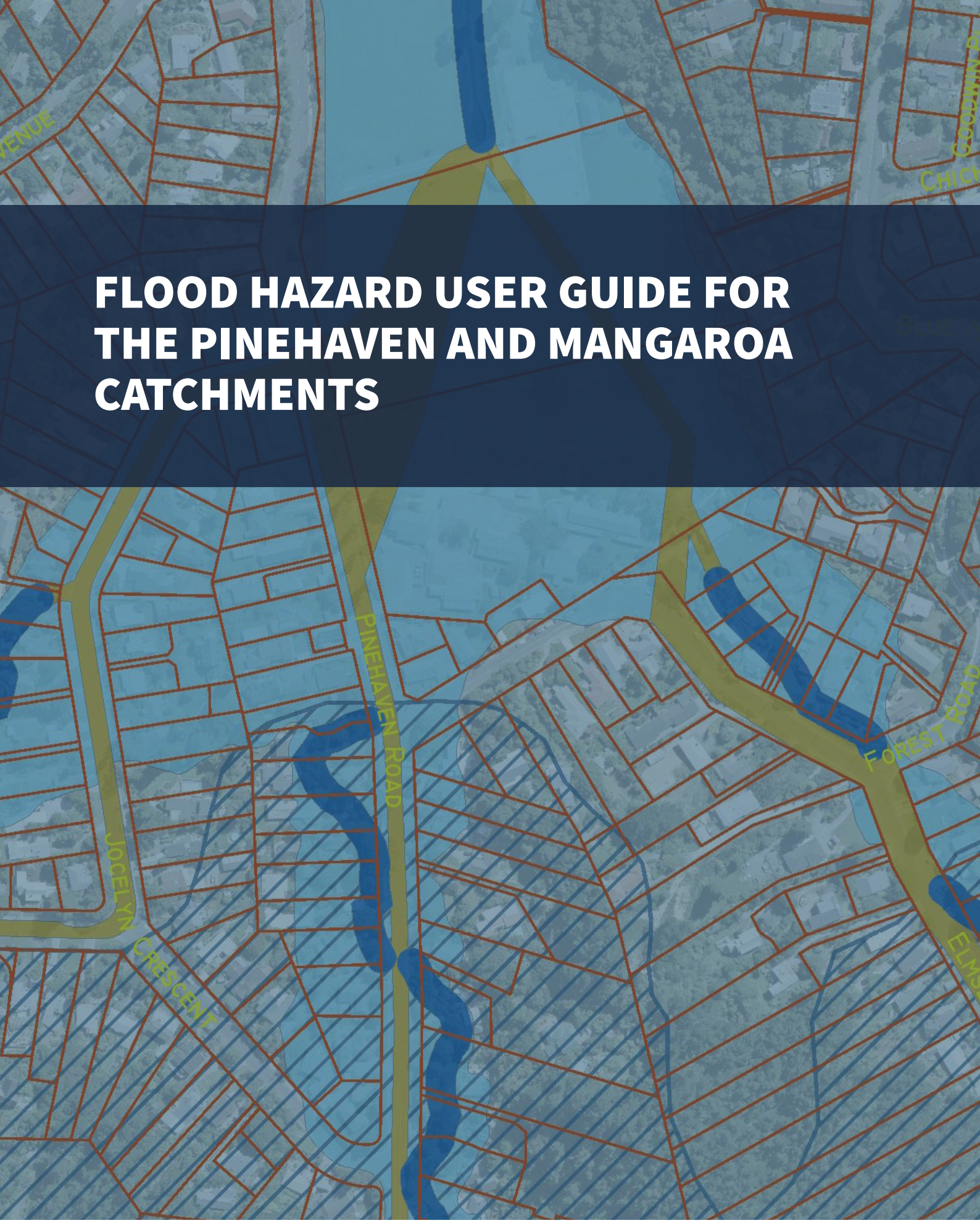
FLOOD HAZARD USER GUIDE FOR THE PINEHAVEN AND MANGAROA CATCHMENTS



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INTRODUCTION

The purpose of this user guide is to assist understanding of the identified flood hazard extents shown on the Flood Hazard Planning Maps in the Upper Hutt District Plan ("UHDP") for the Pinehaven Stream and the Mangaroa River catchments. Flood hazard extents for a 1% Annual Exceedance Probability (1% AEP), known as a 1 in 100-year flood event, were introduced through a plan change to the District Plan in April 2018[1].

The plan change introduced flood hazard overlays to planning maps and assorted rules to manage development in these two catchments to protect people and property based on the modelled extent of a 1 in 100-year flood, as well as erosion hazards for the Mangaroa Catchment.

[1] Plan Change 42.

WHY ARE FLOOD HAZARD EXTENTS NEEDED?

Prior to the introduction of the Mangaroa and Pinehaven flood hazard extents, the District Plan had no controls over activities within areas known to experience flood hazards in these catchments, and only contained a 1 in 100-year flood hazard extent for the Hutt River. As a result, there was no mechanism to avoid or control development on land in order to reduce the risk to people and property from flood and erosion hazards.

While the Greater Wellington Regional Council (GWRC) had already published flood hazard maps for both catchments, these had no ability to fully control activities within the flood hazard extent and the development of land within these hazard areas.

WHERE DO THE FLOOD HAZARD PLANNING MAPS ORIGINATE FROM?

Mangaroa River

In 2006, the GWRC initiated an assessment by Sinclair Knight Merz (SKM) consultants of flooding and erosion hazard for the Mangaroa Valley. The investigation identified extents and depths of flooding in the 1 in 100-year event, as well as identifying areas subject to erosion hazards.

The investigation produced flood and erosion hazard maps which defined hazards as being:

- River Corridor;
- Overflow Path;
- Ponding Area; and
- Erosion Hazard Area (and building setback).

An initial plan change (PC15) sought to introduce provisions into the Upper Hutt District Plan (UHDP) in 2012 but was delayed to update the hydrological and hydraulic models and complete calibration of the model results. This was completed in 2015 so that the flood model included allowance for the effects of climate change, blockage of structures across the river corridor, and freeboard allocation to form a robust flood model.
While the model had been adequately refined, the time taken meant that a new plan change needed to be notified, and therefore Proposed Plan Change 15 was formally withdrawn in March 2016.

In February 2017, the Upper Hutt City Council (UHCC) notified Proposed Plan Change 42 to introduce planning provisions based on the updated model (as well as the Pinehaven Stream). Proposed rules sought to introduce controls which corresponded with the level of identified flooding and/or erosion risk, and introduced flood hazard maps to identify these hazards.

During the submission period, a submission was made to remove areas identified as 'ponding' with a depth of 0.1m or less. This submission was supported and accepted through the hearing, and adopted by UHCC. The ponding area shown on the flood hazard planning maps therefore identifies an area modelled as lying within flood depths of >0.1m of water. Modelled depths are discussed later in this guide.

Pinehaven Stream

Following a period of flood events in 2004, 2005, and 2009, UHCC and GWRC formed a partnership and began engaging with the community to understand the flooding issue, its causes, and to provide options to address the flood hazard. The resulting partnership created the Pinehaven Flood Management Plan (Pinehaven Stream FMP), which recommended a number of structural and non-structural options to manage the flood hazard and achieve the overall purpose of reducing the risk to the community from future flood events.

Flood modelling work was carried out by SKM consultants for GWRC to establish the flood hazard extent, inundation depths, and features such as overflow paths associated with a 1 in 100-year flood event. Modelling incorporated the effects of climate change to 2090 (in line with Ministry for the Environment best practice guidance), blockages of structures across the stream, and freeboard.

Draft modelling was completed in 2009. Community engagement continued from 2009 to 2012, with the final draft Pinehaven Stream FMP notified in October 2014. Submissions on the FMP questioned whether modelling and map extents were accurate, and as a result, an independent audit was undertaken. The audit was conducted by Beca Consulting in 2015 and found that the hydrological and hydraulic modelling was fit for purpose.

This model has therefore been used to define the Flood Hazard Planning maps for the Pinehaven Catchment.

UNDERSTANDING FLOOD TERMS

FREEBOARD

Freeboard is an allowance for uncertainty in the hydraulic model, and accounts for such things as:

- Blockages of bridges and culverts;
- Higher than expected channel or floodplain roughness (larger, denser vegetation or other obstructions, such as fences);
- Uncertainty in the design hydrology;
- Coincidence with high flows in the receiving channel (such as Hulls Creek or the Hutt River) creating backwater effects;
- Build-up of sediment in the channel (aggradation);
- Inaccuracies in the topographical survey;
- Waves from vehicles or due to localised hydraulic effects (for example, upstream of buildings); or
- Higher water levels around the outside of beds (known as superelevation).[1]

Freeboard may be applied differently in different areas to reflect the relative sensitivity of areas to the variables incorporated in freeboard. This is determined by conducting a sensitivity scenario in the catchment based on the inputs above.[2] For example, in the Pinehaven Catchment, freeboard has been applied by increasing flood levels by 0.3m in the flatter parts of the catchment and by 0.5m in the steeper and narrower upper valleys. In the Mangaroa Catchment, freeboard of 0.3m is applied.[3]

[1] Upper Hutt City Council (2017) Plan Change 42- Council Hearing Report- Appendix 7- Kyle Christensen evidence- Para 26

[2] Upper Hutt City Council (2017) Plan Change 42- Council Hearing Report- Appendix 7- Kyle Christensen evidence- Para 27-28

[3] Upper Hutt City Council (2017) Plan Change 42- Council Hearing Report- Appendix 7- Michael Law evidence- Para 53

WHAT IS ON A FLOOD HAZARD MAP AND WHAT ACTIVITIES DOES IT MANAGE?

Ponding Area

Hazard Level: Low Hazard

Modelled Flooding: Depth 0.1m to 0.5m

Velocity < 0.5m/s or Depth x Velocity <0.25m²/s

Development within the Ponding Area presents a lower hazard risk, and therefore a permissive level of consenting with fewer rules is appropriate. Most activities in the Ponding Area either do not require resource consent, or are at a lower-level of consenting requirements whereby consent must be granted, subject to conditions (Controlled Activity).

The remainder of activities within the Ponding Area are generally at a Restricted Discretionary Activity status, and proposed developments below the 1 in 100-year modelled flood level are a Discretionary Activity. Examples of these activities include earthworks, subdivision, and building construction, and reflect the potentially more than minor effects of such activities occurring within the modelled Ponding Area.

Overflow Path

Hazard Level: Medium-High Hazard

Modelled Flooding: Depth > 0.25m & Velocity > 0.5m or Depth x Velocity >0.25m²/s

Proposed developments within the Overflow Path have more restrictive consenting requirements, reflecting the associated medium-high risk. Depending on the catchment, activities such as earthworks, subdivision, and building construction are the most restricted – being a mix of Discretionary and Non-Complying Activities within the District Plan.

Network utility activities are the exception to this general restrictiveness when the works are above the 1 in 100–year flood level and are a specific type of utility work.

Activity Status	Resource Consent Requirements
Permitted Activity	**No consent required –** *Activity may proceed as-of-right without Council approval or notice.*
Controlled Activity	**Consent is required –** *Application meeting set conditions must be approved, with council limited to set conditions of consent to those detailed within the District Plan.*
Restricted Discretionary Activity	**Consent is required –** *Application must address specific matters within District Plan relevant to activity. Conditions of consent must relate to those matters set in Plan.*
Discretionary Activity	**Consent is required –** *Application must address all relevant planning objectives and provisions, with Council unrestricted in its ability to set conditions and assess all actual and potential effects.*
Non-Complying Activity	**Consent is required –** *Application must address all relevant planning objectives and provisions, with Council unrestricted in its ability to set conditions and assess all actual and potential effects. Applications must either have a no more than minor effect or be consistent with relevant objectives and policies.*
Prohibited Activity	**Consent may not be applied for –** *No application may be made for Prohibited activities.*

Stream / River Corridor

Hazard Level: High Hazard

Modelled Flooding: Depth > 0.8m, Velocity > 2 m/s or Depth x Velocity >0.5m²/s, also considers past location of channel

The highest flood hazard risk is represented by the Stream/River Corridor, and therefore works within this area generally have a high degree of consenting requirements. Almost all activities within this extent are of a Non-Complying Activity Status. This high threshold reflects the intention of planning policy to avoid development where the likely exposure of people and property to hazards is high. Some exceptions do exist for certain network utility works, as well as proposed bridges crossing the Pinehaven Stream.

Note that development within a Flood Hazard Extent is not a Prohibited Activity anywhere in the District Plan.

The **Pinehaven Catchment Overlay** represents a **Medium Risk**. Development within the Pinehaven Catchment Overlay can adversely impact on the modelled flood area and risk increasing the effects of a 1 in 100-year flood event. This means that provisions have been made to ensure that any development within the overlay does not adversely increase stormwater runoff from pre-development runoff rates which is commonly referred to as Hydraulic Neutrality. The likes of building extensions, new building construction, and subdivision are therefore Restricted Discretionary Activities, requiring a hydrological assessment from appropriately qualified professionals.

Please refer to paragraph 1.8.11 in Chapter 1 of the UHDP for further application information.

The **Erosion Hazard Area** is unique to the Mangaroa Catchment and is considered a **Medium Risk** area as development within the Erosion Hazard Area could be at risk from erosion during the life of the development. As this presents a risk to people and property, proposed development requires input from appropriately qualified professionals. Therefore, almost every activity within this area is a Restricted Discretionary Activity requiring the applicant to make an assessment against specific matters detailed in the District Plan.

UNDERSTANDING THE DIFFERENCE BETWEEN GWRC FLOOD MAPS AND UHCC FLOOD MAPS

The key reason is the purpose of the flood maps. The GWRC flood maps show the results of the flood modelling, while the UHDP maps are to show areas where the flood hazard objectives and provisions within the District Plan are to be applied.

GWRC flood maps therefore represent the full extent of the modelled flood hazard and this information is used to advise on structural or non-structural flood risk management measures. Structural measures may comprise physical protection works such as stopbanks, or stream and river upgrades. Non-structural measures refer to the District Plan provisions based on the maps used by UHCC for land use planning. Modelled flood water depths and velocities were used to categorise different levels of hazard within the flood hazard area. These formed the basis of the flood hazard areas used in the UHDP maps.

UHDP maps show where development controls are needed, based on the level of associated hazard, to protect people and property. Planning maps effectively 'zone' areas based on these hazards, to which the District Plan provides objectives and provisions that manage subdivision, use, and development based on the level of risk.

The UHDP maps therefore deal with the mechanisms for planning controls only, which is why mapping between the two councils differs: one shows all modelled flooding; and the other shows different levels of hazard where development control is required.

An example of this is shown below:

Difference in mapping: *Pinehaven flood mapping, with GWRC mapping on left and UHDP mapping on right*

There are two visible differences between these two maps. Firstly, the GWRC map shows a larger extent, which is reflective of its purpose to show all flooding. The main area that differs here is within the Ponding Area (shown as light blue). This is because modelled flooding extents less than 0.1m have been removed from UHDP map, as it was considered that flooding less than this was of a very low risk and did not need further planning controls applied (the Building Code applied controls already). Secondly, UHDP maps define different hazard types within the flood hazard extent, and also show some additional layers, such as the Pinehaven Catchment Overlay (shown as blue hatched extent over the lower part of the UHDP map).

As such, the extent or area may differ between the two hazard maps because UHDP maps do not show the complete extent of the 1 in 100-year flood extent, and this is instead shown only on the GWRC maps. UHDP maps exclude flood areas <0.1m deep, while the GWRC maps include all flooding areas.

UNDERSTANDING FLOOD TERMS

FLOOD FREQUENCY

Flood Frequency is described using may different terms such as Annual Exceedance Probability (AEP), flood event recurrence interval (ARI), or flood event return period. It is the estimated probability (as a percentage) that an event of specified magnitude will be equalled or exceeded in any year. For example, an event which is likely to occur, on average, once every 100 years, would have an AEP of 1%. This would also be described as a 1 in 100-year event

The AEP percentage is similar in nature to ARI as this measures the long-term average number of years between the occurrences of a flood as big as or larger than the selected event.

The following table shows the relationship between these two terms:

AEP	ARI	Description
0.23%	1 in 440-year	Over a very long period of time, an event of similar size may occur on average once every 440 years. A flood of this size or larger has a 0.23% chance of occurring in any year.
1%	1 in 100-year	This flood event has 1 chance in 2 of occurring during a single lifetime (70 years). Over a very long period of time, an event of similar size may occur, on average, once every 100 years. A flood of this size or larger has a 1% chance of occurring in any year.
2%	1 in 50-year	This flood event has 1 chance in 1.3 or a 76 % probability of occurring during a single lifespan (70 years). Over a very long period of time, an event of similar size may occur, on average, once every 50 years. A flood of this size or larger has a 2% chance of occurring in any year.
5%	1 in 20-year	A flood event of this scale is likely to occur more than twice in a single lifespan (70 years). A flood of this size or larger has a 5% chance of occurring in any year.
10%	1 in 10-year	A flood event of this size will occur 7 times on average in a single lifespan (70 years). A flood of this size or larger has a 10% chance of occurring in any year.

Additional information on flood hazard area terminology can be found on the GWRC webpage at: http://mapping.gw.govt.nz/GW/Floods/Information/GW%20Flood%20Areas%20Information.htm

Kiln Street Flooding, Silverstream, 1976

I AM IN A HAZARD EXTENT – WHAT DO I DO?

The answer to this depends on the type of overlay affecting your property, what proportion of the property it covers, and what the current and future use of the land is or intends to be. If you are not proposing to develop or build on your land, then no action is required - a resource consent is not required for existing dwellings within a flood extent, catchment overlay, or erosion hazard extent. However, if you want to find out modelled flood depths, you can contact the GWRC directly to obtain these. Note that flood hazard rules still provide for certain activities without the need for Resource Consent.

If a flood hazard, catchment overlay, or erosion hazard extent lies over an area you wish to develop, steps you can undertake are:

1. Consider whether you can move the proposed development to avoid the flood and erosion hazard extent completely.
2. Check the UHDP Maps or use the UHCC online GIS mapping tool to correctly identify what the type of flood hazard is, as well as what your underlying zoning is.
3. Contact GWRC directly to find out modelled flood depths and whether any other Regional Consent may be required for the works you are planning.
4. Make an assessment against the UHDP to see whether your proposed activity triggers the need for Resource Consent. Chapter 33 is a good place to start, followed by the zone-based chapters which relate to the zoning of your property. An enquiry to UHCC Planning Officers can also provide further clarity if there is remaining uncertainty.
5. If you believe Resource Consent is required, ensure that you have all of the information available to apply for Resource Consent, based on the requirements of the associated rules and Chapter 1 of the District Plan.
6. If expert advice is required, make contact with the appropriate personnel to undertake the required assessment.

Obtaining Resource Consent

If the need for Resource Consent is triggered, expert advice from the following professionals may be required:

- Resource Management Planner
- Civil/Stormwater Engineer
- Geotechnical Engineer
- Structural Engineer
- Hydrologist / River Engineer
- Land Surveyor
- Draftsperson

When considering development, the first consideration should be whether it is possible to avoid constructing within a hazard extent. It is important to remember that the extents shown only represents hazards associated with a 1 in 100-year modelled flood event, and larger flood events will occur. GWRC may have flood hazard information for larger flood events (for example the Probable Maximum Flood or PMF if you wish to avoid all flood hazard). Please refer to the boxes on pages three and seven of this guidance document for further explanations on these terms.

It is also important to remember that a 1 in 100-year flood event means that there is a 1 in 100 chance in any given year that a flood of this size or greater will occur. It does not mean that there is exactly one of these floods every 100 years and it is also important to remember that several big floods could happen in quick succession.

Local and Regional Resource Consents

Depending on the activity you wish to carry out, the Resource Consent may need to be applied for through either UHCC or GWRC, or both. The reason for this is because of the different roles and responsibilities each council has under the Resource Management Act 1991 (as discussed earlier in this guide), and therefore the type of rules and consents required by each authority. UHCC is responsible for managing the use and subdivision of land and natural hazards, as well as having other responsibilities. GWRC is generally responsible for the natural environment; controlling the likes of discharges to soil, water, and air, as well as the avoidance or mitigation of natural hazards, and other responsibilities.

The following table provides examples of consents or permissions relating to flood hazards which each council may administer, and their contact details:

Local Council Resource Consent Examples	Regional Council Resource Consent Examples
• Construction of dwelling or extensions in a Flood Hazard Extent • Subdivision of land • Land use consent for commercial development on residential land • Earthworks within Flood Hazard Extents or Erosion Hazard Area • Bridges over the Pinehaven Stream less than 6m long without piles in river or in banks • Establishment of dwelling with the floor level below the 1 in 100-year flood level	• Recommending new building floor levels in flooding area • Earthworks on erosion or flood-prone land • Diverting or damming a river or stream, or establishing or demolishing structures therein • Taking or discharging of water • Bridging a river or installing culverts • Gravel extraction from the bed of a river or stream • Discharge of sediment to water
Contact Details	
Upper Hutt City Council 838-842 Fergusson Drive Private Bag 907 Upper Hutt 5140 Phone: 04 527 2169 Email: askus@uhcc.govt.nz	**Greater Wellington Regional Council** PO Box 11646 Wellington 6142 Phone: 04 384 5708 Email: info@gw.govt.nz

Wellington Water is an asset manager for drinking water, wastewater and stormwater services for the Hutt Valley, Porirua, and Wellington City. Queries regarding works council mains or capacity constraints in these areas should be directed to Wellington Water, however the agency does not process resource consent applications. Their details are as follows:

Wellington Water

Private Bag 39804
Wellington Mail Centre
Petone 5045
Phone: 04 912 4400
Email: info@wellingtonwater.co.nz

OBTAINING BUILDING CONSENT

There is a difference between Resource Consents and Building Consents, and only one or both may be required. For any building consent sought within either the Pinehaven or Mangaroa catchment flood extent, GWRC will provide a recommended level for the building site.

UHCC set requirements for building floor levels through Building Consents under the Building Act 2004, whereby a local authority may only grant Building Consent in natural hazard areas where flood effects are reasonably mitigated.

If you are unsure whether construction you are planning would require a raised building floor level, it is recommended that you contact GWRC directly before proceeding to develop building designs.

I WANT TO BUY OR SELL PROPERTY SUBJECT TO A FLOOD HAZARD EXTENT – WHAT DO I NEED TO KNOW? WHAT ABOUT INSURANCE?

It is important to know that all relevant flooding information will be shown on any Land Information Memorandum (LIM) requested from UHCC which either intersects with a flood hazard extent, and/or where a flood event has been recorded on that property file.

UHCC is required under the Local Government Official Information and Meetings Act 1987 to provide all information UHCC holds relevant to that property at the time a LIM is requested. Therefore, a LIM will include such details as permitted land uses, existing consents, recorded infrastructure, rating information, natural hazard information, as well as any proposed Plan Changes which would affect the property in question.

It is the landowner's responsibility to ensure that their insurance company is aware of all relevant information relating to a property, known as 'material disclosure'. Not doing so may mean that an insurer could decline an insurance claim, therefore it is important to check with your insurer whether they are aware of any hazards the property may be exposed to. The Earthquake Commission (EQC) will also insure against damage to residential land as a result of a storm or flood, but excluding bare land[2].

The insurance premium you will pay will depend on the methodology used by the insurance company to evaluate the level or risk and likelihood of a flood event, and is therefore likely to differ between companies. Accordingly, when considering purchasing a property identified as being subject to flood hazard, it may be appropriate to look into whether premiums would differ between companies and consider making an offer which is conditional on a level of insurance cover you are comfortable with.

Additional information can be found on the GWRC insurance fact sheet here: http://www.gw.govt.nz/assets/floodprotection/Insurance-and-Flood-Hazard-Areas-Fact-Sheet.pdf

[2] EQcover Insurers' Guide 2017 – Accessed July 2018, https://www.eqc.govt.nz/sites/public_files/documents/EQCover/EQCover-Insurers-Guide-2017.pdf

I WANT TO KNOW MORE ON WHAT IS INVOLVED IN MODELLING A 1 IN 100-YEAR FLOOD EVENT

A flood study is carried out to model the 1 in 100-year flood extent as it is impossible to define the extent of land subject to flooding including climate change using historic, observational information only. The flood study includes hydrologic analysis, hydraulic analysis, flood mapping and review.

Hydrologic Analysis

The catchment area is defined, which is all the area able to catch rain for a specific watercourse. Because of the shape of the land, water that falls on the land when it rains cannot get into another catchment. The main watercourse catchment is split up into sub-catchments and these are used for the hydrologic analysis, which models the rainfall falling on the sub-catchments for the critical storm event and duration. The outputs of the hydrological model are run-off flows within the sub-catchments that show how the flow out of the sub-catchments varies over the storm as it happens. The hydrological model is calibrated using rainfall gauge records and measured flows. Historic rain records, as well as climate change are also incorporated into rainfall calibrations. A predicted increase in temperature of 2.1°c for the period 2080-99 was adopted to account for climate change as per the Ministry for the Environment guidelines for the Wellington Region, which predicts a 16% increase in rainfall depths and intensities over this time. The hydrologic analysis provides the input for the second stage hydraulic analysis.

Hydraulic Analysis

Hydraulic analysis uses the outputs of the hydrologic analysis to provide the input flows into a computer hydraulic model set up to represent the watercourse and land being modelled. The shape of the land comes from LiDAR (Light Detection and Ranging) aerial survey data that was taken in mid-2009 in Pinehaven[3] and originally in 2004 for Mangaroa and then also updated in 2013. 'Contours' represent the hills, gullies, depressions in the ground, open channels etc. Cross section surveys through the watercourses are also used to define the channels and structures such as bridges and culverts. The general surface conditions are also taken into account in the model (the type of surface rain falls on affects how fast water flows over it i.e. water flows faster over paved or concreted surfaces compared with grass).

The hydraulic model is run to determine how the input flows spread down the watercourse and across the floodplain. Different boundary conditions are evaluated, such as if the input flows vary and the downstream water levels change – such as the Hulls Creek water level for the Pinehaven Stream or the Hutt River for the Mangaroa River. Effects of changes in the stream channel such as blockage at structures (such as bridges or culverts), and changes in roughness or obstructions in the floodplain are also reviewed. The hydraulic model is run for different modelling scenarios and size events, and the results calibrated with measured flood records where possible. The modelling result tells us which parts of the catchment are likely to be covered by water, the flood water depth, and how fast it is likely to be flowing.

Review & Flood Mapping

The flood study analysis and mapping are reviewed to identify any shortcomings that can then be changed and determine that the end results are fit for purpose. The results of the hydraulic analysis are then mapped to show current and future flood hazard across the catchment.

Disclaimer:

The advice provided in this Users Guide should not be seen as a replacement of professional advice on the management of flood hazards or insurance advice. This information is general in nature and advice should always be obtained from the relevant point of authority on a case-by-case basis.

[3] SKM Pinehaven Report (2010) Appendix A

LINKS TO EXTERNAL RESOURCES

GREATER WELLINGTON REGIONAL COUNCIL LINKS:

- Flood Protection Webpage
- Regional Flood Management Plans
- Pinehaven Flood Management Plan
- How a Flood Hazard Map is Built

UPPER HUTT CITY COUNCIL PLAN CHANGE INFORMATION

- Plan Change 15 – Flood and Erosion Hazard Areas [Mangaroa River]
- Plan Change 42 – Mangaroa and Pinehaven Flood Hazard Extents

FLOOD MODELLING REPORTS & AUDITS

- Mangaroa River Erosion Hazard Report – SKM 2006
- Mangaroa River Flood Hazard Assessment – Jacobs 2015
- Pinehaven Stream Flood Hazard Assessment – SKM 2010, Volume 1
- Pinehaven Stream Flood Hazard Assessment – SKM 2010, Volume 2
- Pinehaven Stream Flood Mapping Audit – Beca 2015