AMCOR BOTANY PAPER MILL
Stormwater Detention Assessment

IMPACTS ON BUNNERONG CHANNEL

- Final
- 21 November 2005

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Contents

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Executive Summary

The AMCOR Botany Paper Mill is located in Botany Road, Matraville. Stormwater runoff from the western part of the site drains into the Bunnerong Channel. The AMCOR site is at the downstream end of the Bunnerong Channel catchment, 150m from the outlet where the extent of Sydney Water ownership of the Channel ends. AMCOR propose to construct a new Paper Mill, and as part of the development of the proposal an assessment has been undertaken to determine if there would be any impact on the peak flow in the Bunnerong Channel as a result of the redevelopment. Any adverse impact on flooding would need to be managed with on-site detention.

Hydrological modelling was undertaken, using the XP-RAFTS model, to ascertain if there would be any adverse impact from runoff from the new Paper Mill development on flows in the Channel.

The modelling results indicate that the runoff from the existing AMCOR site is only a very small fraction of the flow through the Channel. For the proposed development, the fraction impervious of the site would not change. As a sensitivity test, however, the model was run assuming the AMCOR site was 100% impervious in the future case. The impact that this had on the hydrograph through the Bunnerong Channel was negligible and consequently the development would have no impact on the capacity of the Channel. These results indicate that flow in the Channel would not be affected by the proposed new Paper Mill, therefore the development on the AMCOR site would have no effect on flooding impact downstream of the site and on site detention would not be required.

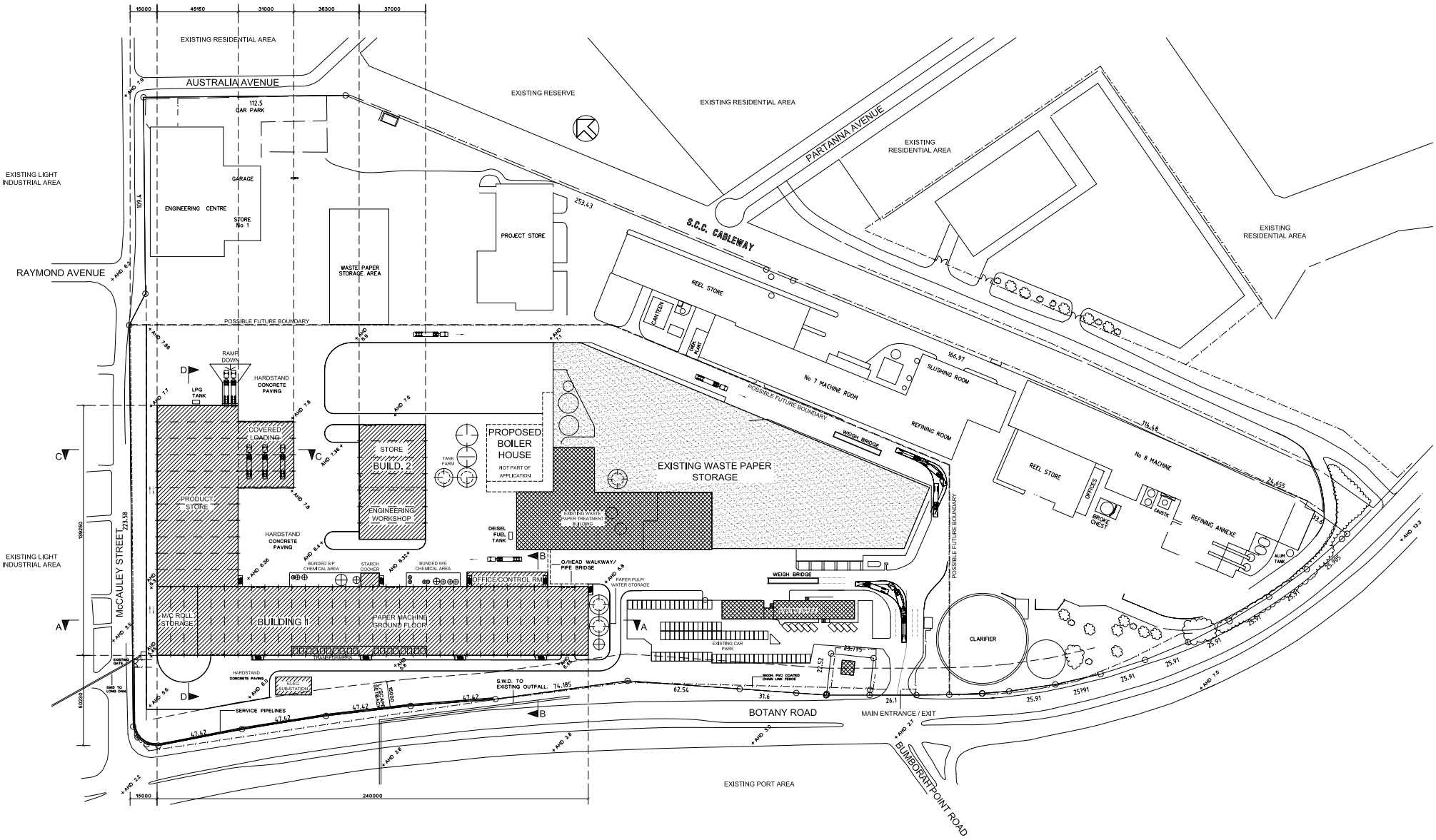
The remainder of the AMCOR site drains east towards the Bunnerong Open Canal. It is expected that the results provided in this report for the western part of the AMCOR site can be applied to the eastern part of the site, indicating that on-site detention would not be required on the entire AMCOR site for the new Paper Mill.

1. Introduction

The AMCOR Botany Paper Mill is located in Botany Road, Matraville. AMCOR wish to re-develop the site, including constructing a new Paper Machine Building. Refer to **Figure 1** for the layout of the proposed facilities.

Stormwater from the western part of the site drains westward to the Bunnerong Channel. Refer to **Figure 2** for a map of the AMCOR site stormwater network. Bunnerong Channel is owned by Sydney Water up to the point shown on **Figure 3.** This point will be referred to herein as the 'outlet'. From the outlet to Botany Bay, the Channel is owned by Sydney Ports Authority. The runoff from the AMCOR site enters the Channel upstream of the outlet.

The aim of this flood assessment is to identify the impact that development on the AMCOR site would have on peak flows in the Bunnerong Channel. This is required in order to determine whether any on-site detention would be required at the AMCOR site in order to mitigate any adverse impact the development may have on any downstream flooding.



SITE PLAN

0 15 30 45 60 75 150

SCALE IN METRES (1:750)

NOTE: REFER TO LANDSCAPE PLAN PREPARED BY TAYLOR BRAMMAR LANDSCAPE ARCHITECTS PTY.LTD. FOR FULL DETAILS OF PROPOSED LANDSCAPING.

LOT 1 - D.P.772737
LOT 2 - D.P.430252
LOT 13 - D.P.236739
LOT 27 - D.P.236738
LOT 1 - D.P.182378
LOT 28 - D.P.236738
LOT 33 - D.P.236738
LOT 1 - D.P.363611

Figure 1

DENOTES PROPOSED BUILDING.

DENOTES EXISTING BUILDING/STRUCTURE REMAINING OPERATIONAL.

REVISIONS.		
ISSUE	DESCRIPTION	DATE

PROJECT NORTH / ISSUE NORTH

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APPLICANT. AMCOR FIBRE PACKAGING AUSTRALASIA

PROJECT. PROPOSED NEW PAPER MILL AT 1891 BOTANY ROAD, MATRAVILLE.

DWG. TITLE. PROJECT B9 PROPOSED SITE PLAN

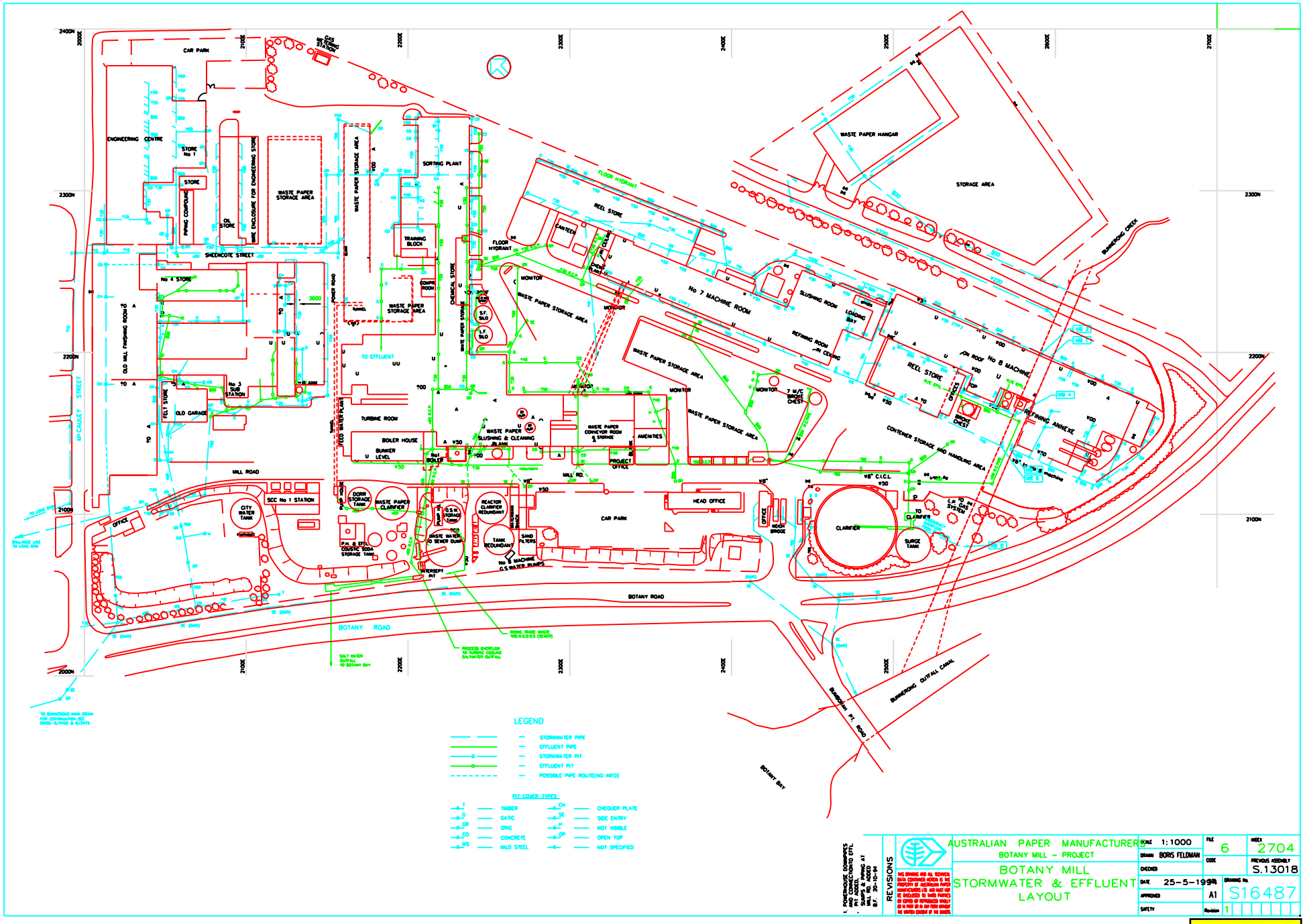
JOB NO. 1597

DATE. 17 AUGUST 2005

SCALE. 1:500

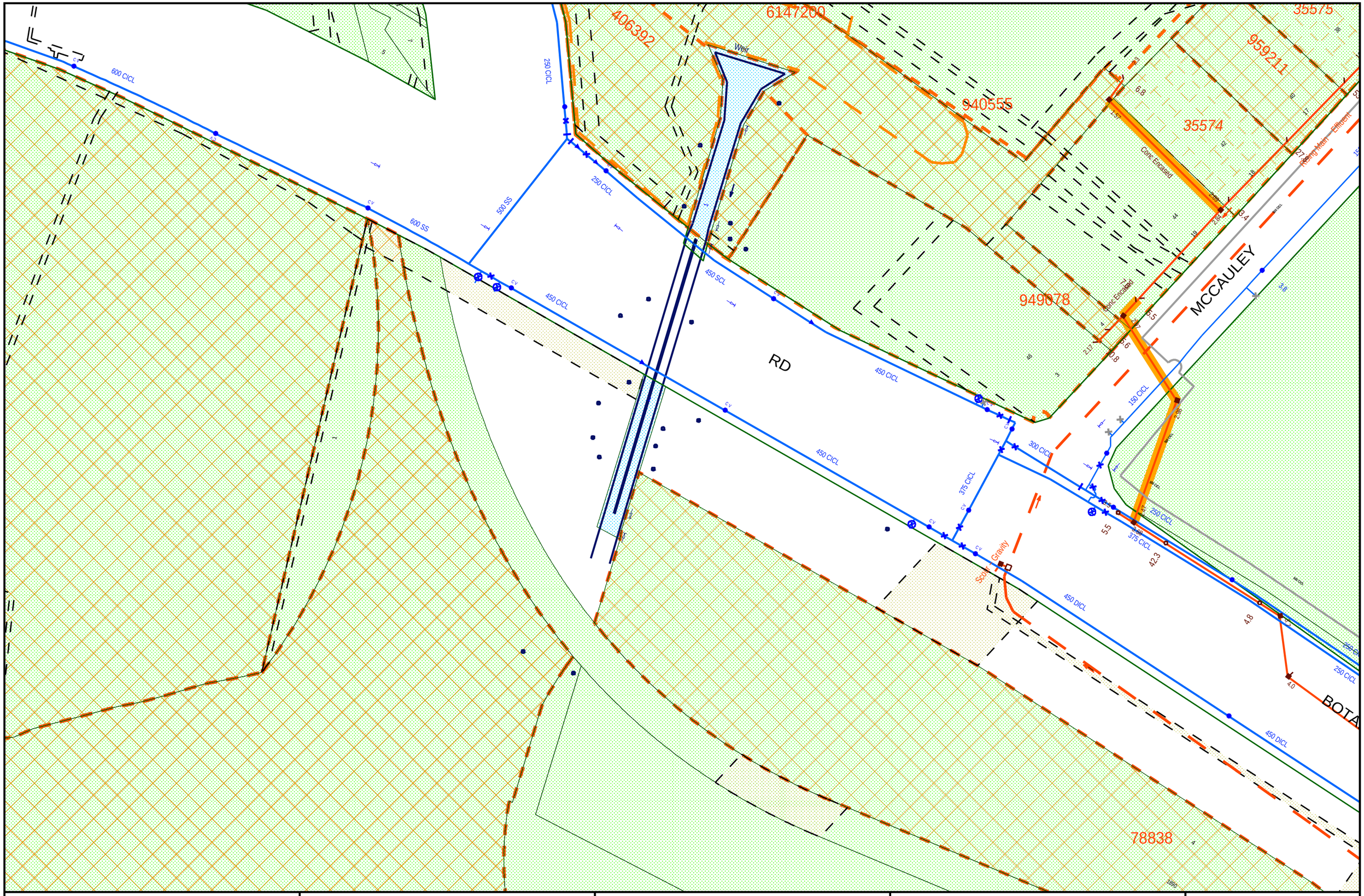
DRAWN BY. S.R.

DRG. NO. TP2 ISSUE. F



...\Botany Storm Water & Effluent S16487.DWG 17/10/2005 9:51:31 AM

Figure 2



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Date of Production: 07/09/2005
1:1000

Plot Theme:
Plot Request: None

Figure 3

2. Detention Requirements

The AMCOR site lies within the Randwick City Council Local Government Area (LGA). Randwick City Council requires most new developments in the Randwick LGA to provide on-site stormwater detention. Detention requirements are detailed in the Randwick City Council "Private Stormwater Code, October 1992" which is the current code.

The development approval authority, however, for the redevelopment of the AMCOR site is the Department of Planning (DoP). A previous AMCOR redevelopment proposal was put forward in 2000, which was similar to the current proposal, and the detention requirements were assessed by Randwick City Council for the Department of Urban Affairs and Planning. For the proposed 2000 development it was determined that on-site detention would not be required. (Refer to Error! Reference source not found. for this correspondence). Nonetheless, a new assessment has been undertaken to determine on-site detention requirements on the AMCOR site for the current redevelopment proposal.

Stormwater from the western part of the AMCOR site drains westward to the Bunnerong Channel. The Bunnerong Channel is owned by Sydney Water and therefore the development will need approval from Sydney Water. Any adverse impacts that the AMCOR development has on the peak flow of the Bunnerong Channel, if any, would need to be managed with on-site detention.

3. Hydrologic Modelling

3.1 Modelling Software

XP-RAFTS was used for the hydrologic modelling to estimate the peak flow in the Bunnerong Channel. The XP-RAFTS model simulates runoff hydrographs at defined points throughout a catchment for a set of catchment conditions and specific rainfall events. XP-RAFTS 2000 version 6.0 was used in this assessment.

3.2 Topographic Data

ArcMap was used in this assessment to analyse the catchment for the hydrological modelling. The topographic data analysed included aerial photography and 2m contour data. The date of the aerial photography is 2003.

3.3 Catchment Characteristics

The Bunnerong Channel catchment area was calculated based on 2m contour information and using GIS tools. Refer to **Figure 4** for a map of the catchment and subcatchments. The total catchment area has been estimated as approximately 395 ha. The catchment spans a length of approximately 3km from the catchment outlet (at the point which is the end of the Sydney Water ownership of the Canal) to the most upstream point. The catchment area is relatively flat with an average slope of approximately 1 percent. The catchment is characterised by urban and some industrial development.

AMCOR Botany Mill is located approximately 160m east of the Bunnerong Canal and approximately 150m upstream from the outlet point, which is the end of Sydney Water ownership of the Canal.

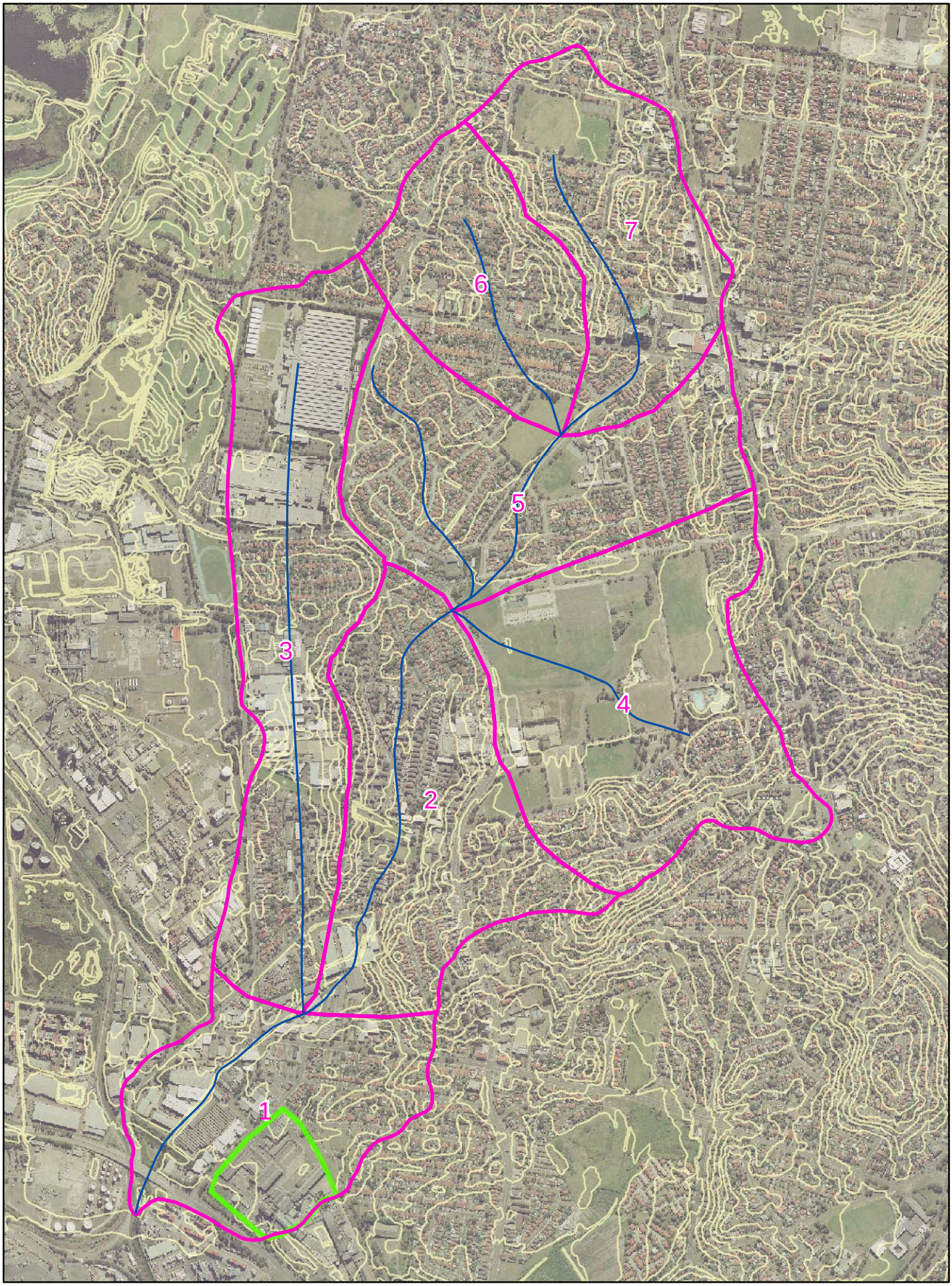
3.4 Model Data

3.4.1 Subcatchment Areas

The Bunnerong Channel catchment area was divided into seven subcatchments which were delineated using the 2m contour data. Refer to **Figure 4** for a map of these subcatchments.

3.4.2 Pervious and Impervious Fractions

The pervious and impervious fractions for each subcatchment were estimated using aerial photography. The area of the existing AMCOR site that drains to the Bunnerong Channel is estimated to be approximately 90% impervious. For the proposed development case, the proposed landscaping layout indicates that the fraction impervious would not change. For this assessment however, a conservative assumption that the site is 100% impervious in the future has been included in the modelling for purposes of comparison and as a sensitivity analysis.



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File Location: \EN01893\Technical\GIS
Date: 13/10/2005
Revision: 4
Datum: GDA94, MGA Zone 56

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Metres

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Legend

- Overland Drainage
- Contours 2m
- Bunnerong Channel Catchment
- AMCOR site area draining to Bunnerong Channel

Bunnerong Channel Catchment
Figure 4

SKM

The fraction impervious used in the modelling for each of the subcatchments is provided in **Table 1.**

- **Table 1 Fraction impervious**

Subcatchment ID	Fraction Impervious (%)
1	62
2	67
3	80
4	26.5
5	67
6	70
7	62
AMCOR site	90

3.4.3 Losses

The initial and continuing loss model was adopted in the modelling. The parameters for pervious and impervious area initial and continuing losses were taken from the RAFTS reference manual:

- Pervious Areas: 10 mm initial loss, 10 mm/hr continuing losses.
- Impervious Areas: 1.5 mm initial loss, 0 mm/hr continuing losses.

3.4.4 Lag times

Lag times were calculated using the kinematic wave equation.

3.4.5 Manning's 'n'

A Manning's 'n' value of 0.02 was adopted for impervious areas, and an 'n' value of 0.05 was used for the pervious areas.

3.5 Methodology

The XP-RAFTS model was run for the 5, 20 and 100 year Average Recurrence Interval (ARI) storm events for a range of durations from the 10 minute to the 24 hour storms. The design rainfall for the storms has been estimated using *Australian Rainfall and Runoff Volume 1* (1987). Recorded flood level data was not available for calibration of the model, however, as this assessment is a comparison of pre and post development conditions that is considered acceptable. A rough calibration of the model was done against the Rational Method and the RAFTS results were within 10% of the Rational Method estimate of peak flows which is reasonable.

The peak flow hydrograph at subcatchment 1 (through the Channel and at the catchment outlet) was compared to the peak flow hydrograph from the AMCOR site. This was done to determine the impact that the runoff from the AMCOR site has on flows in the Bunnerong Channel. The results are provided in **Section 4**.

4. Model Results

4.1.1 Peak Flows

The model was run for the 5, 20 and 100 year ARI storm events and the peak flows at subcatchment 1 (the Channel and catchment outlet) were analysed compared to the peak flows from the AMCOR site.

The peak flow for the three storm events in the Bunnerong Channel and at the catchment outlet are provided below in **Table 2.** The peak flow for the three storm events from the AMCOR site, for the existing case, are provided below in **Table 3.**

- **Table 2 Peak flows in Bunnerong Channel**

ARI storm event	Peak Flow (m3/s)	Critical Storm Duration
5 yr	51.3	2 hr
20 yr	72.1	2 hr
100 yr	109.6	90 min

- **Table 3 Peak flows from the AMCOR site (existing case)**

ARI storm event	Peak Flow (m3/s)	Critical Storm Duration
5 yr	3.5	25 min
20 yr	4.6	25 min
100 yr	5.6	90 min

For the future conditions, the proposed landscaping layout of the site indicates that the fraction impervious of the site will not change. A sensitivity analysis has been undertaken, however, for purposes of comparison by making the AMCOR site 100% impervious. It is assumed that the fraction impervious of the remainder of the Bunnerong Channel catchment would not change in future as it is already entirely developed. The peak flows from the AMCOR site in this case are provided in **Table 4**. As shown in the table, there would be an approximate 11% increase in peak flow runoff from the site for the conservative sensitivity analysis compared to the existing case.

- **Table 4 Peak flows from the AMCOR site (100% impervious case)**

ARI storm event	Peak Flow (m3/s)	Critical Storm Duration	% increase compared to existing case
5 yr	3.9	25 min	11%
20 yr	5.1	25 min	11%
100 yr	6.1	90 min	9%

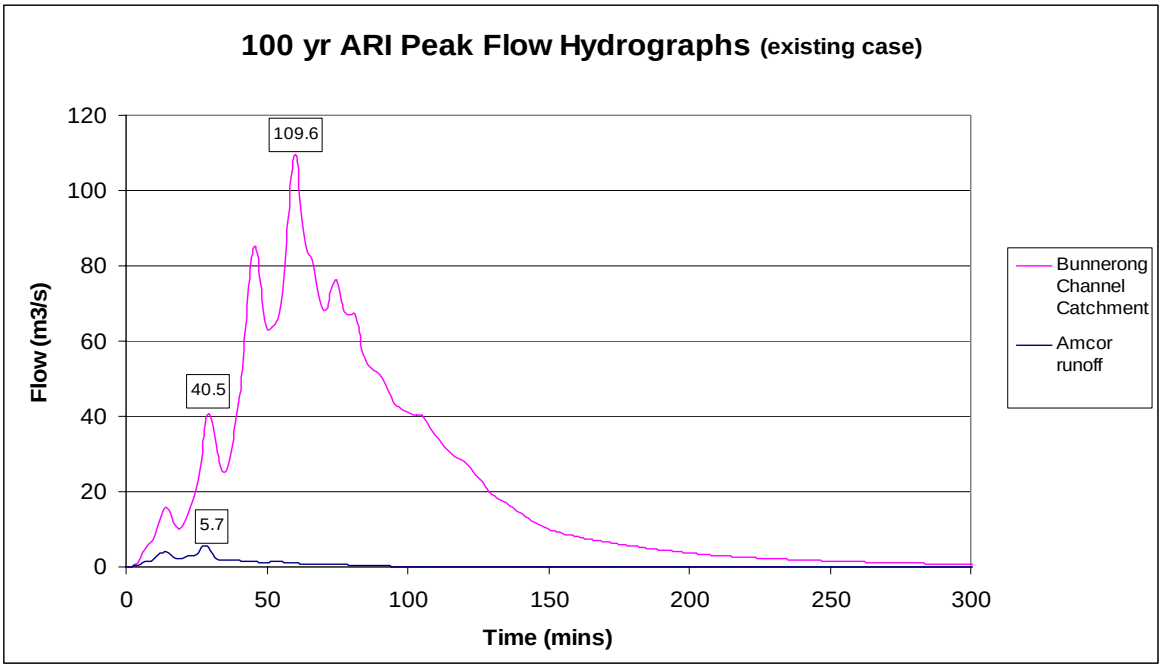
4.1.2 Hydrograph Comparison

To evaluate the impact that the AMCOR runoff has on the Bunnerong Channel hydrograph, a comparison was made between the peak flow hydrograph from the Bunnerong Channel catchment and the AMCOR peak flow hydrograph in the 100 year, 20 year and 5 year ARI events for the existing case. As seen on the graphs, the runoff from the AMCOR site is only a small fraction of the total flow through the Channel.

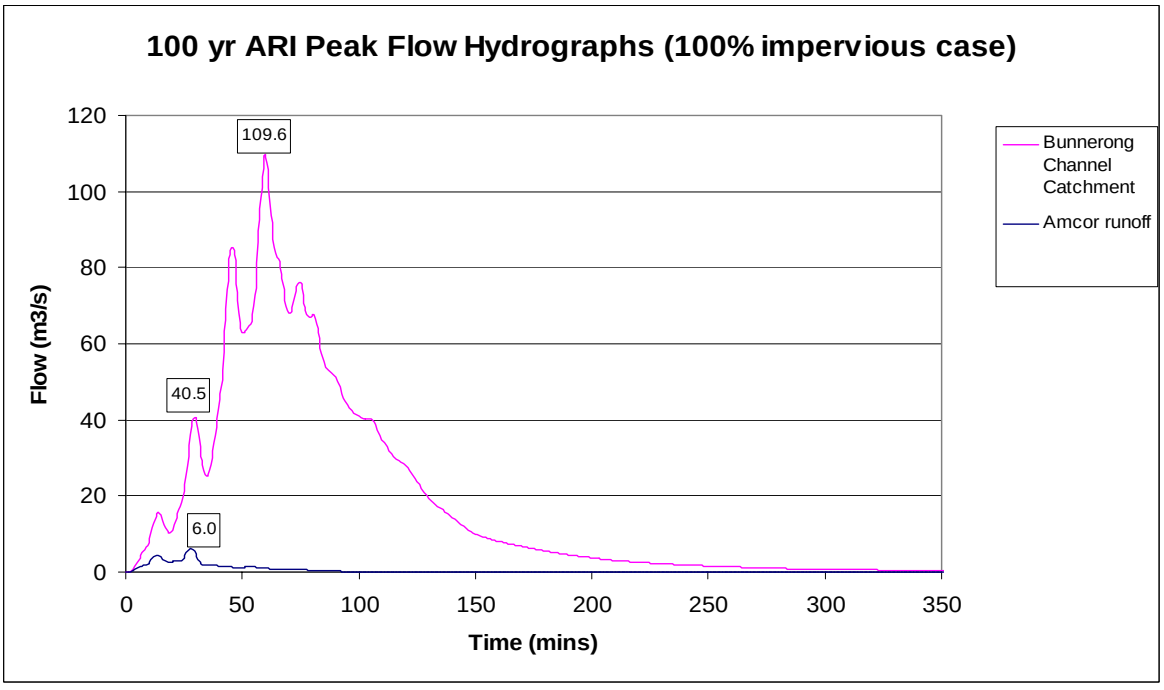
A comparison was then made between the peak flow hydrograph from the Bunnerong Channel catchment and the AMCOR peak flow hydrograph in the 100 year, 20 year and 5 year ARI event for the conservative 100% impervious case. As seen on the graphs, increasing the fraction impervious of the AMCOR site to 100% causes for the 5 and the 20 year hydrograph a 0.1 m^3/s and 0.2 m^3/s increase in flows respectively at the point in the Channel hydrograph which corresponds to the peak in the AMCOR runoff hydrograph. This increase can reasonably be considered negligible. There is no impact on the peak flow in the Bunnerong Channel for any of the storm events. This indicates that the development at the AMCOR site would have no impact on the capacity of the Bunnerong Channel, and on site detention would not be required.

These are expected results and are primarily due to the location of the AMCOR site at the downstream of the Bunnerong Channel catchment, and the size of the AMCOR site compared to the total catchment area. The hydrograph from the AMCOR site has only a tiny, if any, impact on the total hydrograph through the Channel and for all storm events, the peak runoff from the AMCOR site will pass through the Channel before the peak flow from the total Channel catchment passes through.

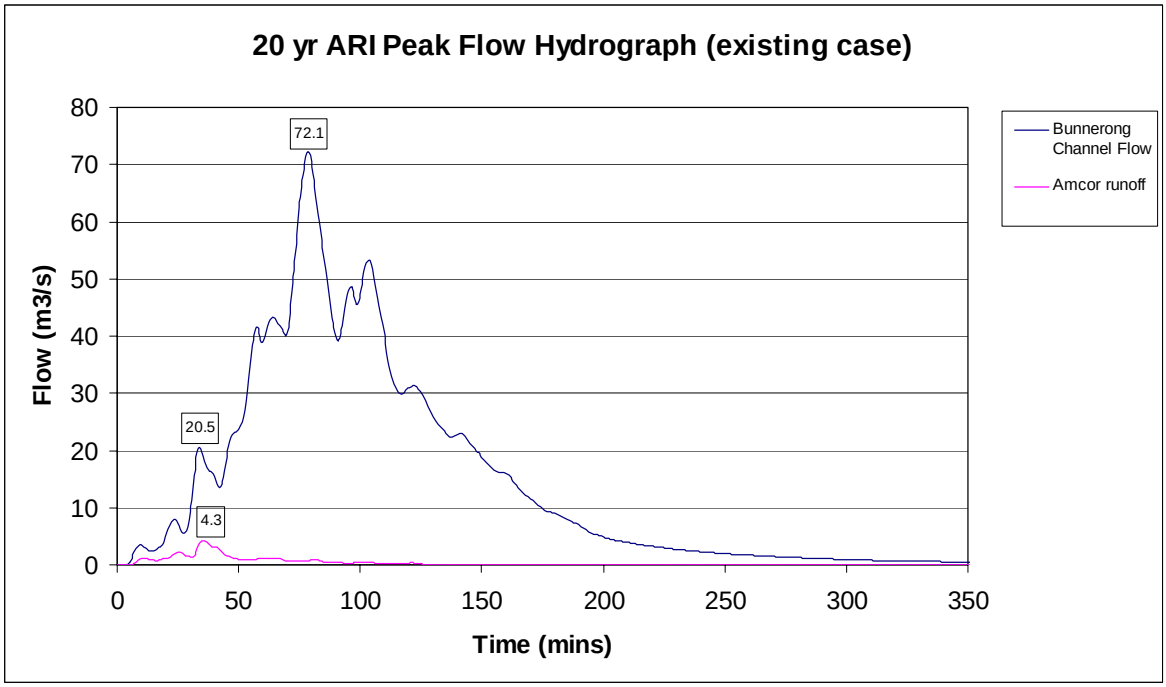
- **Figure 5 Comparison of 100 yr ARI event hydrographs (existing case)**



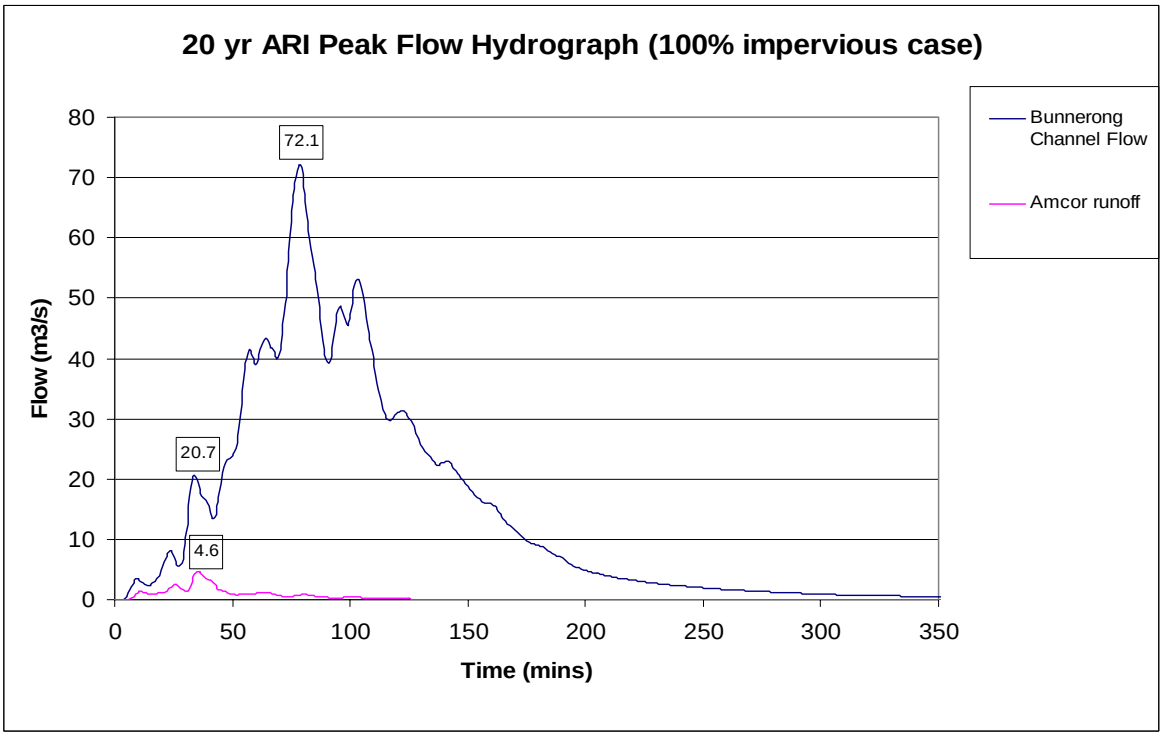
- **Figure 6 Comparison of 100 yr ARI event hydrographs (100% impervious case)**



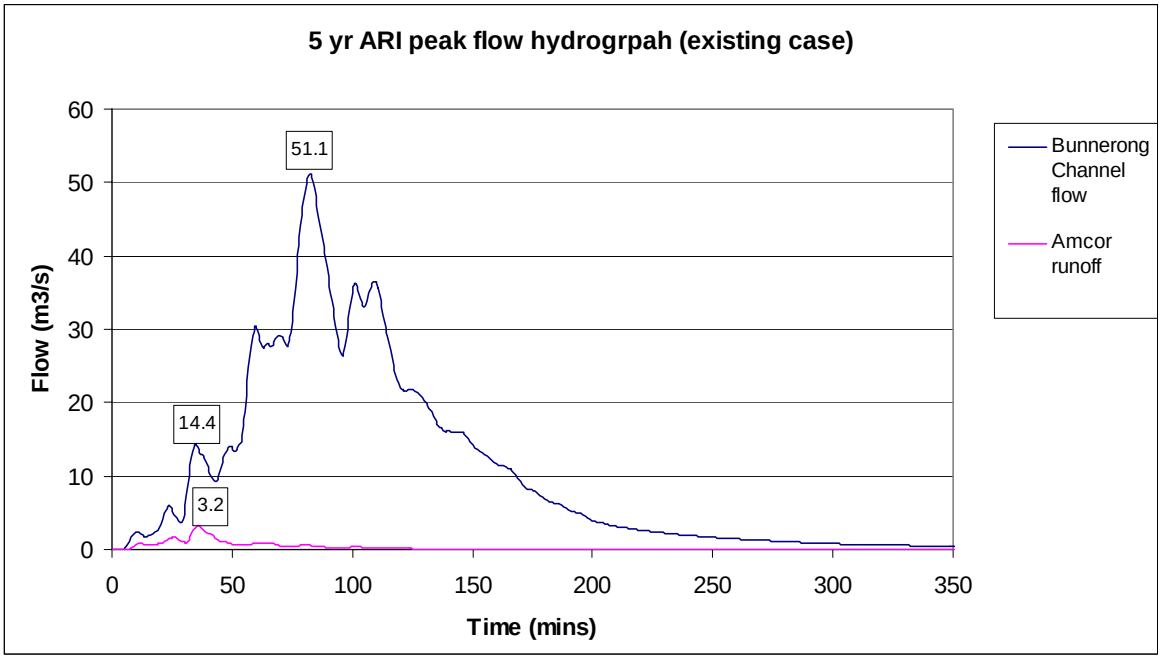
- **Figure 7 Comparison of 20 yr ARI event hydrographs (existing case)**



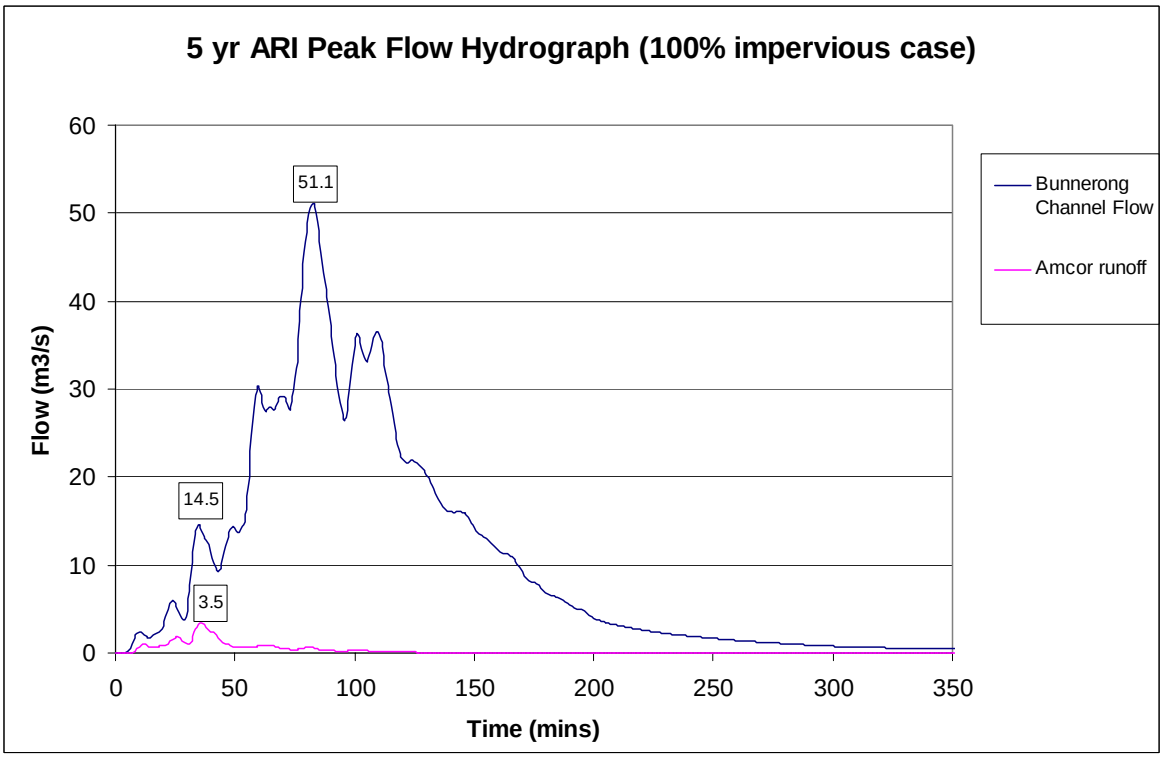
- **Figure 8 Comparison of 20 yr ARI event hydrographs (100% impervious case)**



- **Figure 9 Comparison of 5 yr ARI event hydrographs (existing case)**



- **Figure 10 Comparison of 5 yr ARI event hydrographs (existing case)**



5. Conclusion

The Bunnerong Channel catchment is approximately 3km from the most upstream end to the outlet. The AMCOR site is at the downstream end of the Bunnerong Channel catchment, 150m from the outlet. Stormwater runoff from the west of the AMCOR site drains into the Channel, upstream of the outlet.

Hydrological modelling was undertaken, using the XP-RAFTS model, to determine if there would be any adverse impact that the development would have on flows in the Channel.

The modelling results indicate that the runoff from the AMCOR site is only a very small fraction of the flow through the Channel. For the proposed development case the fraction impervious of the site would not change. As a sensitivity test, however, the model was run assuming the AMCOR site was 100% impervious in the future case. The impact that this had on the hydrograph through the Bunnerong Channel would be negligible, meaning that the development would have no impact on the capacity of the Channel. These results indicate that on flows in the Channel would not be affected by the proposed AMCOR redevelopment, therefore the development on the AMCOR site would have no effect on flooding in the area and on site detention would not be required.

The Eastern part of the AMCOR site drains east towards the Bunnerong Open Canal. It is expected that the results provided in this report for the western part of the AMCOR site can be applied to the eastern part of the site, and that on-site detention would not be required. This is for the same reasons of the location of the AMCOR site at the downstream of the Bunnerong Open Canal catchment, and the size of the AMCOR site compared to the total Canal catchment area.

Appendix A Extract from Randwick City Councils Report to DUAP on previous AMCOR Development

5.2 Landscape Issues

Council's Landscape Technician has considered the application and he advised/recommended the following:

With respect to the retention of the Phoenix palms in McCauley Street please note that although significant, these palms may be infected with Fusarium wilt. At present there is no horticultural treatment for this water borne pathogen and once infected the trees will inevitably die.

Given the presence of Fusarium within populations of Phoenix palms throughout the eastern suburbs it would be advisable to include a condition of consent requiring the testing of these trees and the immediate removal of any trees found to be infected to slow the rate of spread of the disease.

5.3 Drainage Issues

Council's Drainage Engineer has considered the application and advises/recommends the following:

Onsite detention of stormwater is not required for this application.

The above site is located adjacent to, and east of, a major Sydney Water controlled trunk drain. The water extracted from the Long Dam is used for the paper manufacturing process. The development site is also located over a major stormwater culvert that drains from Bunnerong Road.

The applicant will have to submit to Council for approval, and have approved by the Director of Asset & infrastructure Services, a plan with drainage calculations (compiled by a suitably experienced and qualified Civil Engineer) that determines the 1 in 100 year flood event for this area using the "ILSAX" Urban Drainage Simulation Model.

There is a possible overland stormwater flow route down McCauley Street. All internal driveways accessed from McCauley Street shall be designed with a high point above the calculated 1 in 100 year flood level and in such a manner as to ensure that floodwater cannot enter the site. Any floor level shall be required to be a minimum of 300 mm above the calculated 1 in 100 year flood level.

The Planning Department is advised that the required drainage analysis and subsequent consideration of habitable floor levels and driveway levels may affect the height of the development AND/OR floor to ceiling heights within the development. The height variation should be within 300 to 400 mm at the property alignment in McCauley Street.

5.4 Traffic Issues

The Director of Asset and Infrastructure Services has been advised by the Director of Planning and Environment that DUAP will be dealing with the SEPP 11 referrals and