

THREE WATERS MANAGEMENT PRACTICE NOTE

HCC XX: Flood Mapping

1. HOW DOES COUNCIL UNDERTAKE FLOOD MODELLING AND MAPPING?

1.1 Why do we have/need flood modelling/mapping?

The Resource Management Act 1991 makes Council responsible for controlling any effects of the use, development or protection of land to avoid or mitigate the effects of natural hazards. Council's Comprehensive Stormwater Discharge Consent also requires Council to avoid or minimise adverse flooding of land and property. Mapping flood hazards helps Council fulfil these requirements.

Flood hazard mapping is also used to assist Council in its responsibilities in granting consents under the Building Act 2004.

When we receive new or updated data about these potential flood effects on properties in the city, we're required by law to make this publicly available upon request and we use an online tool, Floodviewer, to host Councils best available city-wide data and make it more accessible to the public.

1.2 What is Floodviewer?

Floodviewer is an online, interactive tool that helps us understand what would happen in areas of Hamilton if we had a very large, and rare, amount of rain, and where stormwater is expected to flow when stormwater pipes become blocked, their capacity is exceeded or where there is no piped network.

The tool shows:

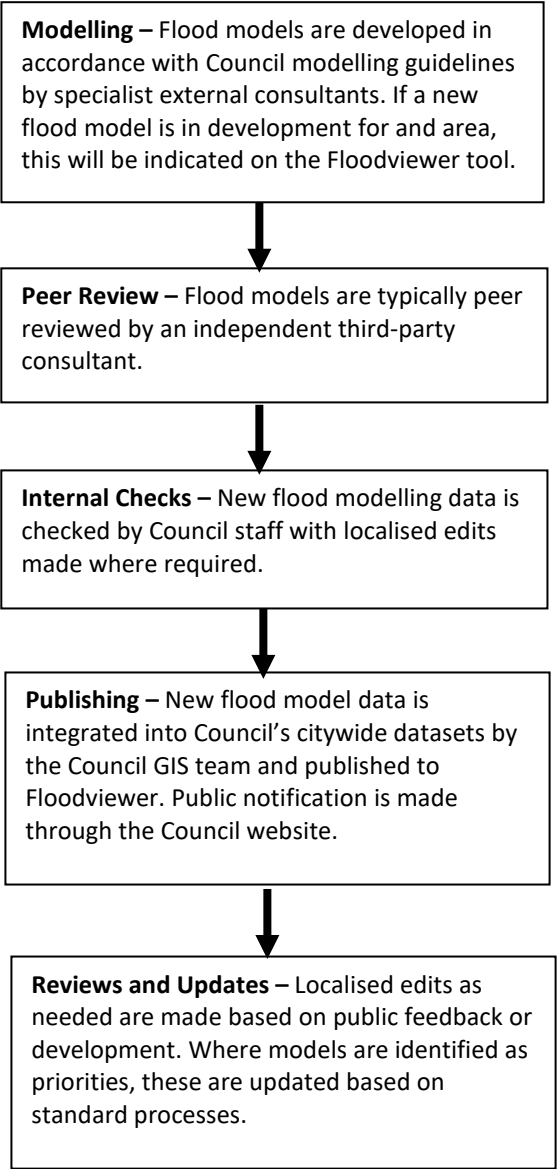
- **Flood hazards/extent** – this is the land that potentially could be covered during a 100-year Average Recurrence Interval (ARI) rainfall event. This is a rainfall event that is expected to occur on average once every 100 years. As of April 2025, 95% of the city is mapped for flood hazards/extent.
- **Overland Flow Path (OLFP)** - these are the paths water will try to flow when our piped network becomes blocked, is exceeded or where there is no piped network. 100% of the city is mapped for Overland Flow Paths.
- **Flood Depression Areas** – these are the areas that have the potential to 'fill up' with water. 100% of the city is mapped for Depression Areas.

1.3 How to use Floodviewer?

Council's Floodviewer tool can be accessed through the Flood Mapping section of Council's website ([LINK](#)). A How-To guide has been prepared to show new users how to navigate the Floodviewer tool. The guide can be accessed through the link above.

1.4 Flood modelling and mapping process

The flowchart below shows the key steps in Council's modelling and flood mapping process.



2. WHAT DO THE FLOOD MAPS SHOW?

The flood maps available on Floodviewer identify land in Hamilton which is potentially at risk of flooding in an extreme rainfall event or other potential hazards associated with surface water runoff (i.e. OLFPs & flood depressions). The flood maps illustrate flooding on land and do not necessarily indicate surface water entering a building.

2.1 Extreme rainfall events

Flood modelling and mapping is produced for an estimated 100-year ARI design flood event. While this is considered an extreme event, these can (and do) occur. There is a 26% chance (or 1-in-4) of this event occurring over the life of a typical mortgage (30-year period). A 100-year ARI event is also known as a 1% Annual Exceedance Probability (AEP) event, which means there is a 1% probability of such an extreme event or larger happening in any given year.

To manage the effects of climate change, Council is required to include predicted climate change impacts when mapping flood hazards. Flood hazard mapping includes the predicted increase in rainfall intensity out to the year 2130.

2.2 Type of data

2.2.1 Flood Hazards

Flood hazard areas are land which is predicted to be affected by flooding of more than 100mm in depth in a 100-year ARI flood event incorporating the effects of climate change based on the RCP8.5 median scenario as of the year 2130. Flood hazards are classified as either 'Low', 'Medium' or 'High' based on a combination of depth and velocity, the classifications are shown below in Figure 1. Definitions are also provided in Appendix 11 of the District Plan. Flood hazard areas are used in the resource consent process to determine what development activities are allowable in each zone, and what mitigations (such as freeboard levels) are required.

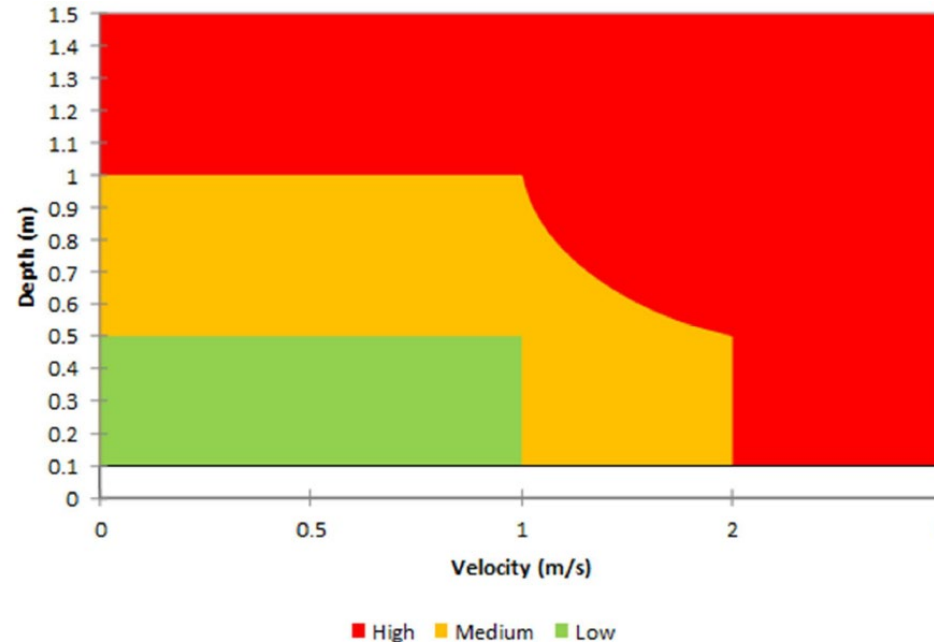


Figure 1 – Flood hazard classification matrix.

2.2.2 Other Detailed Data

Council also maps peak flood levels, depths and velocities for the 100-year ARI RCP 8.5 event, however these are not shown on the Floodviewer tool. These are used to assist Council and owners in the consenting process. Maps of this data can be requested from Council – refer to Section 4.2.

2.2.3 Overland flowpaths

Overland flowpaths (OLFPs) are a type of flood mapping information. They predict the flowpath of water over the ground when the stormwater network is overloaded, if pipes become blocked, capacity is exceeded or where there is no pipe network. The OLFPs shown on Council's online mapping are not linked to a particular rainfall event do not necessarily indicate flow volumes, widths or velocities.

Historically, development has relied on a piped network for stormwater management. Little consideration was given to what might happen if the piped network was exceeded or inlets became blocked.

Minor overland flowpath: Means an overland flowpath with a contributing catchment which is between 2,000m² and 4,000m² in area.

Moderate overland flowpath: Means an overland flowpath with a contributing catchment which is between 4,000m² and 30,000m² in area.

Major overland flowpath: Means an overland flowpath with a contributing catchment of 30,000m² or more.

The OLFP data is useful for determining where flow potentially enters and leaves a site. The district plan requires that earthworks associated with site development do not obstruct or divert overland flowpaths.

2.2.4 Flood Depression Areas

A flood depression area is an area that has the potential to 'fill up' with stormwater if the stormwater pipes, or culverts are blocked.

They are typically created through manmade features (e.g. roads) that can inadvertently act as a dam and stop stormwater from flowing, but they can also be caused by the natural topographical features of Hamilton.

The mapping on Floodviewer shows depression areas based on volumes of rainfall runoff that could be generated in a 10-year ARI and a 100-year ARI 1-day rainfall event.

The 100-year ARI rainfall event depressions are used as part of the resource consent process to determine activity status of some vulnerable land uses such as hospitals, schools or childcare facilities.

The 10-year ARI rainfall event depressions are used in the building consent process to determine required finished floor levels.

2.2.5 Flood Extent

The flood extent area shows the full land area predicted to be affected to any extent in the 100-year ARI event – i.e. including areas with predicted shallow flood depths of less than 100mm.

2.2.6 Earthworks Area

The earthworks layer shows areas that have been affected by significant, consented earthworks. Within this area, the flood hazard mapping may no longer be reliable because land contours and, as a result, flooding, may have changed. The earthworks layer is generally updated at least annually.

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2.2.7 Waikato River Flood Area

This information is provided by Waikato Regional Council to show the extent of Waikato River flooding likely to occur on average once in 100 years.

3. HOW WAS THE MODEL DONE?

3.1 Types of Models

Flood models: Flood models are used to develop the detailed flooding data published on Floodviewer and used in the consenting process. Flood models are made up of detailed hydrologic and hydraulic models developed based on methodologies similar to those adopted in other territorial jurisdiction.

OLFPs modelling: Council's overland flowpath data is generated based on GIS analysis of Council's aerially captured survey data (often referred to as LiDAR). The GIS analysis maps the path water takes as it runs downhill. OLFP modelling is an analysis of the terrain data only, i.e. no hydrologic or hydraulic calculations are undertaken.

Flood depression modelling: Flood depression modelling builds on the overland flowpath modelling. Where OLFPs encounter potential blockages (such as road embankments) or flow through depressions in the landscape the flood depression modelling estimates the volume of runoff the upstream catchment could generate in a 10-year or 100-year ARI rainfall event and maps the level to which that area would 'fill up' if pipes or culverts were blocked. The depression modelling is a combination of GIS analysis and simple rainfall runoff calculations.

3.2 Flood modelling method

Flood modelling developed by HCC is prepared in accordance with the *Hamilton City Council Flood Modelling Guideline*. This guideline is updated from time to time to align with both local and international industry standards and best-practice. Assumptions in specific models may vary based on the age of a particular model or the original purpose the model was developed for.

Rainfall

Rainfall used to develop the flood maps is a 100-year ARI rainfall event or 1% Annual Exceedance Probability (AEP) event. Design rainfall data is sourced from the NIWA High Intensity Rainfall Design System v4 (HIRDS4) which can be accessed at <https://hirds.niwa.co.nz/>.

Council's standard modelling approaches also include modelling of other events such as the 2-year or 10-year ARI event. These are currently not displayed on the Floodviewer tool.

Climate Change Projections

Flood maps illustrate a future scenario of the year 2130 for planning purposes. HCC is required to do this by the Waikato Regional Policy Statement. Climate change projections for the year 2130 are based on the Representative Concentration Pathway (RCP) 8.5 (median) scenario. This corresponds with a temperature increase of 3.8°C.

Hydrologic Modelling

Design hydrology used in the flood modelling is based on the procedures outlined in the *Waikato stormwater runoff modelling guideline (TR202/06)* published by Waikato

Regional Council. In most instances hydrologic modelling has been undertaken using the HEC-HMS software.

Hydraulic Modelling

Hydraulic models have been developed in a range of software which includes TUFLOW, MIKEFLOOD (DHI), and HEC-RAS. Hydraulic modelling is undertaken in accordance with Council's modelling methodology and incorporates best available data sources available at that time.

The models include:

- Topography, from LiDAR (Light Detection and Ranging) and supplemented by survey where required
- Public stormwater infrastructure (from digitised as-built information and survey where required)
- Significant watercourses
- Building footprints
- Landcover and the associated infiltration rate and surface roughness (e.g., asphalt versus vegetation)

They do not represent:

- Private property drainage infrastructure (such as small driveway grates)
- Blockage of public stormwater infrastructure and watercourses
- Localised bow wave effects
- Localised features such as private retaining walls
- Building finished floor levels

3.3 Flood model updates

Council has been mapping and releasing flood hazard information since around 2014 to meet its obligations under legislation and regional planning documents.

Council has an ongoing programme to periodically update the flood models in Hamilton and the flood maps they produce. There are various drivers for this including changes to key modelling inputs (e.g. rainfall, climate change, topography) or updates to the overall methodology. It is expected that updates will occur approximately every 5-10 years.

Updates to flood models follow HCC's standard process as illustrated above, taking the latest land and infrastructure information into account. Where an area of the city is undergoing a mapping update, this will be clearly indicated on the Floodviewer tool including an indicative date of publishing.

4. DATA APPLICATIONS

4.1. How the flood maps are used

New development

Flood maps help ensure that future land use, subdivision and development within Hamilton is planned to be resilient to flooding. They illustrate areas where effects need to be considered to make sure new developments are safe and do not increase flood risk for nearby properties.

For a resource consent application we will check the latest available information on the Floodviewer tool and assess whether the relevant flood hazard areas defined in the District Plan apply to the site.

Building consents are administered under the Building Act 1991. Building consents are required to consider best available information, so will incorporate the flooding information shown on floodviewer.

Land Information Memorandum (LIM)

Council must make hazard information it holds available to the public under the Local Government Official Information and Meetings Act 1987. If flooding is identified on your property, it must be shown via a LIM. The LIM wording will reference mapping undertaken for 'land subject to flooding in a 100-year ARI flood event.' This takes into consideration the modelled effects of climate change and include a map showing the extent of flooding mapped on the property. It also shows if the site is affected by overland flowpaths or flood depression areas.

Council stormwater improvements programme

Flood modelling and mapping is used to inform Council investment in stormwater infrastructure. This investment is subject to Council decisions made through Long Term Plan (LTP) and Annual Plan processes. To prioritise funding Council adopts an approach that prioritise critical public infrastructure and safety to people and property. Through the 2024-34 LTP, Council also improved funding to undertake upgrades to existing stormwater network infrastructure which will also work to reduce significant floodable areas on residential property.

Investment in stormwater improvements will be prioritised in areas where there is the greatest existing risk and greatest community benefit realised from the ratepayer investment. Not all areas of mapped surface flooding will be addressed, as the maps illustrate an extreme event, and the risk to people and property of shallow and/or slow-moving flood water can be managed during an infrequent event.

4.2. Obtaining data

4.1.1 Viewing Flood Mapping Data

As described in previous sections, Council's flood mapping data can be viewed on the Floodviewer portal which can be accessed at maps.hamilton.govt.nz/floodviewer/.

4.1.2 Site-Specific Detailed Flood Maps

Property-scale detailed flood maps can be requested from Council by contacting info@hcc.govt.nz. Detailed property-scale mapping can be provided for peak flood level, depth and velocity from the flood modelling. Detailed flood maps are supplied with an information sheet which documents important information about the modelling/results.

4.1.3 GIS Data

For larger development areas or entities which have infrastructure across various parts of the City, access to the citywide datasets displayed on Floodviewer can be arranged by contacting info@hcc.govt.nz. This contact can also be used to request GIS outputs from other modelled events. As part of this process, signing of a digital data agreement will be required.

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4.1.4 Obtaining Models

Council developed flood models can be requested through contacting info@hcc.govt.nz. Where models are being obtained to support a resource consent application, it is Council's recommendation that applicants engage with the technical consultant who developed the model. This is similar to the approach taken for Council water supply and wastewater models. Where a development is large enough to trigger a sub-catchment ICMP process (refer to District Plan rule 25.13.4.1b), it is a requirement that Council's preferred technical consultant is engaged to either undertake or peer review the modelling. Applicants are required to get agreement from HCC on the proposed modelling scope prior to commencement.

5. SITE-SPECIFIC FLOOD MAP REVIEW PROCESS

A property owner may request a site-specific review of the flood mapping for their property. To request a site-specific review contact info@hcc.govt.nz with the address of the property. This service is currently provided free of charge.

It takes time to undertake site-specific reviews, and timeframes depend on the complexity of the review and whether or not a site visit is required to assess the property in person. Council aims to undertake site-specific reviews within 20 working days.

Review of flood maps on a property considers the available site-specific information to check whether there is a reason the mapped flooding should be altered at the particular property. It is not a review of the flood modelling or mapping process. A site-specific review for a property may consider the following information:

- Flood model water levels and land levels
- Site levels from cadastral survey
- Records of previous flooding on the property and in the area
- Building consent files
- Resource consent files
- Information provided by the property owner, e.g., photos
- Site visit where necessary

The intent of the review is to determine whether there is a localised feature or changes since the modelling was undertaken that would materially affected mapping for a property, it is not a general review of the modelling or mapping process. The review may conclude that there is no reason found to modify flood maps on a property. Alternately, the review may find there is a local, site-specific feature (e.g., a private retaining wall) that warrants modifying the mapped flood extent within the property.

Each property owner who requests a review is provided with a record (typically via email) which documents the conclusion reached and why, and whether flood mapping related to the property is to be removed, amended or retained. If alternative flood information is formally accepted by Council, it supersedes the existing data and is treated as the best available information for the site from the date of acceptance onward.

Any edits to the online flood maps (if applicable) are made in the next batch of periodic map updates (which occur approximately every six months).

Resolution of expert disagreement in relation to review outcomes

If an owner disagrees with the outcome of a mapping review, they may request a meeting between their stormwater engineer (or another suitably qualified expert) and the Council's reviewer. The Council will ensure that its reviewer uses their best endeavours to resolve any areas of technical disagreement. If there remains disagreement with the mapping review an owner can refer the complaint to the Ombudsman (www.ombudsman.parliament.nz).

6. PROVISION OF UPDATED FLOOD MODELLING TO SUPPORT A CONSENT

As part of the resource consent process an applicant may choose (or be required to) undertake detailed flood modelling in support of their development consent.

For smaller or simpler developments, applicants may wish to develop modelling that is more localized to their development site (and surrounding areas). All modelling is expected to be undertaken in accordance with Council's modelling guideline.

For larger, more complicated, development sites use of the Council flood models is recommended. Where developments are large enough to trigger a sub-catchment ICMP process it is a requirement that Council's technical consultant is engaged to either undertake or peer review the modelling. This process is outlined below:

There are two (2) options for use of the Council models:

- 1) The relevant Council model is provided to you under license for your use.
 - a. You must enter into an agreement about use of the model.
 - b. All modelling must be undertaken in accordance with the latest Council modelling guidelines.
 - c. If the final outputs are used in a consent application, Council may arrange a review of the modelling work. This is the same process as other peer reviews required for consent applications, and you will be charged for this as part of the consent processing cost.
- 2) Council can facilitate the modelling to be undertaken by Council's preferred technical consultant:
 - a. A scope of works will be drafted by Council's technical consultant and will be agreed in writing between Council and the applicant.
 - b. Once a scope of works is agreed between parties, the model will be provided to the applicant under license as per (1) above.
 - c. The work will be undertaken under a direct engagement between the applicant and technical consultant, or if a consent application has been lodged with Council then Council may directly engage the technical consultant on your behalf. You will be charged the cost for this modelling work as it is an input into your development proposal.

Whether modelling is undertaken by the applicant or on behalf of the applicant by Council the District Plan sets out reporting requirements for a Flood Risk Assessment Report – refer to Volume 2 Section 1.2.2.9 of the Operative District Plan.