DRAINAGE REPORT

Allen Price & Scarratts Pty Ltd
Land & Development Consultants
75 Plunkett Street
NOWRA NSW 2541

Client:	**Shoalhaven Starches**
Project:	**Proposed Development Stormwater Concept**
Project No:	**N26856**
SCC Ref:	**N/A**
Date:	**20 October 2016**

PROPOSED DEVELOPMENT DRAINAGE DESIGN REPORT at 160 BOLONG ROAD, BOMADERRY

This report has been prepared to support a development application in accordance with Shoalhaven City Council's DCP2014 and Subdivision Engineering Specification D5 for events from the 10% AEP to 1% AEP.

Calculations have been prepared by a qualified practicing engineer using Colebrook-White Method, Bernoulli's Principle and Rational Methods.

The proposed development includes an industrial building 'Flour Mill B' and a related Mill Silo. The existing condition of the areas to be developed is a mixture of concrete and asphalt surfaces, as such the existing area is considered to be 100% impervious.

As there is no change in impervious area for the development, the total discharge pre and post development is determined to be equal and as such no additional detention is required. It is also noted that as the water will be captured from the roof of Flour Mill B it will be significantly cleaner than existing ground surface run-off.

Existing building Flour Mill A currently discharges its roof stormwater via a 150mm diameter PVC pipe the runs down the northern side of the building. Once underground the existing pipe turns south and extends under the Flour Mill A building before entering a Gross Pollutant Trap (AGLASS PTY LTD GPT-10-150). The GPT then discharges to the salt water cooling return pit which discharges into the Shoalhaven River.

It is concluded that as the runoff from the new Flour Mill roof will be cleaner than the current ground level runoff, and will also pass through the GPT prior to discharge, this runoff will be cleaner than the current arrangement and will therefore improve as a result.

Flows from the existing building under a 10% AEP event are calculated to be approximately 16L/s, while the manufacturer reports the GPT to have a maximum design flow of 150L/s.

The pipe as it runs under Flour Mill A is charged and hence has a higher than normal outlet capacity due to the available head (approximately 30m). To determine the suitability of the existing stormwater line some key factors needed to be determined:

a) Total discharge of proposed and roof drainage system
b) Head required to discharge this flow assuming orifice conditions
c) Head required to overcome friction in the line from the base of the down pipe to the outlet
d) Head required to overcome height rise in the pipe as well as the GPT

In compliance with Shoalhaven City Council's DCP2014 and Subdivision Engineering Specification D5 the Major and Minor drainage systems have been designed and summarised as follows:

Minor Drainage (10% AEP):

- Piped flows from the existing Flour Mill A and future Flour Mill B are to discharge to the Shoalhaven River via the existing GPT.
- Based upon the site being 100% paved, the permissible discharge of the site is $0.036m^3/s$ for 10% AEP (See Appendix A).
- Post development the total discharge from the proposed allotment is $0.036m^3/s$ for 10% AEP (See Appendix A).
- The post-development peak flow rates from the site do not exceed the pre-development peak flow rates.

- Total discharge from the site is 36.1L/s which is still far below the existing GPT capcity (as reported by manufacturers).
- Appendix E indicates the location for possible pipe work and survey requirements.

Major Drainage (1% AEP):

- All major drainage flows are to discharge from the site overland as sheet flows. No stormwater is proposed to discharge into adjoining private properties in a concentrated manner.
- Based upon the site being 100% paved, the permissible discharge of the site is $0.053m^3/s$ for 1% AEP.
- Post development the total discharge from the proposed allotment is $0.053m^3/s$ for 1% AEP.
- The post-development peak flow rate from the site does not exceed the pre-development peak flow rate.

Using the 1:10 ARI storm the head pressures requried for successful outlet of stormwater are calculated in Appendix C and D. It is determined that the existing system is capable of discharging the 36.1L/s generated in the 10yr storm event and hence downpipes are able to be slung from the walls of proposed Flour Mill B as long as the connection point to the main stormwater line is greater than 4.21m above ground level. It is recommended that the connection point be no lower than 6m above ground level to ensure adequate discharge.

As part of the design, it is noted that the proposed Flour Mill B building must incorporate the existing 150mm down pipe into its structure to maintain the existing flow from Flour Mill A.

As the Mill Silo has no nearby drainage connections available and is so small in catchment area it is proposed to diffuse the roof water via a modified tee junction as shown in Appendix E. This will maintain the existing flow path, volume and quality of the surface run-off.

It is also noted that the location of existing drainage structures must be confirmed by survey at detail design stage to divert any active stormwater from under the proposed building footprint.

Appendix A to E show the calculations verifying that the discharge from the site for design events up to and including the 100 year average recurrence interval does not exceed the pre-developed conditions.

APPENDIX A – Flour Mill B Flow Generation Calculation Sheet

FLOW GENERATION CALCULATIONS

allen price & scarratts pty ltd
land and development consultants

Allen Price & Scarratts Pty Ltd
75 Plunkett Street
NOWRA NSW 2541

Client: **Shoalhaven Starches**
Project: **Concept Stormwater - Proposed Flour Mill B**
Project No: **N26856**
Council's Ref: **N/A**
Date: **14-Oct-16**

Q=Cy*I*A*2.78 (in L/s)

Time of Concentration (mins) =	5	
Rainfall Intensity 1:10 ARI (mm/hr) for Nowra I =	194	
Rainfall Intensity 1:100 ARI (mm/hr) for Nowra I =	282	
Co-efficient of Runoff Cy=	0.9	(assume 100% impervious)
Total Site Area (ha) =	0.0744	
Total Site Discharge (L/s) =	36.1	1:10 ARI
Total Site Discharge (L/s) =	52.5	1:100 ARI

Catchment Description	Catchment Type	Catchment Area (m2)	Discharge Q (L/s)	Cumulative Discharge (L/s)	Cumulative Discharge (m3/s)	Min Size (mm)	Min Grade
		EXISTING CONDITIONS					
FLOUR MILL A	ROOF AREA	334	16.2	16.2	0.016	**150**	**0.5%**
EXISTING CONCRETE/BITUMEN HARDSTAND AREA	OVERLAND FLOW	410	19.9	36.1	0.036	**N/A**	**N/A**
	Total Pre-development discharge to Shoalhaven River			**36.1**	**0.036**		
		ASSUMING FLOUR MILL COMBINED DRAINAGE					
FLOUR MILL A	ROOF AREA	334	16.2	16.2	0.016	**150**	**0.5%**
FLOUR MILL B	ROOF AREA	410	19.9	36.1	0.036	**150**	**2.0%**
					OR	**225**	**0.5%**
	Total Post-developmentdischarge to Shoalhaven River			**36.1**	**0.036**		
		ASSUMING FLOUR MILL PARALLEL PIPE DRAINAGE					
FLOUR MILL A	ROOF AREA	334	16.2	16.2	0.016	**150**	**0.5%**
FLOUR MILL B	ROOF AREA	410	19.9	19.9	0.020	**150**	**1.0%**
	Total Post-developmentdischarge to Shoalhaven River			**36.1**	**0.036**		

APPENDIX B – Mill Silo Flow Generation Calculation Sheet

FLOW GENERATION CALCULATIONS

allen price & scarratts pty ltd
land and development consultants

Allen Price & Scarratts Pty ltd
75 Plunkett Street
NOWRA NSW 2541

Client:	**Shoalhaven Starches**
Project:	**Concept Stormwater - Mill Silo**
Project No:	**N26856**
Council's Ref:	**N/A**
Date:	**14-Oct-16**

Q=Cy*I*A*2.78 (in L/s)

Time of Concentration (mins) =	5	
Rainfall Intensity 1:10 ARI (mm/hr) for Nowra I =	194	
Rainfall Intensity 1:100 ARI (mm/hr) for Nowra I =	282	
Co-efficient of Runoff Cy=	0.9	(assume 100% impervious)
Total Site Area (ha) =	0.0011	
Total Site Discharge (L/s) =	0.5	1:10 ARI
Total Site Discharge (L/s) =	0.7	1:100 ARI

Catchment Description	Catchment Type	Catchment Area (m2)	Discharge Q (L/s)	Cumulative Discharge (L/s)	Cumulative Discharge (m3/s)	Min Size (mm)	Min Grade
		EXISTING CONDITIONS					
ASPHALT HARD STAND AREA	EXISTING GROUND SURFACE	11	0.5	0.5	0.001	**N/A**	**N/A**
	Total Pre-development discharge to Shoalhaven River			**0.5**	**0.001**		
		ASSUMING FLOUR MILL COMBINED DRAINAGE					
MILL SILO	ROOF AREA	11	0.5	0.5	0.001	**100**	**0.5%**
	Total Post-developmentdischarge to Shoalhaven River			**0.5**	**0.001**		

APPENDIX C – Flour Mill B Friction Loss through a uPVC pipe

Charged Stormwater System - Friction Loss through a PVC-U Stormwater Pipe

Allen Price & Scarratts Pty Ltd
Land & Development Consultants
75 Plunkett Street
NOWRA NSW 2541

Client:	**Shoalhaven Starches**
Project:	**Flour Mill B Concept Stormwater Drainage**
Project No:	**N26856**
SCC Ref:	**N/A**
Date:	**20-Oct-16**

Note: Bold cells only are inputs

Discharge

Development Size =	**744**	m2
ARI =	**10**	years
tc =	**5**	mins
C =	**0.9**	(100% impervious roof area)
I =	**194**	mm/hr
Area =	744	m2 (100% of roof area)
Q =	36.1	L/s
L =	**40**	m for length of pipe from bottom of downpipe to GPT (x2 for safety)
D =	**0.15**	m for diameter of pipe
k =	0.03	mm for upVC with chemically cemented joints
ν =	1.14E-06	Water at 15 degrees C
V =	2.04	m/s
N_R =	2.69E+05	
f =	0.01651	
Sf =	0.02339	m/m
Hf =	0.936	m
Therefore Hf ≈	1	m

APPENDIX D – Flour Mill B Charged Stormwater System Summary and calculation sheets

Charged Stormwater System - Summary Sheet

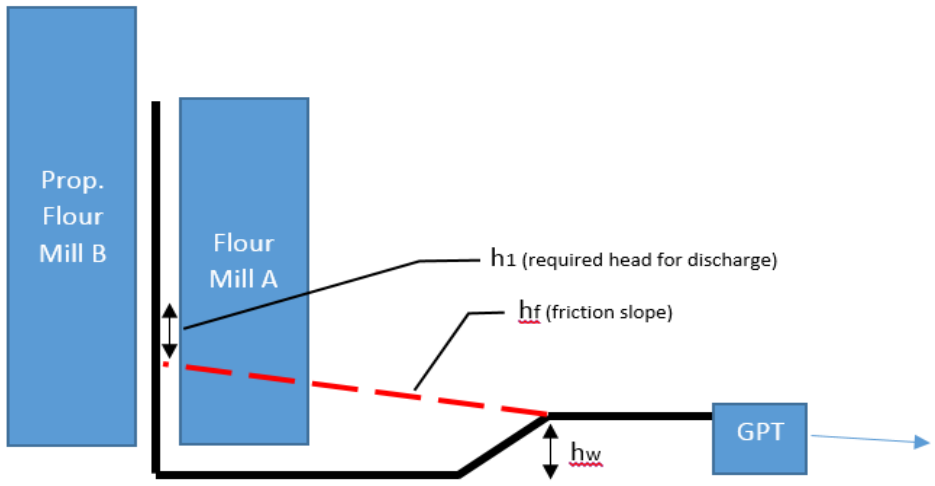
Allen Price & Scarratts Pty Ltd
Land & Development Consultants
75 Plunkett Street
NOWRA NSW 2541

Client:	**Shoalhaven Starches**
Project:	**Flour Mill B Concept Stormwater Drainage**
Project No:	**N26856**
SCC Ref:	**N/A**
Date:	**20-Oct-16**

Note: Bold cells only are inputs

Discharge

Required Flow =	**36.1**	L/s (calculated as per Flow Generation Sheet)
Orifice Diameter (base of downpipe) =	**150**	mm
Pressure Head required at orifice (h_1) =	**0.21**	m (See calculation Sheet)
Friction Head Loss (h_f)=	**1**	m (calculated as 0.936m)
Head Loss through system layout (h_w)=	**3**	m (See head loss for rise over wall)
Total Head Required at downpipe =	**4.21**	m (recommended 6m minimum for safety)
Available Head at downpipe =	**30.0**	m
Maximum Head For Discharge =	26.0	m
Maximum Theoretical Line Capacity =	**243.5**	L/s (assuming Cd = 0.61)



Charged Stormwater System - Calculation Sheet

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75 Plunkett Street
NOWRA NSW 2541

Client:	**Shoalhaven Starches**
Project:	**Flour Mill B Concept Stormwater Drainage**
Project No:	**N26856**
SCC Ref:	**N/A**
Date:	**20-Oct-16**

Note: Bold cells only are inputs

Bernoulli Equation:

$$g \cdot h_1 + \frac{p_1}{\rho} + \frac{V_1^2}{2} = g \cdot h_2 + \frac{p_2}{\rho} + \frac{V_2^2}{2}$$

Assumptions:

$V_1 =$ 0 (negligible as compared to V_2)
$p_1 = p_2$ (Pressure differential negligible under gravity)
$h_2 =$ 0 (Near 0 as per Manildra Elevations)

Simplified Equation

$$g \cdot h_1 = \frac{V_2^2}{2}$$

Assuming Full flow through charged pipe: $V = \frac{Q}{A}$

$$\therefore g \cdot h_1 = \frac{\left(\frac{Q_2}{A_2}\right)^2}{2} \qquad \rightarrow h_1 = \frac{\left(\frac{Q_2}{A_2}\right)^2}{2g}$$

g =	9.81	ms^{-2}
Q_2 =	**36.1**	L/s (Value from Flow Generation Calcs)
Diameter of Pipe =	**150**	mm
A_2 =	0.0177	m^2
h_1 =	0.21	m
Friction Loss in pipe =	1	m (see attached spreadsheet)
Assumed conservative head loss through system for rise over wall GPT =	3	m
Total Head required for adequate discharge =	4.21	m (recommended 6m minimum for safety)
Available head from building elevation =	30	m

Therefore adequate capacity achieved with existing pipe outlet

APPENDIX E: ENGINEERING DRAWINGS
N26856-401 & 402 – Stormwater Concept Drawings

LEGEND

- D — EXISTING STORMWATER DRAINAGE PIPE
- D — EXISTING STORMWATER PIPE (DECOMMISSIONED)
- D — ACTIVE STORMWATER DRAINAGE PIPE TO BE LOCATED AND POSSIBLY DIVERTED
- DP ● — POSSIBLE DOWNPIPE LOCATION
- PROPOSED FLOUR MILL B DRAINAGE AREA

PRE-DEVELOPMENT

PAVED AREA FROM SITE OVERLAND = 410m² (55%)
TOTAL PAVED AREAS = 410m² (55%)

PIPED DISCHARGE FROM FLOUR MILL A = 334m² (45%)
TOTAL PIPED AREAS = 334m² (45%)

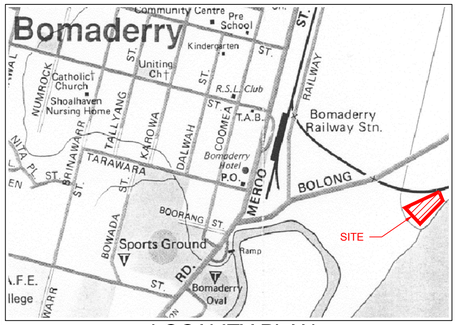
TOTAL SITE AREA = 744m² (100%)

TOTAL SITE DISCHARGE ALLOWING FOR 100% OF THE SITE TO BE IMPERVIOUS:
FOR 1:10YR EVENT = 0.0361m³/s
FOR 1:100YR EVENT = 0.0525m³/s

POST-DEVELOPMENT

PIPED DISCHARGE FROM FLOUR MILL A & B = 744m² (100%)
TOTAL PIPED AREAS = 744m² (100%)

TOTAL SITE AREA = 744m² (100%)
TOTAL SITE DISCHARGE WITH DETENTION 1:10YR EVENT = 0.0361m3/s
TOTAL SITE DISCHARGE WITH DETENTION 1:100YR EVENT = 0.0525m3/s



LOCALITY PLAN
MAP DRAWN & PUBLISHED BY CARTODRAFT AUST P/L

NOTE:

DOWNPIPE LOCATIONS ARE INDICATIVE ONLY. DOWNPIPES TO DRAIN TO EXISTING OUTLET LOCATION VIA PIPES SLUNG TO EXTERNAL WALLS

EXISTING STORMWATER PIT & PIPES TO BE SURVEYED PRIOR TO CONSTRUCTION CERTIFICATE TO CONFIRM POSSIBLE CONFLICT WITH PROPOSED FLOUR MILL B PILES. RELOCATE PIT & PIPE IF REQUIRED.

EXISTING STORMWATER PIT

EXISTING RAIL LINE

EXISTING FLOUR UNLOADER

EXISTING Ø450 PIPE (DECOMMISSIONED AND PLUGGED)

EXISTING AND POSSIBLE FUTURE OUTLET PIPES TO BE INCORPORATED INTO PROPOSED FLOUR MILL B DESIGN

PROPOSED FLOUR MILL B. AREA: 410m²

CONNECT PROPOSED ROOF WATER FROM FLOUR MILL B TO EXISTING DOWN PIPE AS PER CHARGED STORMWATER SYSTEM CALCULATIONS (N26856 - CONCEPT STORMWATER DRAINAGE REPORT)

EXISTING BOILER HOUSE

EXISTING PIPE DRAINING ROOF WATER FROM FLOUR MILL A

EXISTING Ø150 PVC STORMWATER PIPE

EXISTING FLOUR MILL A AREA: 334m²

EXISTING ASH HOPPER

EXISTING COOLING WATER PUMPS SWITCH ROOM

EXISTING GROSS POLLUTANT TRAP MAX CAPACITY 150l/s AS ADVISED BY MANILDRA (LOCATION APPROXIMATE ONLY - TO BE CONFIRMED ON SITE)

EXISTING Ø150 PVC DOWNPIPE TO BE SURVEYED PRIOR TO CONSTRUCTION CERTIFICATE TO CONFIRM HEAD LOSS TO GPT

EXISTING SALT WATER COOLING RETURN LINE

COOLING WATER EXISTING DISCHARGE TO SHOALHAVEN RIVER

EXISTING Ø150 PVC STORMWATER PIPE

SHOALHAVEN RIVER

GRADE OF EXISTING OUTLET PIPE FROM GPT TO BE SURVEYED PRIOR TO CONSTRUCTION CERTIFICATE AND UPGRADED IF NECESSARY (<2% GRADE)

LAYOUT PLAN
SCALE 1:100

BEWARE!
THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.

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0 0.5 1 1.5 2 2.5 5
SCALE:- 1:100

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COVER OF EXCELLENCE

RATIO: 1:100 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: PM 32610 RL 3.245
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consultants@allenprice.com.au www.allenprice.com.au

PROPOSED FLOUR MILL B CONCEPT STORMWATER PLAN
PROPOSED DEVELOPMENT
OVER LOT 1 DP 838753
160 BOLONG ROAD, BOMADERRY
FOR SHOALHAVEN STARCHES PTY LTD

DRAWING STATUS: FOR CONCEPT APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: N26856-401
SHEET 01 OF 02
REVISION 0

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LEGEND

DP ● POSSIBLE DOWNPIPE LOCATION MIN Ø100

PROPOSED MILL SILO DRAINAGE AREA

EXISTING ASPHALT PAVEMENT

PRE-DEVELOPMENT

PAVED AREA FROM SITE OVERLAND = 10.5m² (100%)
TOTAL PAVED AREAS = 10.5m² (100%)

TOTAL SITE AREA = 10.5m² (100%)

TOTAL SITE DISCHARGE ALLOWING FOR 100% OF THE SITE TO BE IMPERVIOUS:
FOR 1:10YR EVENT = 0.0005m³/s
FOR 1:100YR EVENT = 0.0007m³/s

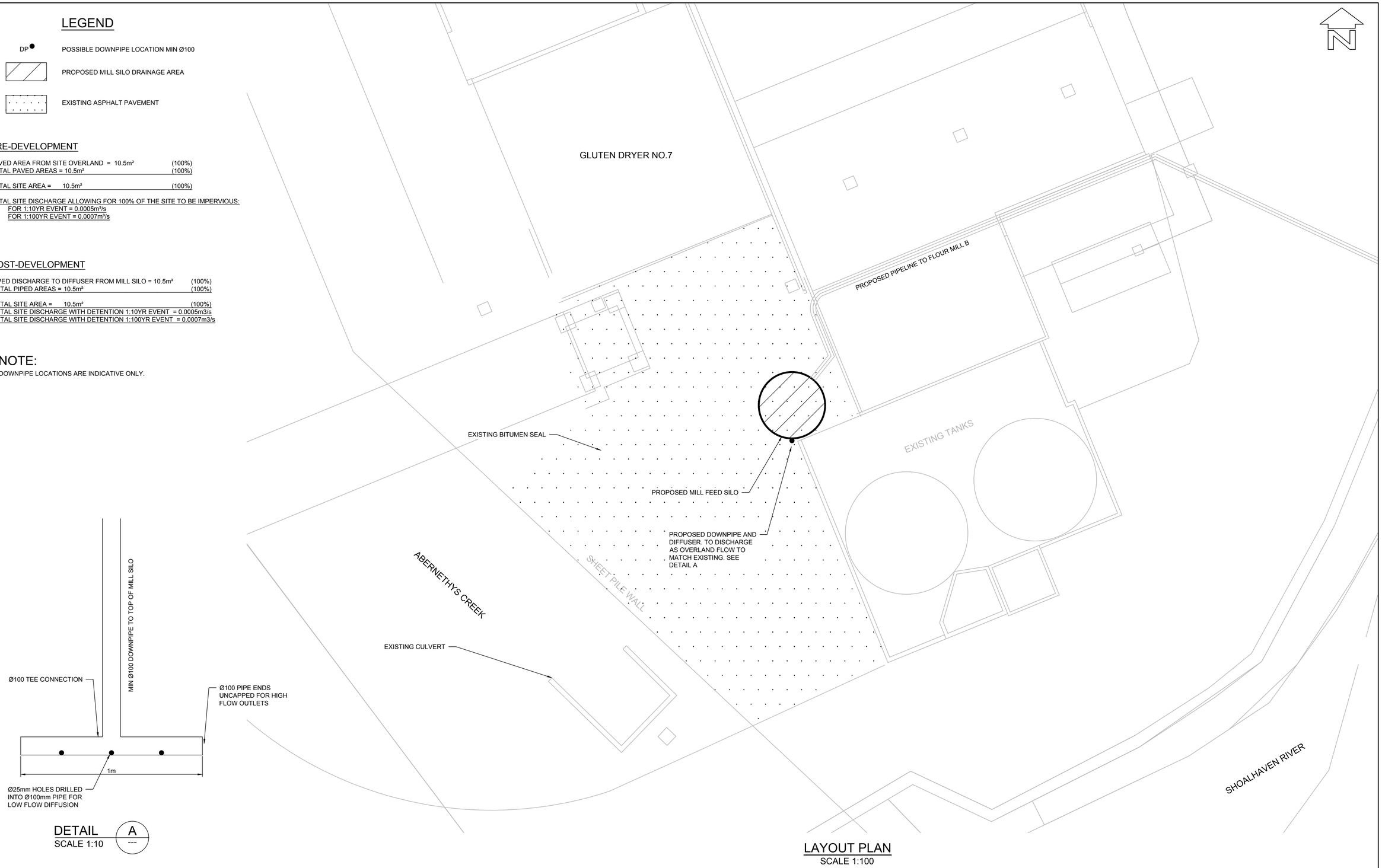
POST-DEVELOPMENT

PIPED DISCHARGE TO DIFFUSER FROM MILL SILO = 10.5m² (100%)
TOTAL PIPED AREAS = 10.5m² (100%)

TOTAL SITE AREA = 10.5m² (100%)
TOTAL SITE DISCHARGE WITH DETENTION 1:10YR EVENT = 0.0005m3/s
TOTAL SITE DISCHARGE WITH DETENTION 1:100YR EVENT = 0.0007m3/s

NOTE:

DOWNPIPE LOCATIONS ARE INDICATIVE ONLY.



LAYOUT PLAN
SCALE 1:100

DETAIL A
SCALE 1:10

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0 0.5 1 1.5 2 2.5 5 SCALE:- 1:100

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DRAWING NUMBER N26856-402
SHEET 02 OF 02
REVISION 0

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LEGEND

- D — EXISTING STORMWATER DRAINAGE PIPE
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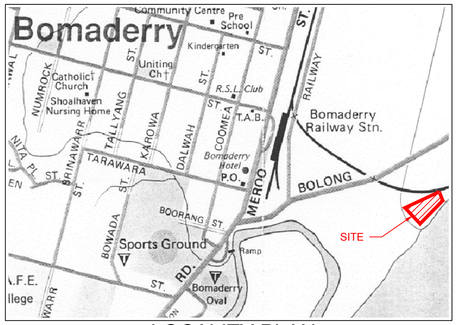

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PROPOSED FLOUR MILL B. AREA: 410m²

CONNECT PROPOSED ROOF WATER FROM FLOUR MILL B TO EXISTING DOWN PIPE AS PER CHARGED STORMWATER SYSTEM CALCULATIONS (N26856 - CONCEPT STORMWATER DRAINAGE REPORT)

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LAYOUT PLAN
SCALE 1:100

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LEGEND

DP ● POSSIBLE DOWNPIPE LOCATION MIN Ø100

PROPOSED MILL SILO DRAINAGE AREA

EXISTING ASPHALT PAVEMENT

PRE-DEVELOPMENT

PAVED AREA FROM SITE OVERLAND = 10.5m² (100%)
TOTAL PAVED AREAS = 10.5m² (100%)

TOTAL SITE AREA = 10.5m² (100%)

TOTAL SITE DISCHARGE ALLOWING FOR 100% OF THE SITE TO BE IMPERVIOUS:
FOR 1:10YR EVENT = 0.0005m³/s
FOR 1:100YR EVENT = 0.0007m³/s

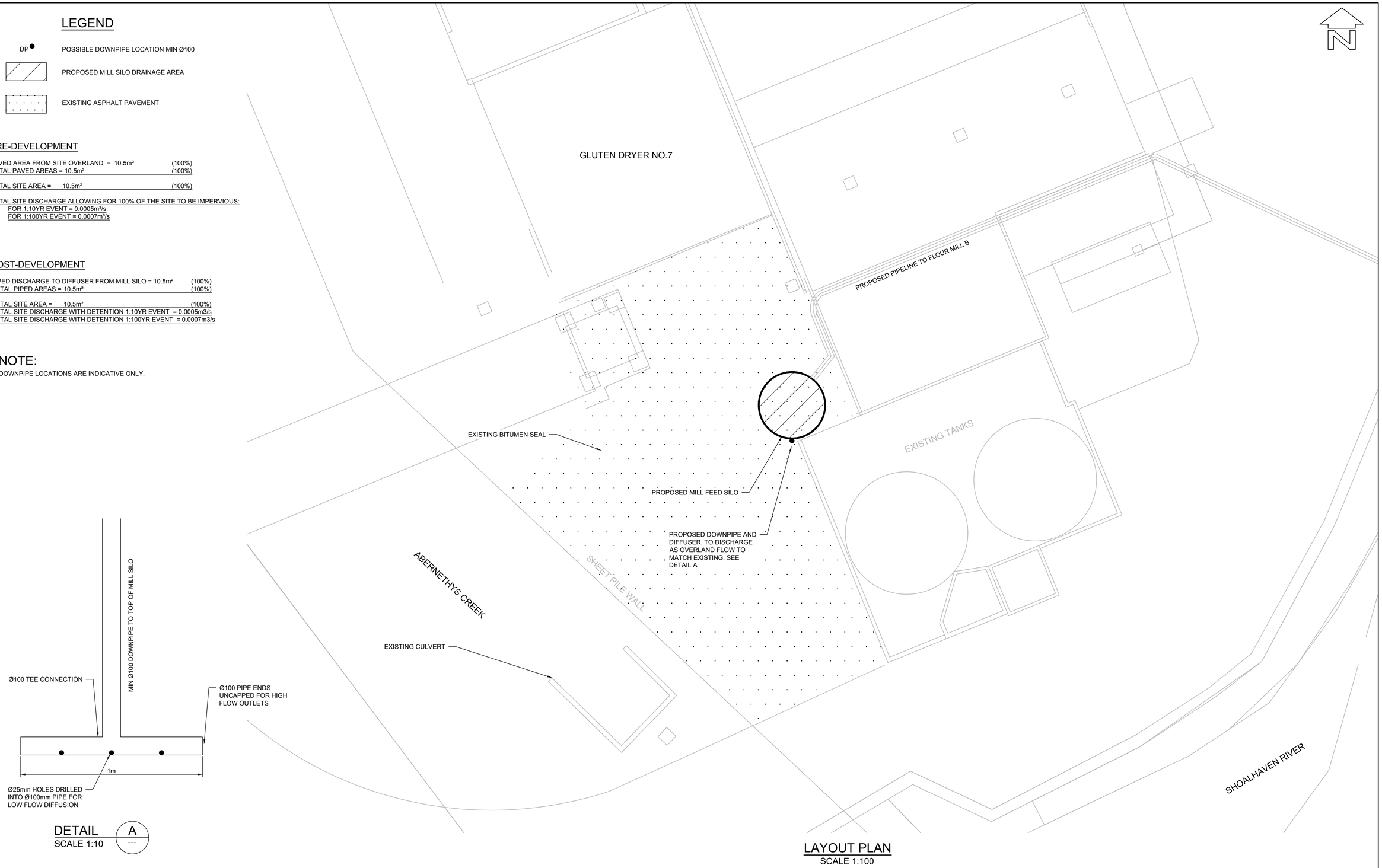
POST-DEVELOPMENT

PIPED DISCHARGE TO DIFFUSER FROM MILL SILO = 10.5m² (100%)
TOTAL PIPED AREAS = 10.5m² (100%)

TOTAL SITE AREA = 10.5m² (100%)
TOTAL SITE DISCHARGE WITH DETENTION 1:10YR EVENT = 0.0005m3/s
TOTAL SITE DISCHARGE WITH DETENTION 1:100YR EVENT = 0.0007m3/s

NOTE:

DOWNPIPE LOCATIONS ARE INDICATIVE ONLY.



LAYOUT PLAN
SCALE 1:100

DETAIL A
SCALE 1:10

BEWARE!

THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.

DIAL BEFORE YOU DIG www.1100.com.au

0 0.1 0.2 0.3 0.4 0.5 SCALE:- 1:10
0 0.5 1 1.5 2 2.5 5 SCALE:- 1:100

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE®

RATIO: 1:100 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: PM 32610 RL 3.245
DATE OF PLAN: OCTOBER 2016

SURVEY	APS
DESIGN	RMH
DRAWN	RMH
CHECK'D	MJP

REV	DESCRIPTION	BY	DATE
P0	ISSUED FOR CONCEPT APPROVAL	RMH	20/10/16

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PROPOSED MILL SILO CONCEPT STORMWATER PLAN
PROPOSED DEVELOPMENT
OVER LOT 1 DP 838753
160 BOLONG ROAD, BOMADERRY
FOR SHOALHAVEN STARCHES PTY LTD

DRAWING STATUS
FOR CONCEPT APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER N26856-402
SHEET 02 OF 02
REVISION 0

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