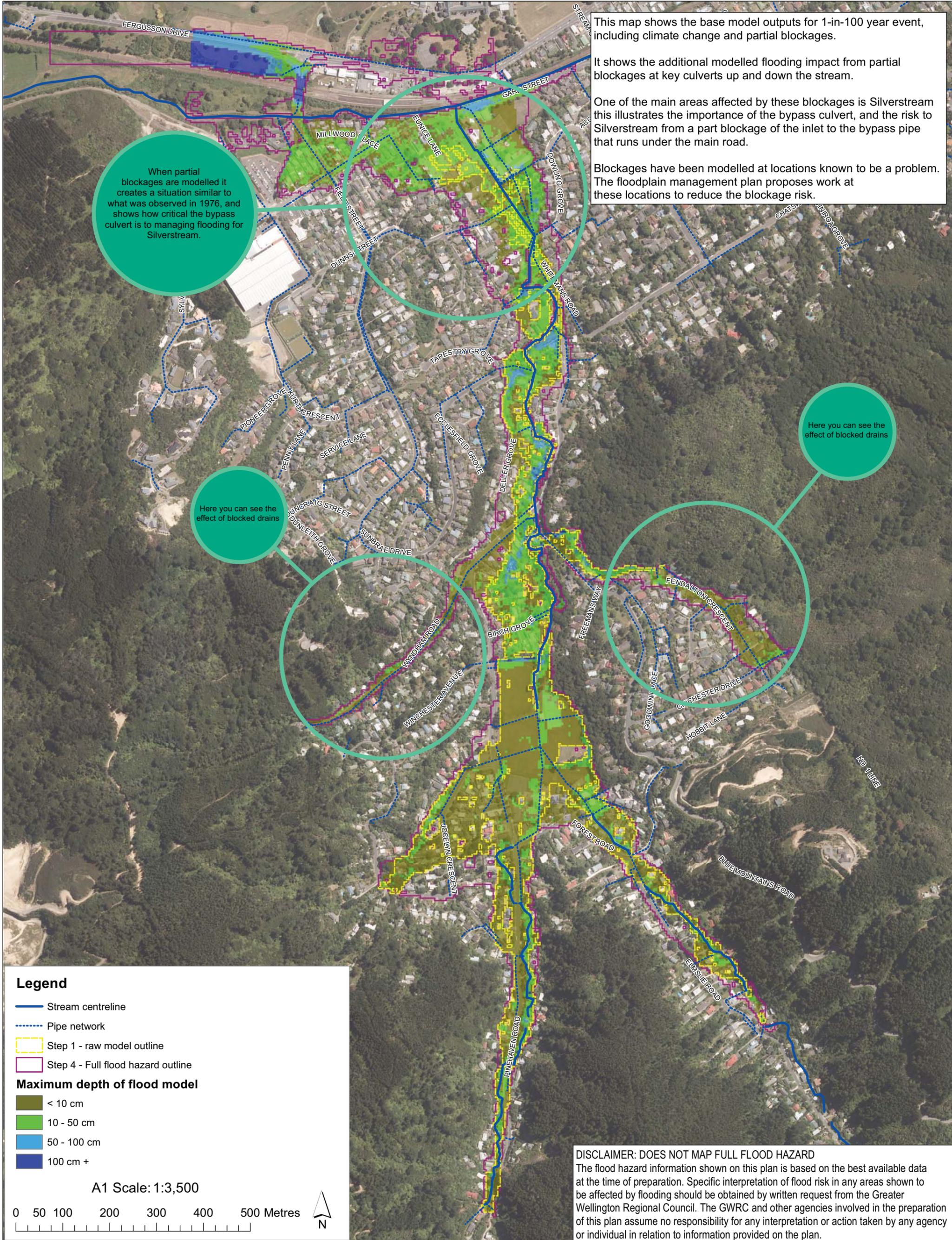
The flood hazard information shown on this plan is based on the best available data at the time of preparation. Specific interpretation of flood risk in any areas shown to be affected by flooding should be obtained by written request from the Greater Wellington Regional Council. The GWRC and other agencies involved in the preparation of this plan assume no responsibility for any interpretation or action taken by any agency or individual in relation to information provided on the plan.

Date Plotted : 9:09:19 a.m. 3/06/2016

# Map 1c - PINEHAVEN STREAM - Building a flood map

## Step 3 of 4: Allowing for blockages

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Topographic and Cadastral data is copyright LINZ



When partial blockages are modelled it creates a situation similar to what was observed in 1976, and shows how critical the bypass culvert is to managing flooding for Silverstream.

This map shows the base model outputs for 1-in-100 year event, including climate change and partial blockages.

It shows the additional modelled flooding impact from partial blockages at key culverts up and down the stream.

One of the main areas affected by these blockages is Silverstream this illustrates the importance of the bypass culvert, and the risk to Silverstream from a part blockage of the inlet to the bypass pipe that runs under the main road.

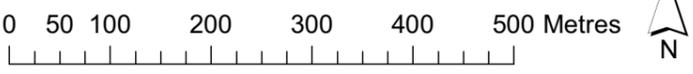
Blockages have been modelled at locations known to be a problem. The floodplain management plan proposes work at these locations to reduce the blockage risk.

Here you can see the effect of blocked drains

Here you can see the effect of blocked drains

- Legend**
- Stream centreline
  - Pipe network
  - Step 1 - raw model outline
  - Step 4 - Full flood hazard outline
- Maximum depth of flood model**
- < 10 cm
  - 10 - 50 cm
  - 50 - 100 cm
  - 100 cm +

A1 Scale: 1:3,500



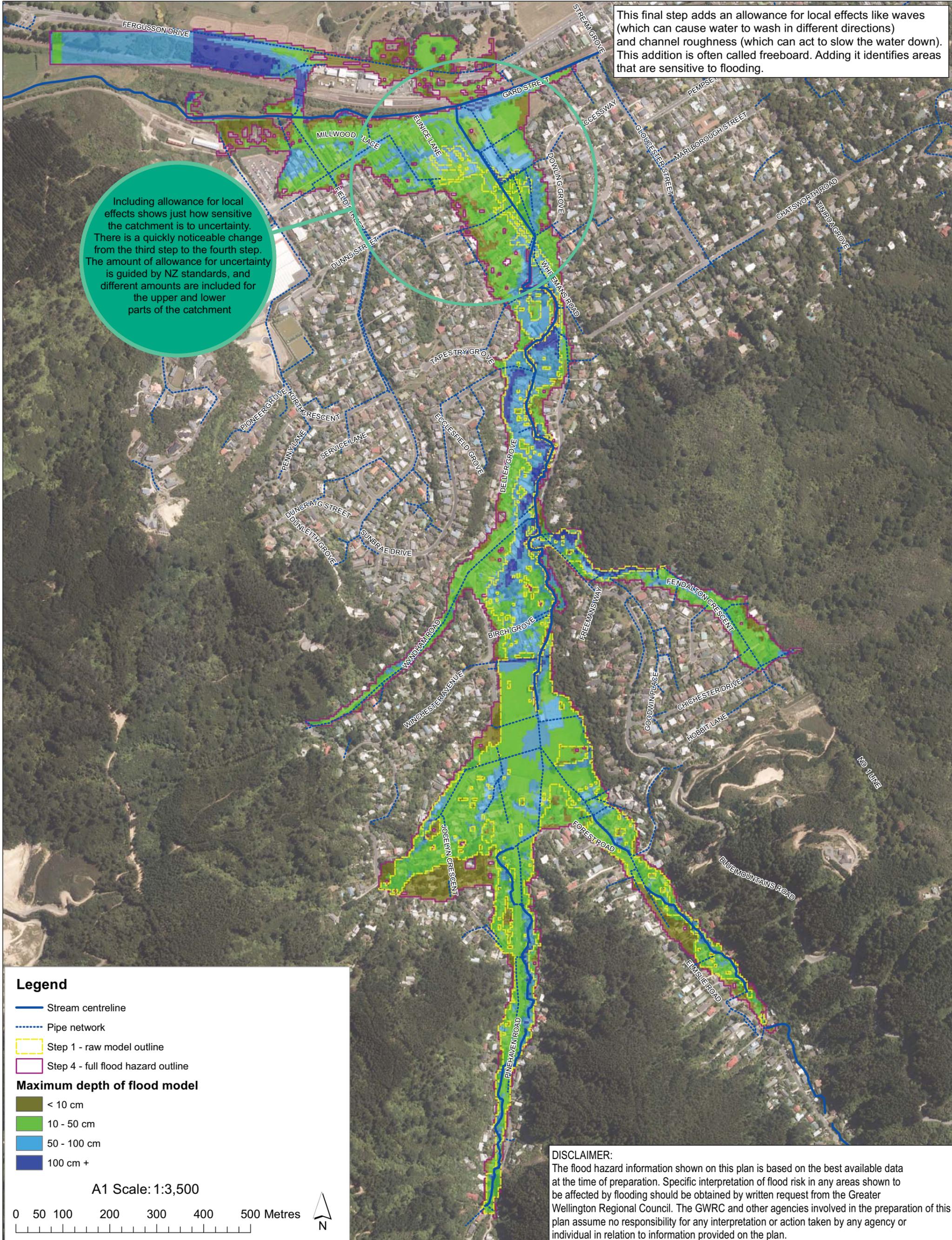
**DISCLAIMER: DOES NOT MAP FULL FLOOD HAZARD**  
The flood hazard information shown on this plan is based on the best available data at the time of preparation. Specific interpretation of flood risk in any areas shown to be affected by flooding should be obtained by written request from the Greater Wellington Regional Council. The GWRC and other agencies involved in the preparation of this plan assume no responsibility for any interpretation or action taken by any agency or individual in relation to information provided on the plan.

Date Plotted : 2:59:02 p.m. 3/06/2016

# Map 1d - PINEHAVEN STREAM - Building a flood map

## Step 4 of 4: Allowing for local effects

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This final step adds an allowance for local effects like waves (which can cause water to wash in different directions) and channel roughness (which can act to slow the water down). This addition is often called freeboard. Adding it identifies areas that are sensitive to flooding.

Including allowance for local effects shows just how sensitive the catchment is to uncertainty. There is a quickly noticeable change from the third step to the fourth step. The amount of allowance for uncertainty is guided by NZ standards, and different amounts are included for the upper and lower parts of the catchment

### Legend

- Stream centreline
  - - - - Pipe network
  - Step 1 - raw model outline
  - Step 4 - full flood hazard outline
- Maximum depth of flood model**
- < 10 cm
  - 10 - 50 cm
  - 50 - 100 cm
  - 100 cm +

A1 Scale: 1:3,500

0 50 100 200 300 400 500 Metres



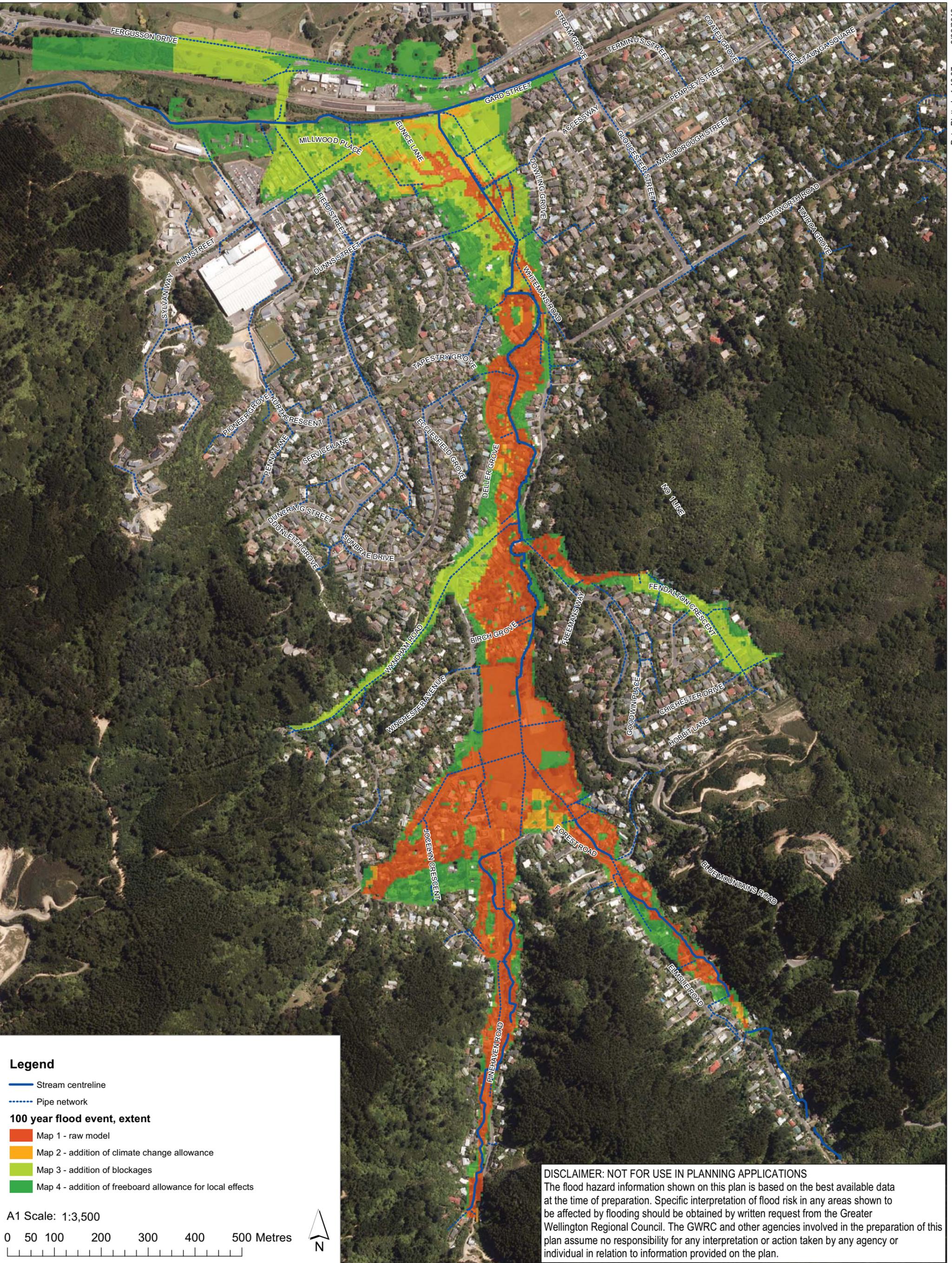
**DISCLAIMER:**  
The flood hazard information shown on this plan is based on the best available data at the time of preparation. Specific interpretation of flood risk in any areas shown to be affected by flooding should be obtained by written request from the Greater Wellington Regional Council. The GWRC and other agencies involved in the preparation of this plan assume no responsibility for any interpretation or action taken by any agency or individual in relation to information provided on the plan.

Date Plotted : 9:12:37 a.m., 3/06/2016

# Map 2 - PINEHAVEN STREAM - building a flood map

## Summary map of steps 1 to 4

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 Topographic and Cadastral data is copyright LINZ



**Legend**

- Stream centreline
- - - Pipe network

**100 year flood event, extent**

- Map 1 - raw model
- Map 2 - addition of climate change allowance
- Map 3 - addition of blockages
- Map 4 - addition of freeboard allowance for local effects

A1 Scale: 1:3,500

0 50 100 200 300 400 500 Metres

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# PINEHAVEN STREAM - Understanding flood risk

## Chance of a flood occurring in any particular year (AEP)

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Date Plotted : 9:19:15 a.m., 3/06/2016



**Legend**

- Stream centreline
- Pipe network

**Probability of flooding occurring in any 1 year**

- 1%
- 2%
- 5%
- 10%
- 20%

A1 Scale: 1:3,500

0 50 100 200 300 400 500 Metres

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# PINEHAVEN STREAM - Time to inundation (length of time from start of storm until flooding occurs)

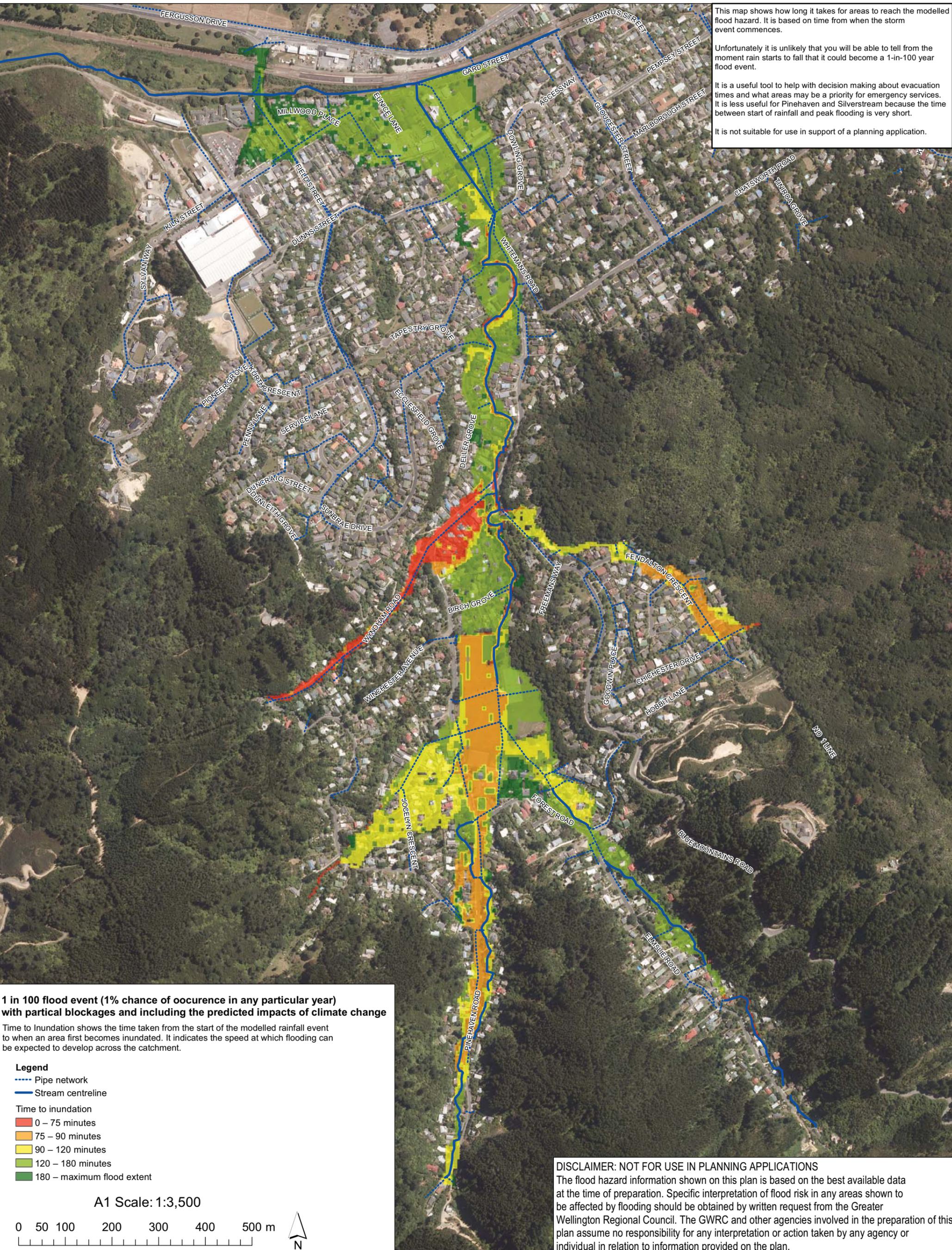
Regional Orthophotography Copyright : GWRC / NZAM 2013  
Topographic and Cadastral data is copyright LINZ

This map shows how long it takes for areas to reach the modelled flood hazard. It is based on time from when the storm event commences.

Unfortunately it is unlikely that you will be able to tell from the moment rain starts to fall that it could become a 1-in-100 year flood event.

It is a useful tool to help with decision making about evacuation times and what areas may be a priority for emergency services. It is less useful for Pinehaven and Silverstream because the time between start of rainfall and peak flooding is very short.

It is not suitable for use in support of a planning application.

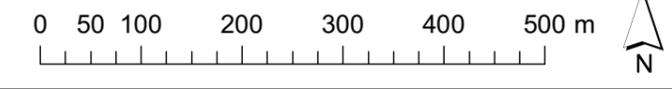


### 1 in 100 flood event (1% chance of occurrence in any particular year) with partial blockages and including the predicted impacts of climate change

Time to Inundation shows the time taken from the start of the modelled rainfall event to when an area first becomes inundated. It indicates the speed at which flooding can be expected to develop across the catchment.

- Legend**
- Pipe network
  - Stream centreline
- Time to inundation**
- 0 – 75 minutes
  - 75 – 90 minutes
  - 90 – 120 minutes
  - 120 – 180 minutes
  - 180 – maximum flood extent

A1 Scale: 1:3,500



**DISCLAIMER: NOT FOR USE IN PLANNING APPLICATIONS**

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# PINEHAVEN STREAM - Flood Hazard to Life map (based on hazard for an able bodied male adult)

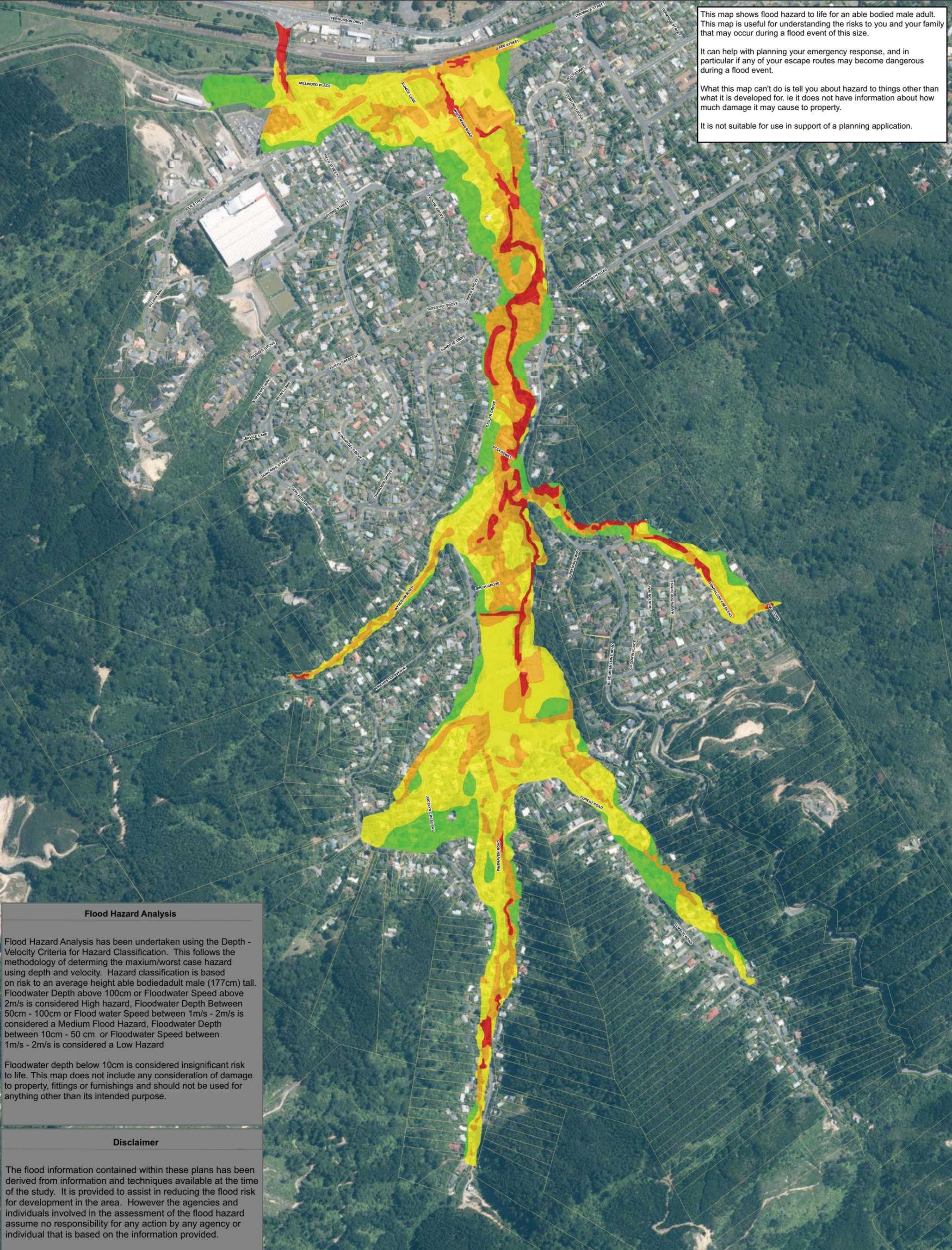
Regional Orthophotography Copyright : GWRC / NZAM 2013  
Topographic and Cadastral data is copyright LINZ

This map shows flood hazard to life for an able bodied male adult. This map is useful for understanding the risks to you and your family that may occur during a flood event of this size.

It can help with planning your emergency response, and in particular if any of your escape routes may become dangerous during a flood event.

What this map can't do is tell you about hazard to things other than what it is developed for. ie it does not have information about how much damage it may cause to property.

It is not suitable for use in support of a planning application.



**Flood Hazard Analysis**

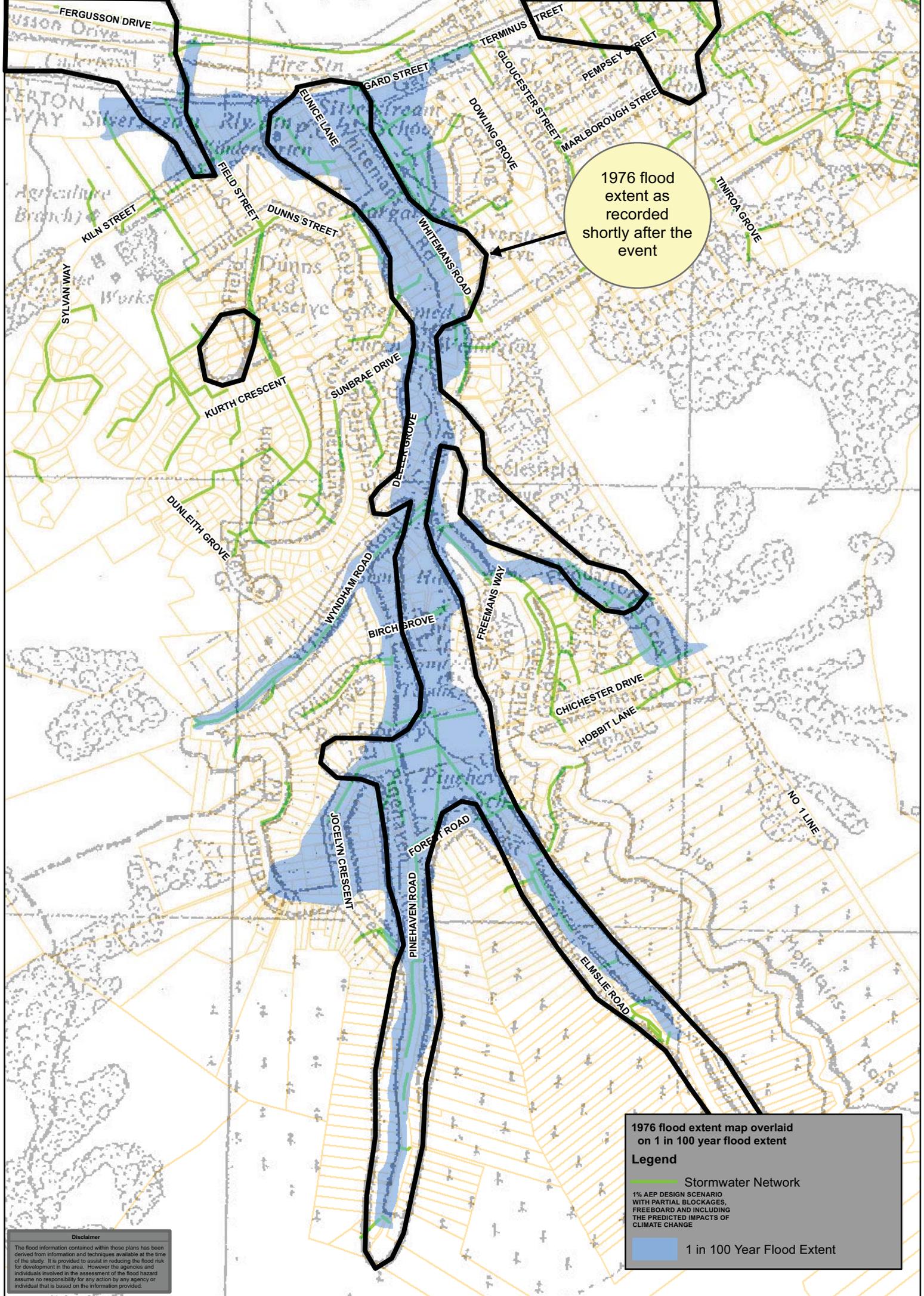
Flood Hazard Analysis has been undertaken using the Depth - Velocity Criteria for Hazard Classification. This follows the methodology of determining the maximum/worst case hazard using depth and velocity. Hazard classification is based on risk to an average height able bodied adult male (177cm) tall. Floodwater Depth above 100cm or Floodwater Speed above 2m/s is considered High hazard, Floodwater Depth Between 50cm - 100cm or Flood water Speed between 1m/s - 2m/s is considered a Medium Flood Hazard, Floodwater Depth between 10cm - 50 cm or Floodwater Speed between 1m/s - 2m/s is considered a Low Hazard

Floodwater depth below 10cm is considered insignificant risk to life. This map does not include any consideration of damage to property, fittings or furnishings and should not be used for anything other than its intended purpose.

**Disclaimer**

The flood information contained within these plans has been derived from information and techniques available at the time of the study. It is provided to assist in reducing the flood risk for development in the area. However the agencies and individuals involved in the assessment of the flood hazard assume no responsibility for any action by any agency or individual that is based on the information provided.

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1976 flood extent as recorded shortly after the event

**1976 flood extent map overlaid on 1 in 100 year flood extent**

**Legend**

- Stormwater Network
- 1 in 100 Year Flood Extent

1% AEP DESIGN SCENARIO WITH PARTIAL BLOCKAGES, FREEBOARD AND INCLUDING THE PREDICTED IMPACTS OF CLIMATE CHANGE

**Disclaimer**

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# Map 7 - PINEHAVEN STREAM - Flood Map

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This map is the standard style of flood map produced to identify properties that may be at risk of flooding. It is designed to be a simple map to use and therefore contains no information about depth or hazard. A property can quickly be determined as either within or outside of the mapped flood area.

This is a 'flag raising' type map that should be used as a first step in determining if a property is at risk of flooding.

If you have an interest in a property within the blue area you should contact GWRC for further information.

Being in the blue does not necessarily mean your house is flood prone. You need to find out what the flood level is and what your floor level is.

GWRC can provide you the flood level. You can find out your floor level either from building plans, or by getting a floor level survey done.

When we use this map to identify property as subject to flooding we are referring to the parcel of land within a boundary area. You will need to contact us for information about flood levels within the property boundary to find out if there is a hazard to floor levels.

This map is produced to help people identify if they are at risk from a 1 in 100 year flood hazard. If your property is within the mapped flood area we recommend you talk to your insurance company and contact GWRC for more information.

## Legend

-  Stream centreline
-  Pipe network

## 100 year flood hazard map

-  Flood Spread

A1 Scale: 1:3,500

0 50 100 200 300 400 500 Metres



## DISCLAIMER:

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