Memorandum

31 January 2019

To	[redacted]
Copy to	[redacted]
From	[redacted]
Subject	Wolverton Street Culverts - Design Flow Assessment [redacted]

Background

A Wolverton Culverts Hydraulic Peer Review meeting was held at Auckland Transport offices on Wednesday 23rd January 2019. The current design methodology for the two Wolverton Street Culvert Upgrade Projects was discussed at this meeting, with particular emphasis on the peer review findings undertaken by GHD. These findings are outlined in the January 2019 GHD report titled "Wolverton Culverts 1 and 2 - Peer Review of Design Flows".

At this meeting it was confirmed that the current design flows are based on the Auckland Council Unitary Plan zonings which retain the existing Maungakiekie and Titirangi Golf Courses land uses. Given the critical nature of both Wolverton Street culvert sites it was agreed that the possibility of these large greenfield areas being converted into residential housing should also be considered as part of the design flow assessment. This memo updates the culvert design flows taking into account this possibility.

Design Flow Assessment

Design flows at both Wolverton Culvert sites have previously been calculated by Auckland Council (refer to memo dated 23rd November 2018) using the following three methods:

1. TP108 hand calculations incorporating Unitary Plan land zoning and Climate Change rainfall
2. Rapid Flood Hazard Mapping (RFHM) model incorporating a 70% uniform imperviousness and peak TP108 rainfall (adjusted for Climate Change)
3. Detailed catchment framework model (ICM) incorporating Unitary Plan land zoning, 24 hour TP108 rainfall profile (adjusted for Climate Change), 10 percentile MHWS tidal level plus 1.0 metre sea level rise and upstream constraining culverts removed.

In addition to this work, TP108 hand calculations have also been calculated by GHD for the Unitary Plan land zoning plus the residential infilling of the Maungakiekie and Titirangi Golf Courses. For these calculations the following assumptions were made:

- The entire 41.69 hectare site of the Maungakiekie Golf Course site is converted to housing with an assumed average 70% impervious surface coverage
- 80% of the 61.29 hectare site of the Titirangi Golf Course site is converted to housing with an assumed average 70% impervious surface coverage (the remaining 20% of the site is currently covered in native bush which is unlikely to be developed).

The results of these various calculation methods are summarised in Table 1 and 2 respectively for Wolverton Culvert Sites No. 1 and No. 2.

Table 1: Design Peak Flows – Wolverton Culvert Site No. 1

ARI Storm Event	Peak Design Flow (m^3/s)				
	TP108 Calculations		RFHM Model	Detailed Framework Model	Supplied to AT (23/11/18)
	Unitary Plan	Unitary Plan + GC Dev			
Catchment Imperviousness	**61%**	**66%**	**70%**	**61%**	**-**
10 Year + CC	54	56	-	57	57
50 Year + CC	77	79	-	79	79
100 Year + CC	86	88	87	89	89

Table 2: Design Peak Flows – Wolverton Culvert Site No. 2

ARI Storm Event	Peak Design Flow (m^3/s)				
	TP108 Calculations		RFHM Model	Detailed Framework Model	Supplied to AT (23/11/18)
	Unitary Plan	Unitary Plan + GC Dev			
Catchment Imperviousness	**57%**	**63%**	**70%**	**57%**	**-**
10 Year + CC	48	50	-	44	48
50 Year + CC	70	72	-	61	68
100 Year + CC	78	80	75	68	75

As discussed at the 23rd January 2019 meeting, the critical design storm is the 2500 year ARI storm event, with the 10 to 100 year ARI flows primarily being used to allow extrapolation of these higher flows. The design flows supplied to AT are still considered acceptable for culvert design for Auckland Council's flood protection Level of Service for upstream property floor levels. However, a sensitivity check should be undertaken to assess the impact of possible future residential infill development within the Maungakiekie and Titirangi Golf Courses.

Time constraints prevent rerunning the detailed framework model for this alternative development scenario. Instead, the impact of infill development within the golf course sites can roughly be assessed by increasing the supplied design flows by the same factor (2 m^3/s) as derived in the TP108 hand calculations. Based on this, the recommended peak flows to be applied for a sensitivity check of possible golf course infill development are summarised in Table 3 for the Wolverton Culvert Sites No. 1 and No. 2.

Table 3: Recommended Peak Flows to be Adopted for a Sensitivity Check

ARI Storm Event	Sensitivity Check Peak Flow (m^3/s)	
	Wolverton Culvert Site No. 1	Wolverton Culvert Site No. 2
10 Year + CC	59	50
50 Year + CC	81	70
100 Year + CC	91	77

Regards

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