

General Manager
City of Parramatta Council
126 Church Street,
PARRAMATTA NSW 2124

January 15, 2018

RE: 21 TUCKS ROAD, TOONGABBIE

To whom it may concern,

I refer to Council's letter recommending the applicant to undertake a current flood study at the subject site to accurately determine flood planning levels for the proposed development proposal. Mance Arraj Engineers have been engaged by the applicant to conduct a 2D flood study as supplementary information for the planning proposal; this letter contains a brief summary of the calculation and considerations of the flood study.

A detailed survey of the sites surrounding roads was prepared by SDG surveyors and was the basis of the 2D terrain model. *(See attached)*

A catchment plan was prepared using Council's drainage maps and LiDAR data. *(See attached)* Council's drainage infrastructure was visually inspected on site. All pipes sizes and locations were found to be consistent with Council's drainage maps with the exception of the following 675mm pipe, which was not evident at the intersection between Fitzwilliam Road and Tucks Roads.

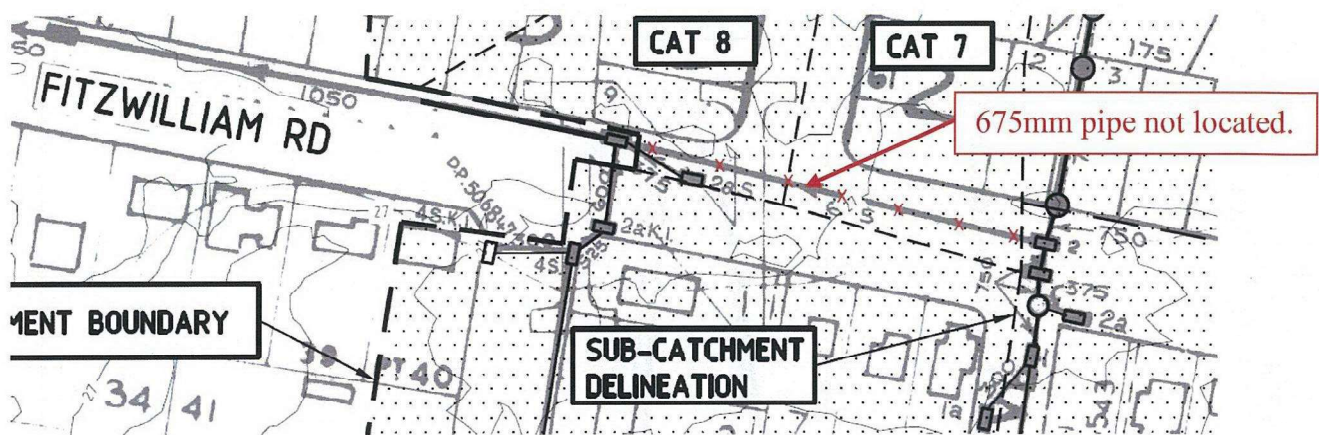
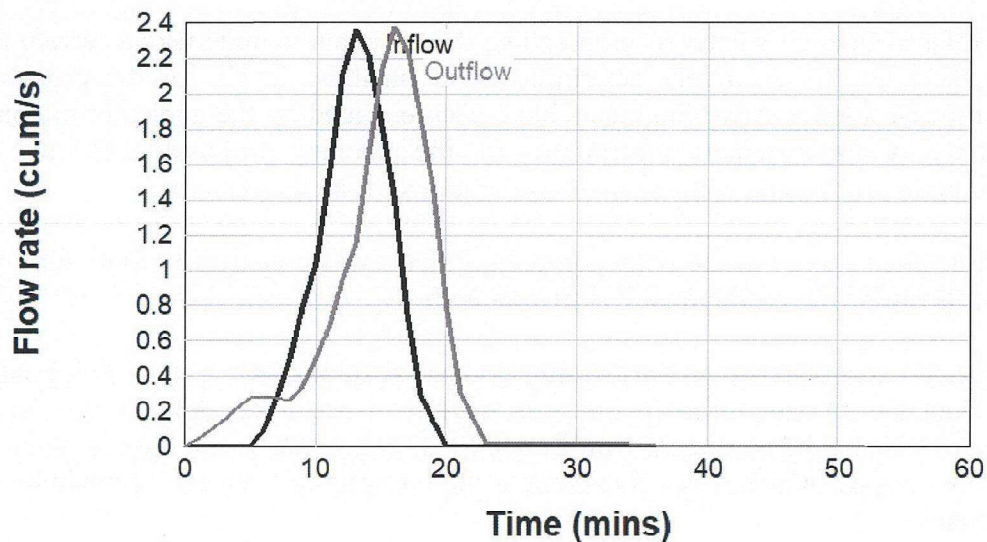
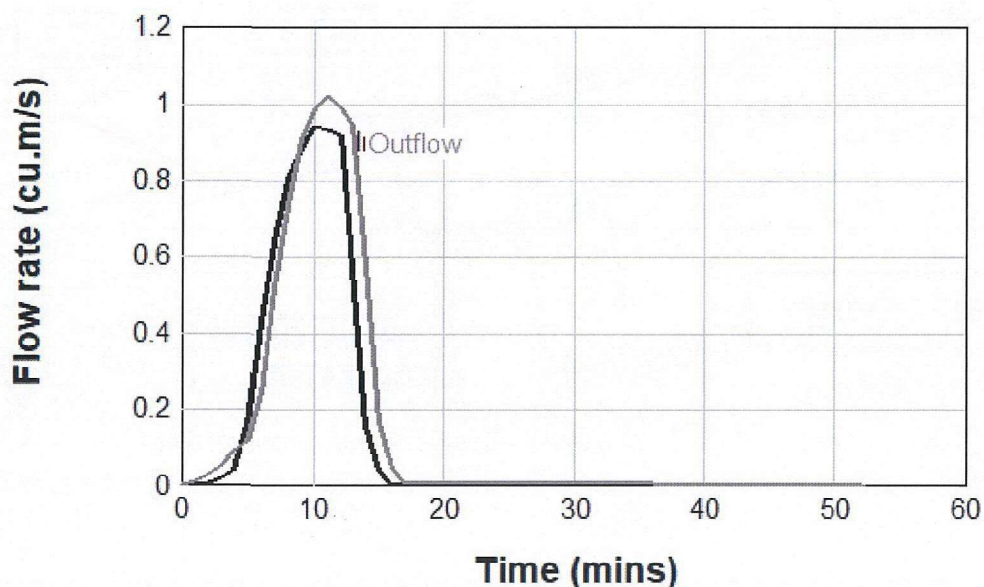


Figure 1 – Non-evident drainage line

From the attached catchment plan, a DRAINS model (utilising an ILSAX Hydrological model for urban development) was then created to simulate the Council's drainage capacities in a 1% AEP storm event and the resulting overland flows. At the subject site, stormwater flows are conveyed via a 600mm diameter pipe in Tucks Road and a 1050mm diameter pipe in Rausch Street. These drainage pipes were modelled with a consideration for blockage by restricting their capacity by 50% to account for a flooding scenario where these pipes may be partially blocked by silt and debris. The model produced the following peak overland flow hydrographs for Tucks Road and Rausch Street.



Graph 1 - Peak Overland Flow Rates for Tucks Road



Graph 2 - Peak Overland Flow Rates for Rausch Street

A two-dimensional model was created using HEC-RAS Version 5.0.3 software and a hydraulic analysis of the sites terrain using the above mentioned flow rates computed the following results:

- Flood Levels



- Flood Depths



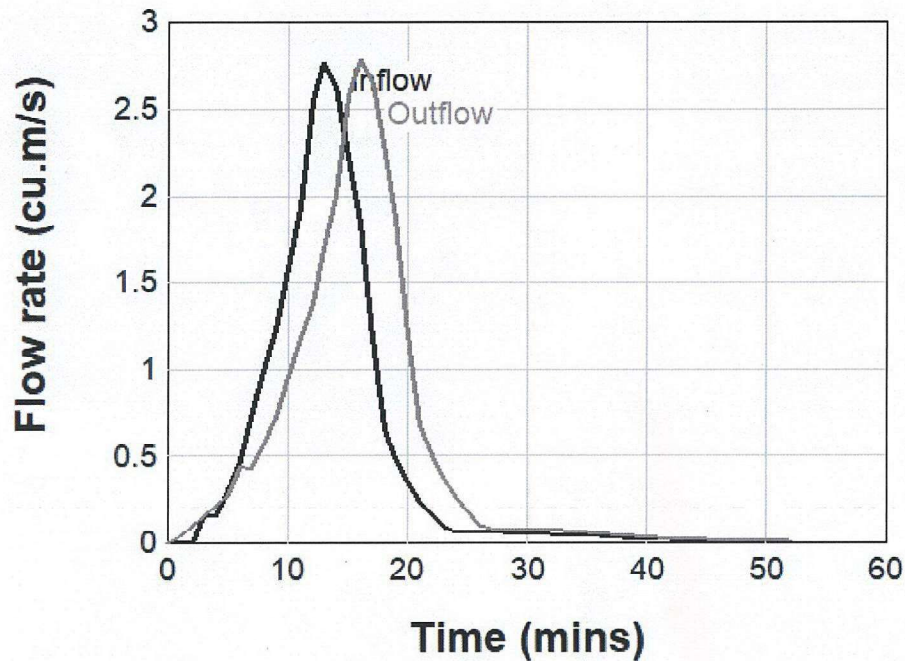
- Flood Velocities



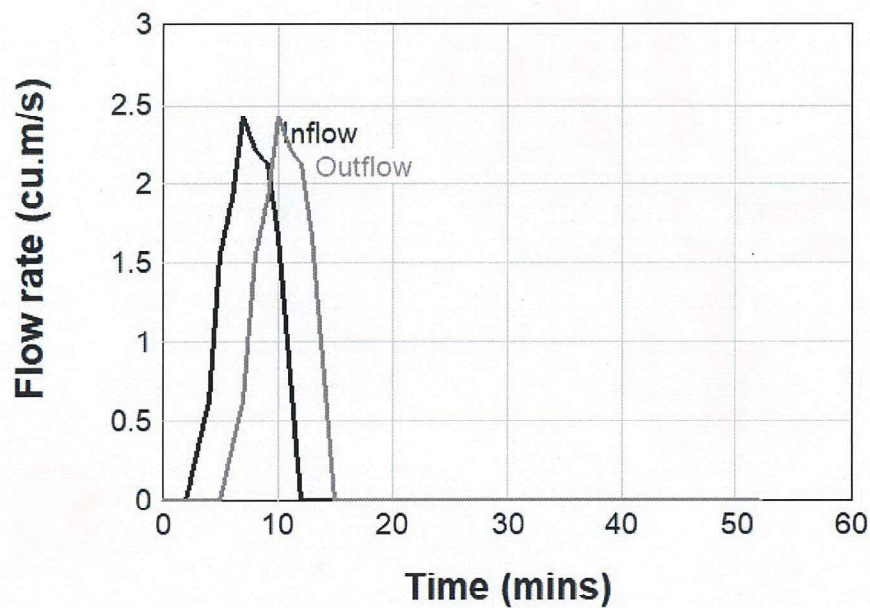
- Flood Hazard (VxD product)



Council has requested that flood scenario of full pipe blockage be modelled as a sensitivity test. As such the following flow rates was determined:



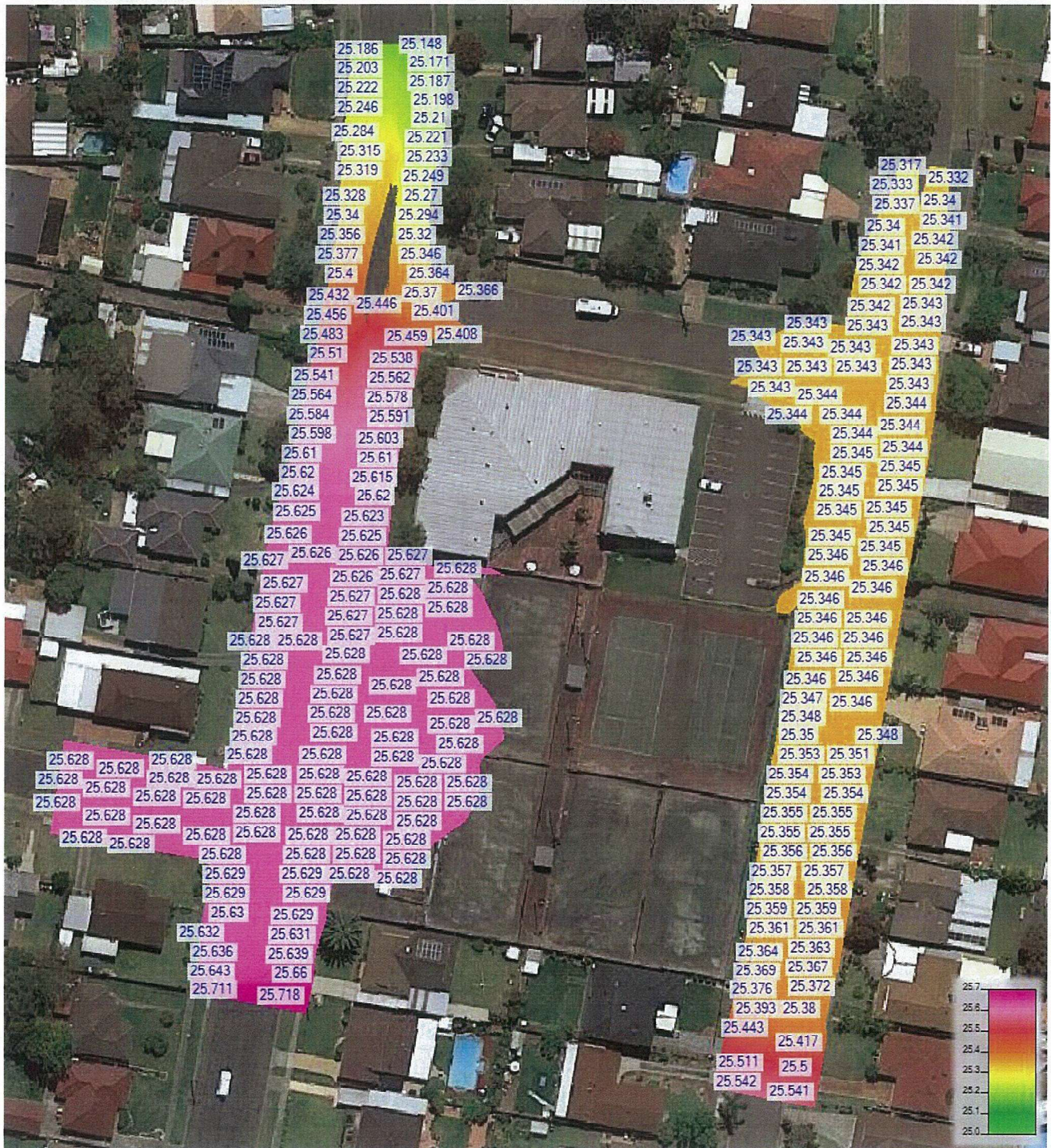
Graph 3 - Peak Overland Flow Rates for Tucks Road



Graph 4 - Peak Overland Flow Rates for Rausch Street

The following results have been computed from a full pipe blockage scenario:

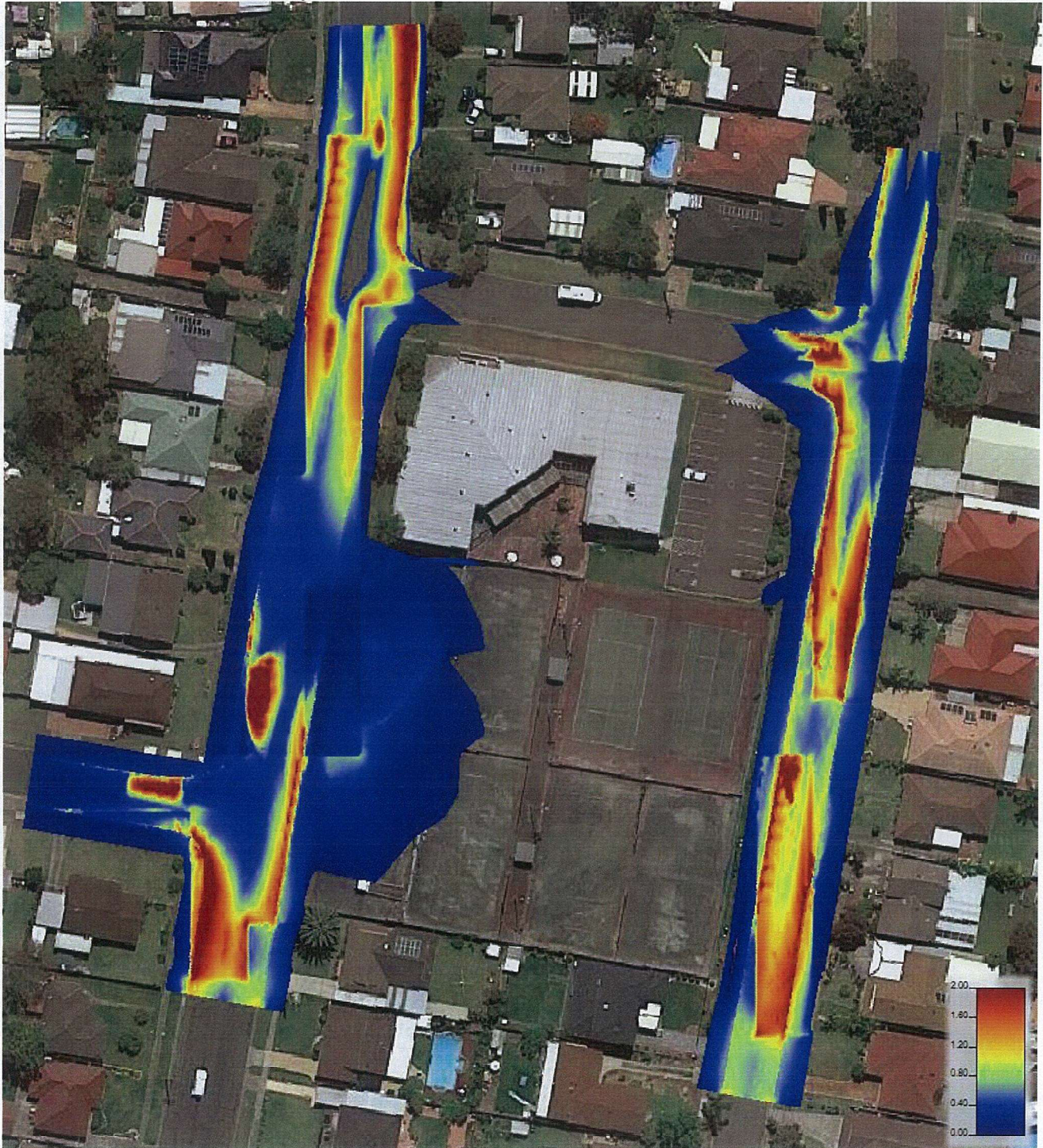
- Flood Levels



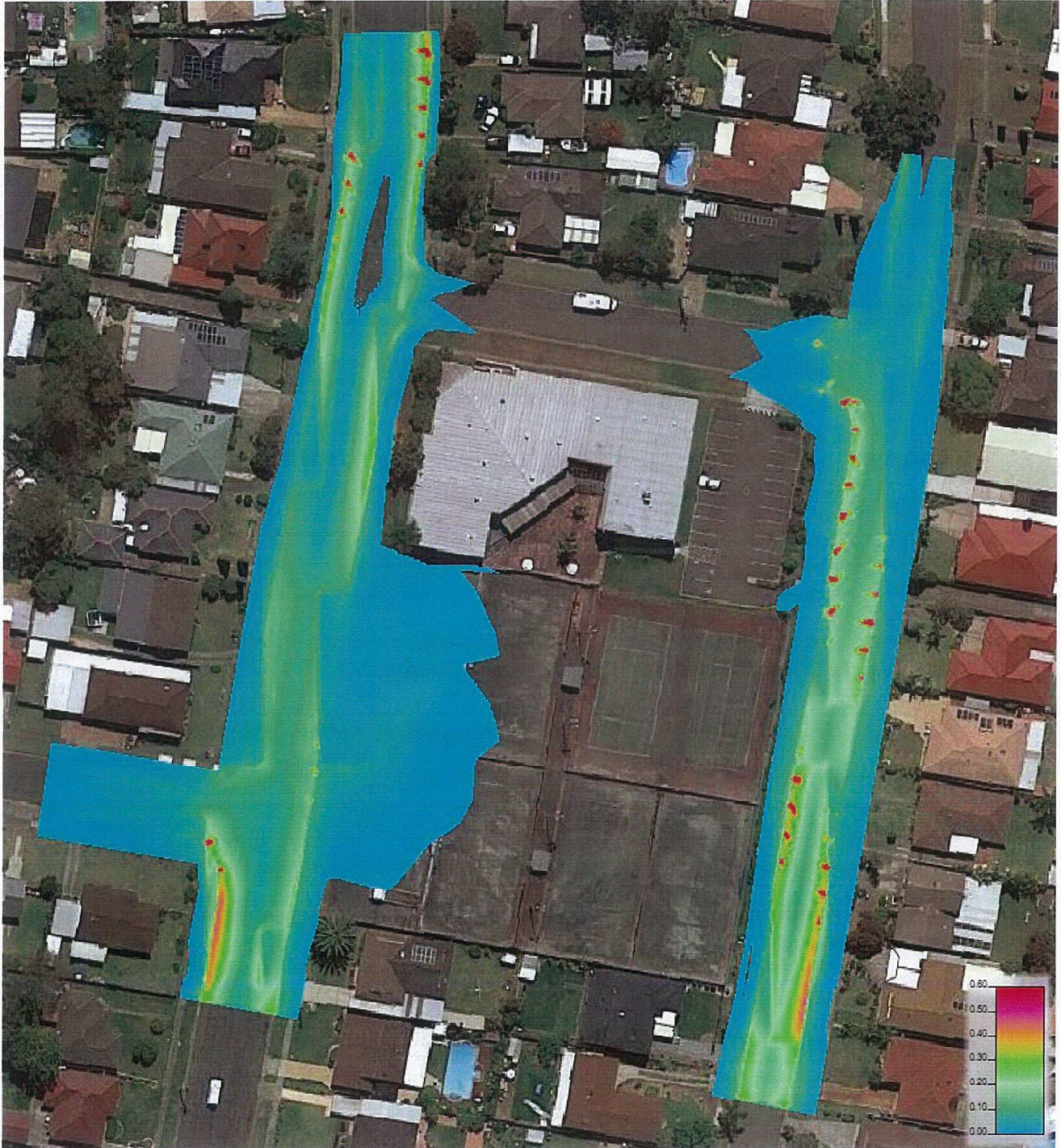
- Flood Depths



- Flood Velocity



- Flood VxD Product





The results of the 2D flood study shows that the site is subjected to localised overland flows from both Tucks Road and Rausch Street with top water levels of RL.25.58 and RL.25.235 respectively.

In accordance with the city of Parramatta Council's flood matrix requirements, the proposed development shall provide a minimum of 500mm freeboard to the flood level. Therefore, a flood planning level of RL.26.18 shall be adopted for the proposal.

The development proposes the entry to basement carpark from Rausch Street, thus it is necessary to protect the basement from inundation. Flood waters in Rausch Street are static and rise to RL.25.235 before eventually overtopping a high point in Rausch Street. Therefore, it is recommended that provisions for flood gates or a driveway crest at RL.25.835 be incorporated into the schematics of the proposed development.

In comparison to Council's issued flood levels (*see attached*) we note the following differences in flood levels, when **50% pipe blockage** is taken into consideration:

Chainage	Flood Levels (metres AHD) – 1% AEP		
	Council Issued	2D HEC-RAS Model	+/- Difference
169	25.65	25.581	-0.069
602	25.40	25.235	-0.165
62	25.40	25.235	-0.165

In comparison to Council's issued flood levels (*see attached*) we note the following differences in flood levels, when **full pipe blockage** is taken into consideration:

Chainage	Flood Levels (metres AHD) – 1% AEP		
	Council Issued	2D HEC-RAS Model	+/- Difference
169	25.65	25.628	-0.022
602	25.40	25.346	-0.054
62	25.40	25.343	-0.057

We trust this explains our position regarding this matter. If you have any queries, please do not hesitate to contact me on 8897 8800.

Sincerely Yours,

A handwritten signature in black ink, appearing to read 'Steve Arraj', is written over a horizontal line.

Steve Arraj
Director – Civil Engineering