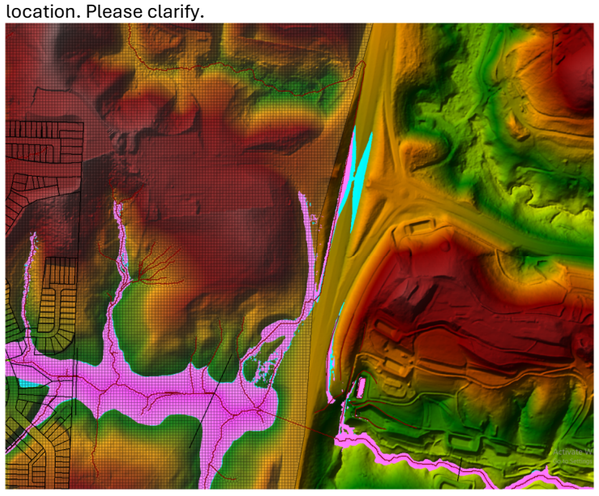
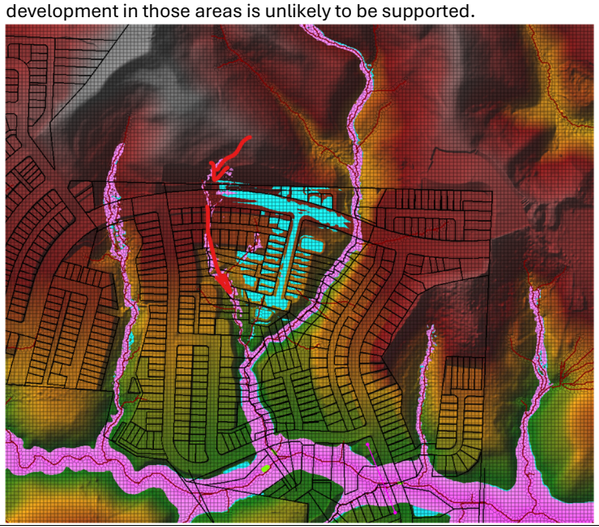
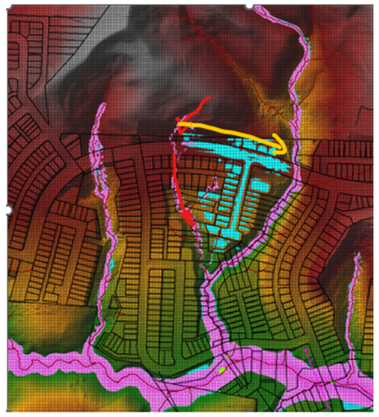
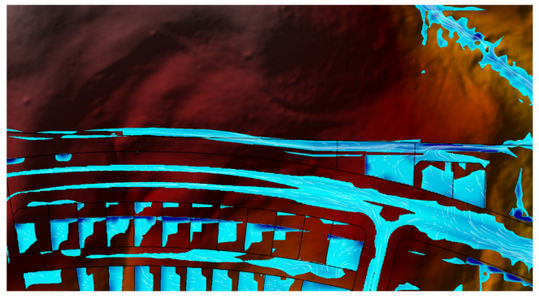
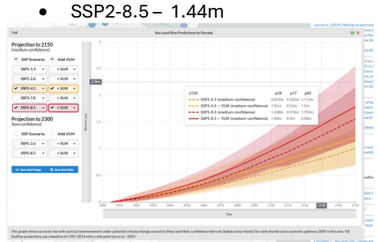
Request No.	Category of information request		Reason for request	Applicant Response (02 July 2025)	Model Update (21 July 2025)
Flooding					
FR-01	Flood Risk	• There are noticeable increase of flood depth and extent at some downstream and upstream properties. The most significant effect will be increased flooding at the trafficable lanes and northbound off ramp at SH1. The post development peak depth at the upstream side of SH1 is predicted to reach more than 10m with an increase of 0.31m. This is due to the limited capacity of the 2.05m ID culvert. Please consider options to improve the culvert capacity. • The increased flood depth at the upstream property at 180 Upper Orewa Road is counter-intuitive, it is mostly likely a model data issue unless it is specifically designed to provide flood attenuation at this location. Please clarify.  •	Adverse effects on downstream properties	- - The increased depth at the northbound lane is due to a localized inflow being applied at that location. This should not differ between pre- and post-development. The updated model will correct this anomaly. - Regarding the culvert, the design has been developed through an iterative modelling process to balance upstream storage and ensure post-development conditions match pre-development flood levels. In the latest version, the redesigned Culvert 11 achieves this balance, and the model now shows no increase in flood level at 180 Upper Orewa Road. - The revised model indicates that, under the 1% AEP event with a 3.8°C climate change uplift, there is approximately 10 m of freeboard at the upstream side of Culvert 11, with no overtopping observed. Increasing the culvert capacity beyond this point would result in higher downstream discharges and potentially adverse effects on downstream properties. - Accordingly, we do not support increasing the culvert capacity, as the current design achieves the required performance without introducing additional downstream impacts. 	- The Trafficable lane difference has been updated as part of the updated model. There is no change in flood depth in this area due to the development, as shown on plan 3725-0-4502. - The post development peak depth at the upstream side of SH1 is now less than the pre development peak, by approximately 211mm for the 1% AEP 3.8 degree CC scenario. This is primarily due to Culverts 8, 9 & 10 amendments, which have been reduced to provide some upstream storage. The storage is contained fully within the Delmore development land, with no effects of this storage on properties upstream. - The 2-, 5- and 10-year storm shown an increase around the motorway culvert, however the increases are well contained within the channel bathymetry and the model does not show any impact on any habitable areas. - At 180 Upper Orewa Rd, the flood depth has been reduced by amending the height of Culvert 11. This reduces the backwater effects on the property on 180 Upper Orewa Road. There is now no increase in water level at this property boundary. Refer to drawing 3725-0-4502 which shows a decrease of 141mm at this location. This reduction from the pre development level, is due to the removal of backwater effect from existing culvert by replacing with a larger culvert in a very similar location.

FR02	Flood Risk	An area of the proposed development on the northern side is predicted to be extensively flooded in shallow depth possibly due to inadequate provision of overland flow path. Please check. CM comment - Any portion of the development footprint intersecting the floodplain must be designed to safely accommodate and proposed habitable floor levels development must be outside any floodplain. Where flood hazards cannot be mitigated through appropriate design development in those areas is unlikely to be supported. 	Post Development flood risk	This is attributed to an anomaly in the design DEM. The proposal includes diversion of upstream flow to the eastern stream. The updated model will demonstrate this diversion. 	The DEM has been corrected and a channel has been applied along the northern boundary inside the development, to divert the minor overland flow to the east. A rain on grid model based on the 1% AEP including 3.38 degree climate change, has been prepared and shows no overtopping of the upstream flow into the development. Refer to below image of the rain on grid model showing the channel along the boundary. Note this will be refined during detailed design phase. 
FR 03	Flood Risk	A normal depth water level boundary is adopted in the HEC-RAS model with a hydraulic gradient of 0.02 or 2% assumed for the receiving estuary channel. A constant tidal level boundary which takes into account of Sea Level Rise (SLR) and Vertical Land Movement (VLM) is considered more appropriate. The SLR scenario should be as per the Coastal Hazards and Climate Change Guideline (July 2024, MfE) for up to year 2130.	Tidal level can have an impact on flood levels.	The model has applied an initial tide level condition of 3.1mRL which comprises of a mean high water springs (2.1m) plus 1m in sea level rise. The MHWS level was obtained from Council RFHA Model Build with values ranging from (1.11mRL – 2.0mRL – NZVD2016) The SLR with an allowance for VLM based on the 50th Percentile is as follows • SSP2-4.5 – 1.01m • SSP2-8.5 – 1.44m  Assuming the worst-case scenario, this brings the total tide level to 3.54mRL	Per the comment provided on 2 July, a constant tidal level boundary of 3.54mRL has been applied. Refer to 2 July comment for details.

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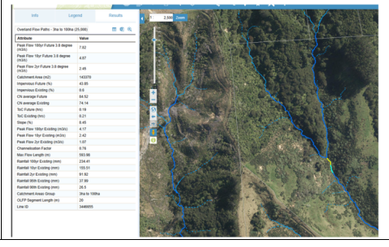
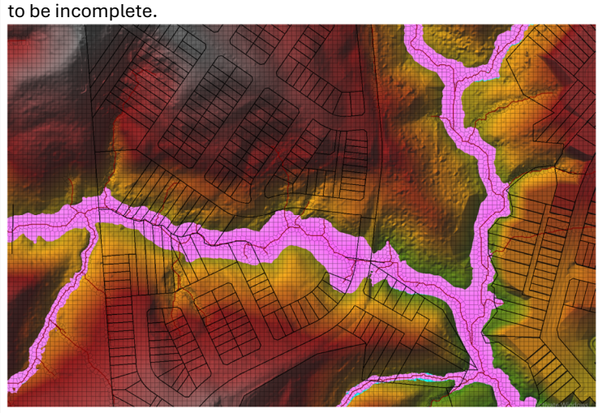
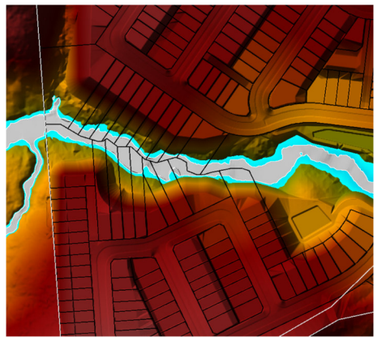
				We believe given the invert measured at the motorway is at RL 6.3, the tidal level is well below the invert level, the backwater effect outlet of the culvert at this area will be negligible. The model is currently being updated with downstream condition applied as a stage hydrograph representing the tidal condition.	
FR 04	Model Review	The inflows from subcatchments have been modelled using HEC-HMS for both the existing and post development scenarios. For the post development scenario, the urbanised subcatchment should be modelled as Heterogeneous Catchment as per TP108 with the pervious and the drained impervious areas modelled separately with separate time of concentrations.	Modelling pervious and impervious area separately can impact peak flows	The HEC-HMS model was re-run using heterogeneous catchment methodology. While most subcatchments showed reduced peak flows, minor increases occurred in three. The original model applied conservative flows. The hydraulic model will be updated accordingly. Refer to Attachment A for a comparison of flows and time of concentration values, Between the submitted model and the updated model based on the Heterogeneous method.	All development catchment has been updated using Heterogeneous method.
FR 05	Model Review	The existing development at CMT PD 19 and CMT PD 1, including added impervious area and terrain changes due to earthwork should be take into account for hydrological and hydraulic modelling for this development. The ultimate zoning or land uses in the overall catchment area for the future 50yr beyond the development sites should be taken into account for hydrological modelling, to ensure the flood risk is not under - estimated for the life of the development. CM - Please also confirm whether the land use assumptions reflect Council's preferred growth strategy and align with the 50-year adaptive planning horizon	Change of roughness value can impact flood depth	- The pre-development model is being updated to reflect existing earthworks, based on EPA plans of the neighbouring development. - The model includes maximum probable development based on Unitary Plan zoning and the Delmore Masterplan.	Land Cover file has been updated. Please refer to drawing 4516 and 4515. A scenario based on combination of Delmore development and future FUZ has been analysed to ensure culverts and floor level within the development complies. This is scenario 5 and the drawing number for this scenario is 4505.
FR 06	Model Review	A runoff curve number of 75.7 is used for existing catchment. The land cover type, e.g. forest land and presence of good top soil should be taken into account when determining the pre-development runoff curve numbers.	Excessive flood depths at some nodes can distort the model results.	Curve Numbers were determined based on the Geotech report assessment and are consistent with values adopted in Council's RFHA modelling (GeoMaps). The CN is considered appropriate for the site conditions. 	Curve Number the same as initial model.

FR 07	Model Review	The land cover data for the proposed development scenario does not cover the new development to the west of SH1 and south of Grand Drive. Please check. 		The lumped inflow does not traverse this area as it is applied directly to the stream west of the Ara Hills development. Changing the land cover in this area will not alter the results of the lumped hydraulic model. This will be amended for the Rain on Grid model requested.	Land Cover has been updated to account for Ara Hills development. Refer to drawing 4515 and 4516. This inclusion ensures cumulative effects of adjacent developments are represented in runoff and storage calculations
FR 08	Model Review	The subcatchment sizes are fairly large ranging from under 10 hectares to over 40 hectares. The flood flow from these subcatchments are loaded into the streams directly. The flood risk associated with overland flow paths within the subcatchments have not been modelled. It is recommended a post development scenario with rain on grid approach should be run to understand the overland flow flood risk with the proposed development terrain.	Need to understand flood risk along future overland flow paths.	Rain on Grid model will be provided as part of a sensitivity check.	Rain on grid model has been prepared for Pre- and Post-development scenario for the 1% AEP event, the overall results are similar with the lumped model. These are shown on plans 3725-0-4518 and 3725-0-4519.
FR 09	Model Review	The design terrain for the portion of development at the western appears to be incomplete. 	Future design terrain should be used in the model.	The latest tin surface has included this area, this will be part of the updated hydraulic model. 	Model has included the development on this area. This ensures terrain continuity and accurate representation of runoff patterns in western areas

SUMMARY OF HYDRAULIC MODEL CHANGES

No.	CHANGES	DETAILED DESCRIPTION
1	CATCHMENT AREA	CATCHMENT AREA HAS BEEN BROKEN DOWN FURTHER WITHIN THE DELMORE AREA TO ACCURATELY CAPTURE THE INCREASE BETWEEN PRE- AND POST- DEVELOPMENT. THE CATCHMENT PLAN ON DRAWIN 4500 DETAILED THE IMPERVIOUS COVER BETWEEN PRE-, POST- AND FUZ-DEVELOPMENT SCENARIO
2.	LAND COVER FILE	THE LAND COVER FILE HAS BEEN UPDATED TO BE CONSISTENT WITH PRE- DEVELOPMENT FOR THE UNAFFECTED AREA AND APPROPRIATE FOR THE DEVELOPMENT AREA
3.	RAIN ON GRID MODEL	ADDED RAIN ON GRID MODEL BASED ON THE 1% AEP SCENARIO. THIS IS ON DRAWING 4518 AND 4519
4.	DOWNSTREAM BOUNDARY CONDITIONS	THE DOWNSTREAM BOUNDARY CONDITIONS HAS ALLOWED FOR SEA LEVEL RISE AND VERTICAL LAND MOVEMENT. A CONSTANT LEVEL OF 3.5mRL HAS BEEN ADOPTED.
5.	CULVERT SIZE	CULVERT 8, 9 & 10 HAS BEEN REDUCED IN SIZE TO PROVIDE FOR UPSTREAM STORAGE TO REDUCE FLOOD LEVEL DURING THE 1% AEP STORM ADJACENT TO THE MOTORWAY.
6.	LUMPED MODEL HYDROLOGY	THE LUMPED MODEL HYDROLOGY CALCULATIONS HAS BEEN UPDATED TO USING HETEROGENEOUS MODEL BETWEEN PERVIOUS AND IMPERVIOUS IN ACCORDANCE WITH TP108
7.	SAMPLE AREA	PREVIOUS SAMPLE AREA OF LOCATION A-F HAS BEEN UPDATED TO COVER MORE INTENSIVE AREA. REFER TO FLOOD DRAWINGS FOR THE DEPTH, WATER ELEVEATION, VELOCITY AND DIFFERENCE BETWEEN PRE- AND POST- SCENARIO. THESE LOCATIONS ARE STILL RECORDED ON THE FLOOD REPORT WITH THE LATEST DATA ON TABLE 11, HIGHLIGHTED IN RED. THE DIFFERENCE BETWEEN PRE- AND POST- WATER LEVEL ARE SHOWN ON TABLE 12.