CAM CONSULTING
STRUCTURAL & CIVIL ENGINEERS

Suite 303/29-31 Lexington Drive
Norwest Business Park
Bella Vista NSW 2153

All Correspondence to:
PO BOX 6080
Baulkham Hills BC
Baulkham Hills NSW 2153

Ph: 8814 6191
Fax: 8814 5301
Email: andrew@camconsulting.com.au

OVERLAND FLOW ASSESSMENT REPORT

for

Report Prepared by: Zia Khorram

Reviewed by: Daniel Krishna

Rev (B) 23 June 2020

CAM CONSULTING
STRUCTURAL & CIVIL ENGINEERS

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Dated: 20 June 2018

Attention: TO WHOM IT MAY CONCERN

Dear Sir/Madam,

Re: OVERLAND FLOW ASSESSMENT REPORT
Property: 612 HIGH STREET PENRITH

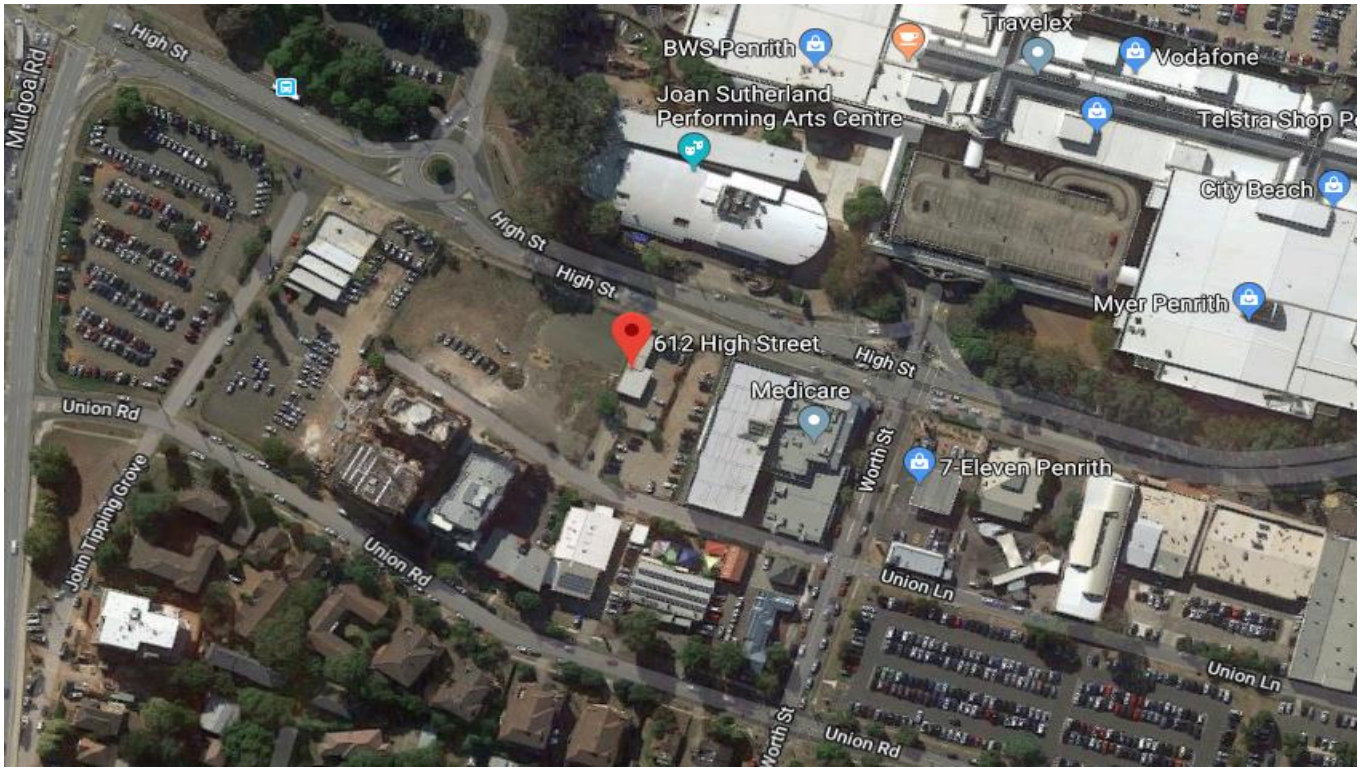

Figure 1: Site Location (from Google maps)

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1. Introduction

Cam Consulting were commissioned by Building Environment Pty Ltd to complete an overland flow study regarding the proposed multi storey residential and commercial building with ground and basement car parking at 608-612 High Street, Penrith.

The objective of this report is to determine the overland flow characteristics and to review the impact that the proposed development will have on the existing drainage system and surrounding properties.

HEC-RAS Modeling was completed by Cam consulting based on the infrastructure and Flood information received from Penrith City Council as well as site inspection.

This report quantifies the overland flood water levels and identifies the flood impact on the surrounding properties as a result of the proposed development.

The proposed development site is located on the south and south west of High street and north of Union road, as shown in Figure 1, above.

Site Description

The site falls within the boundaries of Penrith City Council and is therefore subject to Council's Development Application approvals processes, DCP's and LEP's. The subject site is on the south and south west of High street and north of Union road. Series of council's stormwater pits and pipes are located upstream of the site including culverts, basins and open channels.

The existing site consist of three lots that include a single level masonary building, carport, concrete driveway, pathway and gravel vacant lot. The proposed development comprises of multi storey residential and commercial building with basement and ground level car parking.

The layout of the existing site is shown in Figure 2, below. The existing pits and pipes are located within Union lane at the southern end of the site. A copy of the survey plan may be found in Appendix A.

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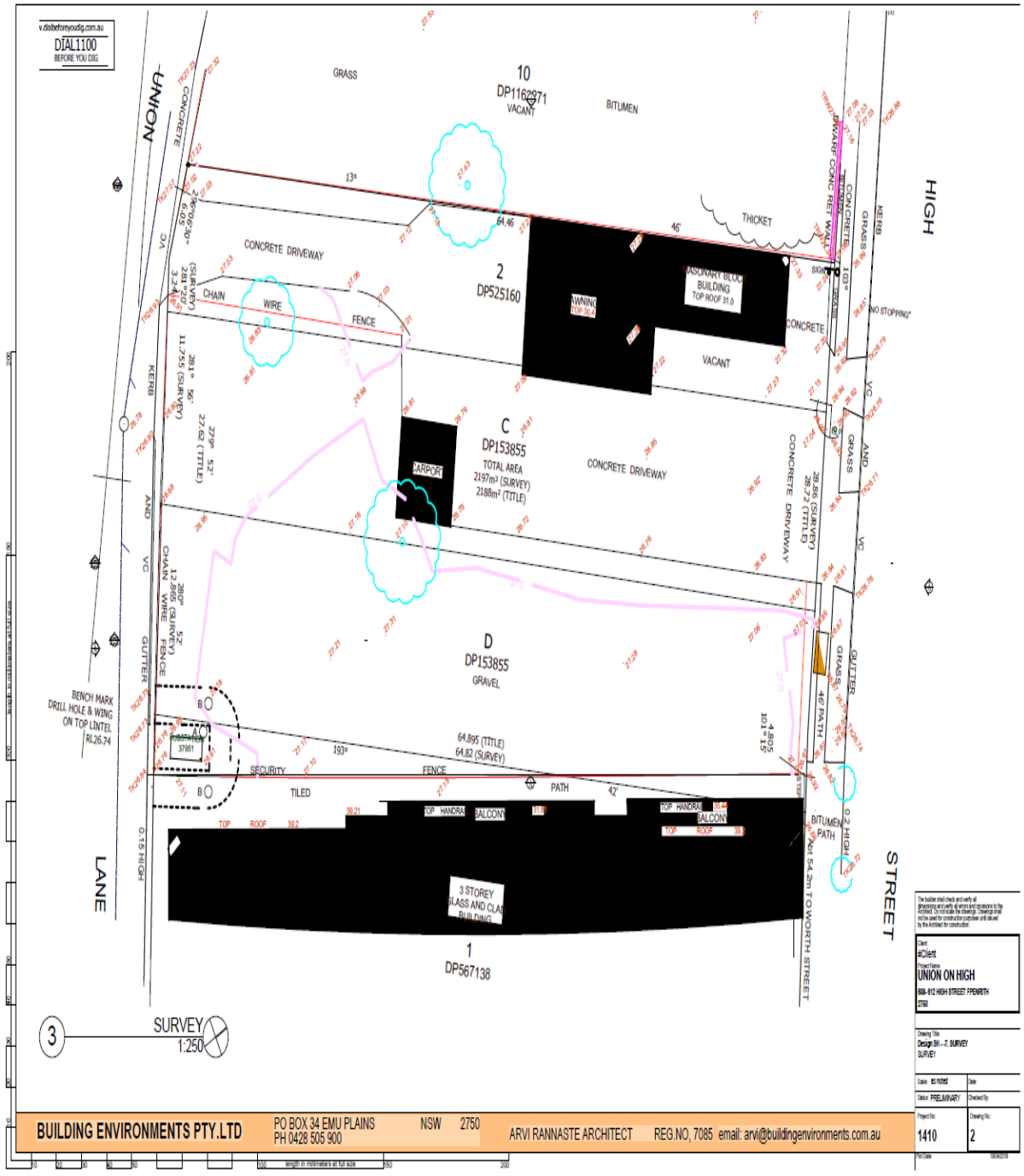

Figure 2: Existing Site Survey Plan

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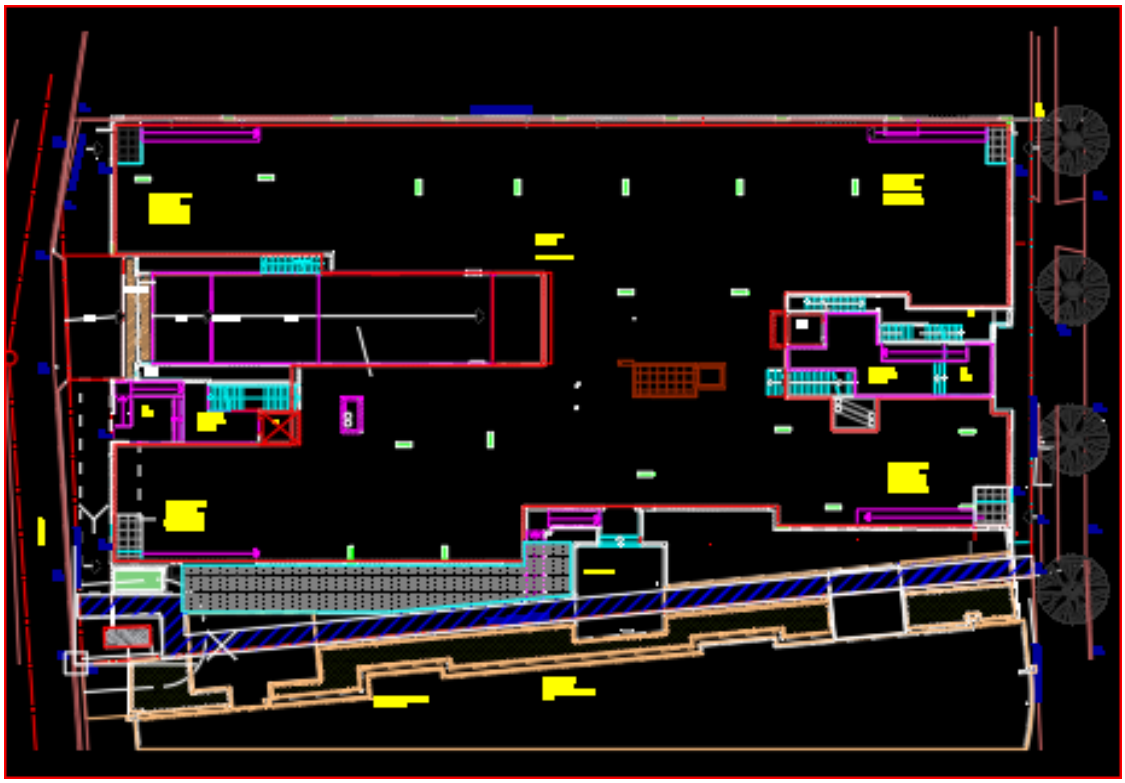
Proposed Development

The proposed development comprises of multi-storey residential and commercial building with basement and ground level car parking.

The extent of the proposed development is shown in Figure 3, below. A copy of the Development Application architectural drawings may be found submitted with this report.



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Flood Risk Assessment

This report quantifies the flood water levels and identifies the flood risks and management procedures necessary for the proposed new development. This report provides:

- A review of the impact of flooding on the proposed development and the surrounding properties and any modifications to the design that might be required to minimise any adverse impacts.

The objective of the hydraulic review was to ensure that the development does not adversely affect neighbouring properties and road reserve and to provide adequate free board against the peak storm event. In order to achieve this, the following scope of works was carried out:

- Review of existing documentation and existing drainage infrastructure provided by Penrith City Council for the subject site and available survey information.
- Liaison with Local Council officers regarding the proposed development and implementation of suitable development controls to ensure adequate performance of the proposed development during flood events.
- A review of PENRITH CBD CATCHMENT Overland flow study by Cardno 7 July 2017, existing topography maps, flood inundation maps, flood hazard maps, etc.
- Engineering assessment and reporting of the proposed development and its impact on the existing developments.

CATCHMENT MODELLING

Background

Based on information from Penrith City Council, the subject site is within the Penrith CBD Catchment overland flow flooding zone.

The contributing catchment study area is from east of Parker street, Jamison Road to Peach Tree Creek. There are series of pits, pipes, culverts and open drains and basins within the study area that conveys flows to downstream receiving waters. The excess flow of the pits, pipes culverts and open drains capacity will run as an overland flow.

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Catchment Details & Modeling Approach

The review of the flood impact for this site and the assessment of flows have been based on the relevant national design guidelines, Australian Standard Codes of Practice, the standards of Penrith City Council Development Control Plan 2014 C3 Water Management section 3.5 Flood planning and accepted engineering practice. Overall site runoff and stormwater management will be designed in accordance with the Institution of Engineers, Australia publication "Australian Rainfall and Runoff" (1987 Edition), Volumes 1 and 2 (AR&R) and Council stormwater code.

The relevant stormwater infrastructure adjacent to the sites was established by survey information.

The discharge rate for the overland flow is extracted from Penrith CBD Catchment Overland Flow Flood study page 250 flow rate reference 290. This flow rate is 0.04 cumec.(i.e $Q_{o/f}$ = 0.04 m^3/s)

The following assumptions were used:

- The entire above flow (Q_{100} = 0.04m^3/s) will enter the overland flow path from Union Lane on southern of the site.
- The overland flow is assumed to enter from upstream catchment through Worth street,
- The cross sectional areas are assumed to be right angle to the flow path,
- The gradient of the flow path is constant
- The flow path roughness (Manning's n value) was assumed to be 0.03 for the banks and 0.05 for main channel areas and 0.015 for concrete and hard surfaces.
- A "Mixed" flow regime is adopted for steady state analysis in the hec-ras model,
- The boundary condition is set as Normal depth with slope equals to the slope of the land.

A HEC-RAS computer model was then devised to analyse the flow path for the site condition and to establish the flow depth.

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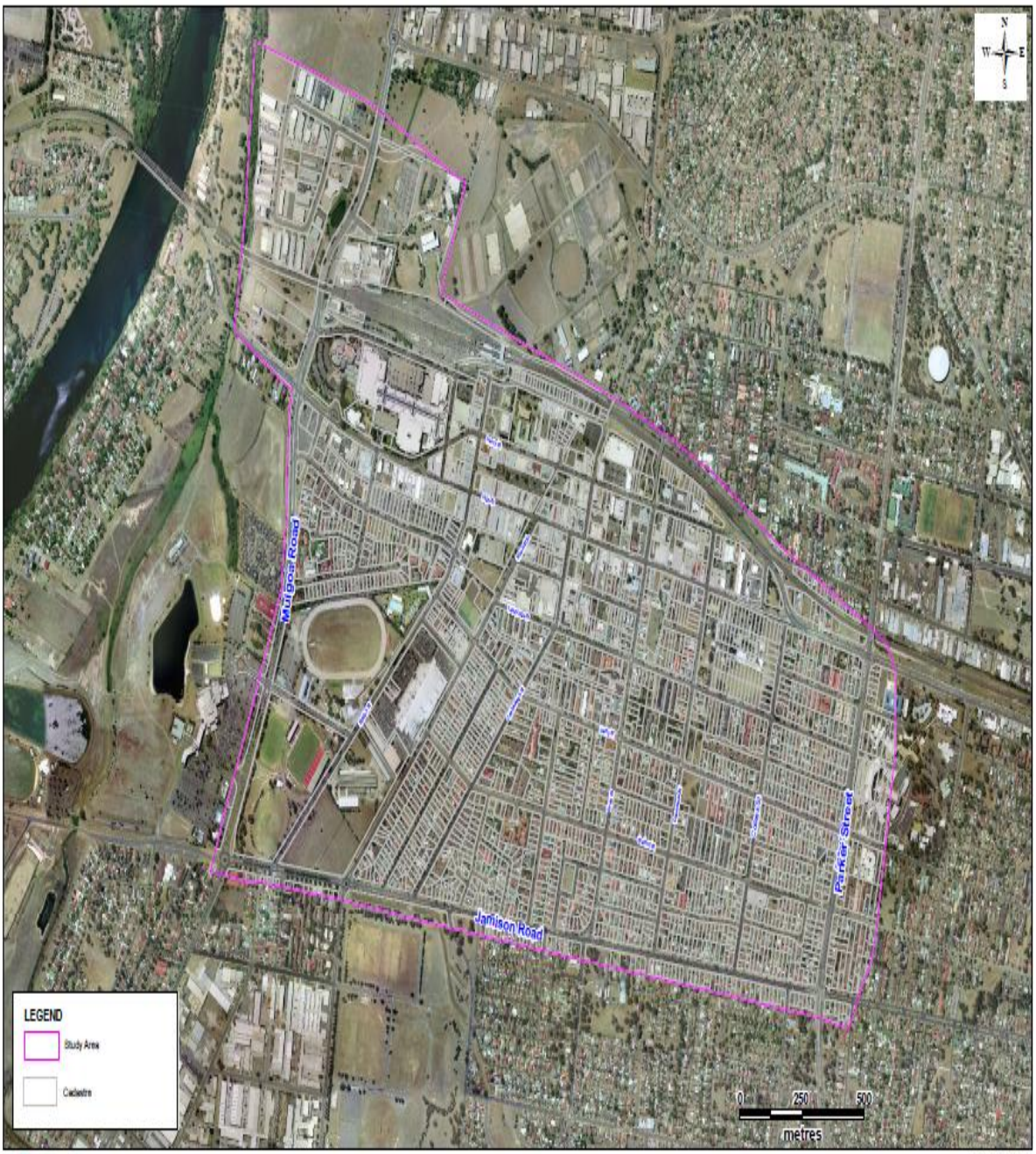

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Penrith CBD Detailed Overland Flow Flood Study

FIGURE 1.2
THE STUDY AREA

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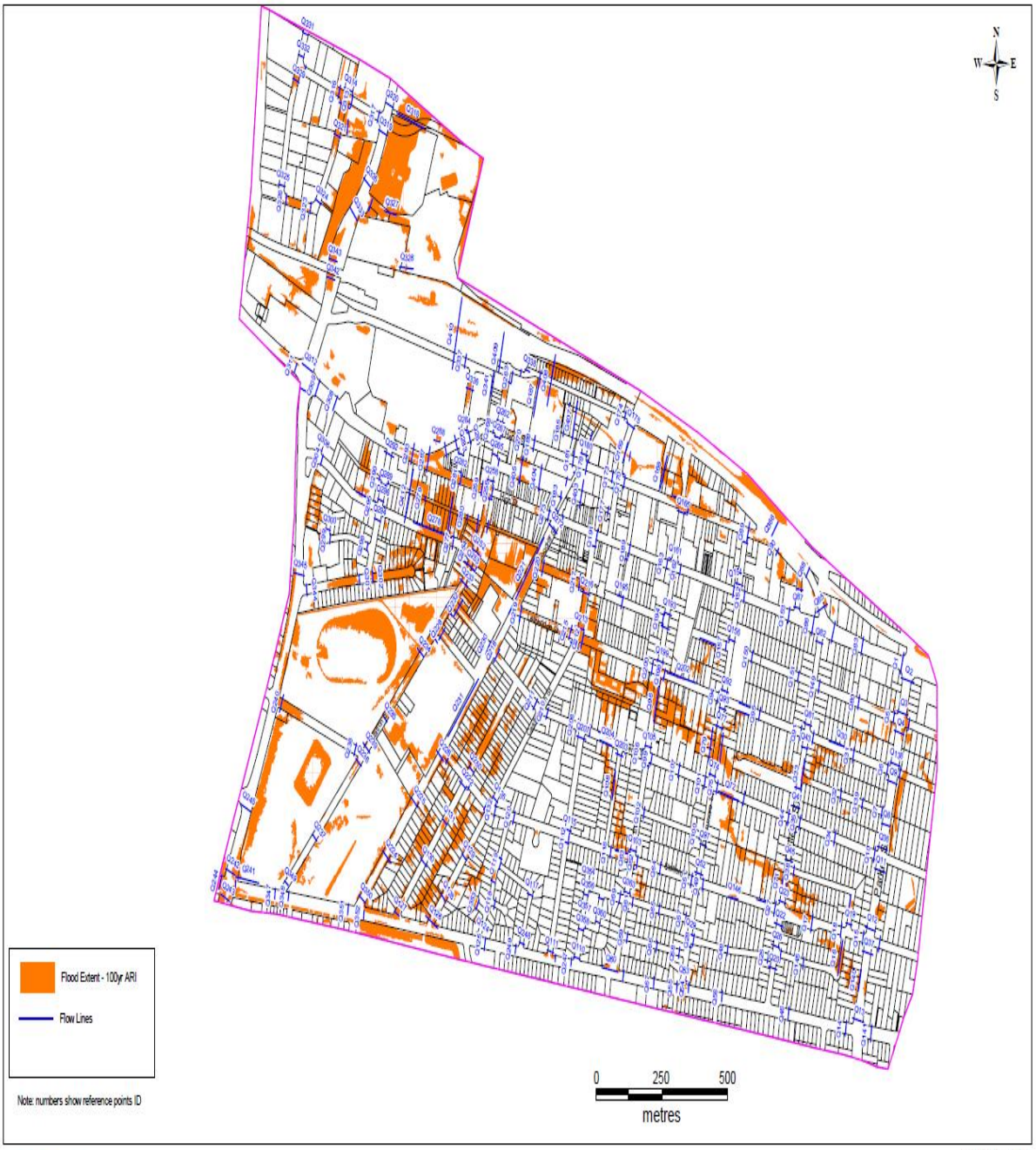

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Penrith CBD Detailed Overland Flow Flood Study

FIGURE 8.40
REFERENCE LOCATIONS FOR 2D PEAK FLOWS

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Reference ID	Peak Flows (m^3/s)								
	PMF	200yr ARI	100yr ARI	50yr ARI	20yr ARI	10yr ARI	5yr ARI	2yr ARI	1yr ARI
Q282	1.72	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.02
Q283	10.79	0.36	0.28	0.13	0.05	0.05	0.03	0.02	0.01
Q284	7.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q285	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Q286	10.55	0.34	0.25	0.12	0.11	0.09	0.08	0.05	0.03
Q287	25.28	1.28	0.78	0.56	0.19	0.02	0.01	0.01	0.01
Q288	0.36	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Q289	0.68	0.11	0.10	0.09	0.07	0.06	0.05	0.04	0.03
Q290	2.78	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.12
Q291	0.82	0.15	0.14	0.12	0.10	0.09	0.07	0.05	0.03
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Q293	24.99	1.04	0.88	0.35	0.07	0.03	0.03	0.02	0.02
Q294	0.25	0.05	0.04	0.05	0.03	0.05	0.03	0.02	0.02
Q295	1.45	0.08	0.08	0.07	0.06	0.05	0.04	0.02	0.01
Q296	0.32	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
Q297	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q298	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q299	0.70	0.11	0.10	0.08	0.07	0.05	0.04	0.03	0.02
Q300	0.21	0.05	0.05	0.04	0.04	0.03	0.03	0.02	0.01
Q301	13.16	0.48	0.36	0.12	0.06	0.05	0.04	0.03	0.02
Q302	13.53	0.48	0.34	0.10	0.00	0.00	0.00	0.00	0.00
Q303	1.08	0.12	0.09	0.03	0.01	0.01	0.01	0.01	0.01
Q304	1.39	0.24	0.22	0.17	0.13	0.10	0.08	0.05	0.03
Q305	0.58	0.07	0.06	0.06	0.05	0.04	0.03	0.02	0.01
Q306	0.40	0.06	0.05	0.04	0.04	0.02	0.02	0.01	0.01
Q307	0.55	0.04	0.03	0.02	0.01	0.01	0.01	0.00	0.00
Q308	6.99	0.12	0.10	0.08	0.06	0.05	0.04	0.02	0.02
Q309	6.45	0.23	0.20	0.17	0.15	0.14	0.11	0.08	0.06
Q310	1.80	0.13	0.09	0.07	0.04	0.02	0.01	0.01	0.00
Q311	2.15	0.35	0.32	0.25	0.20	0.15	0.11	0.05	0.03
Q312	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q313	2.61	0.48	0.41	0.26	0.25	0.11	0.13	0.04	0.02
Q314	1.04	0.24	0.22	0.19	0.15	0.13	0.11	0.07	0.05
Q315	5.95	0.77	0.69	0.51	0.41	0.22	0.19	0.09	0.04
Q316	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q317	0.53	0.10	0.09	0.08	0.08	0.06	0.06	0.04	0.03
Q318	1.46	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
Q319	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q320	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q321	1.88	0.34	0.33	0.31	0.27	0.22	0.19	0.13	0.09
Q322	0.11	0.04	0.04	0.15	0.04	0.57	0.06	0.01	0.58
Q323	0.80	0.23	0.21	0.19	0.16	0.13	0.12	0.08	0.06
Q324	0.51	0.12	0.11	0.10	0.09	0.07	0.06	0.04	0.03
Q325	1.94	0.25	0.22	0.18	0.15	0.12	0.09	0.05	0.04
Q326	2.04	0.46	0.42	0.37	0.31	0.25	0.20	0.11	0.09
Q327	5.45	0.87	0.75	0.59	0.43	0.31	0.23	0.11	0.02
Q328	1.84	0.20	0.17	0.13	0.10	0.09	0.06	0.03	0.02
Q329	2.56	0.34	0.33	0.29	0.27	0.23	0.20	0.14	0.09
Q330	0.45	0.17	0.16	0.15	0.14	0.11	0.09	0.05	0.03
Q331	0.90	0.17	0.16	0.14	0.12	0.10	0.08	0.05	0.03
Q332	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Q333	1.06	0.19	0.17	0.15	0.12	0.08	0.07	0.03	0.02
Q334	0.06	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Q335	0.20	0.05	0.05	0.04	0.04	0.03	0.03	0.02	0.01
Q336	7.42	0.15	0.21	0.13	0.11	0.10	0.12	0.05	0.04
Q337	8.62	0.06	0.03	0.02	0.03	0.01	0.01	0.01	0.01
Q338	2.43	0.15	0.14	0.12	0.10	0.08	0.06	0.04	0.02

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APPENDIX I
2D Peak Flows for Design Events at Reference Locations

Figure 3: Contributing Catchment Map and Flow Rate Nodes

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FLOOD MODELLING & HYDRAULIC REVIEW

Background

A HEC-RAS model has been prepared to suit the detailed survey information available along the overland flow path being through the site from Union lane to High street as labelled Overland flow.

HEC-RAS Pre and Post-Development modelling of the overland flow will determine the impact the development may have on the water flow rate, depth and velocity. Generally, the minimum floor level for the proposed residence and commercial unit will be derived from this process.

HEC-RAS computer modelling has been used for this report to determine the water surface profile at each cross-section covering the site during 1 in 100 year ARI storm event. The model calculates water surface profiles based on a one dimensional, steady state water surface profiles iteration developed by U.S. Army Corp of Engineers. Referring to Penrith catchment plan (Figure 4) and the pre-development flood map (Figure 7), flood water would enter the site from Union lane and marginally ponds within the depressed existing grounds.

Flood Modeling for the Site

Figure 5; below illustrates a layout plan for each HEC-RAS station along the overland flow for Pre- and post-development conditions. It should be noted that the survey information was only extended within the site boundaries and some levels along the banks of the stations were interpolated from surrounding survey spot levels. Although the council flood map is shown that the flood storage area is within eastern side of the site being No 608-610 High street, the survey levels indicate the opposite as the ground levels are higher at the eastern side. Therefore, it is proposed to provide flood storage area on the western boundary area. This area is the ground level parking, driveway and landscaping strip and common open space.

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Three Flood Classifications have been defined as follow:

- **High Flood Risk:** is where the land below the 100 Year flood that is either subject to a high hydraulic hazard or where there are significant evacuation difficulties.

- **Medium Flood Risk:** is where the land below the 100 Year flood that is not subject to a high hydraulic hazard and there are no significant evacuation difficulties.

- **Low Flood Risk:** is where the land is not identified within either the High Flood Risk or the Medium Flood Risk.

Therefore, the site is classified as being within the **Medium to Low Flood Risk** Precinct.

Below are listed the council design criteria for the proposed site as per the flood advise letter:

Floor Level:

• Habitable floor levels to be equal to or greater than the 100 year ARI flood level plus freeboard (500mm).

• Non-habitable floor levels (garages, laundry, sheds, etc) shall be 100mm above the flood level at the upstream side of the structure.

• Crest in driveway to basement car park shall be 300mm above the top water level of the 1% AEP flood.

Building Components & Methods:

• All structures to have flood compatible building components below or at the 1% AEP plus 500mm freeboard.

• The impact of the development on flooding elsewhere shall be considered.

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Evacuation:

• The proposed ground floor level shall be above the flood level (plus freeboard) for 1 in 100 year ARI flood. However, if the flood level is raised above 1 in 100 year ARI, the residents in the building shall move to the upper levels. Residents shall not leave the site during 1 in 100 year ARI and shall stay in their property until be advised by police or SES.

Flood Emergency Response

Floods can occur any time without warning, the residents in the development should

prepare, maintain and replace if necessary the following item for any expected

emergency that may happen.

- Wet weather clothing
- Torch, Radio with Battery and Spare Batteries
- Local map, a prepared home emergency plan
- A First aid Kit and prescription medicines
- Important papers including emergency contact numbers and any personal documentations
- Mobile Phone
- Store basic food items and bottled water

Residents shall develop their own family flood emergency plan following the

instructions provided on http://www.ses.nsw.gov.au/community-safety/. Talk to the council to confirm safe travel route that are less likely to be cut by flood waters. In addition, in case of heavy rainfall listen to your local radio station, check weather condition by BOM and flood information on the flood safe webpage and follow the instruction by SES.

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During the heavy rainfall event, raise any electrical items and high value items within private garage areas as high level as possible to avoid any damage during the flood impact. If possible, turn off and disconnect any large electrical item that cannot be raised. Moreover, residents shall take the actions below,

- Do not try to evacuate and travel through floodwater on foot;

- Do not stay inside any vehicles on the street and in garage;

- Residents and their pets should move and stay in the higher levels of building such as move to First Floor if possible.

- Residents want to leave the site must check and follow the instructions from SES.

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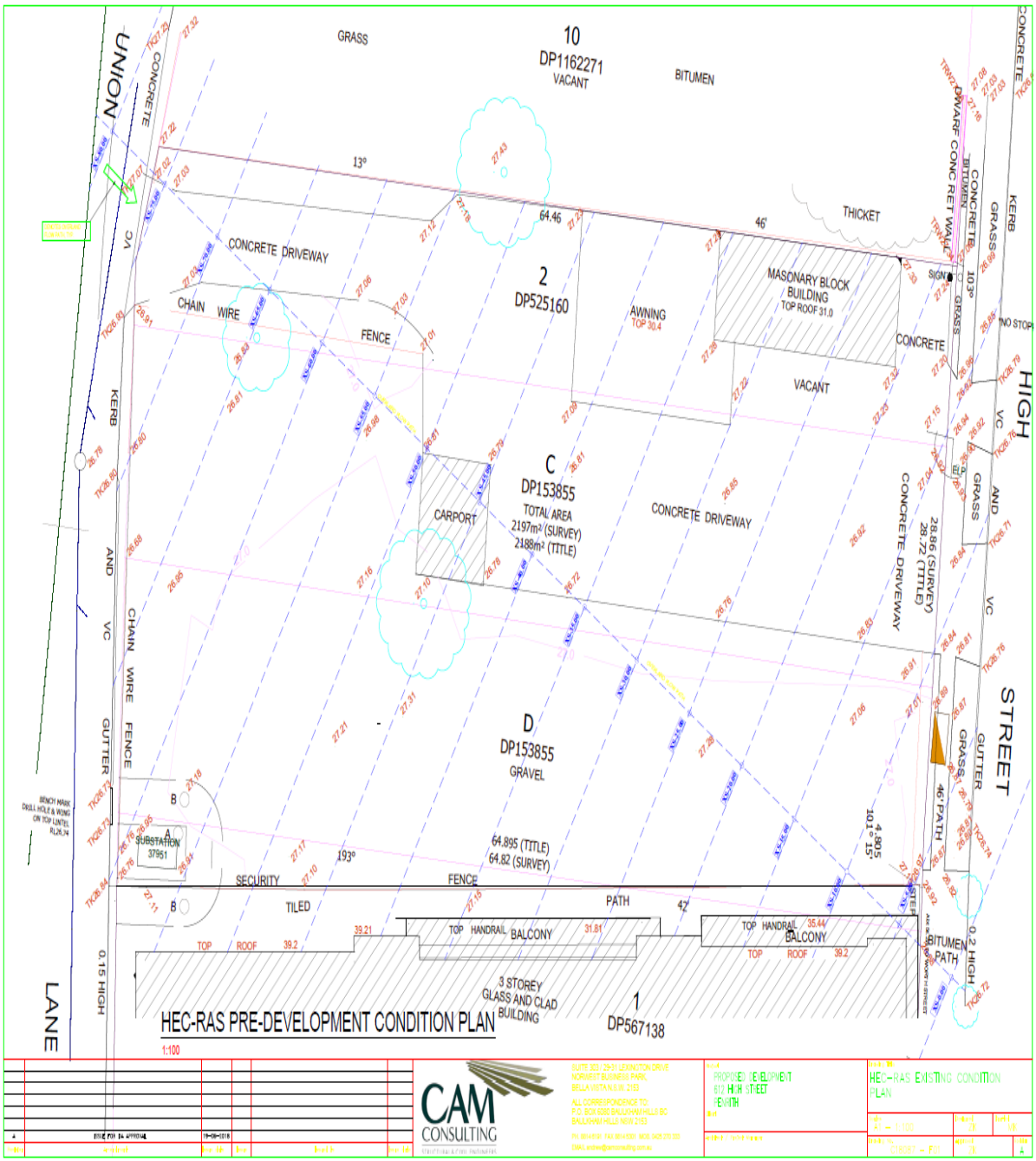

Figure 4: Pre-Development HEC-RAS Stations

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Figure 5: Post-Development HEC-RAS Stations

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Extract of Penrith CBD Catchment Overland Flow Flood Study showing extents of overland flow ponding:

Figure 7: Council flood map

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A summary of the pre and post development flood levels for the critical storm events as calculated from the HEC-RAS model is provided in Table 2 and 3, below. The depth of flow within the flow path for 1% AEP ranges from 10mm – 440mm for existing site condition and 10mm-330mm for post development conditions. The depth and velocity shown in table below are within the main flow path channel areas.

River Station Reach 1	Water Surface Level (AHD)	Velocity, V (m/s)	Depth, D (m)	V x D (m^2/s)
80	27.08	0.44	0.01	0.004
75	27.04	0.06	0.24	0.01
70	27.04	0.01	0.39	0.004
65	27.04	0.01	0.44	0.004
60	27.04	0.01	0.34	0.003
55	27.04	0.04	0.08	0.003
50	27.04	0.01	0.23	0.002
45	27.04	0.01	0.26	0.003
40	27.04	0.01	0.29	0.003
35	27.04	0.00	0.33	0.003
30	27.04	0.06	0.09	0.005
25	27.04	0.13	0.06	0.008
20	27.03	0.41	0.03	0.01
15	26.88	0.99	0.03	0.03
10	26.83	0.15	0.07	0.01
5	26.81	0.55	0.06	0.03
0	26.78	0.41	0.05	0.02

Table 2: Overland flow - Pre-Development HEC-RAS results

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Bella Vista NSW 2153

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PO BOX 6080
Baulkham Hills BC
Baulkham Hills NSW 2153

Ph: 8814 6191
Fax: 8814 5301
Email: andrew@camconsulting.com.au

River Station Reach 1	Water Surface Level (AHD)	Velocity, V (m/s)	Depth, D (m)	V x D (m^2/s)
80	27.08	0.44	0.01	0.004
75	26.99	0.03	0.24	0.007
70	26.98	0.09	0.33	0.03
65	26.98	0.14	0.23	0.03
60	26.98	0.03	0.28	0.008
55	26.98	0.02	0.28	0.006
50	26.98	0.06	0.13	0.008
45	26.98	0.04	0.18	0.007
40	26.98	0.03	0.23	0.007
35	26.98	0.06	0.13	0.008
30	26.98	0.24	0.03	0.007
25	26.97	0.24	0.04	0.01
20	26.95	0.41	0.03	0.01
15	26.89	0.53	0.04	0.02
10	26.83	0.09	0.13	0.01
5	26.81	0.55	0.06	0.03
0	26.78	0.41	0.05	0.02

Table 3: Overland flow - Post-Development HEC-RAS results

The habitable areas are subjected to 500 mm of freeboard while the non-habitable areas require 150 mm of free board. In addition, the stairs to the basement and the driveway crest require a minimum of 300 mm freeboard.

CAM CONSULTING
STRUCTURAL & CIVIL ENGINEERS

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A detailed summary of the HEC-RAS output from the site specific modelling for the pre and post development configuration and elevations can be found in Appendix D & E.

RECOMMENDATIONS & CONCLUSIONS

Cam consulting engineers were commissioned by Building Environment Pty Ltd to complete an overland flow study regarding the proposed development at 608-612 High street Penrith.

The existing site consist of three lots that include a single level masonary building, carport, concrete driveway, pathway and gravel vacant lot. The proposed development comprises of multi storey residential and commercial building with basement and ground level car parking.

The objective of this report is to determine the overland flow characteristics and to review the impact that the proposed development will have on the existing drainage infrastructure and surrounding properties.

The contributing catchment area and flow rates for 1% AEP critical storm event for the overland flow is extracted from Penrith CBD Catchment flood study (refer to figure 4). All flows generated from this catchment is captured through a network of pits and pipes as well as culverts, basins and open drains, the excess flows to the capacity of the existing stormwater system will run as an overland flow from top of the catchment being east of Parker street, Jamison road to the receiving waters Peach Tree Creek.

Based on investigations, design review and calculations undertaken as part of this Flood Impact Report overland flow marginally enters the site from the southern boundary of the site that is Union lane and ponds within depressed ground area and possibly flows downstream to High street. The impact of the overland flow on the adjoining properties is perceived to be nil as result of the proposal. The proposed flow path and flood storage is maintained within the ground level parking area and driveway next to the commercial units as well as in the common open space.

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STRUCTURAL & CIVIL ENGINEERS

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The proposed access ramp to foyer and commercial unit next to ground floor driveway is modelled in Hec-Ras as obstruction to assess its impact on the flow characteristics such as depth, velocity and flow distribution. It is found that the net impact through the flow path area is an increase of 10mm and decrease of up to 80mm to the water surface level. This is achieved by removal of the existing masonary building, carport and having the ramp on piers.

Council engineer has nominated the flood level to be RL 27.10 and hence this level is adopted for flood planning level. The driveway is ramped up to crest RL 27.40 from the boundary this is 300mm above the nominated 1%AEP flood level (i.e Flood level RL 27.10).

The proposed overland flow management meets Penrith City Council's Development Control Plan 2014 C3 Water Management section 3.5 Flood Planning criteria.

The overland flow flood level for 1% AEP (RL 27.10) is adopted as per council flood information. Hence the Finished Floor level is recommended above this level plus 500mm for habitable areas and 300mm for driveway crest. These levels are summarised in the table below and the flood information is shown in Figure 7. – Flood information.

The proposed levels are summarised in Table 4, below.

	Water Surface Level (m)	Min. Finished Floor Level (AHD)	Proposed Finished Floor Level (AHD)
Proposed development			
Ground Level	27.10	27.60	27.60
Driveway Crest	27.10	27.40	27.40

Table 4: Proposed FFL for the proposed development

It is recommended that the finished floor level of the ground level to be adopted as per table above. In addition, the ground level parking area, access driveway and landscape strip along the driveway must not be obstructed at any time. The western boundary fence to be a flow through type fence and landscape area adjacent to the driveway must be planted with flood compatible species. The Driveway ramp is proposed at RL 27.40, this will prevent any flow entering the basement from Union lane.

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STRUCTURAL & CIVIL ENGINEERS

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Bella Vista NSW 2153

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Baulkham Hills BC
Baulkham Hills NSW 2153

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Based on the Hec-Ras overland flow analysis, the flow regime of the overland flow is maintained almost as to the existing conditions.

The proposed development is designed to facilitate this and minimise the impact on the adjoining properties.

Considering the extend of the flood waters within the site and the provision for flood storage, an Onsite detention is only feasible within landscape area on the eastern side.

This report is a brief and basic overland flow investigation and analysis. The input data in the computer models is based on numerous assumptions, therefore this will reflect on the output results.

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Appendix A

Survey plan prepared by C&A Surveyors NSW P/L dated 18 June 2018

CAM CONSULTING
STRUCTURAL & CIVIL ENGINEERS

Suite 303/29-31 Lexington Drive
Norwest Business Park
Bella Vista NSW 2153

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Baulkham Hills NSW 2153

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Appendix B

Contributing Catchment Map provided by Penrith City Council

(From Penrith CBD catchment study)

Cardno

W4735
July 2015

Penrith CBD Detailed Overland Flow Flood Study

FIGURE 1.2
THE STUDY AREA

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STRUCTURAL & CIVIL ENGINEERS

Suite 303/29-31 Lexington Drive
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Baulkham Hills NSW 2153

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Appendix D

Pre-Development HEC-RAS model

PRE DEVELOPMENT

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
OVERLAND	80	PF 1	0.04	27.07	27.08	27.08	27.09	0.026559	0.44	0.09	11	1.56
OVERLAND	75	PF 1	0.04	26.8	27.04	26.88	27.04	0.000015	0.06	0.68	6.02	0.06
OVERLAND	70	PF 1	0.04	26.65	27.04		27.04	0	0.01	3.27	16.96	0.01
OVERLAND	65	PF 1	0.04	26.6	27.04		27.04	0	0.01	5.85	26.94	0
OVERLAND	60	PF 1	0.04	26.7	27.04		27.04	0	0.01	6.86	41.13	0
OVERLAND	55	PF 1	0.04	26.96	27.04		27.04	0.000025	0.04	0.99	23.45	0.06
OVERLAND	50	PF 1	0.04	26.81	27.04		27.04	0	0.01	5.25	39	0.01
OVERLAND	45	PF 1	0.04	26.78	27.04		27.04	0	0.01	3.75	28.12	0.01
OVERLAND	40	PF 1	0.04	26.75	27.04		27.04	0	0.01	5.02	34.05	0.01
OVERLAND	35	PF 1	0.04	26.71	27.04		27.04	0	0.01	4.66	27.84	0.01
OVERLAND	30	PF 1	0.04	26.95	27.04		27.04	0.000054	0.06	0.63	13.29	0.09
OVERLAND	25	PF 1	0.04	26.98	27.04		27.04	0.000388	0.13	0.31	9.68	0.24
OVERLAND	20	PF 1	0.04	27	27.03	27.03	27.04	0.010222	0.41	0.1	6.7	1.07
OVERLAND	15	PF 1	0.04	26.85	26.88	26.89	26.93	0.061251	0.99	0.04	2.69	2.59
OVERLAND	10	PF 1	0.04	26.76	26.83	26.8	26.83	0.000408	0.15	0.27	7.4	0.25
OVERLAND	5	PF 1	0.04	26.75	26.81	26.81	26.83	0.007248	0.55	0.07	2.32	1
OVERLAND	0	PF 1	0.04	26.73	26.78	26.77	26.79	0.004005	0.41	0.1	3.19	0.75

CAM CONSULTING
STRUCTURAL & CIVIL ENGINEERS

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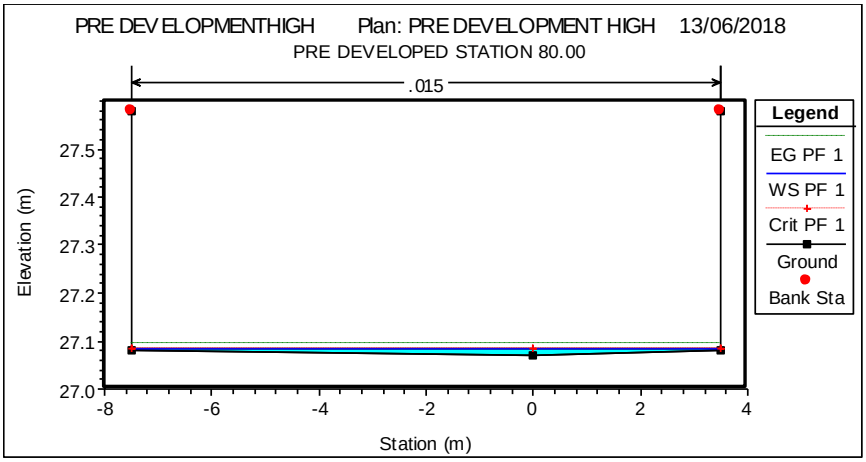

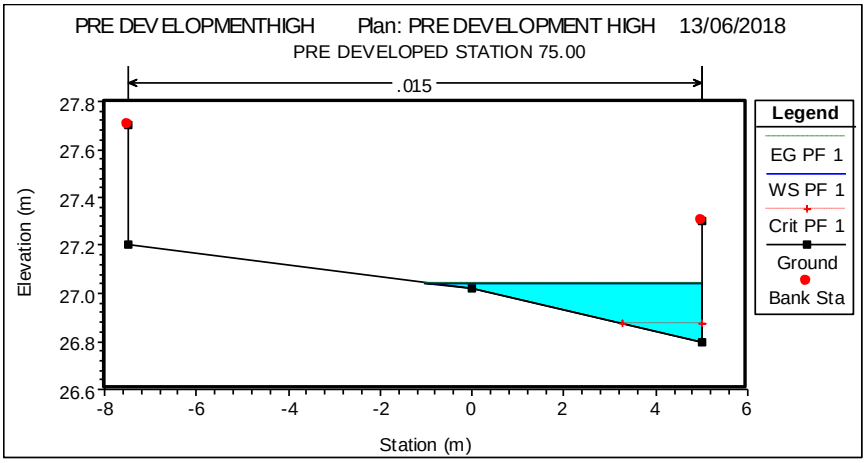

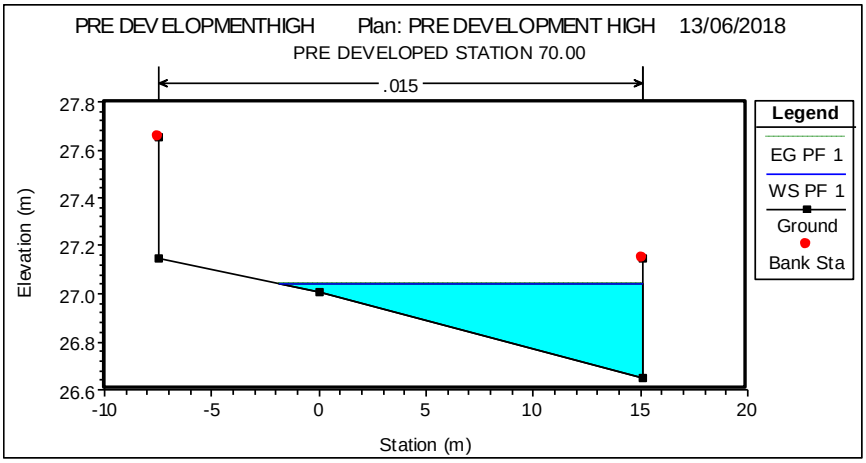

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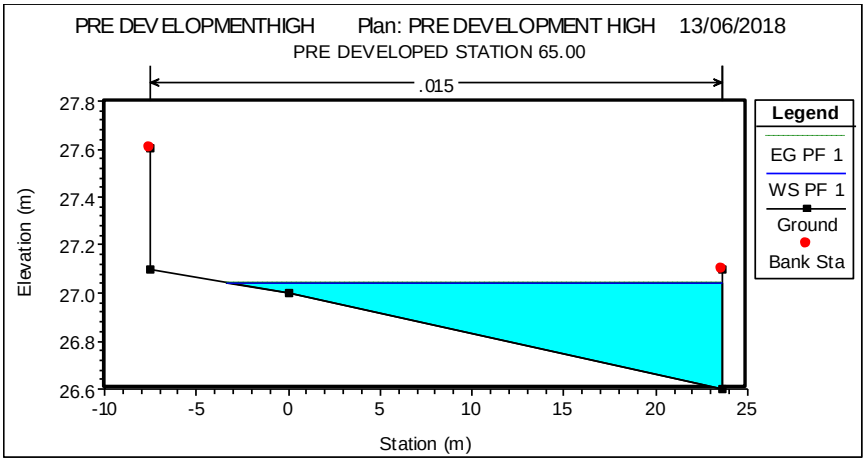

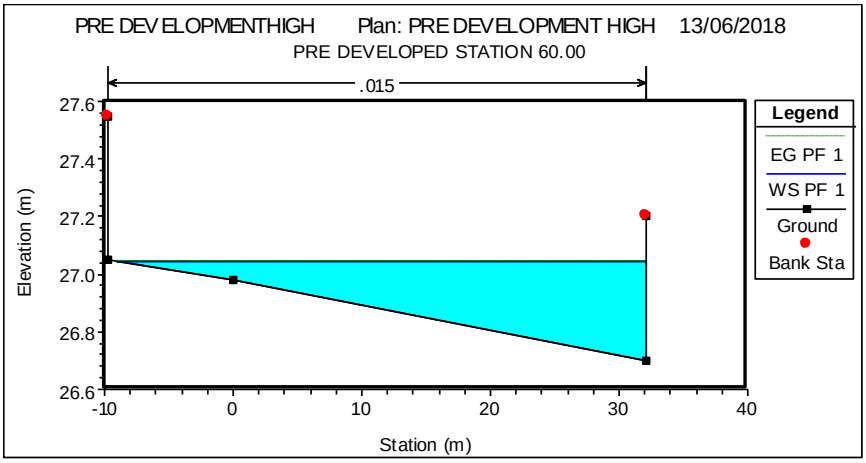

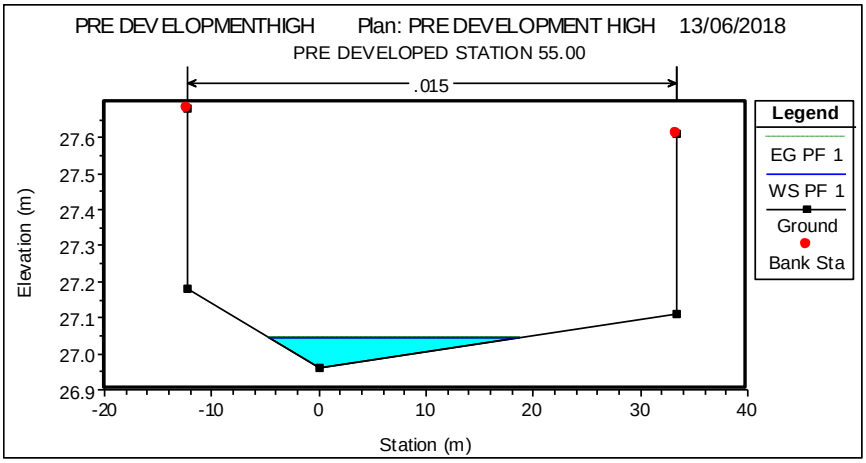

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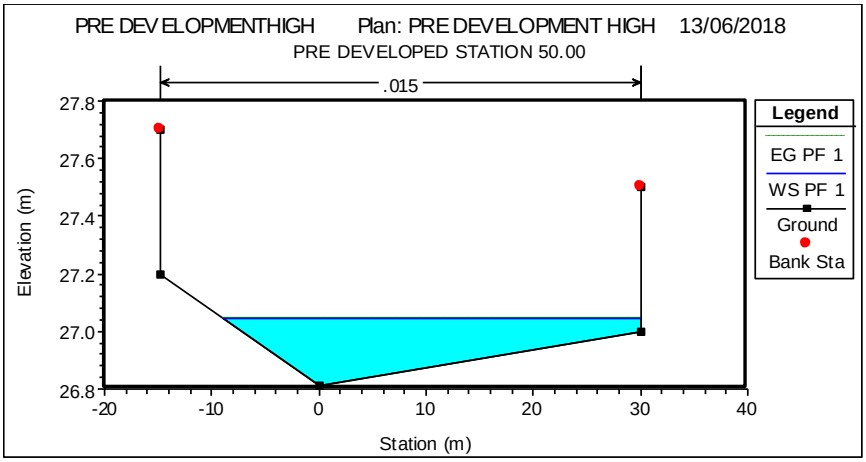

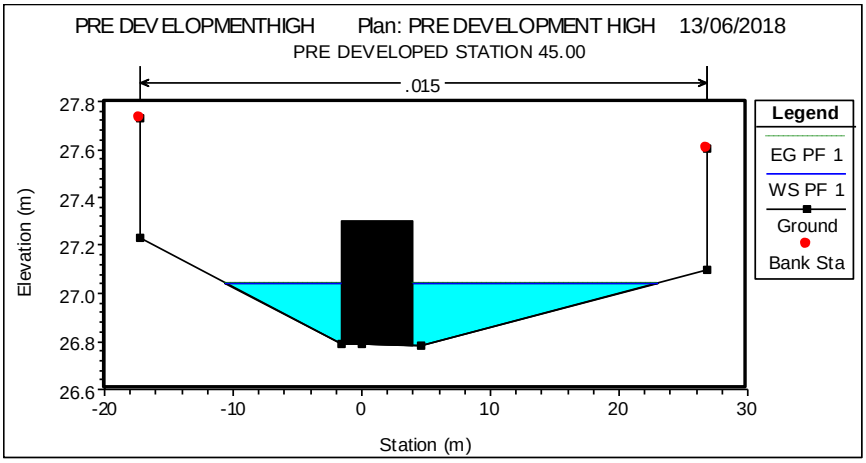

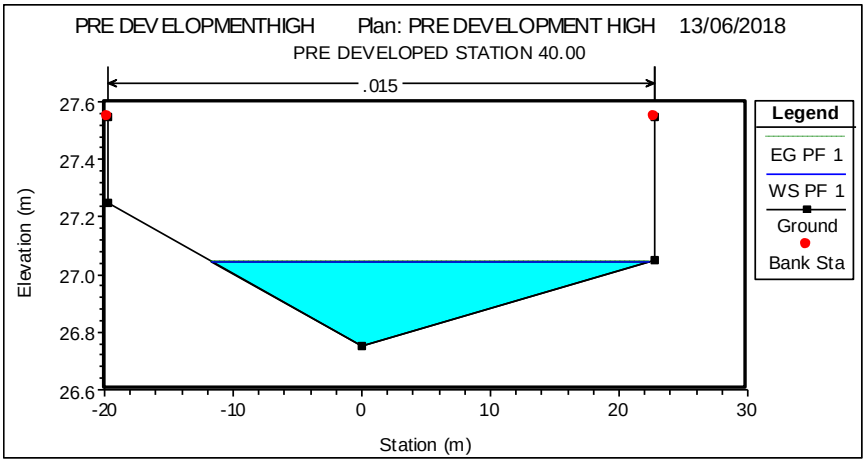

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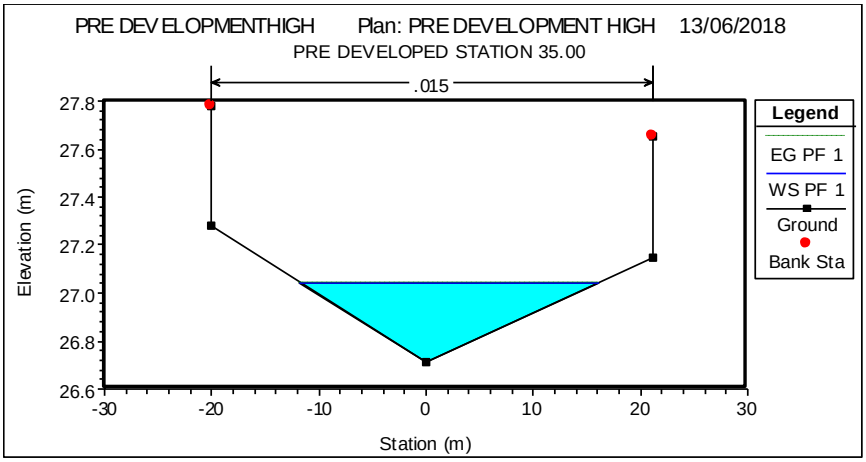

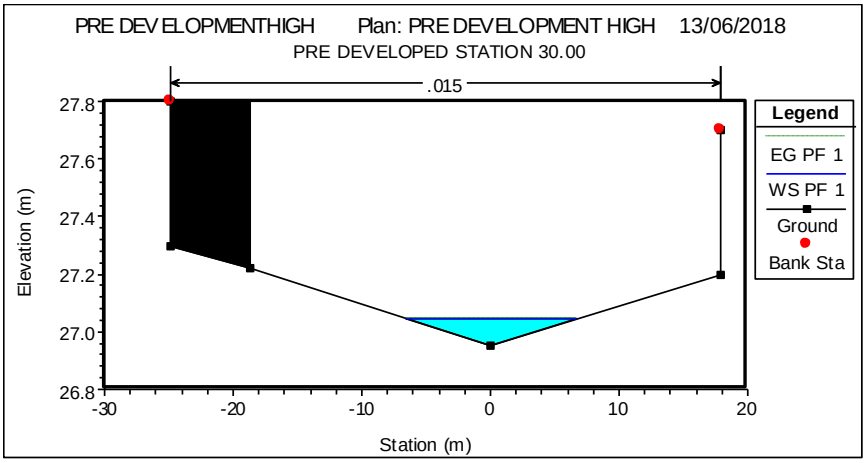

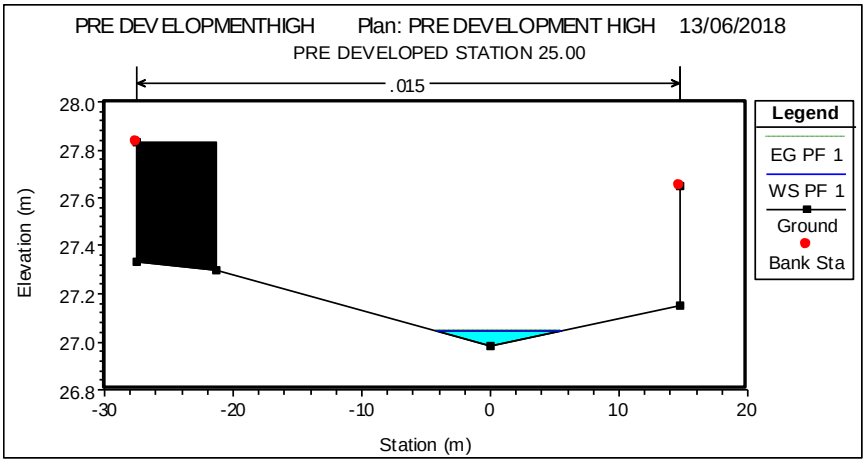

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STRUCTURAL & CIVIL ENGINEERS

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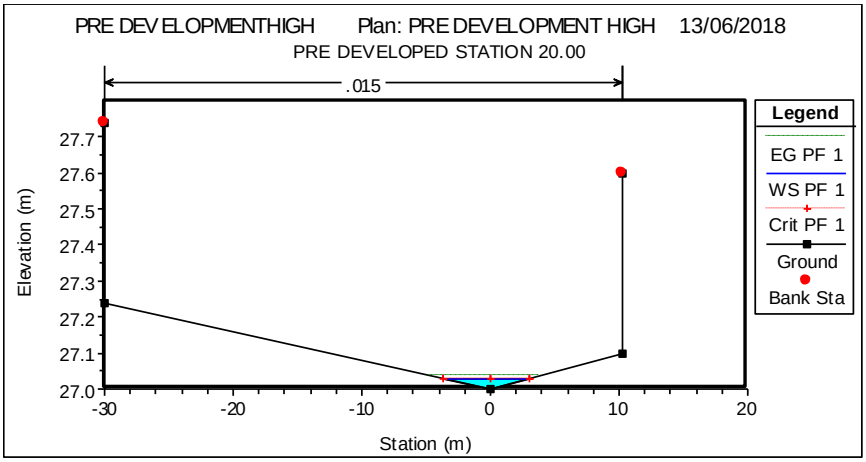

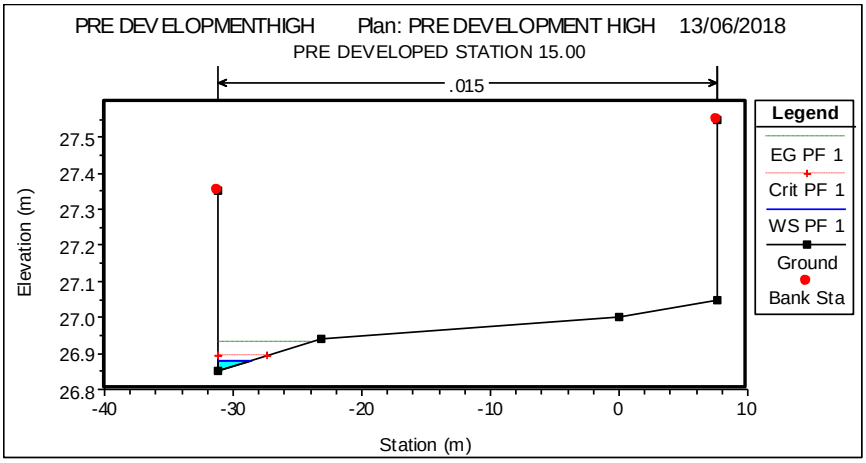

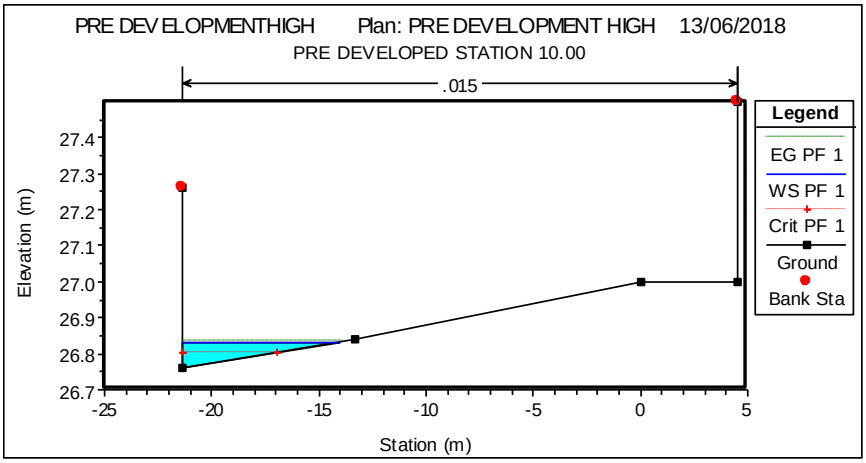

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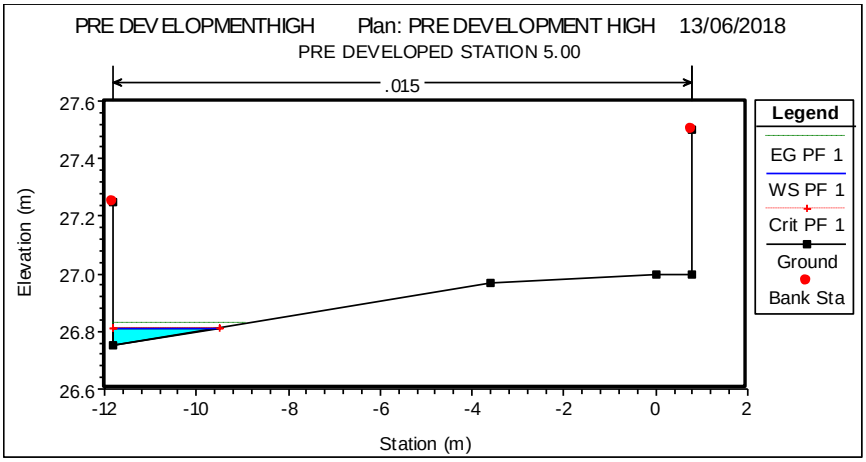

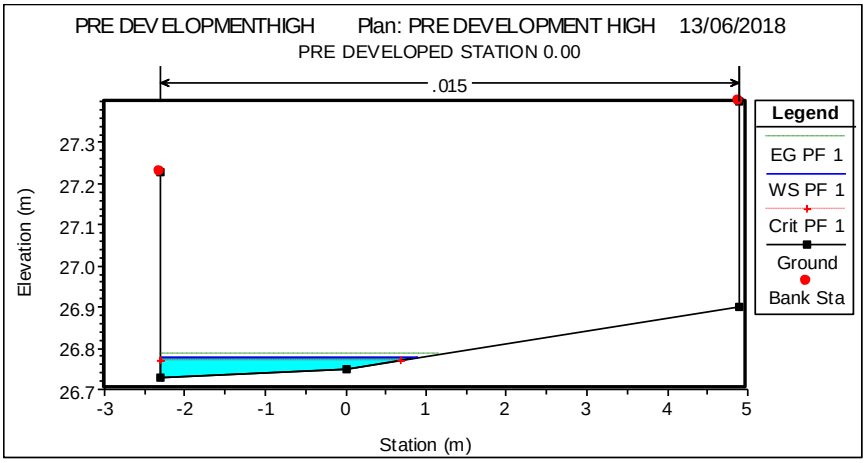

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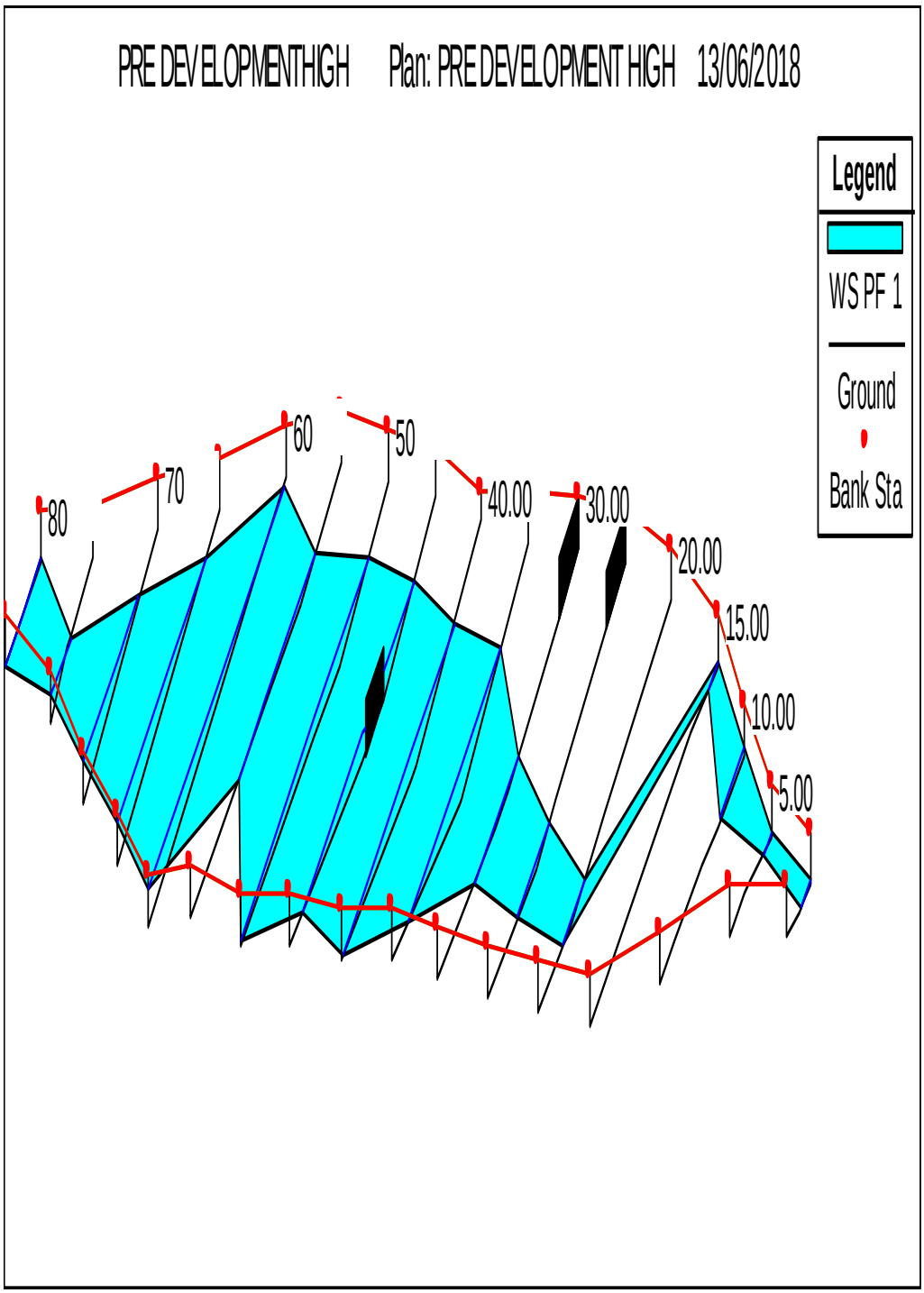

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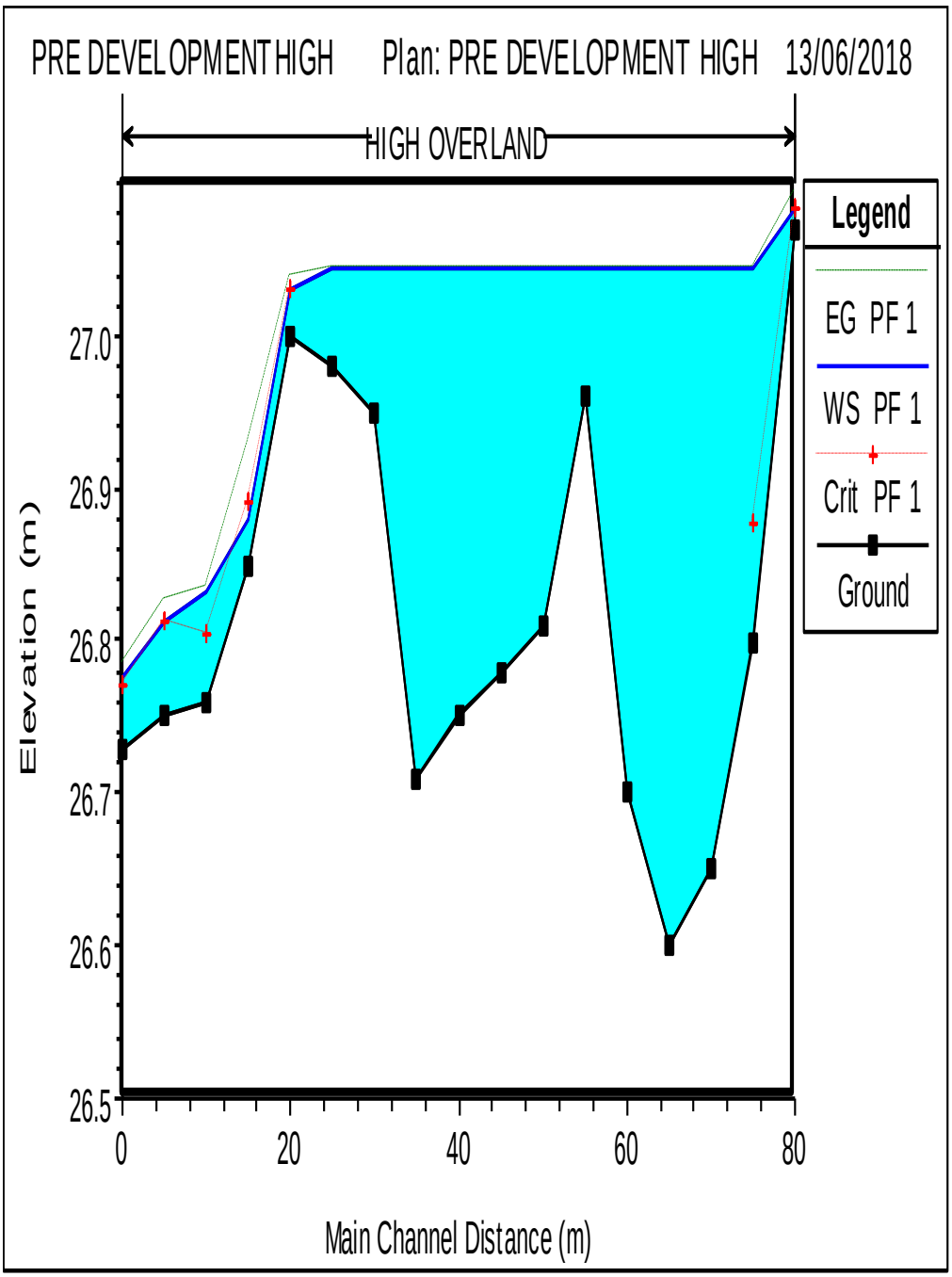

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Appendix E

Post-Development HEC-RAS model

POST-DEVELOPMENT

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
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OVERLAND	75	PF 1	0.04	26.75	26.99	26.8	26.99	0.000002	0.03	1.45	9.6	0.02
OVERLAND	70	PF 1	0.04	26.65	26.98		26.99	0.000022	0.09	0.46	2.75	0.07
OVERLAND	65	PF 1	0.04	26.75	26.98		26.98	0.000078	0.14	0.28	2.1	0.12
OVERLAND	60	PF 1	0.04	26.7	26.98		26.98	0.000003	0.03	1.44	11.79	0.03
OVERLAND	55	PF 1	0.04	26.7	26.98		26.98	0.000001	0.02	2.64	22.16	0.01
OVERLAND	50	PF 1	0.04	26.85	26.98		26.98	0.000034	0.06	0.72	13.19	0.08
OVERLAND	45	PF 1	0.04	26.8	26.98		26.98	0.00001	0.04	0.92	9.41	0.04
OVERLAND	40	PF 1	0.04	26.75	26.98		26.98	0.000004	0.03	1.35	12.42	0.03
OVERLAND	35	PF 1	0.04	26.85	26.98		26.98	0.000031	0.06	0.69	11.33	0.07
OVERLAND	30	PF 1	0.04	26.95	26.98		26.98	0.003358	0.24	0.17	11.04	0.61
OVERLAND	25	PF 1	0.04	26.93	26.97		26.97	0.001797	0.24	0.17	6.85	0.48
OVERLAND	20	PF 1	0.04	26.92	26.95	26.95	26.96	0.009427	0.41	0.1	6.23	1.03
OVERLAND	15	PF 1	0.04	26.85	26.89	26.9	26.91	0.011236	0.53	0.08	3.7	1.17
OVERLAND	10	PF 1	0.04	26.7	26.83	26.76	26.83	0.000066	0.09	0.46	7.1	0.11
OVERLAND	5	PF 1	0.04	26.75	26.81	26.81	26.83	0.007248	0.55	0.07	2.32	1
OVERLAND	0	PF 1	0.04	26.73	26.78	26.77	26.79	0.004005	0.41	0.1	3.19	0.75

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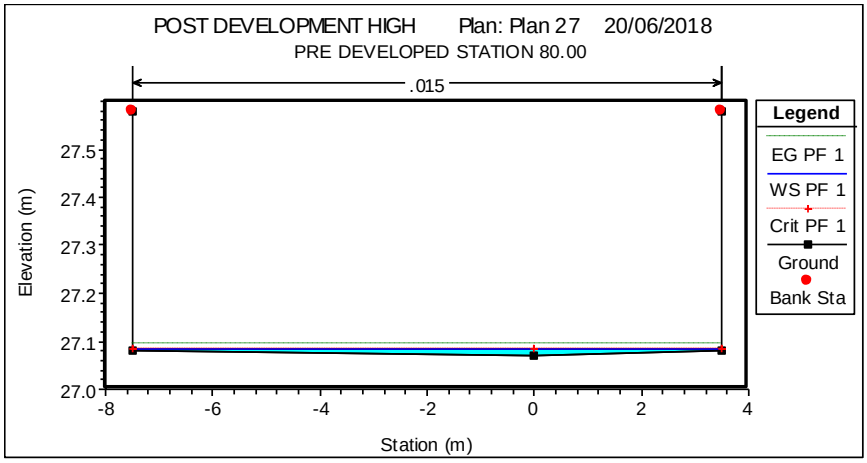

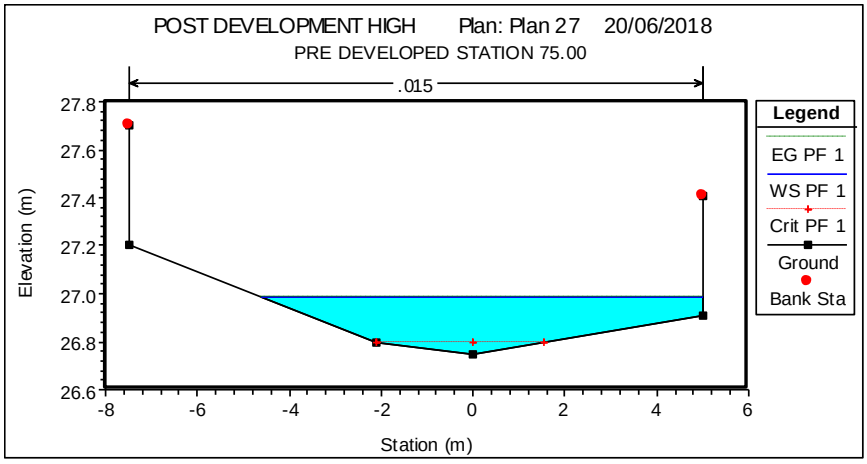

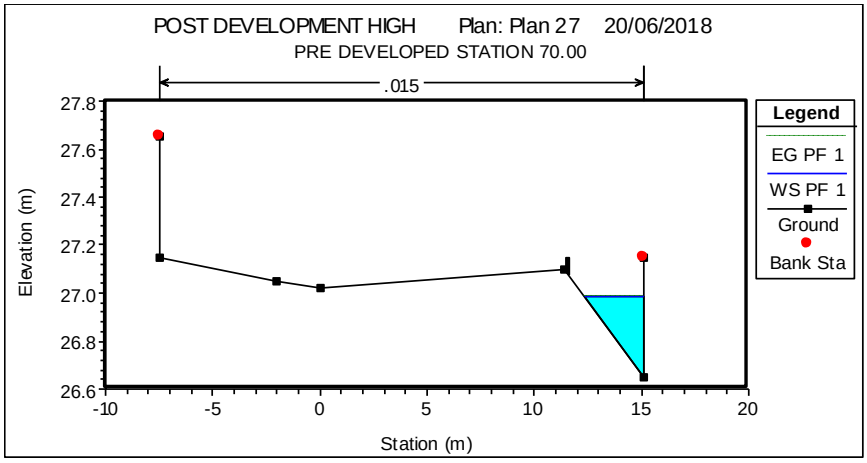

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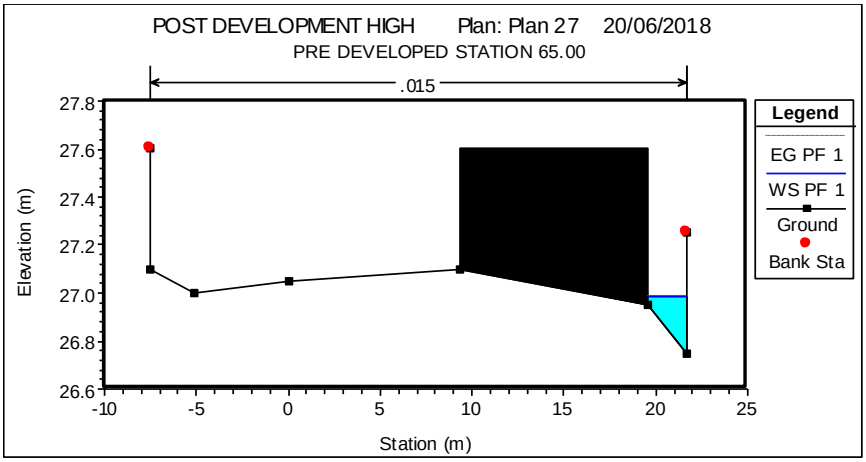

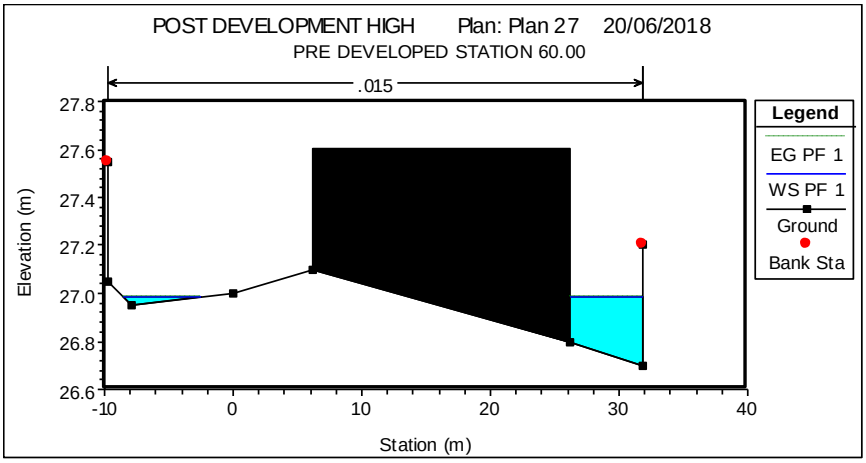

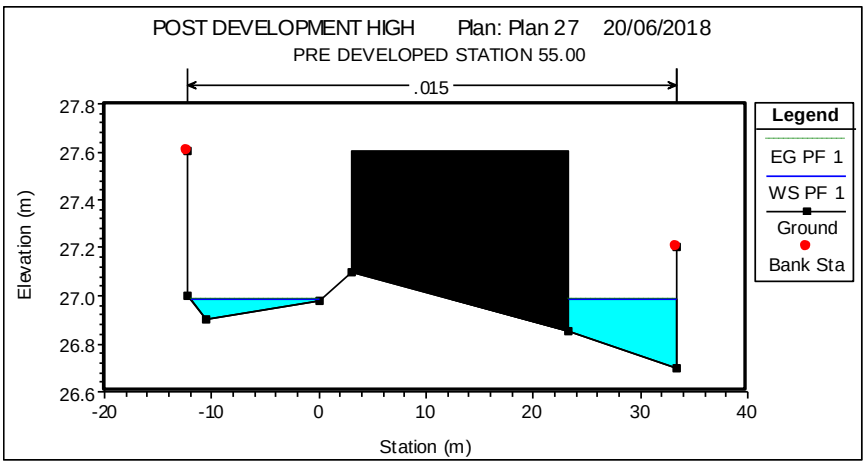

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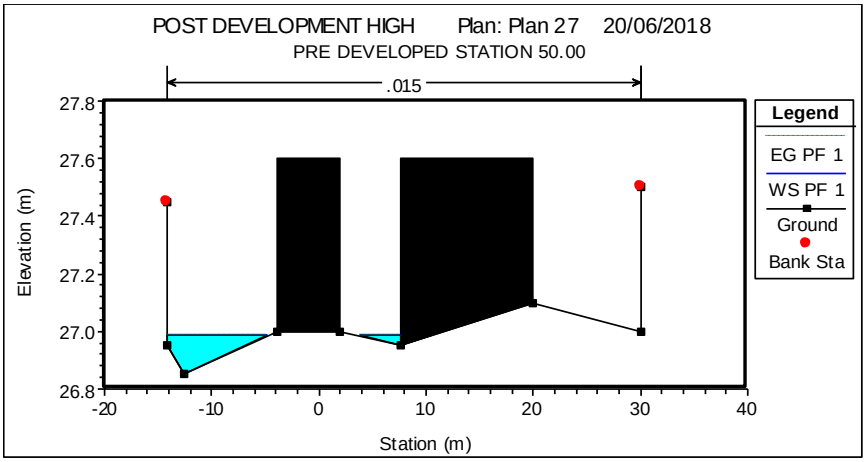
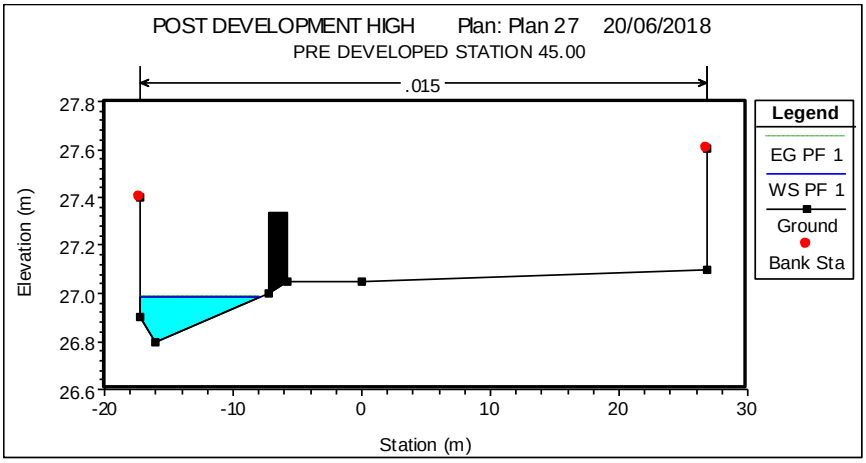
STRUCTURAL & CIVIL ENGINEERS

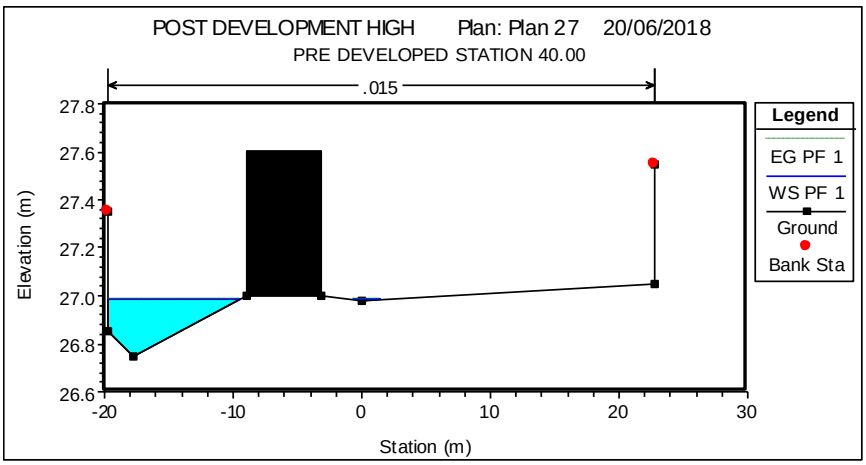
Suite 303/29-31 Lexington Drive
Norwest Business Park
Bella Vista NSW 2153

All Correspondence to:
PO BOX 6080
Baulkham Hills BC
Baulkham Hills NSW 2153

Ph: 8814 6191
Fax: 8814 5301
Email: andrew@camconsulting.com.au







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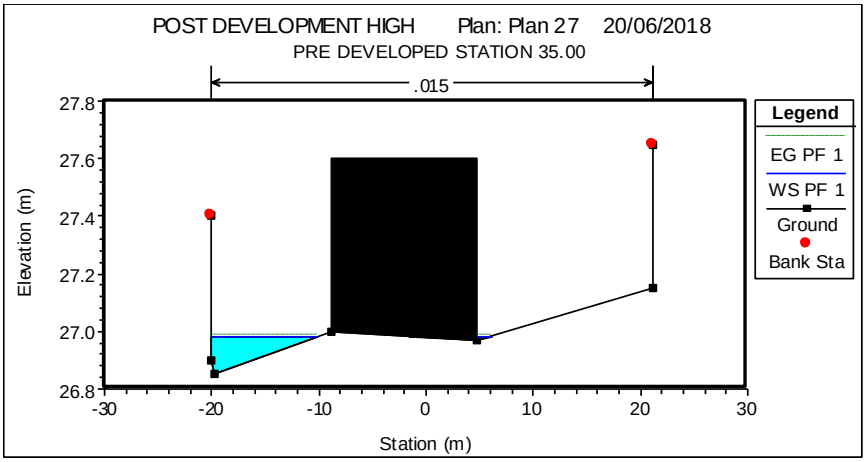

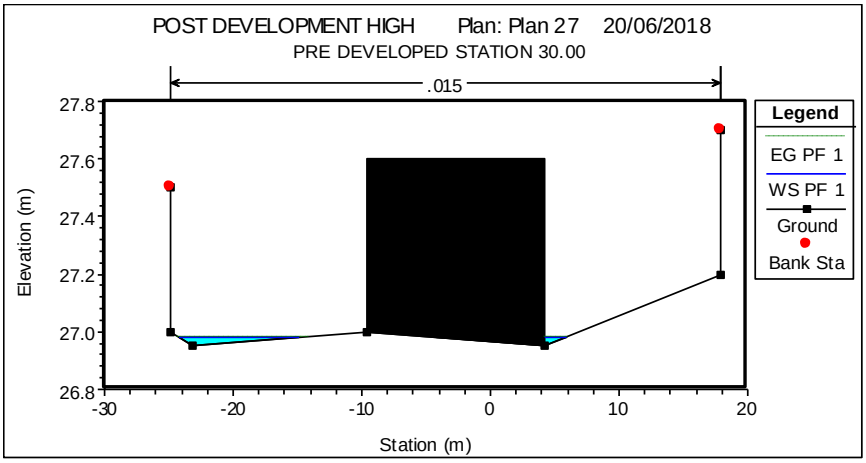

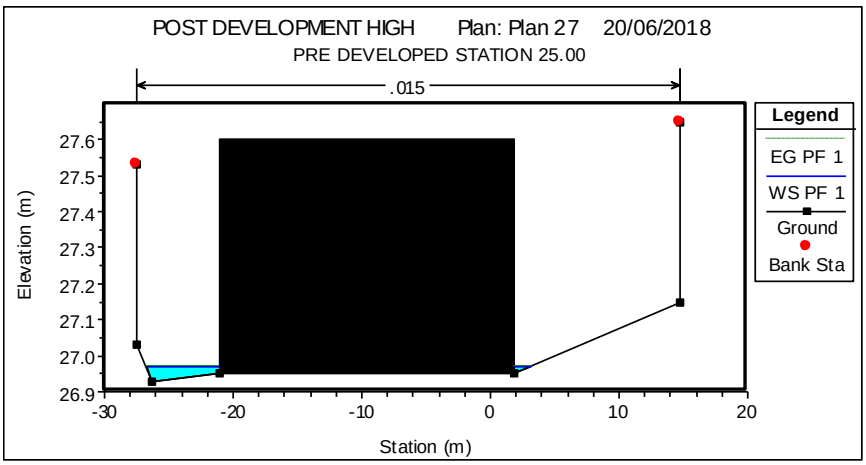

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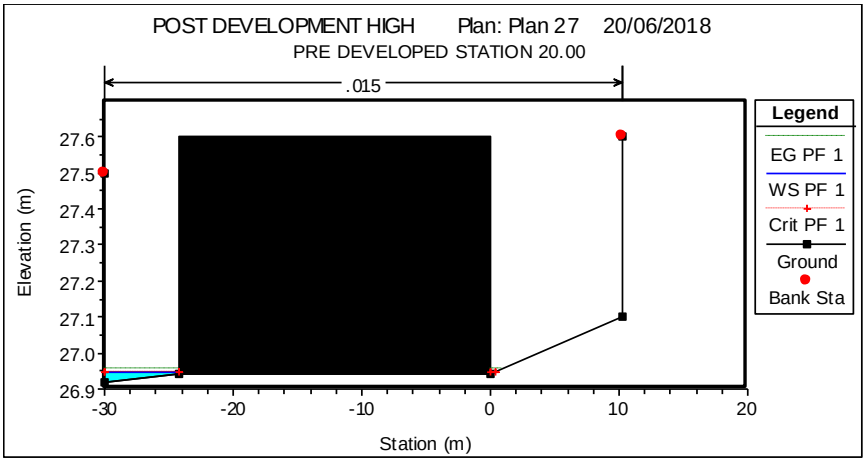

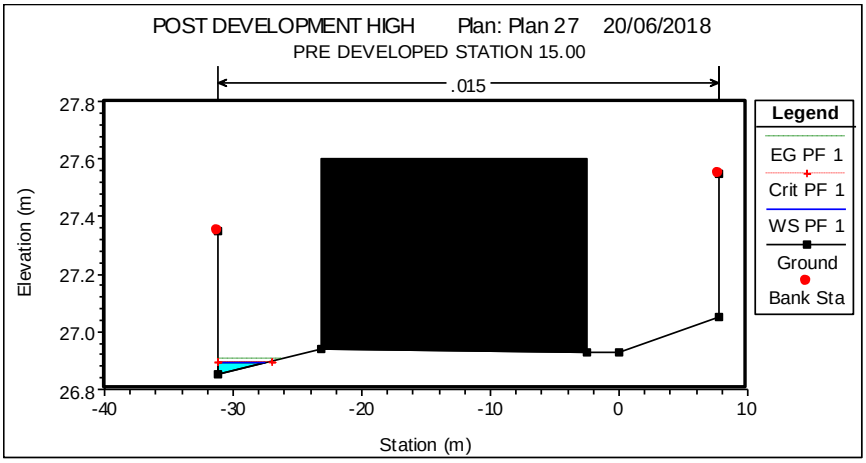

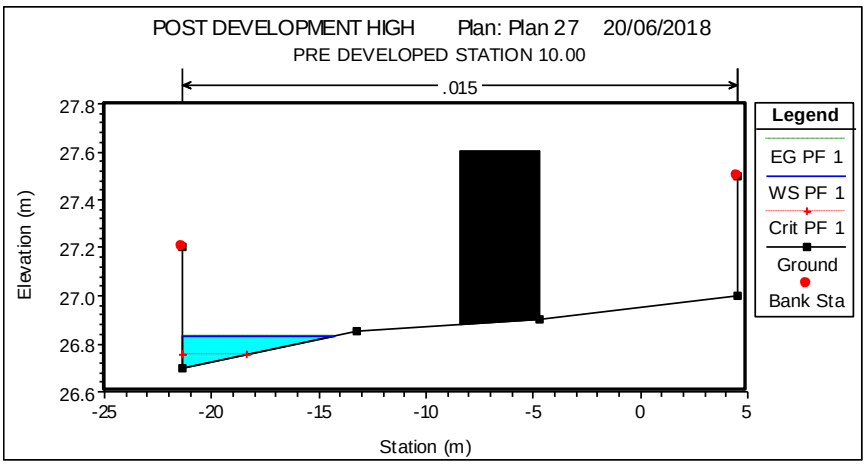

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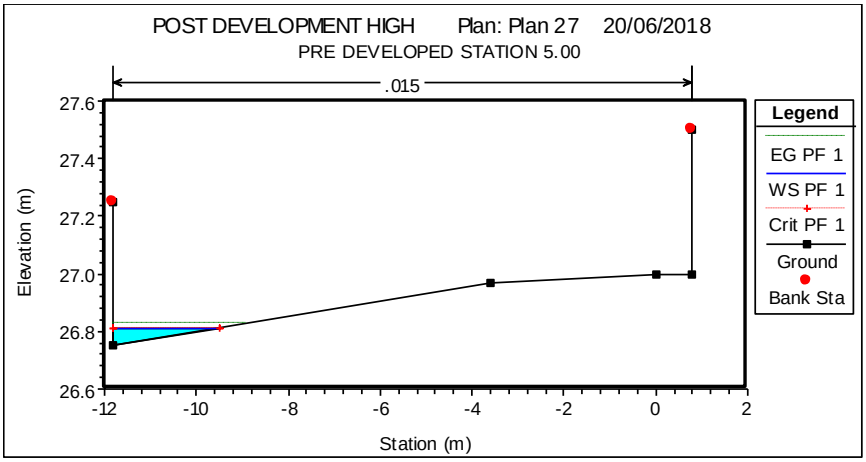

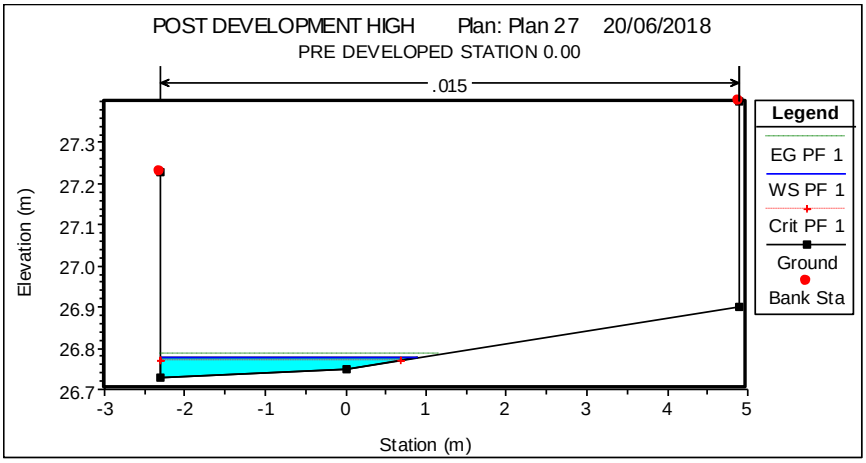

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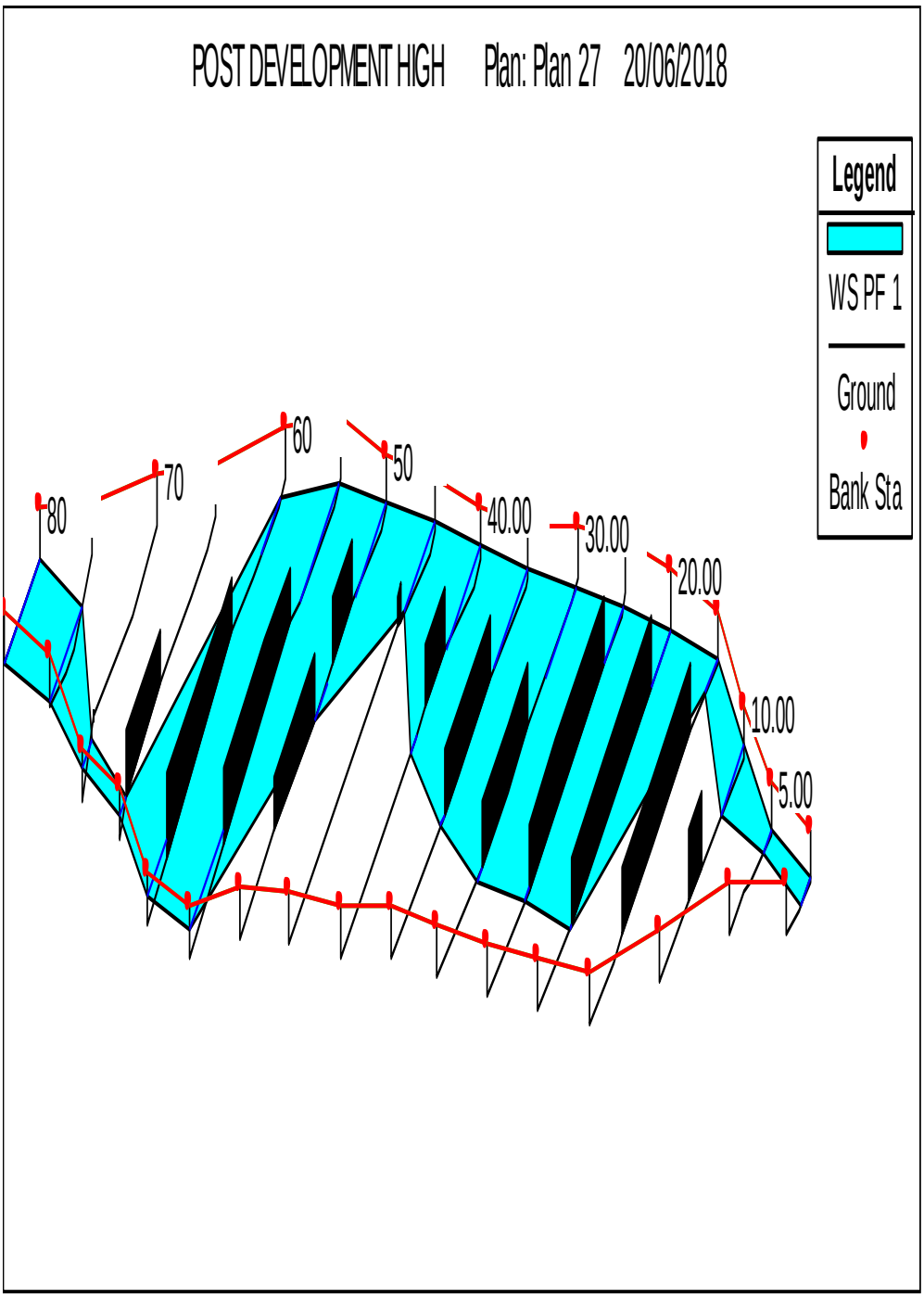

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