Public

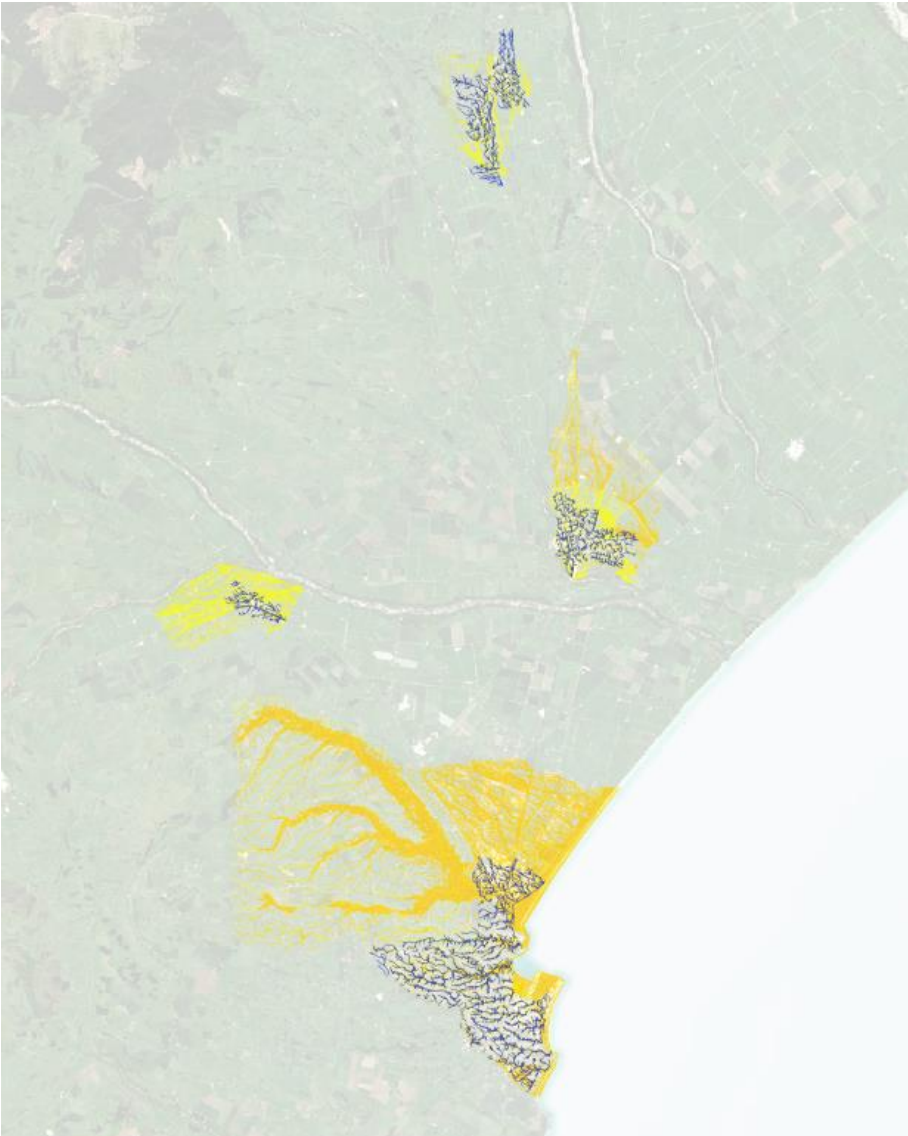
Timaru District Council

Flood Assessment Area & Flood Risk Certificates

Supporting Information Report

10 October 2025

3-C2006.92



Flood Assessment Area & Flood Risk Certificates

Supporting Information Report

Timaru District Council

WSP
Christchurch
12 Moorhouse Avenue
Christchurch 8011
New Zealand
+64 3 363 5400
wsp.com/nz

REV	DATE	DETAILS
1	10 October 2025	Final

	NAME	DATE
Prepared by:	Brendon Schicker, Marion Foglia, Simon Dellis, Thuy Nguyen	10 October 2025
Reviewed by:	Sarah Dudson	10 October 2025
Approved by:	Tom Porter	10 October 2025

TABLE OF CONTENTS

GLOSSARY

2D zone	Area covered by mesh surface
Buffer	Area of a given width surrounding an object
Unit flow	Flow per unit length in the 2D model. Calculated as depth multiplied by velocity.

ABBREVIATIONS

AEP	Annual Exceedance Probability
DEM	Digital Elevation Model (ground terrain model)
ECan	Environment Canterbury
FAA	Flood Assessment Area
LiDAR	Light Detection and Ranging (method of capturing DEMs)
OLFP	Overland Flow Path
PMP	Probable Maximum Precipitation (rainfall profile)
RCP8.5	Representative Concentration Pathway 8.5
RoG	Rain on Grid
TDC	Timaru District Council

1 INTRODUCTION

WSP has collaborated with Timaru District Council (TDC) since 2014 to develop numerous stormwater hydraulic models and GIS-based overland flow path mapping. Outputs from these models have been used to inform two important components of the Proposed Timaru District Plan:

- Generation of the Flood Assessment Area (FAA) overlay for the planning maps.
- Provide data/information for the preparation of Flood Risk Certificates (FRCs).

The Natural Hazards chapter of the Proposed Timaru District Plan sets out rules that apply where an activity is located within the FAA. In which case, a FRC is issued by Council to provide flood risk information pertaining to the site of interest, including identification of land within an overland flow path or High Hazard Area, land subject to flooding in a 0.5% AEP flood event and the associated minimum finished floor level for any new building or structure.

The purpose of this report is to document the process used to create the FAA and to summarise the information used for the FRCs.

2 INPUT DATA

The FAA and FRCs are primarily founded on the following inputs, which are covered in more detail in the corresponding subsections:

- TDC stormwater hydraulic models.
- Digital Elevation Models (DEMs) of the ground terrain.
- TDC mapped overland flow paths.
- Other Information.

2.1 TIMARU DISTRICT COUNCIL HYDRAULIC MODELS

TDC has stormwater hydraulic models covering the townships of Timaru, Temuka, Geraldine, and Pleasant Point. There are broader rain-on-grid models for each area and a programme to create comprehensive 1D-2D hydraulic models of each major catchment that will supersede the rain-on-grid model results as they are completed. Rain-on-grid (RoG) model results come from a simplified 'rain on grid' approach which models rain falling on the ground terrain (created from LiDAR) but ignores any below-ground infrastructure (all pipes and culverts).

Comprehensive 1D-2D models have been built for the Geraldine, Temuka, George Street, Te Ahi Tarakihi, and Waimataitai/Whales Creek catchments. The remaining catchments (Washdyke, Otipua/Saltwater Creek, the other Timaru town catchments and Pleasant Point) will follow in time.

Figure 2-1 shows each model's extent. The Timaru models were updated in 2025 with the latest available LiDAR data. The creation of this updated ground model is described in the *Timaru Rain on Grid: Model Build Report* (WSP, 2025).

All model outputs provide data on water depth, flow velocity, areas of high hazard (2D layer), as well as pipe and node parameters (1D) where available.

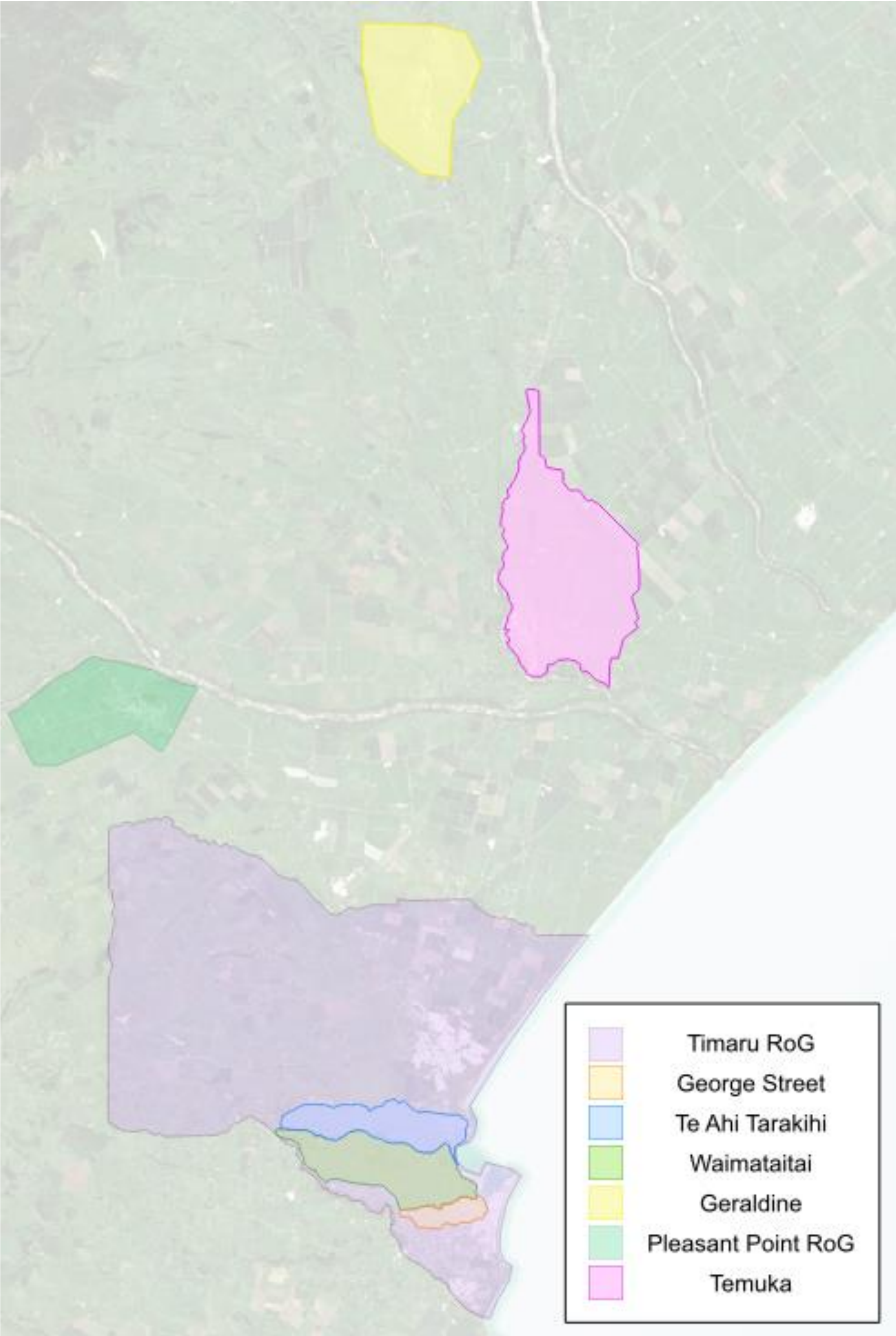


Figure 2-1 2D zone extents of the Timaru stormwater models

All model build details are described in their respective model report listed in the Report Reference (Table 2-1). Table 2-2 summarise the runs in the TDC models.

In the absence of comprehensive 1D-2D hydraulic models, the results from the rain-on-grid model were used.

Table 2-1 Timaru District Council models – Report reference

Model	Report Reference
Te Ahi Tarakihi (1D-2D model)	Te Ahi Tarakihi Stormwater Modelling: System Performance Report (WSP, 2025)
Waimataitai (1D-2D model)	Waimataitai and Whales Creek Stormwater Modelling (WSP, 2024)
Georges Street	George Street Stormwater Model: System Performance Report (WSP, October 2024)
Timaru RoG	Timaru Rain on Grid: Model Build Report (WSP, 2025)
Geraldine 1D-2D	Geraldine Stormwater Modelling: Model Build, Validation and System Performance Report (WSP 2022) + 2025 updates
Pleasant Point RoG	Timaru, Temuka, and Pleasant Point Rain on Grid Analysis - Updated memorandum (WSP 2017)
Temuka 1D-2D	Temuka Stormwater Modelling: Model Build, Validation, and System Performance Report (WSP, 2025)

Table 2-2 Timaru District Council models - summary runs information

Model	Town	50% AEP Existing	20% AEP Existing	10% AEP Existing	2% AEP Existing	2% AEP Climate Change[3] + Growth	1% AEP Climate Change[3]+ Growth	0.5% AEP Climate Change[3] + Growth	0.2% AEP Climate Change[3] + Growth	Rainfall Duration	Boundary Condition [4]
Geraldine [6]	Geraldine	Y	Y	Y	Y	Y	Y	Y	Y	1h & 6h	River
Pleasant Point RoG [1]	Pleasant Point	N	N	N	N	N	N	Y	Y	24h	None
Temuka	Temuka	Y	Y	Y	Y	Y	Y	Y	Y	1h	River
George Street	Timaru	Y	Y	Y	Y	Y	Y	Y	Y	2h	Sea
Te Ahi Tarakihi [2]	Timaru	Y	Y	Y	Y	Y	Y	Y	Y	1h	Sea
Timaru RoG [1]	Timaru	Y	Y	Y	Y	Y	Y	Y	Y	24h	Sea
Waimataitai [5]	Timaru	Y	Y	Y	Y	Y	Y	Y	Y	1h	Sea

[1] The Rain on Grid (RoG) models are based on the District Planning Zones and so do not have an explicit Growth scenario only a Base scenario.

[2] Growth for Te Ahi Tarakihi was assumed to require mitigation and so the model does not have an explicit Growth scenario only a Base Scenario.

[3] All models use the RCP8.5 2100 climate change scenario using the guidance from *Climate Change Projections for New Zealand: Atmospheric Projections Based on Simulations Undertaken for the IPCC 5th Assessment, 2nd Edition* (MfE, September 2018). Pleasant Point RoG has not been updated and uses the

2090 climate change using the previous guidance in *Climate Change Effects and Impacts Assessment: A Guidance Manual for Local Government in New Zealand. 2nd Edition* (MfE, May 2008).

[4] All Timaru models apply sea level boundaries that are adjusted according to the specific event being run. Sea level rise is included alongside climate change scenarios where the boundary condition is the sea. Temuka and Geraldine use a river boundary condition, while Pleasant Point does not have any boundary conditions set.

[5] The Waimataitai model was additionally run to assess the 'Highfield' scenario within the growth scenario. However, these results are not included in the FAA and FRC analyses.

[6] The Geraldine catchment had two critical durations (1h and 6h). Results were combined by keeping the maximum value from each duration, which are used in the FAA and FRC analyses.

2.2 DIGITAL ELEVATION MODEL (DEM)

The DEM representing the ground terrain serves as an input for both the TDC hydraulic models and the FRCs. Table 2-3 presents the source of DEM used for each model. All DEMs, and hence model results, are in the Lyttelton Vertical Datum (LVD) 1937.

Table 2-3 DEM sources

Township	DEM name	Source Data (in order of precedence)	Modifications*
Temuka	Rivers14+Cant18+Grant+ Whitcombe_LYT37	Canterbury - Timaru Rivers LiDAR 1 m DEM (2014) – original Lyttelton 1937 version, not the LINZ version. Canterbury LiDAR 1m DEM (2018-2019)	Proposed subdivisions at 24A Grant Street and 75 Whitcombe Street
Geraldine	Geraldine_DEM_20250917	Canterbury - Timaru Rivers LiDAR 1 m DEM (2014) – original Lyttelton 1937 version, not the LINZ version.	New development areas at Strawberry Place, Majors Road and Templer Street
Pleasant Point	PP_GroundElevation	Canterbury LiDAR 1m DEM (2010)	None
Timaru	linz25+tdc20+linz18+linz20+ harvey+showgrnd+Adjust_lyt 37	Canterbury LiDAR 1m DEM (2010) Timaru Urban (NZAM 2020) Canterbury LiDAR 1m DEM (2018-2019) Canterbury LiDAR 1m DEM (2020-2025)	Harvey Norman & Showgrounds development. with details provided in Timaru Rain on Grid Model Report (WSP, August 2025)

**Exact modifications can be provided on request*

2.3 TIMARU DISTRICT COUNCIL OVERLAND FLOW PATHS

Overland flow paths are routes that stormwater follows to flood plains during heavy storm events. A flood plain is an area next to a river or stream that is likely to flood during heavy storm events[1].

The DEM (section 2.2) is used to derive overland flow paths in conjunction with GIS processing software. The GIS software uses the ground surface layer to determine the likely overland flow paths through a catchment.

The data inputs used in the process were:

— Catchment extent of Timaru, Temuka, Pleasant Point, and Geraldine.

— 1 m DEM data for the Timaru, Temuka, Pleasant Point, and Geraldine catchments.

— Stormwater and culvert shapefile for Timaru, Temuka, Pleasant Point, and Geraldine catchments (culverts over 900 mm in diameter were digitised to show continuous flow paths; smaller culverts were treated as part of the underground network and excluded from the overland flow dataset).

The overland flow paths for the urban areas of Timaru, Temuka, Pleasant Point, and Geraldine was provided in the form of a GIS layer with the supporting *Overland flow path mapping – Timaru District, Report for Timaru District Council* (WSP, 2019) report to document the process and limitations

Overland flow paths for new development areas around Geraldine, Temuka and Timaru were updated in 2020 and detailed in the *TDC OLFP and Depression Mapping* (WSP, 2020) report.

The overland flow paths are available at https://timaru.isoplan.co.nz/eplan.

2.4 OTHER INFORMATION

Several GIS layers are also necessary for the FRC. They are:

— High hazard area

High Hazard Area is defined in the proposed Timaru District Plan as a flood hazard subject to inundation events where the water depth (metres) x velocity (metres per second) is greater than or equal to 1 or where depths are greater than 1 metre, in a 0.2% annual exceedance probability (AEP) flood event (500-year average recurrence interval)

— Flood Assessment Area (see section 3 for more details)

— 100-year coastal erosion and sea water inundation

— Stop banks

— 1D voids for open channels (river reaches and bridges) and storage areas from the model.

[1] https://www.timaru.govt.nz/services/environment/storm-water/stormwater-strategy#:~:text=Overland%20flow%20paths%20are%20routes%20that%20stormwater%20follows,is%20likely%20to%20flood%20during%20heavy%20storm%20events.

3 FLOOD ASSESSMENT AREA (FAA)

3.1 OVERVIEW

Flood Assessment Area (FAA), as defined in the Proposed Timaru District Plan "*means areas that are highly likely to be subject to flooding and inundation but which require site specific assessment to determine the level of risk to people and property.*"

The FAA is created from 0.5% AEP event flood modelling results and mapped overland flow paths.

3.2 MODEL RESULTS PROCESSING

The 0.5% AEP (200-year ARI) growth plus climate change (RCP 8.5) flooding results from the TDC models are processed as follows to create the FAA:

1 2D model results are combined, with results from 1D-2D models taking precedence over rain-on-grid results where they overlap.

2 Flood results less than 100 mm deep are removed, except where the depth x velocity >= 0.05 m^2/s (to incorporate flowing water less than 100 mm that could create a flooding issue if obstructed).

3 Following step 2, any areas of flooding less than or equal to 30 m^2 (that are at least 10 m away from any other flooding) are removed.

4 A 3 m buffer is added to the resultant flood extents. Due to the blocky nature of the raw outputs from the models, a GIS process is then used to 'smooth' the flood extents to a more natural shape as depicted in Figure 3-1.

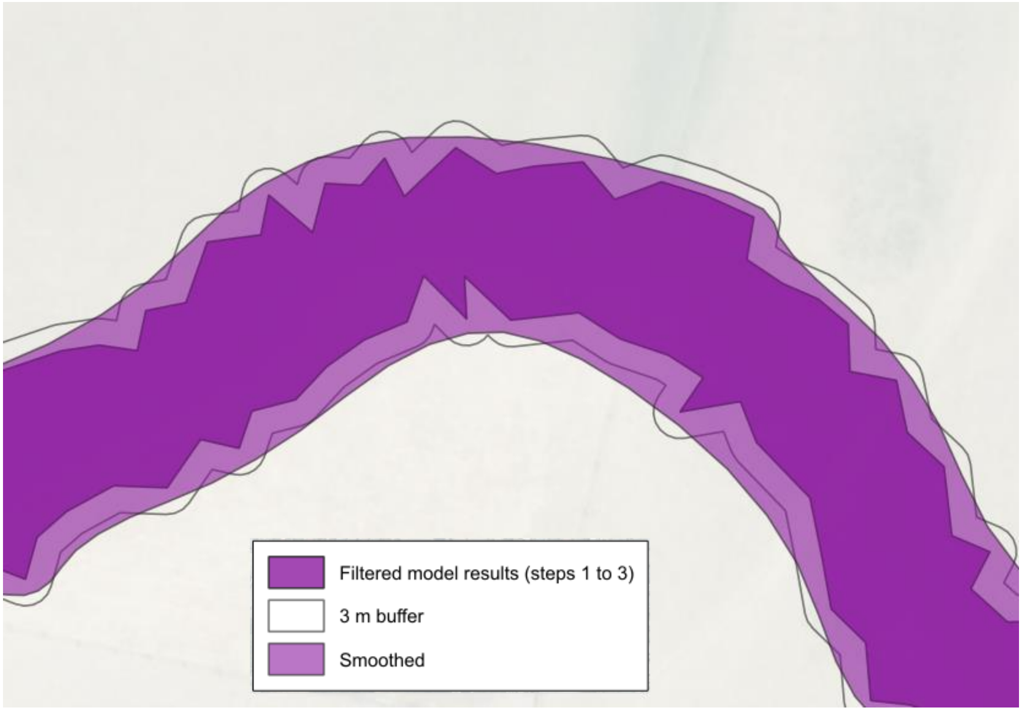


Figure 3-1 Flood Assessment Area Mapping – Process steps

5 The OLFP lines are added with a 5 m buffer.

6 The layers are dissolved to create a single shapefile of the areas at risk of flooding, based on TDC data, that require assessment (the TDC FAA).

7 The TDC FAA is added to the corresponding ECan assessment layer and dissolved to create a single FAA overlay for the Timaru district. Figure 3-2 shows the TDC FAA on top of the ECan assessment layer. The ECan assessment layer represents regional river flood risk and takes precedence over the TDC FAA where the layers overlap.

For Temuka and Pleasant Point, because these two areas are entirely within the ECan assessment layer, the above FAA process was not carried out. Instead, a shapefile of the extent of the 0.5% AEP flood modelling results was created for each catchment to provide information about areas subject to urban flood risk.

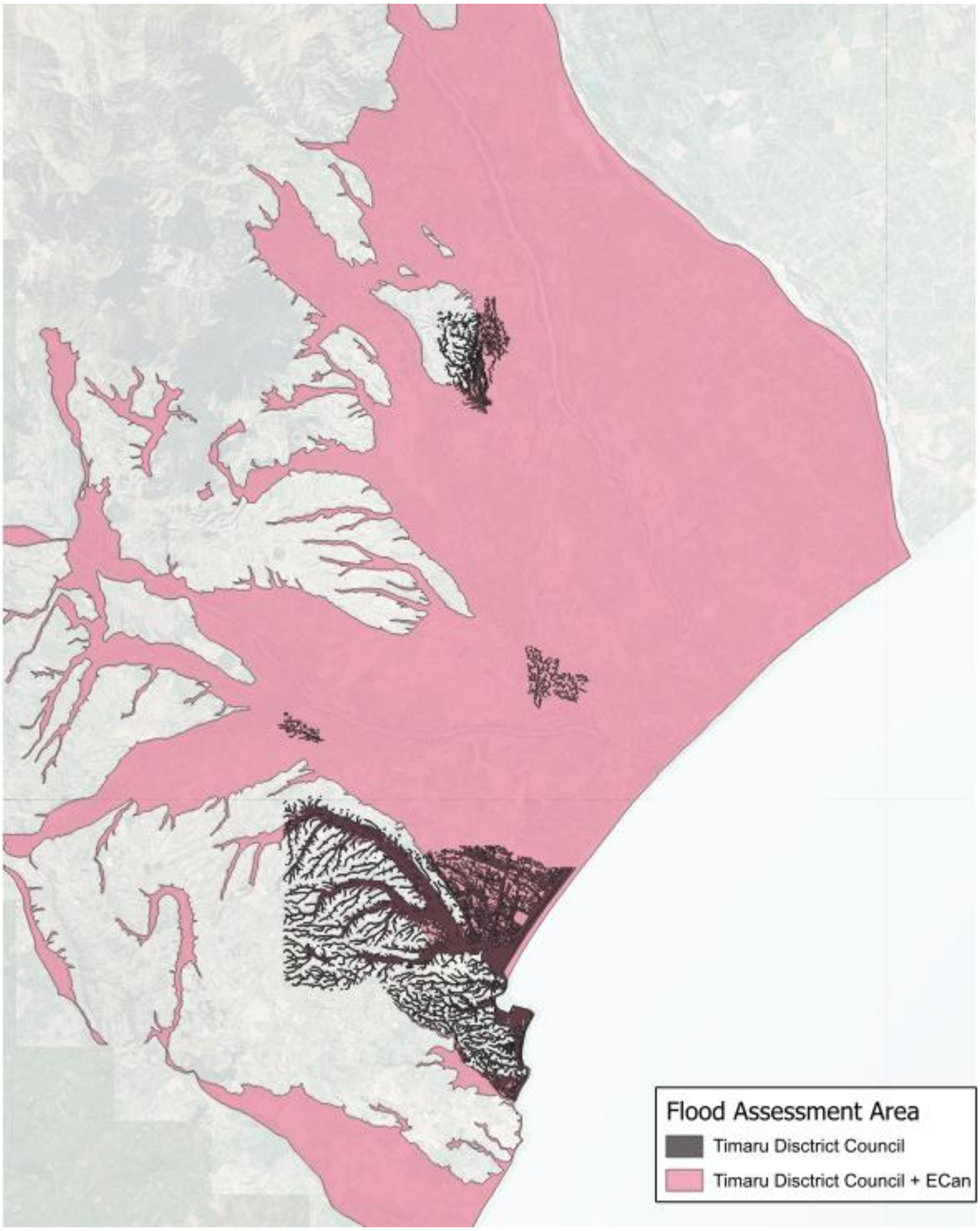


Figure 3-2 Flood Assessment Areas - Outputs

4 FLOOD RISK CERTIFICATES (FRC) PROCESS

4.1 OVERVIEW

FRC (as per the following definition) is issued by Council to provide flood risk information pertaining to a site of interest, where that site is located within the FAA.

FLOOD RISK CERTIFICATE

DEFINITION

means a certificate issued by Timaru District Council which specifies:

a. *the flood event risk level for specific land (being either land not subject to flooding in a 0.5% AEP flood event, or land subject to flooding in a 0.5% AEP flood event, or land within a High Hazard area); and*

b. *where a. above identifies that the specific land is subject to flooding in a 0.5% AEP flood event, the minimum finished floor level for any new building or structure (or part thereof) on the specific land to provide at least 300mm freeboard above the flood level in a 0.5% AEP flood event; and*

c. *if the specific land is within 150m of a stopbank, the minimum finished floor level for any new building or structure (or part thereof) on the specific land to avoid risk from a stopbank failure; and*

d. *whether the specific land is located within an overland flow path.*

The following subsection outlines a step-by step approach for assessing and reporting FRC.

4.2 FRC PROCESS

The level of effort required to prepare a FRC can vary in complexity from simple (e.g. low risk activity, low/no flood risk) to complex (e.g. significant flood risk, suspicious results, outdated/missing data). The type of data that is reviewed and reported on in the FRC is summarised in Table 4-1.

Table 4-1: Reporting requirements for standard and complex FRC

Section	Simple/Standard FRC	Complex FRC
2.1 Type of activity and level of information provided	Simple activity e.g. single building/dwelling with a basic site plan of the proposed development, no major earthworks, or Address only provided i.e. request for known flood risk information about a site (not an assessment of the flood risk impacts of a proposed activity).	Subdivision or proposed activity with comprehensive development plans and/or information to be assessed e.g. cut/fill and earthworks plans for proposed landform changes, stormwater design plans that need to be assessed, flood assessment data from Environment Canterbury, etc.
2.2 Ground levels **** Ground levels are taken from the DEM (see section 2.2).***	Ground level information is reviewed and included in FRCs to help understand the flooding mechanisms relevant to the site. Simple/standard FRCs are typically flat or gently sloping sites without any landform changes proposed (beyond standard house foundations).	FRCs become more complex on sloping sites and/or where significant earthworks are proposed as existing and proposed ground levels need to be analysed to understand the flooding mechanisms and how flood risk may be impacted by the proposed activity.
2.3 High hazard area **** The high hazard layer is derived from the 0.2% AEP flood model results (see section 2.4)*** ***The 100-year inundation map is from the TDC District Plan (see section 2.4)*** ***The 1D river reach boundaries are from the model (see section 2.4)***	A map shows the proposed development site's position relative to the high hazard area. If the site is not located within the high hazard area, no figure will be included. The 100-year coastal inundation overlay will be included, where relevant, if the proposed development site is located near the coast. In this case, the applicant should also seek advice from ECan (via a Flood Hazard Assessment) to determine if the coastal inundation risk exceeds urban flood risk.	A manual evaluation of high hazard area may be necessary when a proposed development is located adjacent to a channel or river depending on how the channel is represented within the flood modelling process (the high hazard mapping has a null result within 1D river reach boundaries so requires flood levels within the river reach to be extracted and used to determine the extent of the high hazard area).
2.4 Overland flow paths **** See section 2.3 for the overland flow paths layer***	A map shows the proposed development site's position relative to the mapped overland flow paths. If the site is not located in a mapped overland flow path, and there are no flow paths in close proximity to the site, no figure will be included under this section.	FRCs become more complex where the mapped overland flow paths are inaccurate/ misleading or if the proposed activity obstructs an overland flow path. Analysis of the flood depth and velocity data and well as local knowledge may be required to better understand how water flows through the site and how the proposed activity may impact flood risk.

Section	Simple/Standard FRC	Complex FRC
2.5 Modelled flood depths [m]	The development site is shown on a 0.5% AEP (200-year ARI) event flood map. The maximum water level and maximum water depth values are documented for the property (and for the location of the proposed activity, where different/relevant). Where additional model results are available, the FRC may also include 2% AEP (50-year) and 10% AEP (10-year ARI) flood maps. ** The maximum water level and water depth values are extracted from the flood model 2D layer (see section 2.1). Only water depths over 100 mm are considered for maximum water level values.*	There are several factors that influence the complexity of the flood depth section of an FRC report. • A FRC for a subdivision covering multiple lots, requires the maximum water level and flood depth to be determined for each lot. • Where the proposed activity displaces flood storage or obstructs an overland flow path, additional modelling may be required to quantify the potential impact of the activity on flood level and depth. • Analysis of smaller events (10% AEP) may be required to understand the flood risk and potential impacts in a smaller level of service event. • Flooding in low-lying areas close to the coast should be assessed to compare flood mapping results for existing climate and future climate scenarios to understand how much of the flooding issues are due to sea level rise. This comparison is available for 2% AEP (50-year ARI). • If the proposed development plan references the New Zealand Vertical Datum (NZVD) 2016, a conversion table may be included to present maximum water level and water depth values in both LVD 1937 and NZVD2016. • Development sites adjacent to a channel or river may require additional analysis of the modelled channel cross section to determine if the water level in the channel / river is similar to the adjacent flood levels. • Stormwater infrastructure not well represented in the model e.g. drains, basins, etc. that warrant additional analysis to understand the potential impact on flood risk.
2.6 Modelled flow velocities [m/s] **** The maximum water flow velocity values are extracted from the 0.5% AEP flood model 2D layer (see section 2.1).***	The development site is shown on a 0.5% AEP (200-year ARI) event flow velocity map. The maximum velocity through the site is documented. Viewing mapped flow velocity information helps to understand the flooding mechanisms for the site, in particular, to better understand how overland flow paths may be impacted by the proposed activity. In some cases, the velocity beyond the site boundary is more important, e.g. fast-moving flow down the road that may impact access to the site.	As outlined under the Overland Flow Path row above, FRCs become more complex where proposed activity obstructs an overland flow path and needs to be assessed in more detail.

Section	Simple/Standard FRC	Complex FRC
2.7 Minimum floor level	Minimum floor levels are calculated as per the definition in section 4.1 above, that is 300 mm (freeboard) above the maximum modelled flood level in a 0.5% AEP event. The TDC planning team are advised if floor levels proposed by the applicant are below the minimum requirement. For FRC's covering multiple lots, a minimum floor level is calculated for each lot.	There are a number of factors that make the minimum floor level determination more difficult, such as: • Sloping sites – these require additional assessment to determine whether there is a static ponding area that governs the flood risk impacts or if obstruction of flowing water (down the slope) is the primary concern. • Flood modelling uncertainty/ inaccuracies – this more commonly occurs for FRCs within RoG model results due to the absence of underground infrastructure (pipes) and pump stations, where modelled flood depths may be unrealistically high. • Datum issues – floor levels are typically given in the same datum as the flood modelling data (LVD). In the instance where there are concerns about the accuracy of the datum used in the flood modelling, floor levels may be given as relative to a fixed point e.g. the crown of the road or a kerb level. In some cases, where the flood mapping information is unreliable, floor levels are assessed relative to neighbouring property floor levels.
2.8 Potential flood risk impacts	Any effects on overland flow paths, flood assessment areas, or high hazard zones will be noted in this section. Recommendations are provided to ensure overland flow paths remain unobstructed or to propose appropriate drainage system solutions.	Pump station failures, stop bank removal or modification, or pipe blockages can be included if input data or model information is incomplete.
3. Summary	This section presents a table summarising the key information for the site.	For a FRC covering multiple lots, the summary table may be expanded to convey the key information relevant to each lot.

5 ASSUMPTIONS MADE

- The flood information used in the FAA and FRC is generated using computer models, most of which have been validated against historical storm events. These models rely on a range of assumptions and limitations, which are detailed in technical reports available upon request.
- The Flood Assessment Area layer has been developed to identify regions with a higher likelihood of significant flooding. This layer omits areas subject to shallow flooding (less than 100 mm unless fast-moving) as well as small, isolated zones of predicted flooding (under 30 square metres). Consequently, flooding or ponding may still occur outside the designated Flood Assessment Area, though such events are typically localised and unlikely to represent broader catchment-scale flood risk. It is important for users to recognise this limitation, as the layer does not encompass all potential flood risks, particularly minor, localised, or shallow flooding incidents.
- The maximum values (e.g. water depth, velocity, water level) given in FRCs are indicative and should not be viewed as absolute limits.
- Overland flow paths are determined by local topography and do not represent a specific likelihood of flooding. The mapping is based on the ground levels at a catchment-wide scale, but it has not been validated at the individual property level. Inaccuracies may exist due to factors such as the exclusion of buildings, walls, fences, and some underground assets like culverts from the ground model and flow path analysis.
- The TDC Infrastructure Design Standard (July 2024) sets out the freeboard requirements for different return period events and is consistently applied (300 mm). This means that for flood risk, the Proposed District Plan requirement for the 0.5% annual exceedance probability (AEP) flood event plus 300 mm freeboard takes precedence over the New Zealand Building Code Clause E1 Surface Water (2020), which requires that surface water from a 2% AEP event does not enter buildings.

6 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Timaru District Council ('Client') in relation to document the process used to create the FAA and to summarise the information used for the FRCs ('Purpose') and in accordance with the ACENZ and ENZ Short Form Agreement for Consultant Engagement between TDC and WSP, signed 4 March 2025 ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

In preparing this Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in this Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable for any incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

BIBLIOGRAPHY

- WSP (October 2025). Temuka Stormwater Modelling: Model Build, Validation, and System Performance Report. WSP Reference: 3-C2006.54.
- WSP (August 2025). Te Ahi Tarakihi Stormwater Modelling: System Performance Report. Christchurch: WSP reference: 3-C2006.56.
- WSP (October 2025). Timaru Rain on Grid: Model Build Report. Christchurch: WSP reference: 3-C2006.92.
- WSP (December 2021). Caroline Bay Stormwater Modelling. WSP Reference: 3-C2006.51.
- WSP (May 2024). Waimataitai and Whales Creek Stormwater Modelling. WSP Reference: 3-C2006.52.
- WSP (October 2024). George Street Stormwater Model: System Performance Report. Christchurch: WSP reference: 3-C2006.55.
- WSP (July 2022). Geraldine Stormwater Modelling: Model Build, Validation and System Performance Report. WSP Reference: 3-C2006.50.
- WSP (2019). Overland flow path mapping – Timaru District, Report for Timaru District Council.
- WSP (2020). TDC OLFP and Depression Mapping. WSP reference: 3-53597.00