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Van der Meer Consulting
Level 6 39 Chandos Street
ST LEONARDS NSW 2065

 GRC Hydro
Level 9, 233 Castlereagh Street
Sydney NSW 2000
Tel: +61 413 631 447
www.grchydro.com.au

Dear Rod,

Re: 1 Sirius Road, Lane Cove West - Flood Report

INTRODUCTION

GRC Hydro Pty Ltd has been engaged by Van der Meer Consulting Pty Ltd to carry out a flood study for 1 Sirius Road, Lane Cove West. Figure 1 presents the location of the subject site which is situated west of Sirius Road, south of Epping Road and north-west of Apollo Place.

The report addresses flood issues for this property via the following:

- Analysis of previous flood information; and
- Hydrologic and hydraulic analysis.

SITE DESCRIPTION

The subject site is situated at the downstream end of the Stringybark Creek. The local catchment of the subject site has an area of 264 hectares which flows to the Lane Cove River. The subject site is immediately adjacent to the confluence of Lane Cove River and Stringybark Creek. A catchment map for the subject site is shown in Figure 2.

PREVIOUS STUDIES

Swaines Creek Flood Study (Lyll& Associates, 2014)

Lyll & Associates consulting undertook a flood study for Swaines Creek which is located at the upstream end of the Lane Cove River. The study was undertaken on behalf of Willoughby City Council and used a TUFLOW model to calculate the 1% peak flood level and Probable Maximum Flood (PMF). They have extended their model to a location 2.2 km downstream of the Epping Road bridge which is approximately 800 meters upstream of the subject site. The designed water surface profile for 20 Year ARI, 100 Year ARI and PMF at the Lane Cove River adjacent to the subject site were determined to be 1.38 m AHD, 2.35 m AHD and 4.3 m AHD respectively. They used 0.04 as the surface roughness parameter known as "Manning's n" for Lane Cove River. Also, they adopted a constant value of 2.5 mm/hr for continuing losses, and they undertook sensitivity analyses for the value of initial losses during their hydraulic model tuning process, as a result, they used 10mm as their initial losses.

The Lyll study has been used to inform model parameters and tailwater levels used in modelling work reported upon herein.

PROJECT SCOPE

The following work scope has been executed:

- Collection and review of previous studies;
- Construction of WBNM and TUFLOW models;
- Reporting inclusive of work undertaken, models, results and recommendations.

HYDROLOGIC MODELLING

A WBNM model was developed in order to generate catchment flows from applied rainfall. Resultant flows were then applied to the Site TUFLOW model.

The following information was used in this model:

- Percentage impervious (0% - 90%) for each catchment based on available aerial photography;
- Bureau of Meteorology 1987 rainfall intensities;
- Initial losses: 10mm (Lyll& Associates, 2014);
- Continuing losses: 2.5 mm/hr (Lyll& Associates, 2014).

The WBNM model was run for a range of durations as per the ARR87 and PMF methodologies. Critical duration for Stringybark Creek analysis was undertaken in the WBNM model to determine the storm duration responsible for 1% AEP and PMF events peak flood levels in the catchment. The results of the critical durations were 2 hours for 1% AEP (assume same for 0.5% AEP event) and 1 hour for PMF.

TUFLOW MODELLING

TUFLOW is a 2D numerical modelling package. This software is widely used and is considered best practice under the NSW Floodplain Risk Management Program. It is used to route applied flow in order to achieve flood levels, depths, extent, velocities and hazard.

The hydraulic modelling system is comprised of the following elements:

- LiDAR data has been used to inform a 2 m finite difference grid. This data has a typical accuracy of ± 0.15 m (1st confidence interval);
- No pipes have been included and instead flow is routed to Stringybark Creek in the hydrologic model. This makes for an appropriately conservative approach as it minimises any in catchment attenuation which may reduce resultant peak flow;
- The kerb/gutter and road crests are hydraulic features that have a significant impact on flood behaviour. As such these features have been represented in the model as break lines with invert heights determined by analysis of the LiDAR;
- Buildings can block flood waters natural flow path and therefore significantly impact flood behaviour. As such, buildings in the vicinity of the subject site were blocked out of the TUFLOW model;
- Manning's roughness values were applied as follows
 - Road - 0.02;
 - Vegetated Area - 0.08;
 - Lane Cove River - 0.04;
 - Commercial Core - 0.04; and
 - Residential - 0.055.

- Fixed inflow and tailwater for different events were adopted at the catchment's upstream and downstream boundary of Lane Cove River.

MODEL RESULTS

The flood levels at the four reported points are shown in Table 1.

Table 1 Flood Levels in Critical Durations for Each Event

	Point 1 Flood Level (m AHD)	Point 2 Flood Level (m AHD)	Point 3 Flood Level (m AHD)	Point 4 Flood Level (m AHD)
1% AEP	2.6	2.5	2.5	2.4
0.5% AEP	2.7	2.5	2.5	2.4
PMF	5.6	5.5	5.4	5.2

Results for the events run (1%, 0.5 AEP and PMF) are presented in Figures 3, 4 and 5.

These results indicate that:

- Flood levels in the relevant reach of Stringybark Creek pertain more to the Lane Cover River water level than they do the flow generated by the catchment; and
- To be flood free buildings would be set at a level no higher than ~ 5.4 mAHD.

TAILWATER SENSITIVITY

The 1% AEP peak flood levels at four critical points have been obtained from the TUFLOW model results, shown in the table below. These result further reinforce the idea that in the reach of Stringybark Creek adjacent to the Site, flood levels are largely determined by Lane Cove River levels, not by the flow magnitude in Stringybark Creek.

Table 2: Sensitivity Study of the Tailwater Level in the Lane Cove River

	Point 1 Flood Level for 1% AEP (m AHD)	Point 2 Flood Level for 1% AEP (m AHD)	Point 3 Flood Level for 1% AEP (m AHD)	Point 4 Flood Level for 1% AEP (m AHD)
Tailwater Level for 20 year ARI event (1.38 m AHD)	2.1	1.8	1.8	1.4
Tailwater Level for 100 year ARI event (2.35 m AHD)	2.5	2.4	2.4	2.4
Tailwater Level for PMF event (4.3 m AHD)	5.0	5.1	5.0	4.8

CONCLUSIONS / RECOMMENDATIONS

An assessment has been undertaken to assess the flood liability of 1 Sirius Road Lane Cove West to Stringybark Creek flooding. The assessment has included the following scope of work:

- Built hydrologic and hydraulic models;
- Utilised model parameters from adjacent flood studies carried out for Council; and
- Incorporated highly conservative Lane Cove River tail water levels.

Based on this work it is apparent that the following mainstream flood levels apply to the Site (or surrounds);

- 1% AEP – 2.5 mAHD;
- 0.5% AEP – 2.5 mAHD;
- PMF – 5.4 mAHD.

As the lowest proposed building level is 6.5 mAHD it is reasonable to suggest that the development is unaffected by flooding. Please note however that intra-lot stormwater will need to be dealt with.

Yours Sincerely



Steve Gray
Director

FIGURES

FIGURE 1
LANE COVE WEST DEVELOPMENT
SUBJECT SITE LOCATION



FIGURE 2
LANE COVE WEST DEVELOPMENT
BASE CASE
CATCHMENTS

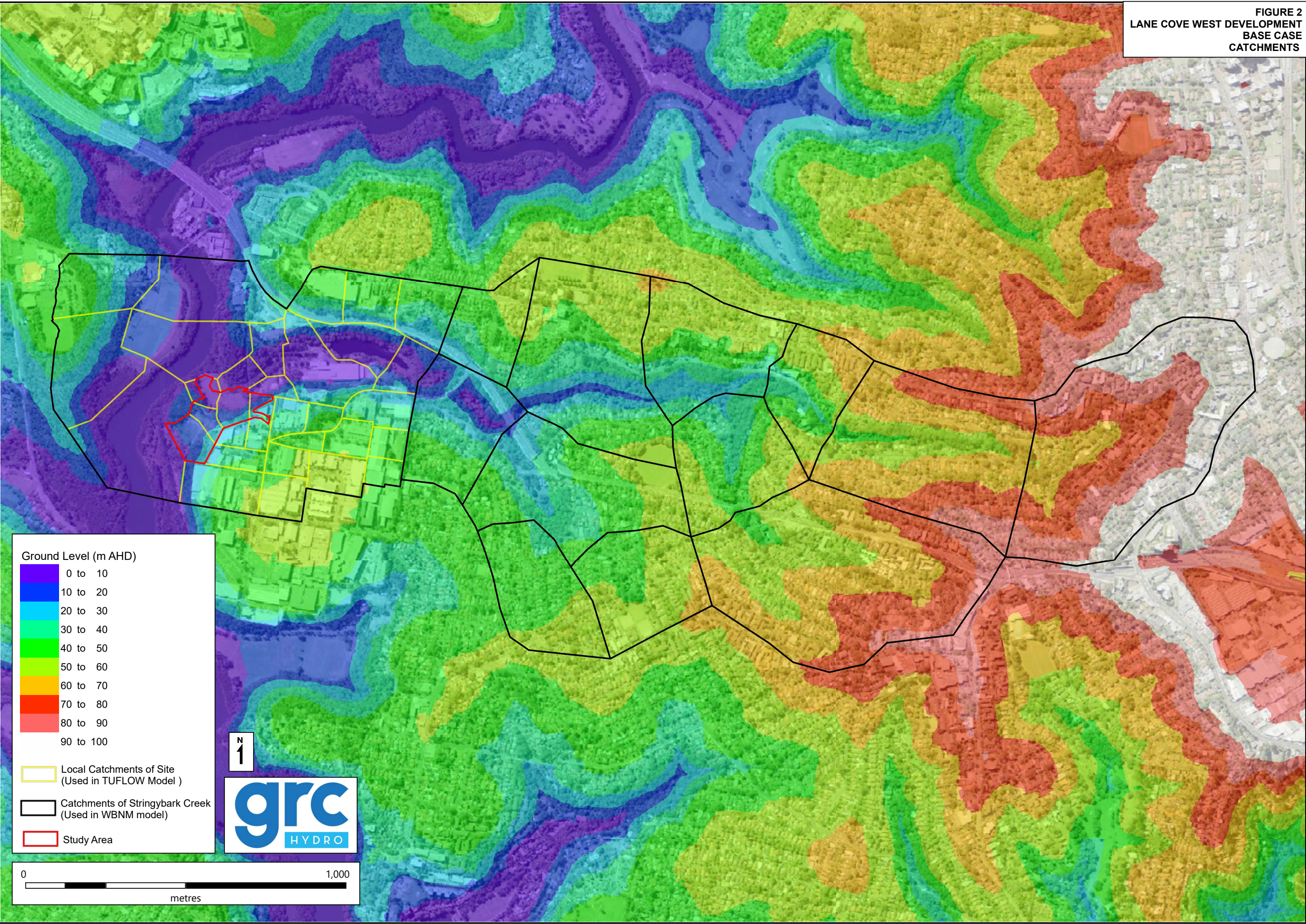
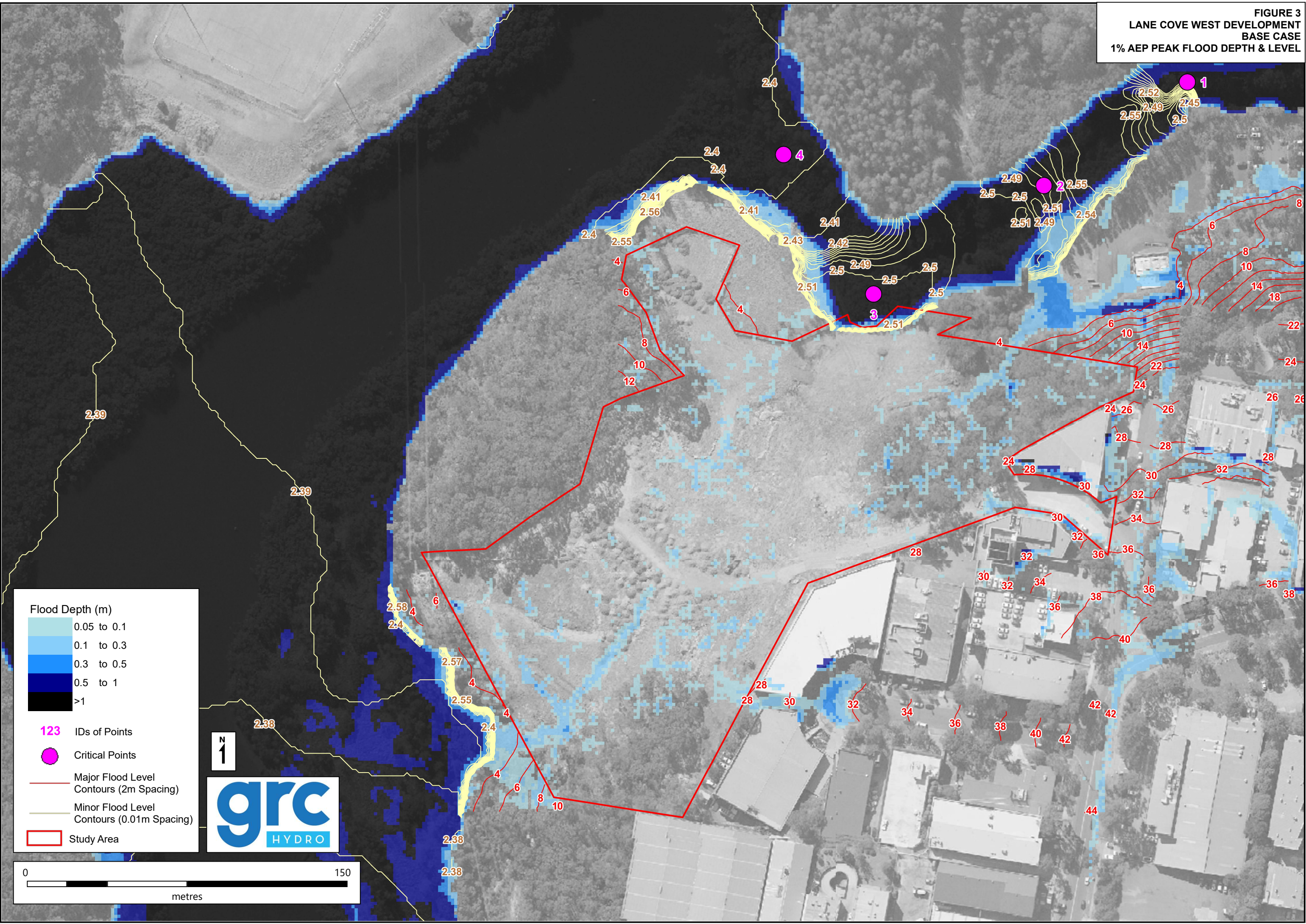


FIGURE 3
LANE COVE WEST DEVELOPMENT
BASE CASE
1% AEP PEAK FLOOD DEPTH & LEVEL



Flood Depth (m)

0.05 to 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
>1

123 IDs of Points

Critical Points

Major Flood Level Contours (2m Spacing)

Minor Flood Level Contours (0.01m Spacing)

Study Area

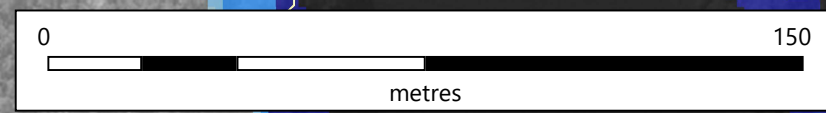


FIGURE 4
LANE COVE WEST DEVELOPMENT
BASE CASE
0.5% AEP PEAK FLOOD DEPTH & LEVEL

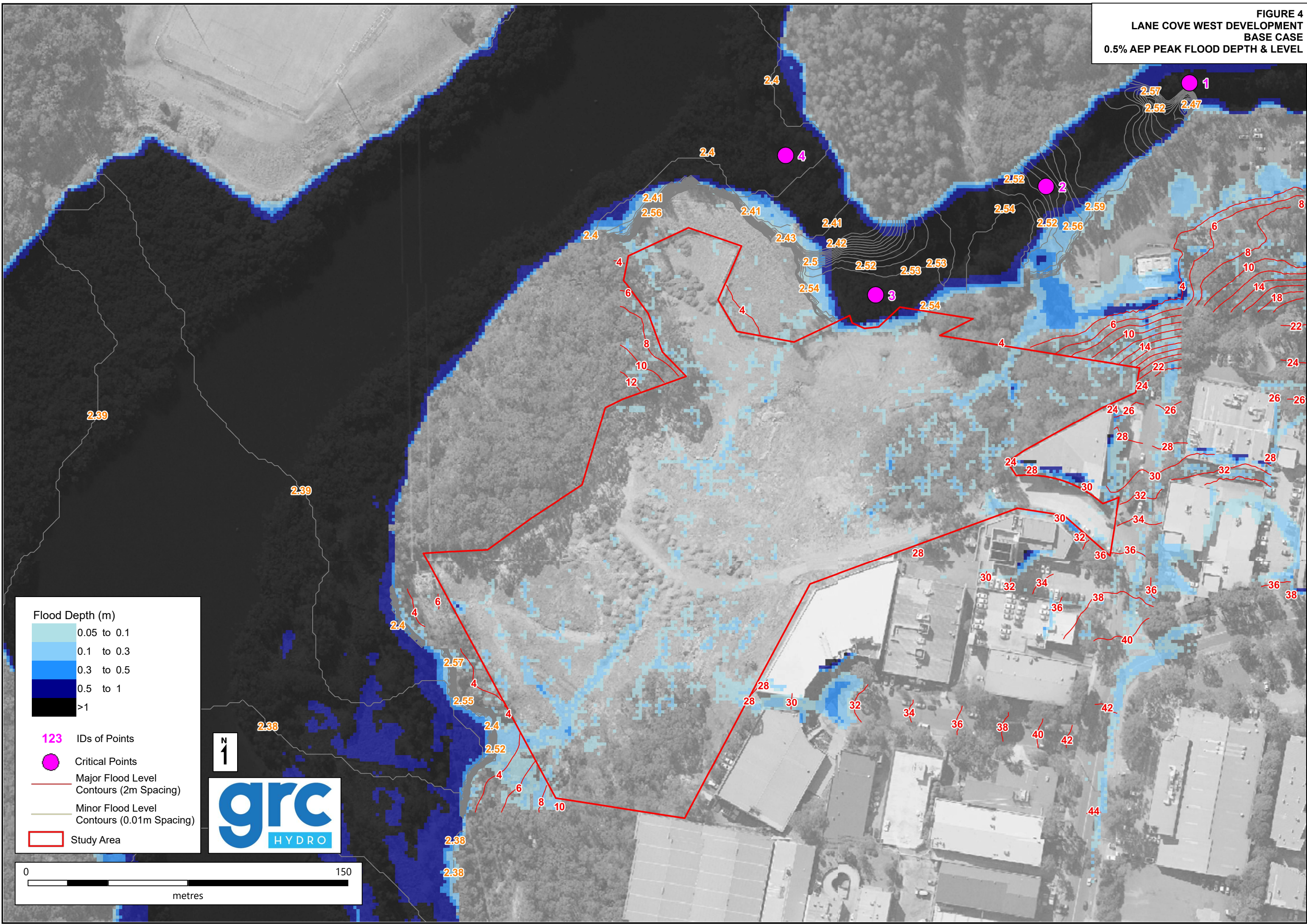


FIGURE 5
LANE COVE WEST DEVELOPMENT
BASE CASE
PMF PEAK FLOOD DEPTH & LEVEL

