SMITH BAY WHARF

DRAFT ENVIRONMENTAL IMPACT STATEMENT

APPENDIX C

PREPARED FOR KANGAROO ISLAND PLANTATION TIMBERS BY ENVIRONMENTAL PROJECTS

JANUARY 2019

SMITH BAY WHARF

DRAFT ENVIRONMENTAL IMPACT STATEMENT

APPENDIX C

PREPARED FOR KANGAROO ISLAND PLANTATION TIMBERS BY ENVIRONMENTAL PROJECTS

JANUARY 2019

APPENDIX **C**

APPENDIX C – PROJECT DESCRIPTION

Appendix C1 – Geotechnical Investigation Report – CMW Geosciences

30 November 2017

SMITH BAY TIMBER EXPORT FACILITY
KANGAROO ISLAND, SA

GEOTECHNICAL INVESTIGATION REPORT

Maritime Constructions Pty Ltd

ADL2017-0211AB Rev0

Table of Contents

1 INTRODUCTION

1.1 Project History

CMW Geosciences (East Coast) Partnership (CMW) was authorised by Maritime Constructions Pty Ltd to carry out an offshore geotechnical investigation at Smith Bay, Kangaroo Island, South Australia by way of authorisation dated 13 September 2017. The scope of work and associated terms and conditions of our engagement were detailed in our services proposal letter referenced ADL2017-0211AA Rev0 dated 12 September 2017.

This project was initially managed by Wallbridge Gilbert Aztec(WGA) up until September 2017. CMW carried out fieldwork on behalf of WGA for the same project as per our services proposal letter referenced ADL2017-0038AA Rev0 dated 22 February 2017. Maritime Constructions became CMW's client from September 2017.

1.2 Scheme Engineering Proposal

The preliminary location plans of the proposed export facility prepared by Aztec Analysis (Ref AAD140132 SK01 E) show that the proposed offshore development comprises a causeway, floating and piled structures and dredging of the bay.

At the time of undertaking this investigation and of writing this report the project was in the early stages of planning and it was anticipated that the geotechnical investigation would provide details of preliminary design options for the site.

1.3 Purpose of this report

The purpose of this report is to present the factual data from the geotechnical investigation.

2 SCOPE OF GROUND INVESTIGATION WORKS

CMW were present for all intrusive investigation works carried out between 6 March 2017 and 21 November 2017. All fieldwork was carried out under the supervision of CMW in general accordance with AS1726:2017, Geotechnical Site Investigations.

The scope of fieldwork completed was as follows:

- Six "deep" machine boreholes, denoted OSBH01a to OSBH06, were advanced using HQ3 diamond coring drilling techniques to depths of up to 17.5 metres. Engineering logs of the boreholes are provided in Appendix A;
- Six "shallow" machine boreholes, denoted OSBH08 to OSBH11 and OSBH14 to OSBH15, were advanced using HQ3 diamond coring drilling techniques to depths of up to 5 metres.

The locations of the site investigations referred to above were located by Maritime Constructions and are shown on the attached Site Plan (Figure No. 02, AAD140132, SK01 E).

3 CLOSURE

The investigation has been carried out in accordance with AS1726:2017. Whilst every attempt is made to record full details of strata encountered in the boreholes, drilling and sampling techniques will inevitably lead to disturbance, mixing or loss of material in some soils.

This report has been prepared for use by Maritime Constructions Pty Ltd in relation to the Smith Bay Timber Export Facility on Kangaroo Island, in accordance with generally accepted consulting practice. Use of this report by parties other than Maritime Constructions Pty Ltd and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

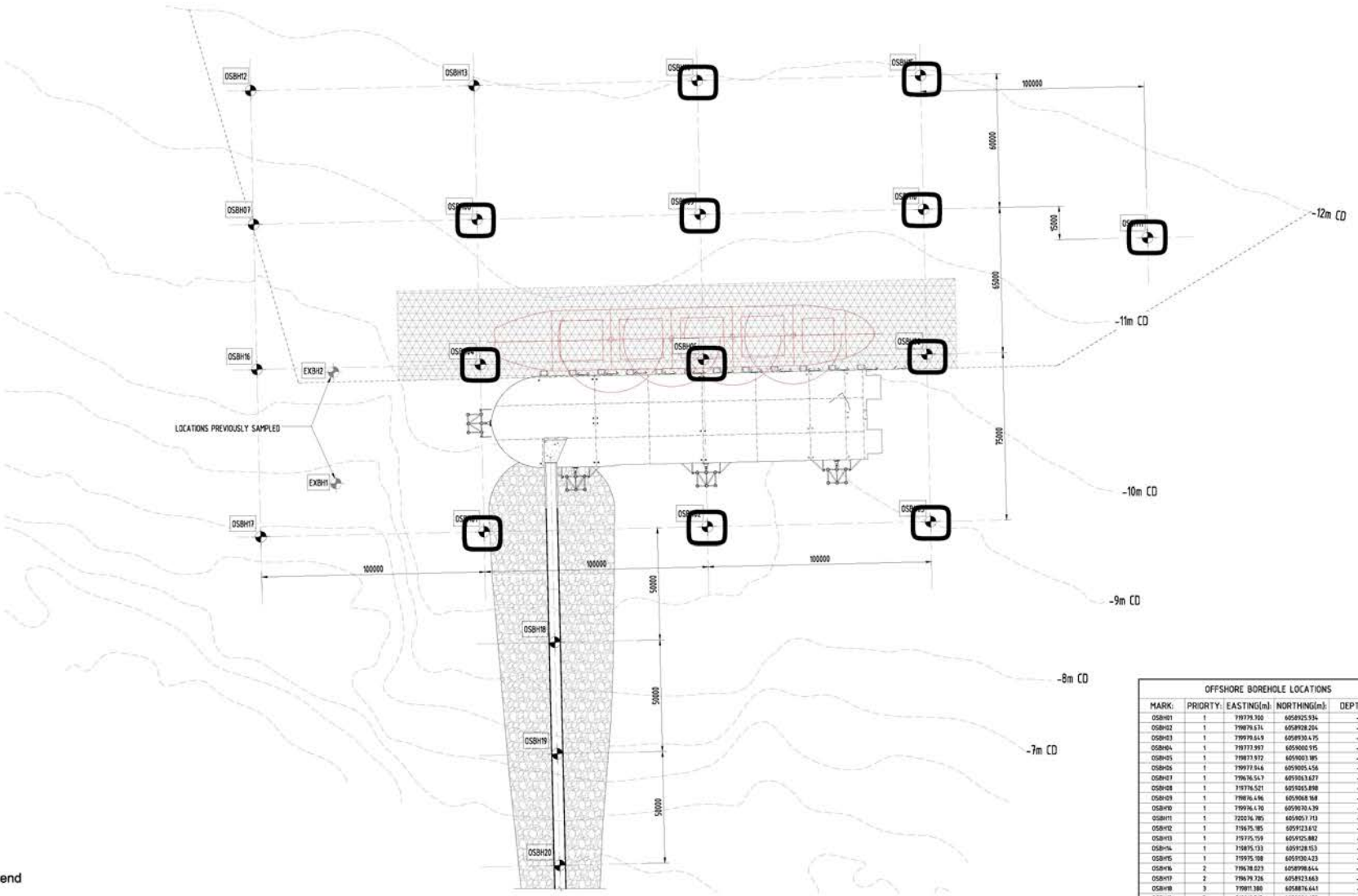
For and on behalf of
CMW Geosciences (East Coast) Partnership

Kayne Allen
Geotechnical Engineer

Mark Argent
East Coast Technical Manager, CPEng

Distribution: 1 copy to Maritime Constructions Pty Ltd (electronic)
Original held by CMW Geosciences (East Coast) Partnership

Appendix A: Site Investigation Plan



OFFSHORE BOREHOLE LOCATIONS

MARK:	PRIORTY:	EASTING(m):	NORTHING(m):	DEPTH(mCD):
OSBH01	1	719739.300	6058925.934	-24.0
OSBH02	1	719879.634	6058928.204	-24.0
OSBH03	1	719979.649	6058930.475	-24.0
OSBH04	1	719777.997	6059000.595	-24.0
OSBH05	1	719877.972	6059003.185	-24.0
OSBH06	1	719977.946	6059005.456	-24.0
OSBH07	1	719676.547	6059063.627	-15.0
OSBH08	1	719776.521	6059065.898	-15.0
OSBH09	1	719876.496	6059068.168	-15.0
OSBH10	1	719976.470	6059070.439	-15.0
OSBH11	1	720076.785	6059057.713	-15.0
OSBH12	1	719675.185	6059123.612	-15.0
OSBH13	1	719775.159	6059125.882	-15.0
OSBH14	1	719875.133	6059128.153	-15.0
OSBH15	1	719975.108	6059130.423	-15.0
OSBH16	2	719678.023	6058998.644	-24.0
OSBH17	2	719679.726	6058923.663	-24.0
OSBH18	3	719811.380	6058876.641	-15.0
OSBH19	3	719812.515	6058826.653	-15.0
OSBH20	3	719813.650	6058776.666	-15.0

Legend

Completed Boreholes

When sheet printed full size, the scale bar is 1:1 (100mm).

0 50 100mm

OFFSHORE BOREHOLE LOCATION PLAN

SCALE : NTS

KANGAROO ISLAND PLANTATION TIMBERS

MARITIME CONSTRUCTIONS

FOR USE

REV.	DATE	DESCRIPTION	DRAFT.	ENG.	CHKD.
A	16/12/16	PRELIMINARY - INFORMATION ONLY	BL	DM	
B	20/12/16	PRELIMINARY - INFORMATION ONLY	BL	DM	
C	24/01/17	FOR USE	BL	DM	
D	25/01/17	FOR USE	BL	DM	
E	24/03/17	FOR USE	BL	DM	

AZTEC ANALYSIS
Engineers & Project Managers
60 Wyatt Street, Adelaide, SA 5000
Phone: 08 8223 5100

KANGAROO ISLAND, SA
K.I PLANTATION TIMBERS
PROPOSED EXPORT FACILITY AT SMITH BAY
OFFSHORE BOREHOLE LOCATION PLAN

A1

DRAWING NUMBER
Job Number: AAD140132 Sheet No.: SK01 Rev.: E

Design: DM Drawn: BL

Appendix B: Borehole Logs

BOREHOLE LOG - OSBH01

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 20/10/2017

1:25 Sheet 1 of 1

Logged by: DBA
Checked by: MA

Position: E.719787m N.6058933m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification VL L M H VH EH (6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3		30	0	0		1		SM: SILTY SAND: fine to medium grained sand, grey, low plasticity, trace coarse, rounded, elongated gravel, with some shell grit,.						0.00-2.00m: Marine Deposits
								CORE LOSS - inferred silty sand						
		0	0	0		2		Borehole terminated at 2.0 m						
						3								
						4								
						5								

Termination reason: Equipment Failure
Remarks:

BOREHOLE LOG - OSBH01'

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 17/11/2017

1:25 Sheet 1 of 1

Logged by: BND
Checked by: MA

Position: E.719783m N.6058939m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20; 20-40; 40-100; 100-300; 300-1000; >1000)	Comments
HQ3		0	0	0		1		CORE LOSS - inferred silty sand						0.00-2.90m: Marine Deposits
		0	0	0										
		40	0	0		2		GP: GRAVEL: subangular to subrounded, medium to coarse grained gravel, brown and white, gravel of sandstone and limestone, with some sea weed.						
								CORE LOSS - inferred sandy gravel						
	2.64m:PP=150kPa 2.74m:PP=400kPa 2.85m:PP=300kPa	68	0	0				CI: Gravelly Sandy CLAY: medium plasticity, fine to medium grained sand, subangular to subrounded, fine to medium grained gravel, dark brown, with some shellgrit.						
						3		Borehole terminated at 2.9 m						
						4								
						5								

Termination reason: Reset rods
Remarks:

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - OSBH01a

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 17/11/2017

CMW Geosciences

1:25 Sheet 1 of 3

Logged by: KAA
Checked by: MA

Position: E.719779m N.6058925m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		0	0	0		1		NO RECOVERY - INFERRED SAND.						0.00-5.80m: Marine Deposits
	2.70m:PP=150kPa 2.80m:PP=100kPa 2.90m:PP=100kPa	60	7	7		2		SM: SILTY SAND: low plasticity, subrounded, fine to medium grained sand, grey, with shells. *... from 2.35m to 2.40m, rounded mudstone cobbles*						
						3		ML: CLAYEY SILT: low plasticity, brown, with fine grained sand.						
								COBBLES: pink to brown, Sandstone cobbles.						
		60	28	20				NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
								COBBLES: pink to brown, Sandstone cobbles.						
		40	0	0		4		NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
								COBBLES: pink to brown, Sandstone cobbles.						
		40	0	0				NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
								COBBLES: pink to brown, Sandstone cobbles.						
						5		NO RECOVERY - INFERRED SILT/SAND/GRAVEL						

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH01a

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 17/11/2017

1:25 Sheet 2 of 3

Logged by: KAA
Checked by: MA

Position: E.719779m N.6058925m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20, 20-40, 40-100, 100-300, 300-1000, >1000)	Comments
HQ3								GP: GRAVEL: angular to subrounded, fine to coarse grained gravel, grey to brown, with cobbles.						
		100	0	0				ML: Sandy SILT: low plasticity, subangular, fine grained sand, dark brown, moderate to strong cementation, Moderate to strong cementation.						
		80	80	80		6		Conglomerate: fine, pale brown, Fine grained highly cemented clayey sand interbedded with mudstone gravel.						5.80-15.00m: Cape Jervis Formation 6.09m:JT, 0°, UN, SO, CN
		100	90	48								HW		6.19m:JT, 5°, UN, RO, CN 6.24m:, DB 6.31m:, DB 6.34m:JT, 0°, PL, RO, CN 6.49m:, DB 6.59-6.64m:CS
								NO RECOVERY - INFERRED SAND						
		93	77	40		7		Conglomerate: fine, pale brown, Fine grained highly cemented clayey sand interbedded with mudstone gravel.						7.11m:JT, 0°, PL, RO, CN 7.24m:JT, 15°, IR, RO, CN 7.31-7.36m:SM, Fine grained sand 7.45m:JT, 0°, ST, RO, CN 7.53m:, DB 7.69-7.80m:CS 7.92m:JT, 10°, UN, SO, VN 8.00m:JT, 20°, PL, SO, CN 8.07m:JT, 25°, IR, RO, CN
						8		... from 8.10m to 8.20m, mudstone cobble						
		100	85	73				Conglomerate: fine, grey, With mudstone gravel interbedded.						8.13m:JT, 65°, IR, SO, VN 8.25m:JT, 0°, IR, RO, CN 8.40m:JT, 0°, IR, RO, CN 8.45-8.54m:CS
								... from 8.64m to 8.72m, mudstone cobble						8.64m:JT, 20°, PL, SO, CN 8.72m:JT, 15°, CU, SO, CN
						9								9.00m:JT, 10°, PL, SO, CN 9.30-9.35m:CS 9.50-9.57m:CS 9.67m:JT, DB 9.80m:JT, 0°, IR, SO, infilled, Gravel
						10								

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH01a

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 17/11/2017

CMW Geosciences

1:25 Sheet 3 of 3

Logged by: KAA
Checked by: MA

Position: E.719779m N.6058925m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20, 20-40, 40-100, 100-300, 300-1000, >1000)	Comments
		100	100	87		11		Conglomerate: fine, grey, With mudstone gravel interbedded.						10.09m:JT, 10°, UN, RO, CN 10.21m:JT, 20°, CU, RO, CN 10.43m:, DB 10.53m:JT, 35°, IR, RO, CN 10.64m:JT, 0°, IR, RO, CN 11.00m:JT, 10°, PL, SO, CN 11.10m:JT, 10°, IR, RO, CN 11.17m:JT, 20°, PL, SO, CN 11.20-11.25m:CS 11.65-11.67m:CS
		100	87	87		12						MW		11.90m:JT, 90°, PL, SO, CN 12.14m:, DB 12.80m:JT, 0°, IR, RO, CN
		100	93	89		13								13.00m:JT, 5°, CU, SO, VN 13.17m:JT, 65°, PL, SO, CN 13.21m:JT, 25°, PL, SO, CN 13.30-13.33m:CS 13.53m:JT, 0°, IR, RO, VN 13.56m:JT, 5°, IR, RO, VN 13.73-13.76m:JT, 30°, PL, SO, CN, x2 13.90m:JT, 5°, UN, SO, CN 13.95m:JT, 40°, IR, RO, CN 13.98m:JT, 0°, PL, SO, CN 14.22-14.32m:CS
		100	100	15		14								14.45m:, DB 14.50m:JT, 0°, PL, SO, CN 14.55-14.58m:CS 14.61-14.63m:SM 14.70m:JT, 0°, IR, RO, CN 14.76m:JT, 30°, IR, RO, CO 14.81m:, DB 14.85m:JT, 0°, IR, SO, CN
						15		Borehole terminated at 15.0 m						

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH02

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 16/11/2017

CMW Geosciences

1:25 Sheet 1 of 3

Logged by: BND
Checked by: MA

Position: E.719871m N.6058944m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		0	0	0		1		CORE LOSS - inferred sandy gravel						0.00-7.50m: Marine Deposits
		0	0	0										
		84	0	0		2		GW: SANDY GRAVEL: fine grained sand, subangular to subrounded, medium to coarse grained gravel, white and black, mudstone gravel, with some shell grit.						
		14	0	0				CORE LOSS - inferred sandy gravel						
		75	0	0		3		COBBLES: brown grey, sandstone and mudstone.						
								CORE LOSS - inferred sandy gravel						
		90	0	0		4		COBBLES: brown grey, sandstone and mudstone. *... from 4.20m to 4.50m, recovered as medium to coarse grained gravel* *... from 4.60m to 4.90m, trace silty clay, high plasticity*						
						5		CORE LOSS - inferred silty clay						

Termination reason: high tide and turbulence
Remarks:

BOREHOLE LOG - OSBH02

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 16/11/2017

CMW Geosciences

1:25 Sheet 2 of 3

Logged by: BND
Checked by: MA

Position: E.719871m N.6058944m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; UCS (MPa) 6 60)	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		0	0	0				CORE LOSS - inferred silty clay						
	6.00m:PP=100kPa					6		CH: SILTY CLAY: brown, high plasticity.						
	6.30m:PP=210kPa	100	0	0										
	6.40m:PP=250kPa													
	6.50m:PP=100kPa													
	6.80m:PP=300kPa													
	7.00m:PP=350kPa	100	0	0		7								
	7.20m:PP=350kPa													
	7.40m:PP=400kPa													
HQ3	7.50m:PP=570kPa							Mudstone: indistinctly bedded, brown grey						7.50-11.90m: Smith Bay Shale
	7.80m:PP=600kPa													
	7.90m:PP=600kPa	100	58	0		8						HW		
														8.45m:PT, 0°, PL, RO
		80	80	28								MW		8.61-8.76m:PT, 5°, ST, RO
												EW		8.81m:PT, 0°, IR, RO, CO, (clay)
		88	88	60		9						MW		8.89m:PT, 0°, IR, RO, VN, (clay)
														8.90-9.00m:, 0°, Extremely weathered
														9.10-9.15m:PT, 0°, IR, RO, VN, (clay)
														9.41m:PT, 0°, PL, RO
														9.60m:PT, 5°, IR, RO
								Conglomerate: medium, grey.						
						10								

Termination reason: high tide and turbulence
Remarks:

BOREHOLE LOG - OSBH02

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 16/11/2017

1:25 Sheet 3 of 3

Logged by: BND
Checked by: MA

Position: E.719871m N.6058944m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20, 20-40, 40-100, 100-300, 300-1000, >1000)	Comments
		93	93	69		11		Conglomerate: medium, grey.				MW		10.50m:PT, 0°, IR, VR 10.69m:PT, 5°, IR, VR 10.80m:PT, 5°, IR, VR 10.89m:PT, 5°, IR, VR
								CORE LOSS inferred sand						
		65	30	22				Conglomerate: medium, grey.				MW		11.42-11.65m:, Highly Fractured Zone 11.65m:PT, 0°, IR, VR 11.87m:PT, 5°, ST, VR
						12		Borehole terminated at 11.9 m						
						13								
						14								
						15								

Termination reason: high tide and turbulence
Remarks:

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - OSBH03

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 18/11/2017

1:25 Sheet 1 of 4

Logged by: KAA
Checked by: MA

Position: E.719979m N.6098530m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		17	0	0		1		NO RECOVERY - INFERRED SAND.						0.00-13.20m: Marine Deposits
								COBBLES: pink to brown, Sandstone cobbles.						
		0	0	0		2		NO RECOVERY - INFERRED SAND.						
		39	0	0		3		SW: Gravelly SAND: subangular to subrounded, fine to coarse grained sand, subangular to subrounded, medium to coarse grained gravel, pale brown, Moderate cementation.						
								NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
						4		COBBLES: pink to brown, Sandstone cobbles.						
		20	0	0		5		NO RECOVERY - INFERRED SILT/SAND						

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH03

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 18/11/2017

1:25 Sheet 2 of 4

Logged by: KAA
Checked by: MA

Position: E.719979m N.6098530m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3	5.30m:PP=5 50kPa 5.40m:PP=5 50kPa							NO RECOVERY - INFERRED SILT/SAND						
								ML: CLAYEY SILT: low plasticity, brown, with fine grained sand.						
								NO RECOVERY - INFERRED CLAY/SILT/SAND						
		33	0	0		6								
								SM: SILTY SAND: low plasticity, subrounded, fine to medium grained sand, grey. *... from 6.50m to 6.55m, with cobbles*						
						7		NO RECOVERY - INFERRED SILT/SAND						
		33	0	0										
						8		CL: CLAY: low plasticity, pale grey.						
								COBBLES: pale grey, Mudstone.						
								CL: CLAY: low plasticity, pale grey. *... from 8.60m to 8.63m, mudstone cobble*						
								NO RECOVERY - INFERRED CLAY/SILT						
		20	0	0		9								
						10		COBBLES: pale grey, Mudstone.						

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH03

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 18/11/2017

CMW Geosciences

1:25 Sheet 3 of 4

Logged by: KAA
Checked by: MA
Position: E.719979m N.6098530m (MGA 53)
Elevation:
Hole Diameter: 63mm
Angle from horizontal: 90°
Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		50	0	0		11		COBBLES: pale grey, Mudstone.						
								NO RECOVERY - INFERRED SILT/SAND						
								SM: SILTY SAND: low plasticity, subrounded, fine to medium grained sand, pale brown.						
		100	0	0		12								
								SM: SILTY SAND: low plasticity, subrounded, fine to medium grained sand, pale grey, Highly cemented.						
						13		NO RECOVERY - INFERRED SILT/SAND						
		87	57	30				Mudstone: grey, Indistinctly bedded.				MW		13.20-17.50m: Smith Bay Shale 13.36-13.66m:CS 13.81m:JT, 0°, IR, SO, CN 14.00m:JT, 15°, IR, SO, CN 14.09-14.18m:CS 14.25m:JT, 25°, IR, SO, CN 14.33m:JT, 60°, IR, SO, CN 14.37-14.43m:CS 14.50-14.67m:CS
						14								
								NO RECOVERY - INFERRED CLAY/SILT						
						15								

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH03

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 18/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719979m N.6098530m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20 20-40 40-100 100-300 300-1000 >1000)	Comments
								NO RECOVERY - INFERRED CLAY/SILT						
		52	41	9				Mudstone: grey, Indistinctly bedded.				MW		15.46m:, DB 15.50m:, DB 15.54m:JT, 15°, PL, SO, CN 15.68m:JT, 20°, PL, SO, CN 15.74m:, DB 15.85m:JT, 20°, IR, SO, CN 15.93m:, DB
						16								16.10-16.17m:SM 16.21m:, DB 16.39-16.52m:SM
		67	57									EW		16.57-16.70m:SM
								NO RECOVERY - INFERRED CLAY/SILT						
						17		Mudstone: grey, Indistinctly bedded.				MW		17.27m:, DB
								Borehole terminated at 17.5 m						
						18								
						19								
						20								

Termination reason: Limit of investigation
Remarks:

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - OSBH04

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 20/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719777m N.6059000m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		7	0	0		1		CI: Sandy CLAY: medium plasticity, subrounded, fine to coarse grained sand, brown, with fine to coarse grained gravel, with organics. NO RECOVERY - INFERRED CLAY/SILT						0.00-15.00m: Marine Deposits
		3	0	0		2								
		40	16	16		3		COBBLES: grey, sandstone. NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
		72	32	32		4		COBBLES: grey and brown, with fine to coarse grained gravel, Sandstone. NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
		60	20	20		5		Gravelly COBBLES: angular to subangular, fine to coarse grained gravel, grey and brown, Sandstone.						

Termination reason: Limit of invesitgation
Remarks:

BOREHOLE LOG - OSBH04

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 20/11/2017

CMW Geosciences

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Logged by: KAA
Checked by: MA
Position: E.719777m N.6059000m (MGA 53)
Elevation:
Hole Diameter: 63mm
Angle from horizontal: 90°
Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3		65	10	10		6		NO RECOVERY - INFERRED SILT/SAND/GRAVEL Gravelly COBBLES: angular to subangular, fine to coarse grained gravel, grey and brown, Sandstone.						
		100	27	16				*... from 6.20m to 6.57m, becoming interbedded with grey medium plasticity clay, every 50-150mm*						
		60	0	0		7		NO RECOVERY - INFERRED SILT/SAND/GRAVEL Gravelly COBBLES: angular to subangular, fine to coarse grained gravel, grey and brown, with clay, Interbedded with clay.						
		40	13	13		8		NO RECOVERY - INFERRED SILT/SAND/GRAVEL Gravelly COBBLES: angular to subangular, fine to coarse grained gravel, grey and brown. *... at 8.40m, becoming clayey*						
		0	0	0				NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
		57	24	20		9		Gravelly COBBLES: subangular to rounded, fine to coarse grained gravel, dark grey, with fines, with fine grained sand, Basalt gravel. *... at 9.28m, becoming silty sand* NO RECOVERY - INFERRED SILT/SAND/GRAVEL Conglomerate: fine to coarse, pale brown grey and dark grey.				MW		9.77m:JT, 40°, IR, RO, CN
						10		Gravelly COBBLES: subangular to rounded, fine to coarse grained gravel, dark grey, with fines, with fine grained sand, mudstone gravel. *... at 9.95m, becoming clayey sand*						

Termination reason: Limit of invesitgation
Remarks:

BOREHOLE LOG - OSBH04

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 20/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719777m N.6059000m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20, 20-40, 40-100, 100-300, 300-1000, >1000)	Comments
						11		NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
		57	29	29				GW: Sandy GRAVEL: subangular to subrounded, fine grained sand, angular to subangular, medium to coarse grained gravel, pale brown and grey, Cemented sand gravel, mudstone gravel.						
								Conglomerate: pale brown.				MW		11.56m:JT, 15°, IR, RO, CN
								... at 11.60m, becoming grey						11.73-11.76m:CS
						12		Gravelly COBBLES: subangular to rounded, fine to coarse grained gravel, dark grey, with fines, with fine grained sand, mudstone gravel.						
		100	84	63				Conglomerate: fine to coarse, grey.						12.33m:JT, 45°, IR, RO, CN 12.40m:, DB 12.63m:JT, 0°, IR, RO, CN 12.71m:JT, 0°, CU, RO, CN 12.82m:JT, 5°, ST, RO, CN
						13		... from 13.25m to 13.34m, mudstone cobble				MW		13.11m:JT, 65°, CU, SO, infilled, (mudstone cobble) 13.21m:JT, 40°, PL, SO, CN 13.31-13.34m:CS 13.38m:JT, 5°, IR, RO, CO
		56	28	10				GW: Sandy GRAVEL: subangular to subrounded, fine grained sand, angular to subangular, medium to coarse grained gravel, pale brown and grey, with cobbles, Cemented sand gravel, mudstone gravel.						
								NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
						14		COBBLES: grey sandstone						
		33	0	0				NO RECOVERY - INFERRED SILT/SAND/GRAVEL						
								Gravelly COBBLES: grey sandstone						
								SC: CLAYEY SAND: medium plasticity, subrounded, fine to medium grained gravel, grey, strong cementation.						
						15		Borehole terminated at 15.0 m						

Termination reason: Limit of invesitgation
Remarks:

BOREHOLE LOG - OSBH05

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 19/11/2017

CMW Geosciences

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Logged by: KAA
Checked by: MA

Position: E.719877m N.6059003m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification VL L M H VH EH (6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		0	0	0		1		NO RECOVERY.						0.00-8.55m: Marine Deposits
		13	0	0		2		NO RECOVERY.						
		90	0	0		3		COBBLES: grey. ML: Sandy SILT: low plasticity, subrounded, fine grained sand, black, trace fine grained gravel, trace organics. NO RECOVERY. COBBLES: brown and pink. *... from 3.07m to 3.19m, becoming gravelly with shells*						
		100	0	0		4		CL: Sandy CLAY: low plasticity, subangular to subrounded, fine grained sand, pale brown and grey. COBBLES: brown grey and pink. *... from 3.75m to 4.00m, becoming coarse grained gravel* *... from 4.10m to 4.17m, becoming clayey*						
		10	0	0		5		NO RECOVERY.						

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH05

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 19/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719877m N.6059003m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20; 20-40; 40-100; 100-300; 300-1000; >1000)	Comments
HQ3	7.15m:PP=50kPa					6		NO RECOVERY.						
								COBBLES: brown and pink.						
		0	0	0				NO RECOVERY.						
								COBBLES: brown and pink.						
								NO RECOVERY.						
		43	23	20				Mudstone: grey, Indistinctly bedded.				MW		
						7		CL: Sandy CLAY: low plasticity, subangular to subrounded, fine grained sand, grey, XW mudstone.						
								NO RECOVERY.						
		10	6	0		8		Mudstone: grey, Indistinctly bedded. *... from 8.55m to 8.60m, recovered as coarse grained gravel*				MW		8.55-14.70m: Smith Bay Shale 8.71m:, DB 8.76m:, DB 8.88-8.90m:SM 8.92m:JT, 50°, PL, SO, CN 8.97m:, DB
						9		NO RECOVERY.						
		82	61	38				Mudstone: grey, Indistinctly bedded.				MW		9.21m:, DB 9.31m:JT, 10°, PL, SO, SN 9.43m:JT, 70°, IR, RO, SN 9.50-9.57m:SM 9.60-9.67m:SM
								NO RECOVERY.						
		0	0	0		10								

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH05

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 19/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719877m N.6059003m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20, 20-40, 40-100, 100-300, 300-1000, >1000)	Comments
								NO RECOVERY.						
		0	0	0										
		85	0	0		11		SM: SILTY SAND: low plasticity, subrounded, fine to medium grained sand, pale grey, Highly cemented.						
								Mudstone: grey, Indistinctly bedded.				H...		
								NO RECOVERY.						
		95	95	95		12		Mudstone: pale brown, Indistinctly bedded.				MW		11.87m:, DB
								... at 12.12m, becoming grey						12.13m:, DB
								... at 12.57m, becoming distinctly bedded at 0°						12.50m:, DB
														12.83m:, DB
						13								13.00m:, DB
														13.14m:JT, 25°, PL, SO, CN
														13.25-13.34m:SM
														13.55m:JT, 5°, IR, SO, CN
														13.68-13.71m:SM
		87	69	44										13.80m:, DB
						14		NO RECOVERY.						
								Mudstone: grey, Indistinctly bedded.				MW		14.07m:JT, 65°, PL, SO, CN
														14.14m:JT, 0°, IR, SO, CN
														14.46m:JT, 0°, UN, SO, CN
														14.53m:JT, 85°, IR, RO, CN
								Borehole terminated at 14.7 m						14.62m:JT, 70°, ST, SO, CN
						15								

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH06

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 21/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719977m N.6059005m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant:

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
		0	0	0		1		NO RECOVERY.						0.00-5.50m: Marine Deposits
		20	0	0		2		Gravelly COBBLES: subangular to rounded, coarse grained gravel, grey and brown, Sandstone and mudstone. *... from 2.53m to 2.57m, calcrete*						
		33	0	0		3		NO RECOVERY.						
						4		Gravelly COBBLES: subangular to rounded, coarse grained gravel, grey and brown, Sandstone and mudstone. *... from 4.08m to 4.15m, sandy clay*						
	4.45m:PP=450kPa 4.55m:PP=550kPa	100	0	0				CH: CLAY: high plasticity, grey mottled yellow. *... at 4.65m, becoming brown*	H					
		100	0	0		5								

Termination reason: rough sea conditions
Remarks:

BOREHOLE LOG - OSBH06

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 21/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719977m N.6059005m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant:

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
	5.10m:PP=600kPa							CH: CLAY: high plasticity, grey mottled yellow.						
	5.30m:PP=600kPa													
	5.50m:PP=600kPa							Mudstone: brown to grey.						5.50-13.20m: Smith Bay Shale
		100	0	0										5.57-5.60m:SM
	5.80m:PP=600kPa					6								6.14m:, DB
														6.20-6.30m:CS
														6.46m:, DB
														6.55-6.63m:SM
		100	93	87		7								6.80m:, DB
								... from 7.40m to 7.57m, yellow						7.19-7.23m:CS
														7.26m:JT, 60°, PL, SO, CN
														7.47-7.57m:SM
		100	95	95		8								7.72m:, DB
														7.92m:, DB
														8.12m:, DB
								... from 8.34m to 8.44m, bedded at 10°						8.31m:JT, 10°, CU, SO, CN
														8.40m:PT, 10°, PL, RO, CN
														8.52-8.54m:CS
														8.71-8.74m:SM
														8.81-8.88m:CS
														8.96-9.00m:CS
		100	81	8		9								9.05m:JT, 0°, CU, SO, CO, (clay)
														9.11m:, DB
														9.15-9.22m:CS
														9.28-9.32m:CS
														9.41-9.44m:CS
														9.53-9.55m:CS
														9.63m:JT, 0°, ST, SO, SN
														9.69-9.72m:SM
														9.81m:, DB
														9.88m:JT, 0°, PL, SO, CO, (clay)
						10								10.00-10.05m:SM
														10.10m:, DB

Termination reason: rough sea conditions
Remarks:

BOREHOLE LOG - OSBH06

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 21/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719977m N.6059005m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant:

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3						11		Mudstone: brown to grey.						10.16m:, DB
								NO RECOVERY.						10.50-10.91m:CS
		80	51	35				Mudstone: brown to grey.						11.53-11.55m:CS 11.59m:, DB 11.64m:JT, 0°, CU, SO, CN 11.71m:, DB 11.88m:JT, 45°, PL, SL, CN
						12								12.00m:, DB 12.12-12.24m:CS 12.32-12.39m:CS
		100	60	29										12.43m:JT, 5°, PL, SO, CN 12.46-12.50m:CS 12.54-12.60m:SM 12.65m:JT, 0°, ST, SO, CN 12.72m:, DB 12.78m:JT, 0°, ST, SO, CN 12.80m:JT, 0°, IR, SO, CN, x2 12.91m:JT, 30°, ST, SO, CN
						13		Borehole terminated at 13.2 m						12.97-13.14m:, Inferred crushed seam
						14								
						15								

Termination reason: rough sea conditions
Remarks:

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - OSBH08

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 19/11/2017

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Logged by: KAA
Checked by: MA

Position: E.719776m N.6059065m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3		0	0	0		1		NO RECOVERY.						0.00-5.00m: Marine Deposits
		0	0	0		2								
		75	0	0		3		COBBLES: brown and pink.						
		0	0	0				NO RECOVERY.						
		10	0	0		4								
		100	0	0				COBBLES: brown and pink.						
						5		Borehole terminated at 5.0 m						

Termination reason: Limit of investigation
Remarks:

BOREHOLE LOG - OSBH09

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 15/11/2017

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Logged by: BND
Checked by: MA

Position: E.719853m N.6059077m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3		0	0	0		1		CORE LOSS inferred sand/gravel						0.00-5.00m: Marine Deposits
		0	0	0		2								
		0	0	0		3								
		0	0	0		4								
		0	0	0		5								
		100	0	0				Mudstone: fine, black, recovered as gravelly cobbles *... from 4.55m to 4.65m, with low plasticity fines*						
								Borehole terminated at 5.0 m						

Termination reason: Target depth reached
Remarks:

BOREHOLE LOG - OSBH10

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 15/11/2017

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Logged by: BND
Checked by: MA

Position: E.719970m N.6059075m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3		5	0	0		1		CORE LOSS.						0.00-2.00m: Marine Deposits
								COBBLES: brown, sandstone						
		52	0	0		2		CORE LOSS.						
								COBBLES: brown , sandstone						
								Borehole terminated at 2.0 m						
						3								
						4								
						5								

Termination reason: high tidal movement and turbulence, poor drill progress
Remarks:

BOREHOLE LOG - OSBH11

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 18/11/2017

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: KAA
Checked by: MA

Position: E.720076m N.6059057m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3		18	0	0		1		NO RECOVERY - INFERRED SAND.						0.00-5.00m: Marine Deposits
								COBBLES: pale grey to blue, Sandstone cobbles.						
		100	30	0		2		COBBLES: Conglomerate						
								COBBLES: pale grey to brown, with gravel, Sandstone, sandstone gravel.						
								Calcareous Sandstone: Interbedded with shells.						
						3		COBBLES: pale grey to brown, Sandstone.						
		1000	0	0				Conglomerate: Sandstone with Sandstone gravel.						
								CH: Sandy CLAY: high plasticity, subrounded, fine to medium grained sand, grey green pink, with fine to coarse grained gravel.						
						4		COBBLES: brown, Sandstone.						
		32	0	0				NO RECOVERY - INFERRED CLAY.						
						5		CH: Sandy CLAY: high plasticity, subrounded, fine to medium grained sand, grey green.						
								~~Borehole terminated at 5.0 m~~						

Termination reason: Limit of investigation
Remarks:

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - OSBH14

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 14/11/2017

1:25 Sheet 1 of 1

Logged by: BND
Checked by: MA

Position: E.719865m N.6059151m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) (<20; 20-40; 40-100; 100-300; 300-1000; >1000)	Comments
HQ3		0	0	0		1		CORE LOSS - inferred sand/gravel						0.00-4.00m: Marine Deposits
		0	0	0		2								
		0	0	0										
		100	0	0		3		COBBLES: dark brown and red, sandstone						
						4		Borehole terminated at 4.0 m						
						5								

Termination reason: high tide and turbulence, poor drill progress
Remarks:

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - OSBH15

Client: Maritime Constructions
Project: Smith Bay Barge Investigation
Location: Smith Bay
Project ID: ADL2017-0211
Date: 21/11/2017

1:25 Sheet 1 of 1

Logged by: KAA
Checked by: MA

Position: E.719975m N.6059130m (MGA 53)
Elevation:

Hole Diameter: 63mm
Angle from horizontal: 90°

Plant: Investigator Mk5
Contractor: Drilling Solutions

Drilling Method	Samples	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength Classification (VL L M H VH EH; 6 60 UCS (MPa))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Comments
HQ3		10	0	0		1		NO RECOVERY - INFERRED SAND/GRAVEL						0.00-4.00m: Marine Deposits
								Gravelly COBBLES: subangular to rounded, coarse grained gravel, grey and brown, Sandstone.						
		40	0	0		2		NO RECOVERY - INFERRED SAND/GRAVEL						
								Gravelly COBBLES: subangular to rounded, coarse grained gravel, grey and brown, Sandstone.						
		0	0	0		3		NO RECOVERY - INFERRED SAND/GRAVEL						
		0	0	0										
		0	0	0		4		Borehole terminated at 4.0 m						
						5								

Termination reason: Rough sea conditions
Remarks:

This report must be read in conjunction with accompanying notes and abbreviations.

CORE PHOTOGRAPHS: SMITH BAY - OSBH01a

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA		Hole Diameter:	HQ3	Plant: Investigator Mk5
Checked by:	DA		Angle from Horizontal:	90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH01a: 0m to 5.0m

Smith Bay Barge OSBH01a: 5m to 10.0m

Smith Bay Barge OSBH01a: 10m to 15.0m

CORE PHOTOGRAPHS: SMITH BAY - OSBH02

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	BD	Hole Diameter: HQ3	Plant: Investigator Mk5
Checked by:	DA	Angle from Horizontal: 90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH02: 0m to 5.0m

Smith Bay Barge OSBH02: 5m to 10.0m

Smith Bay Barge OSBH02: 10m to 11.9m

CORE PHOTOGRAPHS: SMITH BAY - OSBH03

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA	Hole Diameter:	HQ3	Plant:	Investigator Mk5
Checked by:	DA	Angle from Horizontal:	90°	Contractor:	Drilling Solutions

Smith Bay Barge OSBH03: 0m to 5.0m

Smith Bay Barge OSBH03: 5m to 10.0m

Smith Bay Barge OSBH03: 10m to 15.0m

Smith Bay Barge OSBH03: 15m to 17.5m

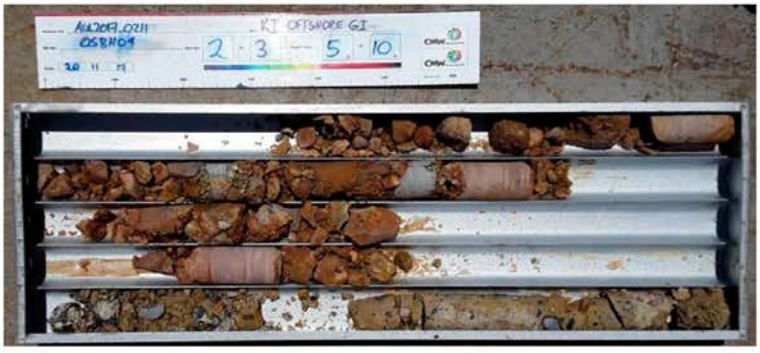
CORE PHOTOGRAPHS: SMITH BAY - OSBH04

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA		Hole Diameter:	HQ3	Plant: Investigator Mk5
Checked by:	DA		Angle from Horizontal:	90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH04: 0m to 5.0m



Smith Bay Barge OSBH04: 5m to 10.0m

Smith Bay Barge OSBH04: 10m to 15m

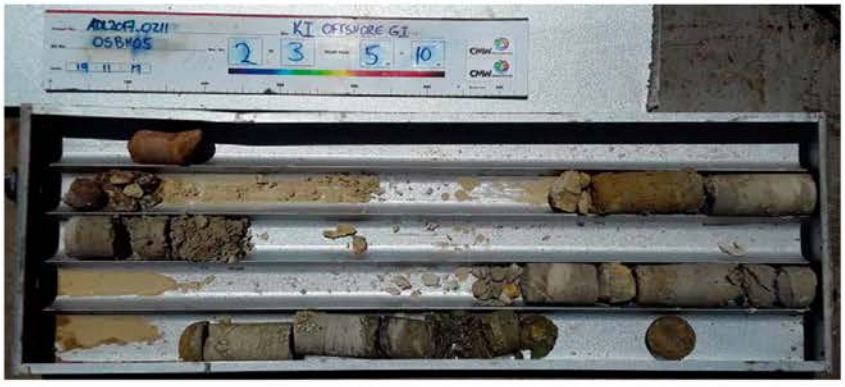
CORE PHOTOGRAPHS: SMITH BAY - OSBH05

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA	Hole Diameter: HQ3	Plant: Investigator Mk5
Checked by:	DA	Angle from Horizontal: 90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH05: 0m to 5.0m



Smith Bay Barge OSBH05: 5m to 10.0m

Smith Bay Barge OSBH05: 10m to 14.7m

CORE PHOTOGRAPHS: SMITH BAY - OSBH06

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA		Hole Diameter:	HQ3	Plant: Investigator Mk5
Checked by:	DA		Angle from Horizontal:	90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH06: 0m to 5.0m

Smith Bay Barge OSBH06: 5m to 10.0m

Smith Bay Barge OSBH05: 10m to 13.2m

CORE PHOTOGRAPHS: SMITH BAY - OSBH08

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA		Hole Diameter:	HQ3	Plant: Investigator Mk5
Checked by:	DA		Angle from Horizontal:	90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH08: 0m to 5.0m

CORE PHOTOGRAPHS: SMITH BAY - OSBH09

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	BD		Hole Diameter:	HQ3	Plant: Investigator Mk5
Checked by:	DA		Angle from Horizontal:	90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH09: 0m to 5.0m

CORE PHOTOGRAPHS: SMITH BAY - OSBH10

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	BD	Hole Diameter:	HQ3	Plant:	Investigator Mk5
Checked by:	DA	Angle from Horizontal:	90°	Contractor:	Drilling Solutions

Smith Bay Barge OSBH10: 0m to 5.0m

CORE PHOTOGRAPHS: SMITH BAY - OSBH11

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA	Hole Diameter: HQ3	Plant: Investigator Mk5
Checked by:	DA	Angle from Horizontal: 90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH11: 0m to 5.0m

CORE PHOTOGRAPHS: SMITH BAY - OSBH14

Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	BD	Hole Diameter: HQ3	Plant: Investigator Mk5
Checked by:	DA	Angle from Horizontal: 90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH14: 0m to 4.0m

CORE PHOTOGRAPHS: SMITH BAY - OSBH15

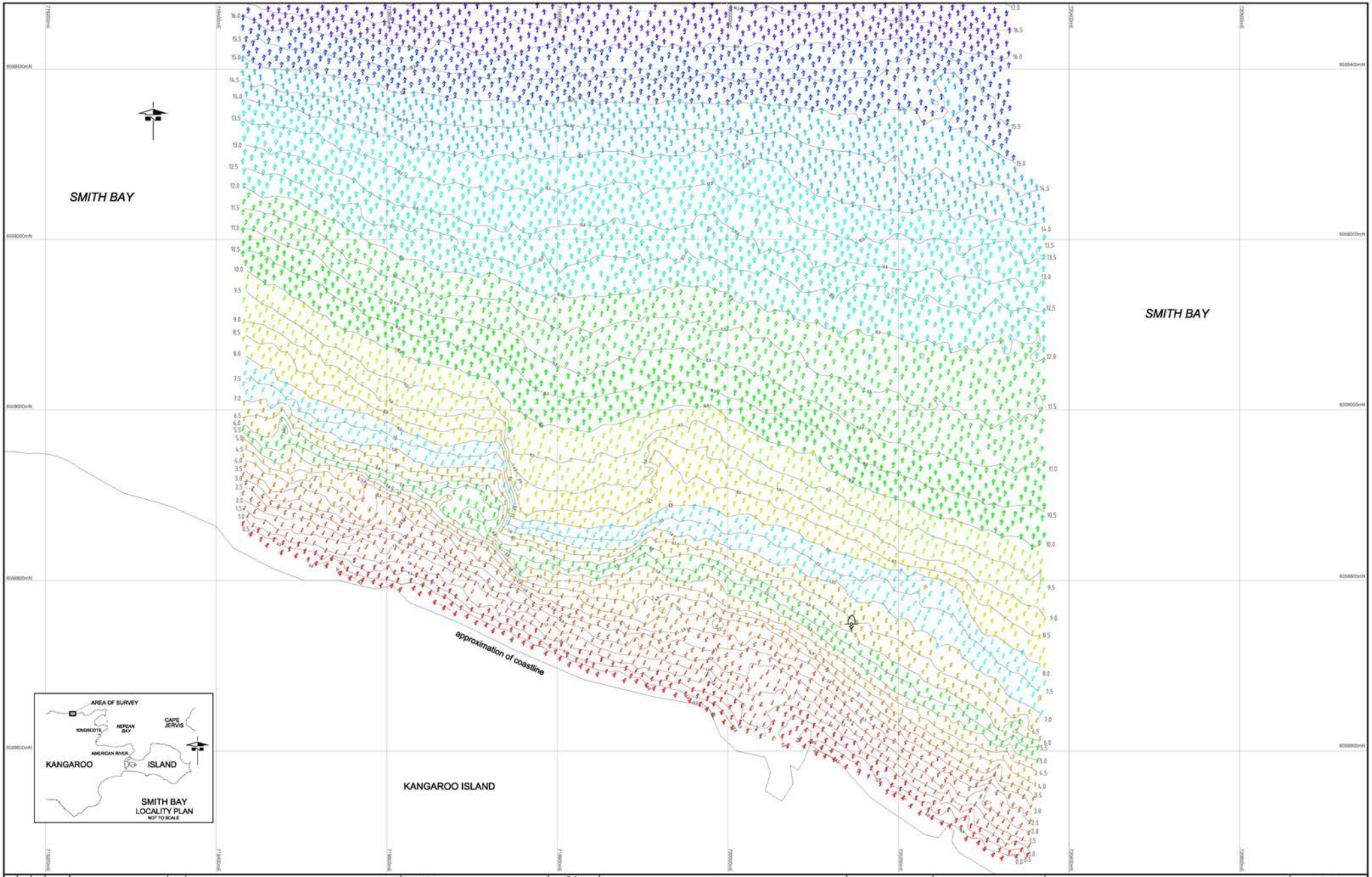
Client:	Maritime Constructions
Project:	Smith Bay Barge Investigation
Location:	Smith Bay
Project ID:	ADL2017-0211
Date:	1/12/2017

Sheet No. 1 of 1

Logged by:	KA	Hole Diameter: HQ3	Plant: Investigator Mk5
Checked by:	DA	Angle from Horizontal: 90°	Contractor: Drilling Solutions

Smith Bay Barge OSBH15: 0m to 4.0m

Appendix C2 – Bathymetric Survey (Soundings) – Hydro Survey (Flinders Ports)



Revisions

No.	By	Date	Description	Appd.

This survey has been carried out using a Geoswath Interferometric wide swath survey system to I.H.O. S44 standard for special order surveys and that:

(A) Full search area (ie total bottom coverage) has been achieved over survey area

(B) A depth uncertainty for reduced depths (95% confidence level) of ± 0.15m has been achieved

(C) Data processing and modelling has been carried out using a 0.5m grid

(D) Selected soundings shown on this plan are minimum depths within a 18m circle of influence

(E) Horizontal position has an uncertainty of ±0.5m (95% confidence level)

Vertical Datum
Soundings are in metres and decimetres reduced to chart datum. (Approx. L.A.T.)
Chart datum is 5.588m below PSMP 6426/1315 at Emu Bay.
Chart Datum is -0.802m AHD
Chart Datum is 30.48m FP Datum
Horizontal Datum
Map Grid of Australia 1994 (MGA94) Zone 53
Equipment
Survey launch 'Felix'
MarineStar G2 HP, POSMV
GeoAcoustics GS+ swath system
HydroPro navigation system

Refs
Hydro
18-003_Smith Bay KI.zip
CAD
KI18_FP4422_ Smith Bay.dwg
GIS
KI18.002

Notes
Soundings taken 02 January 2018.
PSMP 6426/1315 height is 5.086m AHD (published 3rd Order)
Approximate position of coastline - digitised from aerial photography

Scale
Before reduction : 1 : 2000
metres 0 40 80 120 160 200 metres

Hydro Survey

FLINDERS PORTS PTY LTD
Level 1, 296 St. Vincent Street
Port Adelaide SA 5015
Phone 08 8447 0611
Fax 08 8447 0606

Flinders Ports

Chief Hydrographic Surveyor

Manager Survey

KANGAROO ISLAND
SMITH BAY
MARITIME CONSTRUCTIONS
SOUNDINGS

Job No	HA2500
Sheet	1 of 1
Loc 479	Type 13
Drg. No.	FP4422
Rev	
Surveyor PJW	Drawn LMA 11/01/18
Supersedes	

Appendix C3 – Stormwater Management Strategy 2018 – WGA

WALLBRIDGE GILBERT AZTEC

KANGAROO ISLAND PLANTATION TIMBERS (KIPT)

Export Facility at Smith Bay

STORMWATER MANAGEMENT STRATEGY

Project No. 140132
Doc No. WGA140132-RP-CV-0001
Rev. A

20 December 2018

CONTENTS

Appendices

EXECUTIVE SUMMARY

This report develops the stormwater management strategy for a parcel of land located at Smith Bay on Kangaroo Island. The land will be developed by Kangaroo Island Plantation Timber Plantations (KIPT) for an export facility. The strategy adopts a risk-based approach to address stormwater impacts on the downstream receiving environment. In doing so, best management practice techniques are adopted to manage the quantity and quality of runoff to suit the functionality and layout of the development site.

The stormwater management strategy considers the characteristics, constraints and opportunities within the site as much as possible. This report provides a strategy for the on-shore and off-shore facilities which are managed according to the risk they pose to the environment. In summary these our described below.

On-Shore

General Site Stormwater Drainage

- Surface cut off drains at the upstream interface of the site to intercept any overland flow from the upstream catchment
- Surface swale drains and conveyance system throughout the site to control and manage stormwater runoff to 1 in 20-year ARI capacity
- All site areas (with exception of timber yards) are directed to a proposed wetland basin incorporating detention storage

Timber Log and Wood Chip Storage Yards

- Timber log and wood chip storage yards are isolated from the general stormwater system. Each yard will drain via a concrete forebay to intercept sediment and debris. Stormwater will then enter the retention basin (holding pond)
- Retention Basin (holding pond)
  - 10ML storage volume – water balance assessment uses approximately 100 years of rainfall data
  - No discharge to stormwater or receiving environment
  - Lined to prevent infiltration. Evaporation losses, and used for irrigation of adjacent landscape buffer, and for dust suppression
  - Irrigation system will require separate filter system to remove sediments and fine debris

Stormwater Treatment – General Areas

- Ephemeral wetland pond – detention basin
  - Surface area 0.1 Ha
  - Volume 1ML
  - Provides stormwater treatment for the general site (excluding timber and wood chip storage yards)
  - Unlined to allow for infiltration loss
  - Planted with indigenous vegetation

- Attenuates the post development 5 yr. ARI critical storm event to release the 5-yr. pre-development critical flow rate
- Hydraulic controls include:
  i. Discharge control pit – frequent flow management and detention storage control
  ii. Spillway – overflow for larger storms and if basin is full
  iii. Vegetated discharge swale with level spreader, also includes porous rock weir to dissipate stormwater towards to coastal zone
- Vegetated swale (inlet to wetland system) - Incorporates pool and riffles sequence to reduce bed gradients, encourage infiltration and reduce velocity

- Stormwater treatment modelling (MUSIC) – reveals that EPA and WSUD targets will be met

Off-Shore

Causeway

- Spill kits to be provided on the causeway
- The conveyor will be covered with a canopy

Floating Wharf

- The surface of the wharf comprises of a concrete pavement that will be graded to prevent any runoff entering the ocean
- Surface grades and surface flow will enter a series of grated inlet pits. Each pit is to be fitted with a Ecosol litter basket to trap debris
- An end of line gross poullant trap / oil, grease and water separator intercepts pollutants that enter the drainage system prior to discharge to the Ocean. Spel Class 3 Ecoceptor.
- The management of the wharf requires maintenance regime to be actioned following each export process as provided in Section 5.4 of this report. This is a critical function and must be actioned following each export episode.

The stormwater management strategy plan is attached to this report in Appendix D. The plan represents a master plan for the development which will require further design documentation prior to construction submission.

1 INTRODUCTION

1.1 BACKGROUND

Wallbridge Gilbert Aztec (WGA) has been engaged by Kangaroo Island Plantation Timbers Ltd (KIPT) to prepare a stormwater management strategy for a proposed log export wharf and associated on-shore log yard at Smith Bay, Kangaroo Island for Kangaroo Island Plantation Timbers (KIPT). The purpose of the strategy is to ensure stormwater generated from the development is managed in an environmentally responsive manner that addresses risks and Environmental Protection Authority requirements.

KIPT and other owners manage 58 plantations on Kangaroo Island, which are either already mature or will begin to reach maturity in the coming years and will be harvested between 2019 and 2030. As the plantations are harvested, timber will be shipped directly to overseas markets. Currently, all shipping from the island is via the Sealink ferry terminal in Penneshaw, which is used for both passenger and freight movements. Penneshaw, for a variety of economic, logistical, social and safety reasons, is unsuitable as a site for a deep-water wharf.

KIPT is currently planning to construct a new multi-user deep-water wharf at Smith Bay on the island's north coast to handle the shipping of harvested timber. The wharf will include a storage area for a total of 30 kilotons of timber plus other non-forestry cargo. The location of Smith Bay is illustrated in Figure 1.1, and the extent of the land-based site is shown on Figure 1.2.

Figure 1.1: Smith Bay Location

Figure 1.2: Site Location

1.2 SCOPE

This Strategy applies to the management of stormwater runoff from the surfaces of the proposed on and off shore infrastructure elements. It does not apply to the marine waters and wastewater management.

The stormwater management strategy aims to develop methodologies that embody the principles of Water Sensitive Urban Design (WSUD). This strategy addresses the stormwater management requirements defined by the Environment Protection Authority (EPA). These requirements apply to:

- Stormwater runoff volume and flow management
- Quality of stormwater discharged, and
- The environmental aspects associated with stormwater and the receiving environment.

These requirements have been defined through an engagement process with the EPA and therefore are specific to the Development. In this regard some of these requirements encapsulate the standard requirements for water quality and quantity management as defined by the EPA's Environment Protection Act and its associated water quality criteria.

The intent of this report is to provide the strategic basis for the multi-objective management of stormwater on the Development based on the following:

- A general overview of the stormwater Internal network drainage design
- A general overview of WSUD and opportunities within the Development
- Preliminary sizing for a retention basin to cater for organically loaded stormwater runoff
- Preliminary design of a wetland treatment system and its basis to deliver performance objectives
- The management of stormwater within an overall risk management framework, and
- The management of stormwater runoff during the construction and operational phases

The stormwater management strategy presented in this report is intended to demonstrate responsive performance outcomes. This is supported by calculations, modelling and a concept layout.

1.3 STORMWATER MANAGEMENT REQUIREMENTS AND REFERENCES

Through an engagement process within the Project Team and the EPA the following requirements have been advised that are specific to the Development. These have been outlined below.

WGA has reviewed the proposed Development to understand key site issues, constraints and opportunities within the site. Through this understanding WGA has developed a number of key stormwater management principles to apply to the Strategy. Based on this, several design methodologies guided by the application of best practice management in the context of stormwater management. On this basis WGA has identified the minimum requirements as follows:

- Stormwater treated to WSUD pollutant reduction targets
- Sediment and other primary pollutants trapped and treated within the development
- No erosion downstream from any stormwater outlet
- Manage stormwater according to its pollutant composition and level of risk it poses to the receiving environment, and

- Identify operational management processes that form an integral part of the stormwater management strategy.

Other management requirements are outlined in this strategy as deemed necessary to address any specific and identified risks in Section 3.

The EPA adopts the WSUD management approach which essentially define their requirements, which relate to management of both stormwater quantity and quality.'.

A meeting with the EPA was carried out to define minimum requirements. These are listed as follows:

- Run-off rates should not exceed the rate of discharge from the site that existed pre-development;
- Water quality treatment reduction targets of the average annual load as follows
  - Total Suspended Solids (TSS) 80%
  - Total Phosphorus (TP) 60%
  - Total Nitrogen (TN) 45%
  - Retention of litter greater than 50mm for flows up to a 3 month Average Recurrence Interval (ARI) peak flow
  - No visible oils for flows up to a 3-month ARI peak flow
  - No discharge of organically loaded stormwater to the receiving environment
  - Management and interception of oils, grease from operations resulting from the movement of plant and equipment, including both on and off shore operations
  - Intercept and trap wood chip prior to any discharge of stormwater from onshore and off shore operations
  - Adopt the treatment train approach to stormwater management
- Environment Protection Policy (Water Quality) 2015, under the Environment Protection Act, 1993.

Based on the EPP Water Quality (2015) for fresh water environments, the listed pollutant concentrations will be used as the limiting targets in the stormwater discharge. These are based on the general water quality criteria listed EPP (2015) and are listed below for reference.

EPP Water Quality (2015) Criteria

- Total Phosphorous = 0.5 mg/L
- Total Nitrogen = 5 mg/L
- Suspended Sediment = 20 mg/L

References

The stormwater management strategy is developed to encompass the design criteria in accordance with the following recognised references:

- EPA Environment Protection Act 1993, (Water Quality) Policy 2015 (WQ EPP 2015);
- WSUD Engineering Procedures – Stormwater (2005);
- Australian Runoff Quality, Engineers Australia (2006); and
- Water Sensitive Urban Design - Greater Adelaide Region Technical Manual (Dec 2010).

These handbooks and guidelines are considered as Australian and South Australian standards and cover all aspects of stormwater management. This includes the design for major and minor storm flow, and stormwater quality improvement. The Stormwater Management Strategy adopts the design standards, principles and practices covered by the handbooks.

2 CATCHMENT OVERVIEW

2.1 EXISTING SITE AND CATCHMENTS

The site of the proposed export wharf is located at Smith Bay in Kangaroo Island as shown Figure 1.2. The site is accessible from a private access road extending from North Coast Road.

The area nominated for the wharf comprises a section of coastline with a shoreline typically comprising various sized cobbles and boulders of orange to red, rounded, sandstone, except for a small section of beach and sandy inlet at the eastern end (possibly man-made) used for launching boats.

At the back of the shoreline the sandstone cobbles and boulders were formed up into a linear mound, parallel to the coastline, although a small sand dune was observed behind the beach section.

The land behind the mound of cobbles and boulders comprised of paddock / grass lands to the south.

Smith creek is located to the west of the site; however, the site falls directly to the north.

Figure 2.1 Shows a Typical Photo of The Site and its Features.

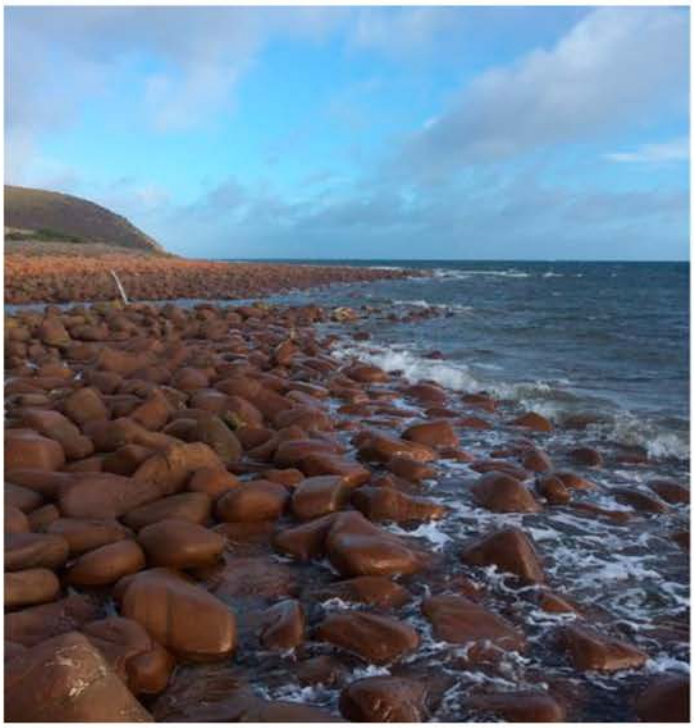


Figure 2.2: Site Photo Looking West Along the Cobbled Beach

The topography of the site falls north with an average gradient of 2 – 3%. Levels at the southern boundary are approximately at RL 28.0 AHD to RL 5.0 AHD adjacent to the Coast on the northern boundary. The fall of the land defines the site as its own catchment. All external and existing areas to the south of the site also drains towards the site (external catchment

Figure 2.2 depicts the existing site contours in meters to Australian Height Datum (AHD) and shows that the site falls towards the coast.

Figure 2.2: General Land Contours

Regional Geology

The Geological Survey of South Australia (1:250,000 scale "*Kingscote*" map sheet) and 1:100,000 scale geology present on the SARIG website indicate that the site of the wharf lies near to a geological boundary between Permian aged Glacial Till (east) and Cambrian aged bedrock. Where the Glacial Till is shown near to the surface, it would be expected to overlie the Cambrian rocks at depth.

Descriptions of the various geological units expected in the area are presented in Table 2.1.

Age	Geological Unit	Description
Permian	Glacial Till (Cape Jervis Formation)	Boulder beds, chiefly clay with numerous granite, gneiss and quartzite erratics, frequently > 300 mm in length. Also includes glaciofluvial deposits with sand, gravel, clay and porcellanized clay.
Cambrian (1)	Smith Bay Shale	Mudstone, micaceous, siltstone; sandstone (inferred to be unnamed grey and purple shale unit shown in Kingscote map sheet)
	Stokes Bay Sandstone (2)	Arkose red-brown to orange, described as principally massive coarsely current and slump bedded red and white sandstone and quartzite in Kingscote map sheet.
Notes: **(1) Smith Bay Shale is expected west of the Stokes Bay Sandstone, and underlying the Glacial Till;** **(2) The Kingscote map sheet indicates that bedding in the Stokes Bay Sandstone dips between about 5 and 20 degrees to the east to south east immediately west of the site**		

Table 2.1: Summary of Regional Geology

Groundwater Setting

The site is elevated above sea level in the range of 5m near the coast, and up to approximately 30 to the south. Based on the site's location, the regional groundwater level in the area is expected to be related to water levels in the nearby creek and sea level.

2.2 DEVELOPMENT

The proposed development will comprise of on-shore and off-shore facilities.

The on-shore facility will comprise:

- Total site area 11.5 Ha
- Log storage yard 2.4Ha
- Woodchip stockpile 2.4 Ha
- Office and car park
- Access roadways and hardstands

The off-shore facilities will include:

- Causeway and access roadway with conveyor – approximately 250m long from the shore line
- Floating wharf – approximately 40 wide x 170m long

Figure 2.3 provides an of the overall development.

Design Export Product / Loading Operation

The primary design export product at Smith Bay is intended to be bulk log export. Once the export facility is established, KIPT expects the wharf will be used for 50-75 days per year for timber exports. This is expected to cater for the entire Kangaroo Island Forestry Estate. Allowing for other products, 20-25% berth utilization would be expected. Due to the low utilization, it is anticipated that the exposed nature of the site will be controlled by environmental limitations on berth availability.

It is expected that KIPT and other forestry users will produce 600,000tpa of logs in the first four years of use, with a reduction to a sustainable flow of 400,000tpa thereafter. As such, 15-20 vessel berths per year could be expected.

The on-shore log yard storage will cater to the management of export demand. It is expected that trucks will deliver the logs to the yard and be offloaded with mobile material handling machines, an example of which is depicted in Figure 2.4 Vessel loading procedure will be by loading purpose built trailers from the log yard, which will traverse along the causeway then onto the floating wharf (off-shore) where the vessels cranes will receive and load the log bundles onto the vessel.

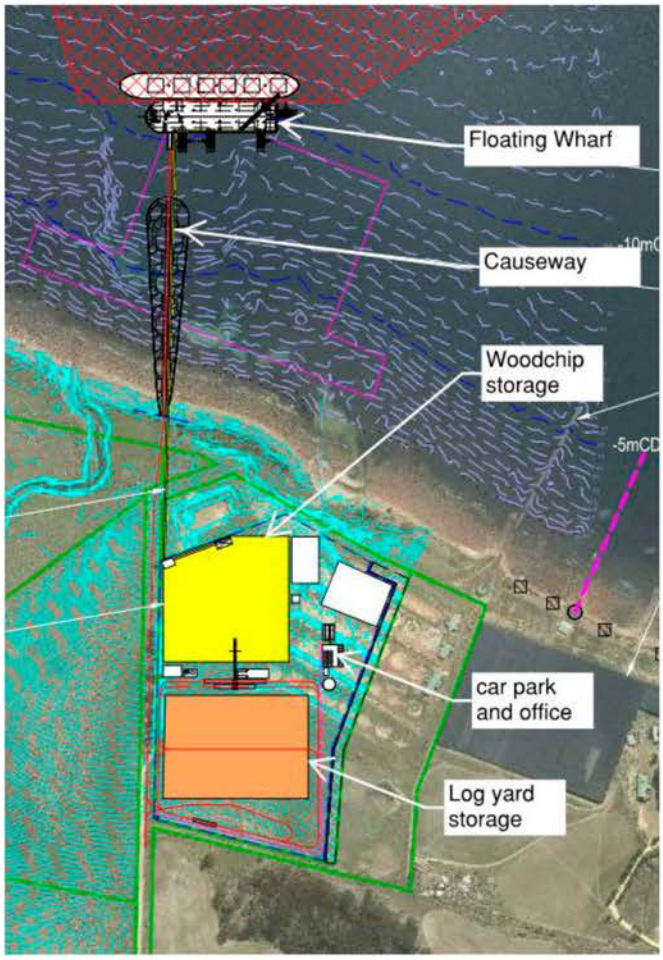


Figure 2.3: Preliminary Development Layout

Figure 2.4: Example Crane Truck Loading Operation in Log Yard

3 IDENTIFICATION OF RISKS AND OPPORTUNITIES

3.1 RISK MANAGEMENT

This risk management process aims to determine the potential nature, scale and likelihood of any impacts on water quality, erosion and degradation of the receiving environment during the design, construction and operational phases of the development. This process is undertaken to assist in identifying appropriate management strategies to manage the project impacts, and / or determine if intervention is required to manage risks.

The main steps in the risk management process are:

- Identify risks – as determined by the site and its characteristics;
- Analyse risks – how likely is it to happen, what are the likely consequences;
- Evaluate risks – against the likelihood and consequence matrix; and
- Treat risks – prioritise, address and mitigate identified risks through the adoption of mitigating strategies.

This Risk Management process covers the proposed development, with more detail focussed on using the proposed stormwater management systems to manage risks.

Following a review of the site and relevant studies, the risk assessment has been prepared for the design, construction and operational phases of the project. This is presented in Tables 3.2 to 3.4. The likelihood and consequence matrix is provided in Table 3.1 for reference.

Table 3.1: Likelihood and Consequence Matrix

	CONSEQUENCE		
LIKELIHOOD	**Low** Minor adverse social or environmental impact	**Medium** Measurable adverse environmental or social impact. Will result in annoyance or nuisance to community	**High** Significant damage or impact on environmental systems and local community
Low The event could occur only rarely, or is unlikely to occur	Low Risk	Low Risk	Medium Risk (could be high)
Medium The event will occur occasionally or could occur	Low Risk	Medium Risk	High Risk
High The event will occur often or is most likely to occur	Medium Risk	High Risk	High Risk

Table 3.2: Design Phase Risk Management Process

1. DESIGN PHASE							
ID	**Issue**	**Potential Impact**	**Likelihood**	**Consequence**	**Level of Risk**	**Response / Management Measure**	**Notes**
A	Overland flooding - upstream catchments	Increased flooding potential on site due to increase in impervious areas	Low	High	Medium	On site drainage systems (including culverts, drainage networks, and open drains shall cater for 1 in 20 Average Recurrence Interval (ARI) storm events, with a 1 in 100 year ARI storm event checked for overland flooding through flow paths. The system shall be designed to intercept potential upstream overland flow at the southern boundary and have sufficient capacity (1 in 20 yr. ARI) to accommodate the design drainage flow within the development without causing damage or nuisance to adjacent landowners and properties.	Drainage network designed to separate drainage from log and wood chip hardstands from the rest of the site generated stormwater runoff.
B	Flooding – on site	Flooding due to overland flooding from impervious areas within the site	Low	Low	Low	Design the internal network of open drains, culvert and pipes to cater for the 1 in 20 year ARI peak storm event flow into the wetland pond and retention basin. The open drain network to be rock lined or be designed to ensure sufficient carrying capacity with gradients and appropriate controls to prevent bed erosion and damage.	
C	Retention pond and wetland system - deep water	Safety hazard to site personnel	Low	High	High	All deep water areas to be designed with safety bench bank profiles. These profiles will be graded to recognized Australian Practice reference guides. Where pond is liner using poly lining system, safety fencing to be provided around retention basin.	
D	Erosion of the open drains / swale wetland system	Scouring and erosion associated with velocities, peak, volume of water	Medium	High	High	Drainage outlets to incorporate rock pitching, energy dissipation and vegetation. Discharge points to be designed with WSUD principles. Wetland to include appropriate measures to control velocity in both low and high flows. Velocities to be assessed as part of design process to determine appropriate treatments. Swales upstream of wetland system to be designed with pool and riffle systems to control velocity.	Limits in velocity • 1.6m/s flow swales • 1.0m/s for high flow through wetland system
E	Erosion at the outlet of the wetland system	Coastal erosion, loss of sand, sedimentation, erosion, water quality	High	Medium	High	The design and layout for wetland system will follow the rationale and design features associated with naturalistic waterway design. The discharge system to incorporate a porous rock weir at the wetland outlet to distribute water flow over a wide area (i.e. not one concentrated flow). Adopt frequent flow management technique Provide level spreader at outlet and porous rock weir to dissipate flows overalnd	
F	Debris from site operations being discharged to the beach and ocean	Spread of debris onto coastal area and beach leading to degradation of marine quality	High	High	High	Forebay traps to be incorporated at the each of the log and wood chip storage areas to intercept debris at source Retention pond has no outlet Design discharge control pit from the wetland system as a submerged system Floating wharf to have strict maintenance regime after each export operation, and including in pit debris trap, and gross pollutant trap	
G	Water Sensitive Urban Design	Runoff quality leads to long term water quality impacts to receiving environments.	Medium	Medium	Medium	Project based treatment design using treatment train approach using WSUD measures along the main drainage corridors proposed in the Development. The WSUD strategy is also supported by the proposed end of line wetland system and retention basin. Treatment will achieve reductions in total pollutant load from the contributing site catchment. Treatment standards to comply with WSUD urban design standards and EPP (Water Quality 2015	MUSIC modelling used to verify treatment systems adopted in design. Design demonstrates meets targets as specified Using treatment train approach for pollutant reduction targets and checked against EPA Water Quality Policy (2015)

Table 3.3: Construction Phase Risk Management Process

2. CONSTRUCTION							
ID	**Issue**	**Potential Impact**	**Likelihood**	**Consequence**	**Level of Risk**	**Response / Management Measure**	**Notes**
A	Site erosion and sedimentation downstream	Sedimentation impacts on receiving water quality. Increase in turbidity / total suspended solids / total dissolved solids to aquatic ecosystems by reducing light and smothering organisms	High	Medium	High	SEDMP	Excavate retention basin and wetland basin early and direct all site generated runoff into the basins to trap sediment
B	Vegetative matter	Increase in natural organic matter impacts on receiving water quality including, increase in Nitrogen / Phosphorus and reduced oxygen levels - algae outbreaks and eutrophication - visual / surface scum	Low	Medium	Medium	CEMP and SEDMP	Incorporate screen to trap vegetative matter and reduce the risk of mobilisation into flows during construction
C	Gross pollution (litter)	Impacts on receiving waters: - visual / aesthetics - decreased water quality	Medium	Low	Medium	CEMP Waste recycling and reuse	
D	Accidental spills (including hazardous materials)	Impacts on receiving water quality: - increased toxicity - aquatic flora death / breakdown and increases in organic matter - aquatic fauna death / breakdown and increases in organic matter	Low	High	High	CEMP	
E	Hydrocarbons	Impacts to water quality including: - increased toxicity - algae outbreaks and eutrophication - visual / surface scum	Low	High	High	CEMP	
F	Interception of groundwater	Impacts on receiving water quality (associated with dewatering activities)	Low	Low	Medium	CEMP	
G	Accidental spills and/or release of contaminated soil into groundwater systems	Contamination of groundwater	Low	High	Medium	CEMP	
H	Temporary changes in direction and flow of surface water and groundwater	Pooling in undesirable areas, including excavations.	Medium	Low	Low	CEMP	
I	Increased volume of surface water flow	Increased turbidity levels in receiving beach area for excessive sediment accumulation	Medium	Medium	Medium	CEMP Temporary drainage systems required during the construction of the works. Diversion drains and sedimentation basin to intercept all flows.	

Table 3.4: Operations (post construction) Phase Risk Management Process

3. OPERATIONAL - POST CONSTRUCTION							
ID	**Issue**	**Potential Impact**	**Likelihood**	**Consequence**	**Level of Risk**	**Response / Management Measure**	**Notes**
A	Site generated stormwater pollution	Impacts to water quality including: - increased toxicity - accumulation in aquatic sediments	High	Medium	High	Project based treatment design e.g. Vegetated swale / pool riffle system and wetland system measures Maintenance and monitoring of system to achieve design outcomes.	
B	Hydrocarbons	Impacts to water quality including: - increased toxicity - algae outbreaks and eutrophication - visual / surface scum	High	Medium	High	No runoff from any part of the project shall be discharged out of the development boundary unless it is intercepted by the stormwater system and retention pond. Wharf drainage to be intercept by hydrocarbon separator as part of the GPT.	
C	Sediment	Impacts on receiving water quality: - increase in turbidity / total suspended solids / total dissolved solids - to aquatic ecosystems by reducing light and smothering organisms - release of associated metals and nutrients.	High	Medium	High	Project based treatment design e.g. Vegetated swale / pool riffle system and wetland system measures Maintenance and monitoring of system to achieve design outcomes.	
D	Nutrients	Impacts on receiving water quality: - increase in Nitrogen / Phosphorus and reduced oxygen levels - aquatic flora death / breakdown and increases in organic matter - aquatic fauna death / breakdown and increases in organic matter	High	Medium	High	Project based treatment design e.g. WSUD, wetland system, treatment train approach. Maintenance and monitoring of system to achieve design outcomes.	
E	Vegetative matter, wood chip debris and dust Stormwater runoff from wood chip stockpile and log storage yard	Increase in natural organic matter impacts on receiving water quality including: - increase in Nitrogen / Phosphorus and reduced oxygen levels - algae outbreaks and eutrophication - visual / surface scum - weed growth in downstream wetland system and Park	High	High	High	Project based treatment design e.g. WSUD, wetland system, treatment train approach. Maintenance and monitoring of system to achieve design outcomes Design response – Forebay debris traps for each of the log yard and wood chip storage yard and discharge to retention basin with no discharge to receiving environment. Periodic clearing of intercept debris in traps. Remainder of site to be drained to treatment wetland system with controlled discharge	Concrete forebay with trap to intercept all debris. Low flow riser to be contained in discharge pit and submerged
F	Gross pollution (litter) Wharf surface	Impacts on receiving waters: - visual / aesthetics - decreased water quality	Medium	Medium	Medium	Grade the surface of wharf to contain all stormwater on wharf surface and drain to inlet pits. Clean up wharf surface - Maintenance following each export operation Inclusion of pit litter baskets and a gross pollutant trap / oil water separator at the main stormwater outlet to ocean.	Wharf operations to incorporate maintenance regime into its operations. Sweep debris off wharf into inlet pits with litter baskets. Clean out baskets and dispose on-shore to use as mulch or as appropriate
G	Increased runoff volumes due to increased impermeable surfaces	Impact to flow regimes and function of receiving waters	High	Medium	High	Design response- Using WSUD techniques to slow rate of runoff through swales, interconnected vegetated pools with riffles, and wetland system. Incorporate frequent flow management approach to accommodate storage volume in wetland to allow for infiltration and trickle flow release via the discharge system. Refer other Sections for further details. Revegetate proposed pool and riffle system and wetland system with indigenous plant species to slow surface water flow, protect from erosion, and restore habitat and environmental values.	Incorporate frequent flow management into the wetland system design

3.2 STRATEGIES TO MANAGE RISK

The response measures are outlined in the Risk Management Tables 3.2 to 3.4 inclusive for the overall development is described in more detail below. In addition to these management measures, the Construction Contractor will be required to prepare a Construction Environmental Management Plan (CEMP) including a Soil Erosion and Drainage Management Plan (SEDMP). These are further discussed in Section 8.

Water Sensitive Urban Design (WSUD)

A design framework that uses the principles of WSUD to manage risks is a widely accepted approach to manage stormwater in an environmentally sensitive manner. In this regard the design using a treatment train approach as well as isolating stormwater that has come into contact with timber products is considered an appropriate means of the managing the Development.

Principles within the WSUD framework are proposed for:

- Improving quality of general stormwater runoff, and along the stormwater conveyance network leading to an end of line wetland system
- Intercept stormwater runoff from sources where stormwater has come into contact with timber products. Retain stormwater on site in retention basin without discharge.
- Managing the rates of runoff for regular rainfall events through attenuation via green systems;
- Managing the volume of general site runoff for < 3month ARI and release as trickle flow;
- Utilise stormwater runoff captured in retention basin for onsite irrigation (to maintain heathy landscape buffer, mitigation of dust, hardstand washdown; and
- Adoption of a treatment train approach that is robust and easy to maintain given the locality.

Retention Pond

The design approach is based on managing the different sources of stormwater according to its pollutant constituents. In this regard, the runoff from the log and wood chip storage areas will be contaminated with organic loading which cannot be discharged to a marine environment. The following principles will apply:

- stormwater contaminated with organic loading will be intercepted and retained on site
- Prevent infiltration loss through the base of the retention basin and therefore the potential to contaminate groundwater
- Intercept debris that enter stormwater by incorporating traps at source.

Wetland System

The treatment of general site runoff uses the conventional design principles of constructed wetland system to treat stormwater runoff from non-wood source runoff. Wetland systems are a widely accepted approach to manage stormwater in an environmentally sensitive manner. A hybrid wetland system that will be incorporated that will adopt the following principles:

- Improving quality of stormwater runoff to comply with referenced standards identified in this report
- A key focus will be to intercept sediment

- Managing the rates and volume of runoff for regular rainfall events < 3-month ARI (frequent flow management) to mitigate the risk of erosion forming rivulets downstream a the discharge point and along the beach area
- Allow the wetland system to function as an ephemeral vegetated basin that allows for infiltration to underlying soils
- The design basis for vegetation design and the wetland system should be largely self-sustaining to avoid the need for ongoing maintenance intervention.

Causeway and Floating Wharf

The design approach for the off-shore infrastructure requirements associated with the causeway and floating wharf is based on the following principals:

- The conveyor that transfers wood chip to the wharf will be covered with a canopy. Therefore, the woodchip will not come into contact with rainwater
- The roadway along the causeway will be partially covered, however the majority will be exposed to rainfall. Pollutant runoff will be minimal because there is no parking or vehicles standing on the causeway. Spill kits should be made available to attend to any spills
- The Wharf will be activated approximately every 3 weeks to export logs and wood chip. It is expected that the wharf will have machinery loading product onto ships. There is a high likelihood that wood chip and debris will remain on the wharf upon completion of the export routine. This will require manual sweeping of debris into pit traps and removal of contents for appropriate disposal onshore. Hydro carbon and silt will need to be managed via a gross pollutant trap / oil and water separator to intercept any remaining pollutants prior to discharge of stormwater into the ocean.

4 CATCHMENT HYDROLOGY

4.1 EXISTING CATCHMENT

The existing site catchment characteristics are described in Section 2. The pre-development flow rate at the 1 in 5 year storm event forms the basis of the permissible discharge rate from the development for the critical storm frequency.

The Kinematic Wave Equation was used to calculate the pre-development time of concentration for the purposes of defining the permissible discharge rate for the 1 in 5 year critical event. Refer to Appendix B for all DRAIN modelling results and calculations. The parameters are summarised as follows:

- Existing site Coefficient of runoff = 0.25
- Site time of concentration = 11minutes; and
- Pre-development peak 5-year ARI flow rate was calculated to be approximately 0.043m^3/s.

4.2 POST DEVELOPMENT DETENTION BASIN SIZING

A DRAINS model was used to determine that a detention basin of the order of 1,000m^3 would be required to attenuate the 1 in 5-year ARI peak flows to a maximum outflow of 0.023m3/s, with the critical duration storm being the 120-minute event. The following is a summary of key outcomes from the DRAINS modelling relating to attenuation of stormwater flows:

- Pre-development peak 5-year ARI flow rate was calculated to be approximately 0.043m^3/s
- Post-development peak 5-year ARI discharge flow rate was found to be 0.023m^3/s
- The proposed detention basin will be incorporated along the northern part of the development and is to be incorporated into the treatment wetland system. The wetland system will reduce the 1 in 5-year peak flows from the site to a maximum of 0.023m^3/s
- The location for the detention basin was chosen for the following reasons:
  - Close to the lowest point on the site
  - Lies within a shallow and broad low-lying area / flow path
  - The min site area can be drained to the wetland pond
  - Allows stormwater to be managed and discharged overland towards the coastal area in a controlled manner.
- The detention storage has been modelled using DRAINS and spreadsheets to confirm the detention storage requirement of 1ML.

Refer to Appendix D for the general site layout indicating the intent for swale network and detention storage location. General catchment plan is provided in Appendix A. Modelling outputs have been summarised in Appendix B.

4.3 FREQUENT FLOW MANAGEMENT

An important feature of the strategy is the management of frequent rainfall events in the order of less than and equal to the 1 year ARI. It is widely understood that the stormwater generation and frequency of flows from new development in minor storm events will increase. This is considered to pose a risk of erosion forming rivulets over land towards the coastal environment.

The significance of this relates to the management and protection of the coastal soils and prevention of overland erosion from the impacts of frequent flows that will be generated from the development. It is not practical to remove or reduce volumetric discharge due to site constraints; however techniques to reduce the impact of frequent flows have been considered and incorporated into the strategy through the following means:

- Use of infiltration wetland pond systems within the development to receive direct flow from general areas within the site and encourage infiltration to reduce overland discharge
- Swale and pool and riffle system –will be designed as to allow for infiltration and slow the rate of flow to prevent erosion by reducing the responsiveness of the catchment
- Inclusion of detention storage (both minor and major) into the wetland pond to accommodate a 1-year ARI, 30-minute storm runoff volume from its contributing catchment
- It is widely acknowledged in Australian practice to consider management of a 3 month - 1 year volumetric runoff volume is equivalent to managing 90% of all annual rainfall events; and
- The detention volume will be released and controlled over a 3-day period via a discharge control pit with downstream level spreader swale and porous rock weir.

This strategy is aimed at ensuring the development would not cause a significant increase in the magnitude and frequency of erosion causing flows in minor storms.

Refer to Table 4.1 below for a summary of key parameters to integrate frequent flow management into the wetland / detention basin.

Table 4.1: Summary of Frequent Flow Management Parameters

Parameter	Value	Comment
Total rainfall event considered (10mm)	10	This rainfall is a common event within the realm of a 3 month to 1-year frequency. However, for this calculation we have considered a 1 yr. 30-minute rainfall event.
1yr ARI 30 min peak flow rate (m^3/s)	0.038	30-minute duration is generally equivalent to a 10mm rainfall event.
1yr ARI, 30 min volume (m^3)	550	Frequent flow volume from a 30-minute rainfall event (10mm).
Release flow rate (m^3/s)	0.002	Total trickle flow released over a 3-day period.
Detention depth (m)	0.50	Detention depth over the entire surface area of the wetland system.

Detailed design of the wetland system to incorporate discharge control pit which will be provided via a separate design report in the future. The discharge control pit will incorporate a dual discharge system to control the frequent flow discharge (as outlined above) as well as the attenuation of the 5 yr. ARI event as discussed in Section 4.2.

4.4 MANAGEMENT OF STORMWATER DISCHARGE

The management of stormwater discharge from the wetland / detention basin will be controlled using:

- Discharge control pit incorporating a dual level discharge orifice to release
  - Trickle flows (as outlined in Section 4.3 – Frequent flow management)
  - Porous rock weir downstream of the discharge out to disperse low and high flow rates
  - High flow discharge controlled by a higher level orifice to limit the post development flow rate down to the pre-development flow for the 1 in 100 year critical duration.
- Overflow spillway if the outlet system becomes blocked, or for a large storm event and basin is full.

Refer to the concept sketch provided in Appendix D showing the discharge locations.

4.5 RETENTION BASIN SIZING

A water balance assessment was undertaken to define the size of a hold storage required to retain runoff volumes from the log and wood chip storage yards. The water balance assessment was undertaken using a spreadsheet with continuous rainfall historical data spanning over 100 years from Kingscote Station gauge. A simple runoff model that considers evaporation losses was assessed, while infiltration losses and irrigation use was set to zero. The water balance assessment indicates that that a holding volume of 10ML (which corresponds to volume of retention basin) will retain all stormwater runoff volumes generated from the storage yards with no overflow.

A copy of the spreadsheet is provided in Appendix B. A plot of the fluctuating storage level over a shorter time span is depicted below in Figure 4.1

It is further noted that the retention storage water will be used on site for irrigation to the landscape buffer and for dust suppression. It is therefore expected more volume will be available in the basin.

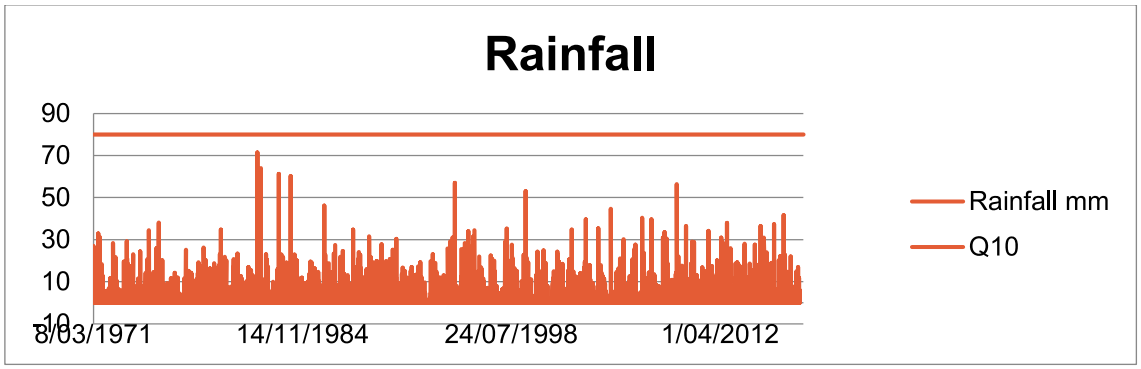


Figure 4.1: Rainfall Data Over Modelled Period

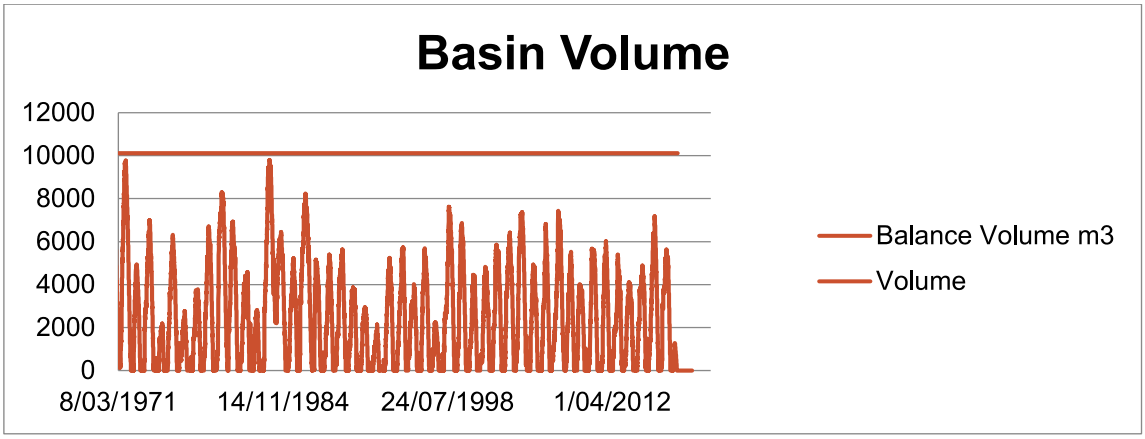


Figure 4.2: Water Balance Assessment for Retention Basin

4.6 STORMWATER NETWORK DESIGN

The network comprises of swales and culvert pipe designed to convey the 1 in 20-year ARI peak storm event within the site. DRAINS modelling was undertaken the define the swale sizes and detention basin sizing. Refer to Appendix B for model input and outputs.

Upstream catchment overland flow will be intercepted and diverted through the site to the detention basin so that it is controlled and prevents damage and or interaction with the log and wood chip storage yards.

Refer to stormwater management plan in Appendix D which shows each of the proposed swale drains throughout the site to control stormwater.

5 STORMWATER TREATMENT SYSTEMS

5.1 ON SHORE STORMWATER TREATMENT FOR GENERAL SITE AREAS

As discussed in this strategy, an ephemeral wetland system is proposed along the north-west area of the site. The wetland system will comprise of a densely vegetated unlined basin that will provide treatment of stormwater from the general site areas (Excluding the log and wood chip storage yards).

The ephemeral wetland basin will consist of an online inlet zone (swale), a macrophyte zone which is a shallow densely vegetated (reed bed) that will occupy the frequent flow detention areas. A high flow bypass spillway at the northern side of the pond will ensure that the basin is not damaged in high flow events. The spillway and outlet swale will be designed with appropriate scour controls (rock pitching) to prevent erosion downstream towards the coastal area.

The wetland basin will be unlined to allow infiltration into the underlying soil strata, therefore it will likely to frequently dry out. This approach will mean that storage volume is likely to be available to manage and retain frequent rainfall / runoff events from the site. Thus, providing an effective treatment system. It is also noted that wetting and drying systems are highly biologically productive that can provide habitat and ecological value within the site. This system is also intended to provide an environmental buffer between the development and the neighbouring property to the east.

Refer to Figure 5.1 images that depict the general visual intent of the treatment wetland

Figure 5.1: Example Vegetated Ephemeral Wetland Basin with Inlet Swale

Preliminary Wetland Sizing

Three methods comprising proven approaches were used to determine the size of the treatment wetland. This included calculations using first principles were carried out were sufficient to define the required wetland surface area to satisfy:

- Sediment capture performance; and
- Nutrient and suspended solids treatment.

In total, 3 methods to define the wetland size were used to define the order of magnitude surface area requirement to satisfy treatment objectives.

Refer to Appendix B for the preliminary sizing calculations. Functional and detailed calculations for discharge control pits and other hydraulic control devices associated with the wetland would be carried as part of future separate detailed engineering design.

In summary the wetland sizing methods revealed the following surface areas listed in Table 5.1.

Table 5.1: Wetland Sizing – Comparison of Various Sizing Methods

Sizing method	Wetland surface area requirement (Ha)	Comments
1. Generic curve method (Melbourne Water)	0.28	Not local design curve but provides guidance.
2. % catchment area method (Applying 2% of impervious urban fraction)	0.10	May not account for the higher level of treatment required to meet downstream environmental values.
3. Rainfall volumetric capture (rainfall depth) 1year, 30-minute rainfall event)	10mm rainfall = 0.11	This method uses a rainfall event held within the wetland. The Volume is converted to a surface area based on 500mm extended detention depth.

A wetland surface area of 0.1 Ha was adopted for preliminary conceptual design. MUSIC modelling as discussed in Section 6 was used to confirm surface area and treatment performance outcomes for the adopted size.

5.2 ON SHORE STORMWATER TREATMENT FOR WOOD STORAGE AREAS

Two hardstand areas measuring approximately 2.4Ha each will be used to store logs and wood chips prior to export within the development site.

Stormwater runoff from the hardstands will be isolated from general stormwater runoff generated from the other areas of the site. This will be achieved by grading the hardstands to create a single drainage flow path and providing an upstand to ensure runoff is directed to a single outlet point. At the outlet point of each hardstand, stormwater would enter a concrete forebay sediment and debris trap. The forebay will incorporate a submerged stormwater outlet with mesh screen to ensure floating debris are not transferred into the stormwater retention basin. This stormwater system is separate from the general site system and is directed to a retention basin.

The retention basin is essentially a poly lined holding pond where all runoff from the log and wood chip yards is held on not released to the environment. (Refer to Section 4.5 for water balance assessment and sizing) Water held in the basin is lost through evaporation and on site uses: irrigation of landscape buffer and dust suppression. It is understood that the log and wood chip product is not be treated with chemicals at the yard. It is recommended that the irrigation system and usage for dust suppression include filtration systems to reduce suspended particles in the water.

Refer to Figures 5.4 and 5.5 for indicative images of a forebay and retention basin.

Figure 5.4: Example images of Concrete Forebays

Figure 5.5: Example Image of Lined Retention Basin

5.3 OFF SHORE STORMWATER TREATMENT

As discussed in this strategy, the treatment systems proposed for the off-shore facilities are based on intercepting pollutants rather than treatment. By intercepting these pollutants, they will be trapped such that pollution is not released to the ocean. These systems will comprise of in pit litter traps /

baskets fitted to all stormwater inlet pits on the Floating Wharf. The inlet pits will be connected to a main drain which drains to an end of line gross pollutant trap / oil water separator.

The treatment systems selected are:

- Ecosol Litter Basket – The Ecosol™ Litter Basket provides effective primary treatment of stormwater flows at point of source. The Ecosol™ Litter Basket is an effective at-source filtration system that intercepts litter, debris, coarse sediment and oils. The system is designed to be robust and durable to suit marine conditions. Therefore, ensuring durability, longevity, cost and maintainability.
- Spel Class 3 Ecoceptor - The SPEL Ecoceptor is a hydrodynamic in-line Gross Pollutant Trap (GPT) that has a unique treatment action producing low velocity conditions resulting in discharge water quality outcomes complying to statutory guidelines across Australia. It operates and captures sediments, silt, total suspended solids, and oil and grease. Oil & grease rise to the "oil-capture" zone of the treatment chamber and are contained in all flow events. Areas with a high fraction of impervious surfaces, including ports. This unit has also been selected for its one-piece, self-contained fibreglass construction which is lightweight and yet robust in strength making it simple and cost-effective when performing installations. It is therefore considered suitable for this application off-shore.

Further detailed information is also provided in Appendix C.

The Wharf's stormwater treatment systems will be reliant upon a strict maintenance regime that coincides with a requirement to undertake operations maintenance after each export event. We understand that each export event may occur every 3 weeks. This regime requires the Wharf to be swept after each export operation such that any surface wood chips and debris are swept into the inlet pits there-by trapping all the debris. Refer to Table 5.3 for the maintenance requirements associated with the off-shore treatment systems

5.4 STORMWATER SYSTEM MAINTENANCE

The maintenance of several key elements of the stormwater strategy is a pivotal part of the functioning treatment system and ongoing operation of the on-shore and off-shore facilities. We draw attention to the operational maintenance of the floating wharf will be critical to ensure that pollution is prevented from being released to the marine environment.

General maintenance tasks are also listed for the on-shore treatment systems for information purposes. (Refer Table 5.2).

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Table 5.2: Maintenance Activities for Stormwater Systems – On-shore

On-Shore Treatment Systems	
Stormwater Element	**Operations Maintenance Activity / Task**
Infiltration swales, and	Check if sediment is accumulating at inflow points. Clear sediment and debris
Pool and riffle sequences	Check if there is litter within the swale and remove.
	Check if there is erosion at the inlet or other structures (e.g. Crossovers). Undertake repairs as required.
	Check if there has been damage from traffic.
	Check if replanting is needed. Replace dead plants as required on an annual basis during the appropriate season.
	Check if mowing is needed. Undertake mowing of grass and or slashing of weeds as required.
	Check if drainage points are clogged. Record sediment or debris. Unblock when necessary to maintain operation.
	Check / monitor drainage structures.
Ephemeral Wetland System	Check if there is debris within inlet or macrophyte zones. Remove as required.
	Check if there is sediment within the inlet zone that needs removal. Record depth and remove if it fills >50% of basin. Generally clear out sediment every 1 year.
	Check that the overflow structure integrity is satisfactory.
	Check that the terrestrial vegetation is in satisfactory condition (record density, weeds, etc.) Replace any dead plants on an annual basis during the appropriate season.
	Undertake mowing, slashing weeding as required. Weeding should be undertaken at higher frequency during the establishment phase.
	Check if there is erosion of bunds/batters.
	Check if there is damage to structures and arrange repairs if required.
	Check that the outlet structure is free of debris. Clear if required.
Retention basin	Check if there is sediment in the inlet zone that needs removal.
	Check that the irrigation off take structure integrity is satisfactory.
	Check if there is damage to structures.
	Check that the inlet structure is free of debris.
Sediment and Debris Forebays	
	Check inlet and outlet structures for damage and blockages, repair and clear as needed
	Remove sediment and debris trapped in forebay every 1 - 3 months (Note: may need to be more often depending on loading)
	Check and clear mesh screen every 2 weeks (Note: may need to be more often depending on loading)

Table 5.3: Maintenance Activities for Stormwater Systems – Off-shore

Off-Shore Treatment Systems	
Stormwater Element	**Operations Maintenance Activity / Task**
Floating wharf - deck	Upon completion of each export operation, the deck shall be swept. All dust and debris shall be swept into inlet pits and be trapped by pit traps.
	Once wharf is cleaned, immediately remove pit trap baskets and dispose of debris appropriately to on-shore location to use as mulch (away from drainage systems) Carry out this task immediately after each export operation.
	Check if there is erosion at the inlet or other structures (e.g. Crossovers). Undertake repairs as required.
	Check if there has been damage to drainage systems and repair.
Pit traps / baskets **Ecosol Litter Baskets**	Once wharf is cleaned, immediately clear out pit trap baskets and dispose of debris appropriately to on-shore location to use as mulch (away from drainage systems) Carry out this task immediately after each export operation. (every 3 weeks)
	Check if there is damage to grate and pipes and arrange repairs if required.
	Check that the outlet pipe is free of debris. Clear if required.
	Check and replace any components that may have rusted or damaged
Gross pollutant trap / Oil water separator SPEL Class 3 Ecoceptor	Check if there is sediment in the inlet zone that needs removal.
	Maintain and clean out contents using vac truck to remove all accumulated debris, sediment, oils and grease within the chamber. This should be undertaken yearly. Dispose contents in accordance with EPA requirements to licenced depot.
	Check if there is damage to structures and pipes
	Check that the inlet structure is free of debris.
	Check and replace any components that may have rusted or is damaged.

6 STORMWATER QUALITY MODELLING

6.1 MUSIC MODELLING

This section summarizes the stormwater quality simulation carried out using MUSIC software and compares the outcomes to the EPA Water Policy (2015) and recognised Australian best practice guidelines for pollutant reduction targets as defined in the WSUD Guidelines for the Greater Adelaide Region (2013).

MUSIC modelling is utilised to conceptually confirm the required surface areas of the all treatment systems to ensure that the treatment requirements can be met for the overall development. MUSIC version 6.2 has been used to assess the performance of the strategy. The model layout has been shown in Figure 6.1 and shows that development area catchment has been included in the model to provide proof of concept that the treatment strategy will accommodate the development.

Modelling Input Parameters

Development characteristics, site parameters and local climatic data sets have been entered in the MUSIC model. Refer to Figure 6.1 for screen output of the model showing catchment nodes and treatment systems graphically displayed. The treatment elements associated with the strategy are all included in the model as per their adopted design configurations. The MUSIC model is based on modelling the on-shore strategy only. The off-shore component is based on the debris trap and gross pollutant, and therefore is not modelled on the basis that these treatment systems are based on intercepting pollutants and not treatment.

MUSIC model uses climatic data comprising of daily rainfall interval and evaporation data from the closest data source. In this case the closest is Kingscote Aero (Station No 022841) with data from 2002 to 2010. This data is used to simulate the rainfall runoff on site and the subsequent treatment performance for the development strategy. The results and outcomes are presented in this Section.

The parameters entered into MUSIC model for the on-shore source and treatment nodes are summarised in Table 6.1. It is noted that, the impervious fraction parameter for the urban source nodes have been selected to be conservative (I.e. higher than the proposed development density) and will therefore provide a margin of assurance that the strategy will be achieved. Table 6.1 is not intended to provide details of each node within the model; instead it provides a general overview of the typical parameters used for the source and treatment nodes. In this case the source nodes are represented by “urban nodes”,

The on-shore treatment nodes are represented by vegetated swales, and wetland pond. The off-shore systems are based on intercepting pollutants which are: Ecosol Litter basket incorporated into each grated inlet pit, and the end of line Gross pollutant trap / Oil water separator SPEL Class 3 Ecoceptor.

However for the purposes of this report, we have not modelled the off-shore systems as previously discussed.

A screen copy of the model is provided in Figure 6.2.

Table 6.1: MUSIC Model Parameters – On-Shore

Node Types	**Parameters**				
Urban	Soil storage capacity 40mm	1 mm depression storage	Typical impervious fraction 70%	Stochastically generated pollutants	Initial storage capacity % of capacity 30%
Treatment	**Parameters**				
Vegetated Swale	Gradient 2%	Vegetation height 200mm	Base width varies 1m	Infiltration loss 3.6mm/hr	Batter varies 1 in 3 Depth varies 0.3 to 0.6m
Infiltration Ephemeral Wetland pond	Typical surface area 1000m^2	Permanent pool volume = 0m^3 and 0.0m depth	Extended detention depth 500mm	Infiltration loss 3.6mm/hr	Detention time is approximately 24 hours

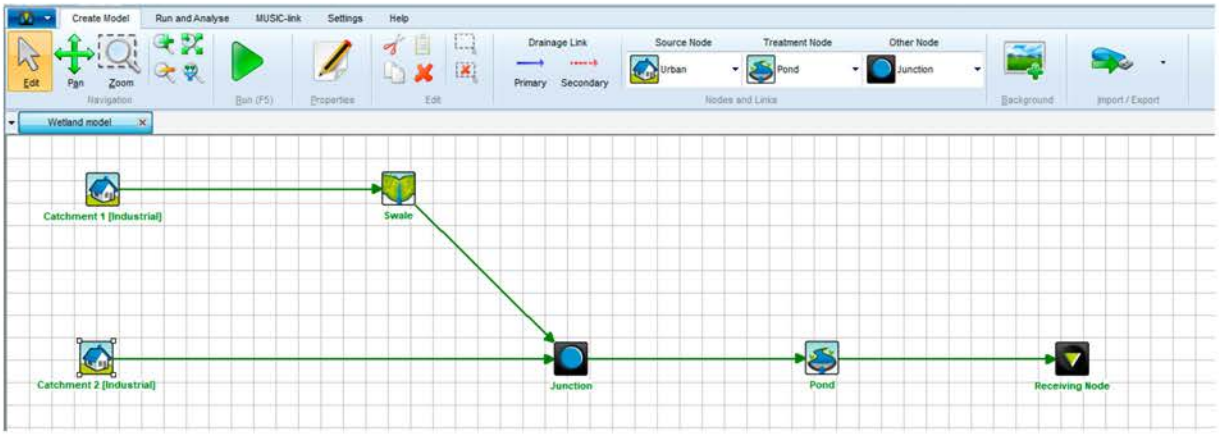


Figure 6.2: MUSIC Model Screen Copy

6.2 TREATMENT REQUIREMENTS

The design of the site treatment system aims to treat stormwater in accordance with the standards as defined by:

- The South Australian EPA Water Quality Policy, EPP Water Quality (2015) (Based on fresh water environments); and

- WSUD best management practice pollutant reduction targets as defined in the WSUD Guidelines for the Greater Adelaide Region.

The pollutant treatment criteria are presented below, and these have been compared to the simulated results using MUSIC.

6.3 MODELLING RESULTS

The results presented in this section demonstrate water quality compliance in accordance with the target values specified. These are assessed against the standards defined in the tables below. These standards were entered in the model to enable a direct comparison to be made. The results have been reported at the downstream outlet from the proposed development.

Based on the EPP (2015) Water Quality limiting concentrations, the model results are presented in Table 6.2 and compared to the target values.

Table 6.2: Water Quality Results Compared to EPP (2015) Water Quality Parameters

Pollutant Type	TP	TN	TSS	Gross Pollutants
Target value (mean) mg/L	0.5	5	20	**Not specified**
Result value (mean) mg/L	0.013	0.193	2.56	**-**
Target value (maximum) mg/L	0.5	5	20	**Not specified**
Result value (maximum) mg/L	**0.376**	**5.50**	**217**	**-**

The results were also compared to the WSUD Guidelines for the Greater Adelaide Region, which are based on recognised Australian best practice. These are presented in Table 6.3 along with the results achieved.

Table 6.3: Water Quality Results Compared to Best Practice Standards

Pollutant Type	TP	TN	TSS	Gross Pollutants
Target percentage reduction	60%	45%	80%	**90%**
Resultant percentage reduction	**80**	**59**	**92**	**100**

The results summarised in Tables 6.2 and 6.3 demonstrate that the TSS, TP and TN reductions will meet the required performance criteria. Whilst other pollutant loads are not considered due to the limitations of MUSIC, the software assumes that other pollutants would be effectively removed and or treated. The rationale is based on the premise that very fine pollutants are attached to other particulate pollutants such as TP and TSS. Therefore, while targeting TP and TSS, it is reasonable to expect that many more pollutants are in fact being removed, trapped and or treated.

The off-shore systems are based on intercepting pollutants rather than treatment. For the purposes of this Strategy these systems have been selected but not modelled using MUSIC. The nominated GPT will specifically intercept oil, grease and fine sediment. Information brochures have been provided in Appendix C.

In summary, the resultant pollutant concentrations from the simulations revealed that each fall within the average (mean) limits set by the EPA in South Australia in addition to complying with the best management performance targets set by referenced codes and guidelines, therefore the treatment strategy is satisfactory.

7 WATER SENSITIVE URBAN DESIGN

7.1 WSUD STRATEGY

As part of the planning process, and as identified in previous Sections, the following WSUD opportunities were identified and are planned for the Development:

- Ephemeral wetland pond to provide stormwater treatment, biodiversity and habitat
- Level spreader and porous rock weir at outlet
- Vegetated swale to convey, treat and infiltrate stormwater runoff from general site areas
- Forebay traps to intercept sediment and wood debris that enter stormwater from the log and wood chip storage yards
- Inlet pits incorporating debris traps to intercept wood debris that either enter or are swept into the inlet pits on the floating wharf
- Oil / grease water separator to provide final separation of pollutants that enter stormwater runoff s from surface of the floating wharf
- Retention basin to hold, store and retain stormwater runoff that has organic leachate content resulting from contact with wood chip and dust (Log and wood chip storage yards only)

8 CONSTRUCTION ON SITE MANAGEMENT

8.1 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

The CEMP will be developed to mitigate the risks associated with construction and to address risks as appropriate avoid impacts to the land and marine environments. A CEMP is not within the scope of this strategy; however it is noted that it will form part of the Planning approval submission. As a guide, the CEMP is expected to have contents similar to that listed as follows:

- Overview
- Introduction
- Project Scope
- Purpose
- Roles and Responsibilities
- Project Environmental Process
- Environmental Management System
- Induction and Training
- Contractor and Subcontractor Management
- Communication
- Feedback and Enquiries
- Document Control
- Monitoring, Inspection and Audits
- Emergency Preparedness and Response
- Incidents/Non-Compliance Reporting
- Reporting and Review
- Environmental Control Planning
- Project Environmental Objectives
- Key Environmental Risks and Controls
- Noise and Vibration
- Air Quality
- Water Quality – Sediment, Erosion and Drainage Management
- Waste Management
- Dangerous Goods Storage

- Energy Use and Greenhouse Gas Emission/Sustainability

The Construction Environment Management Plan will be prepared by the Construction Contractor (for each stage of the development) and will be submitted for approval prior to construction. The CEMP will incorporate a SEDMP, which will form an important part of the site management during the construction phase. It is expected that the SEDMP will be developed using a risk-based approach that considers all contributing site physical factors that contribute soil erosion. The CEMP will be prepared by the Construction Contractor and therefore not covered in this report. A preliminary SEDMP is not covered in this report in detail, however guidance is provided in Section 8.2.

8.2 MANAGEMENT OF CONSTRUCTION SEDIMENT LOADS

Overview and Context Setting

During the construction phase of the development a Soil Erosion and Drainage Management Plan (SEDMP) shall be implemented in accordance with the Environment Protection Act 1993. A plan will be prepared to meet the requirements in accordance with the Code of Practice for the Construction and Building Industry (1999) as part of the construction documentation for the development.

The SEDMP encompasses surface stormwater management practices that shall be implemented during the construction phase by the constructor. The SEDMP provides a guide to the constructor to plan site management measures that should be implemented in order to prevent the mobilisation of sediment and pollutant exports to receiving environment during construction. Whilst the site's conditions will change as the construction progresses, it is the environmental duty of the constructor to ensure that the site SEDMP is progressively maintained and upgraded to suit changing site conditions and stages of construction.

The SEDMP will be prepared to include several techniques to be implemented during the land division construction phase. Typical techniques include (but are not limited to), sediment traps / basins, silt fences, diversion swales to control site flow, single site access point with shaker pad and other measures as deemed necessary. It is noted that the SEDMP will not be limited to the adoption of sediment basins within development area, the SEDMP will require a sequence of management techniques to work collectively.

The Contractor shall consider other techniques that form part of the SEDMP strategy to address the following principal outcomes such as:

- The minimisation of cleared land to minimise exposure to wind and rain;
- Focussing efforts on minimising soil loss resulting from surface erosion;
- Minimise the generation of airborne dust and other potential nuisances to the environment and nearby residences; and
- Trap debris and vegetative matter and sediment at source and prevent its mobilisation downstream.

It should be noted that the proposed wetland pond, retention basin and swale system could be constructed during the early phase of construction and can function as sediment capture basins during the major earthworks and civil works construction phases. In this regard these basins will ensure that all site-generated runoff will pass through sediment interception system. Upon completion of the construction works, these sediment intercepts / basins will be reinstated, completed and landscaped in accordance with the design documentation to meet their ultimate operational function of stormwater treatment. This approach provides a fundamental SEDMP strategy that uses operational phase treatment systems, which would be adapted and used to facilitate construction phase sediment interception.

The SEDMP will form a key component of the CEMP that will be developed and submitted prior to construction.

Development of The SEDMP During the Design Phase

During the design phase, the SEDMP would be developed to consider the following key points:

- Site and area characteristics;
- Soil types (in particular if dispersive characteristics have been identified);
- Land slope, and topography;
- Flow paths – to be considered as this needs to be managed on site;
- Sensitivity of receiving environments (Downstream marine);
- Use where possible the design phase WSUD systems during construction phase. Upon completion of the construction these systems are completed to address operational phase stormwater treatment;
- Slope lengths – to minimise the potential for rill erosion; and
- Environmental assets and areas that may require specific protection (Trees and downstream rocky beach).

General Management Approach – Construction Phase

The SEDMP would include, but not be limited to the implementation of the following techniques such as:

- Perimeter site fencing to compound;
- Flagging areas of the site that may be sensitive, need to be protected, or where vegetation (grass) should not be stripped;
- Bunting around trees and their root zones (tree protection zones) to be protected;
- Location of soil stockpiles at an appropriate location, away from flow paths, and protected to minimise mobilisation of airborne dust;
- Sediment traps, and incorporate debris traps;
- Sediment capture – the proposed wetland pond, retention basin and other WSUD treatment systems could be excavated early and used to trap sediments and provide treatment of stormwater during the construction phase. This is an example where construction phase treatment measures can revert to providing stormwater treatment for the life of the development. This approach is considered the appropriate and best means to facilitate construction phase treatment, in particular to trap sediment loads;
- Swales – diversion swales proposed as part of the stormwater network system can be constructed early to intercept, divert and convey surface stormwater to the sediment capture basins;
- Silt fences and hay bales;
- Diversion swales to control site flow around work sites;
- Single site access point with shaker pad and other measures as deemed necessary to prevent sediment entering Council roadways; and
- Dust management techniques, including:
  - cover stockpiles with mulch if they are to remain over the long term
  - maintain adequate moisture levels to all site access tracks and earthworks areas
  - adoption of a proactive approach to dust control by remaining informed of forecast weather conditions

- Hydro seeding and or hydro mulching areas left exposed for periods of time.

These elements shall be considered, and where appropriate they would be included as part of the design of the SEDMP. It is understood that the SEDMP would be prepared as part of the contractor's CEMP or as part of the detailed design phase.

Dust Control

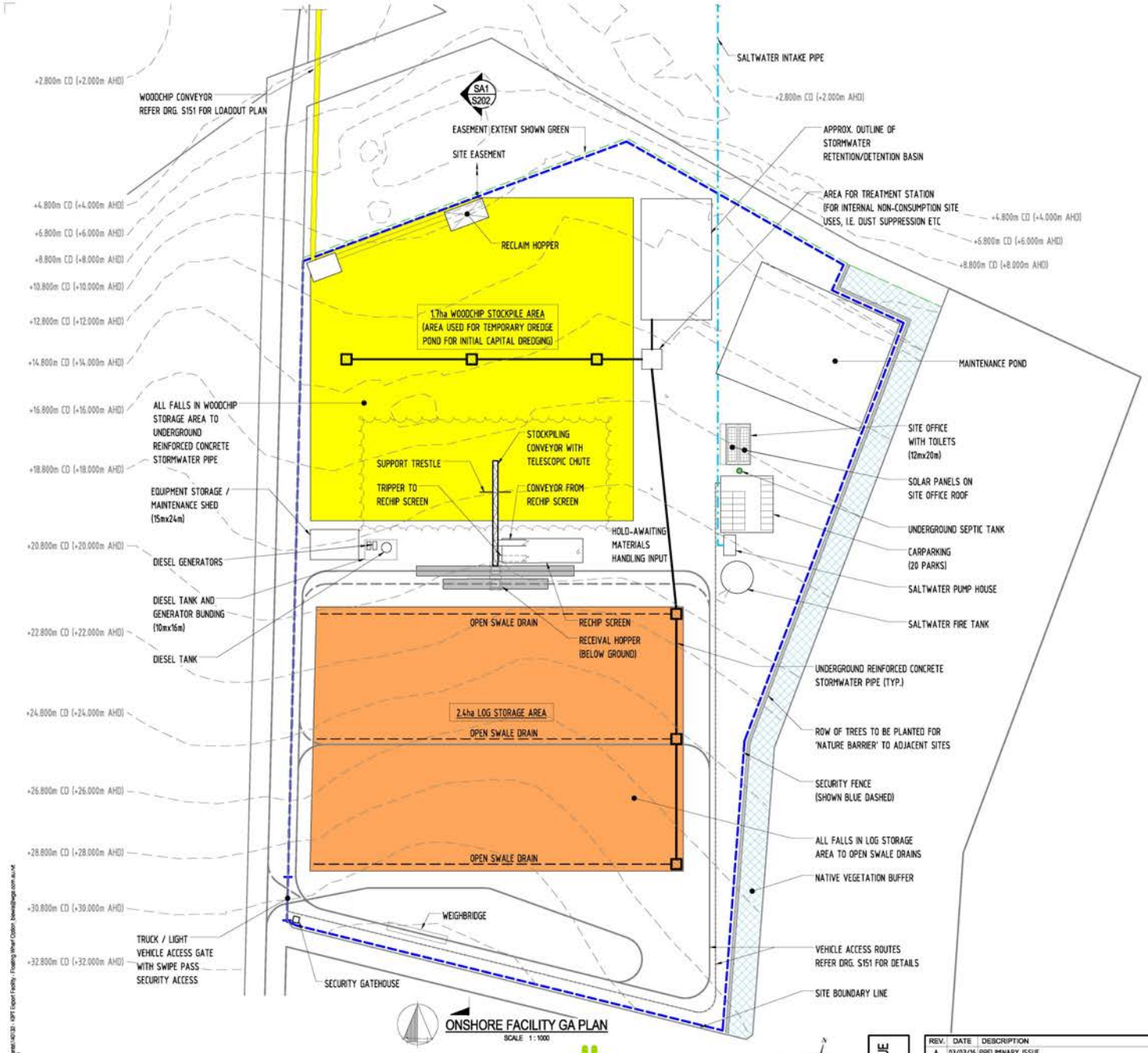
During the construction phase of the development, an Environmental Management Plan (EMP) will be prepared by the constructor and implemented in accordance with the Environment Protection Act 1993 and its associated regulations (2009). The plan shall also be prepared to meet the requirements in accordance with the Code of Practice for the Construction and Building Industry (1999).

The contractor shall implement measures to minimise and manage nuisance issues associated with the mobilisation of dust resulting from earthworks and construction activities undertaken on the development site during the construction phase. Measures to control dust shall be implemented and maintained at all times. Measures will include but not be limited to the following:

- Minimise the area of land that is cleared and exposed to wind at any given time during the construction phase;
- Perimeter dust filter screen attached to fencing;
- Covering stockpiles with mulch;
- Maintain adequate moisture levels to all site access tracks and earthworks areas;
- Adopting a proactive approach to dust control by remaining informed of forecast weather conditions and preparing strategies in advance of high-risk days; and
- Hydro seeding areas left exposed for periods of time.

APPENDIX A

CATCHMENT PLAN



ONSHORE FACILITY GA PLAN

SCALE 1 : 1000

When sheet printed full size, the scale bar is 1:1 (100mm).

0 50 100mm

KANGAROO ISLAND PLANTATION TIMBERS

MARITIME CONSTRUCTIONS

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	DRAFT.	ENG.	CHKD.
A	03/03/16	PRELIMINARY ISSUE	BL	DM	
B	26/06/18	PRELIMINARY ISSUE	BL	DM	

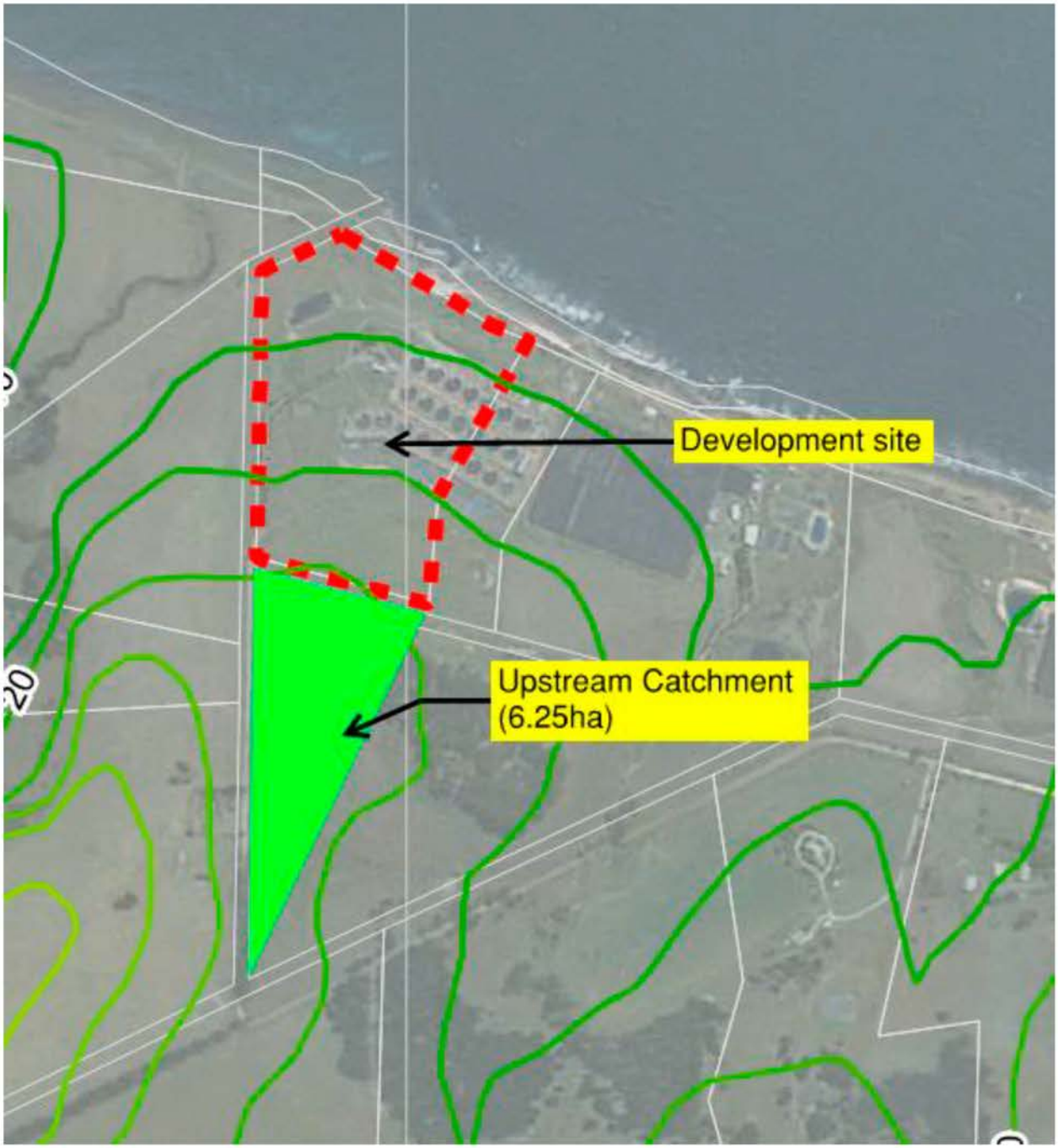
WGA
WALLBRIDGE GILBERT AZTEC
60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

KANGAROO ISLAND, SA
K.I PLANTATION TIMBERS
PROPOSED EXPORT FACILITY AT SMITH BAY
ONSHORE FACILITY GA PLAN

A1

DRAWING NUMBER
Job Number AAD140132
Sheet No. S201
Rev. B

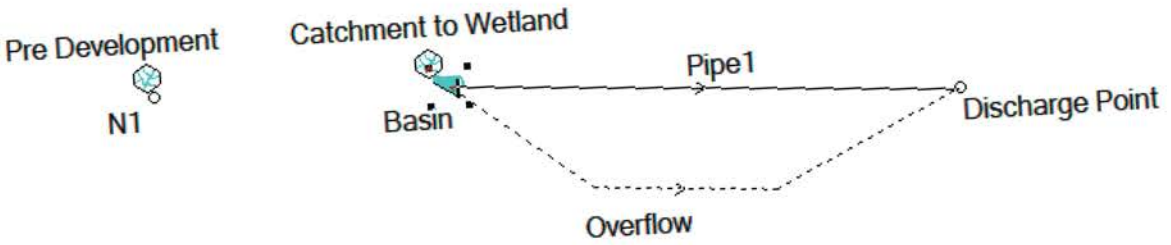
Design DM
Drawn BL


Development site
Upstream Catchment
(6.25ha)

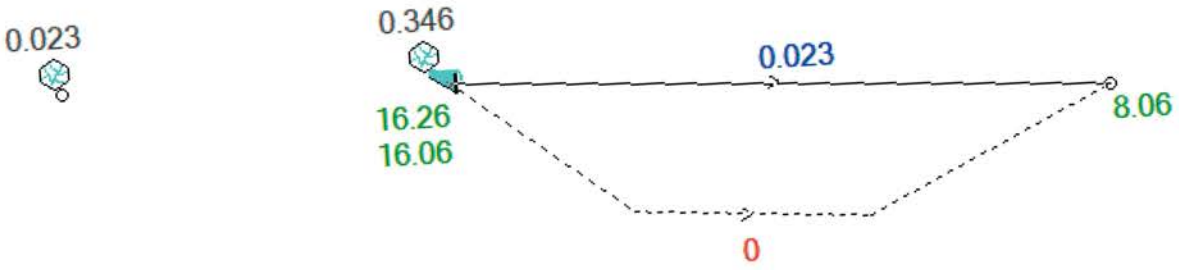
APPENDIX B

CALCULATIONS

DRAINS MODEL



RESULTS



WGA

WALLBRIDGE GILBERT AZTEC

Job Number

Designer

Date

Page Number

Pipe flow Calculations:

Log Storage Area

$C = 0.8$ $I_{20yr,5min} = 118\ mm/h$ $A = 2.55\ ha$

$$Q = \frac{CIA}{360}$$

$$= \frac{0.8 \times 118 \times 2.55}{360}$$

$$= 0.668\ m^3/s$$

∴ Ø600mm RCP at min 1%

Woodchip stockpile area

$C = 0.6$ $I_{20yr,5min} = 118\ mm/h$ $A = 2.5\ ha$

$$Q = \frac{0.6 \times 118 \times 2.5}{360}$$

$$= 0.492\ m^3/s$$

∴ Ø525mm RCP at min 1%

Combined flow

$$Q_T = 0.668 + 0.492$$

$$= 1.16\ m^3/s$$

∴ Ø675mm RCP at min 1%

Location	Kangaroo Island	S	-35.5875
Date	6/12/2018	E	137.4375

IFD (mm/hr)							
DURATION	1 Year	2 years	5 years	10 years	20 years	50 years	100 years
5 Mins	38.9	53.1	76.5	94.1	118	154	187
10 min	34.9	39.5	55.3	67.3	80	98.8	115
15 min	28	31.6	44.3	53.8	64	79.1	92
20 min	23.7	26.8	37.5	45.6	54.2	66.9	77.8
25 min	20.7	23.5	32.8	39.9	47.4	58.6	68
30 min	18.6	21	29.3	35.7	42.4	52.4	60.8
45 min	14.5	16.3	22.8	27.7	32.9	40.6	47
1 hour	12.1	13.6	19	23	27.4	33.7	39
1.5 hour	9.33	10.5	14.6	17.7	21	25.9	29.9
2 hour	7.75	8.72	12.1	14.7	17.4	21.4	24.7
3 hour	5.94	6.68	9.24	11.2	13.3	16.3	18.8
4.5 hour	4.53	5.09	7.03	8.5	10.1	12.3	14.3
6 hour	3.73	4.19	5.77	6.97	8.25	10.1	11.7
9 hour	2.82	3.16	4.35	5.25	6.2	7.64	8.88
12 hour	2.3	2.58	3.55	4.27	5.04	6.23	7.26
18 hour	1.72	1.93	2.64	3.18	3.74	4.64	5.42
24 hour	1.39	1.56	2.14	2.56	3	3.74	4.38
30 hour	1.18	1.32	1.8	2.16	2.53	3.15	3.69
36 hour	1.03	1.15	1.57	1.87	2.19	2.73	3.2
48 hour	0.829	0.927	1.25	1.49	1.73	2.17	2.54
72 hour	0.611	0.681	0.908	1.07	1.24	1.54	1.8

Region	Runoff coefficient	Area (m2)	C x A	C weighted average
Log Storage	0.8	25500	20400	0.403960396
Woodchip stockpile	0.6	25000	15000	0.297029703
		50500		0.501386139

C	I (mm/hr)	I(mm/s)	Q (m3/s)	Q (L/s)
0.601663366	80.0	2.22242E-05	0.675260683	675.2606831

Time of concentration 1 in 20				
I	80.0	*mm/hr*	*L*	*200*
tc	10.2	*mins*	*n*	*0.035*
	0.0		*S*	*0.04*
tc	10.2	*mins*		
1 in 20	80.0	*mm/hr*	Calculate Tc	

140132

Kangaroo Island Port Facility

Stormwater Calculations

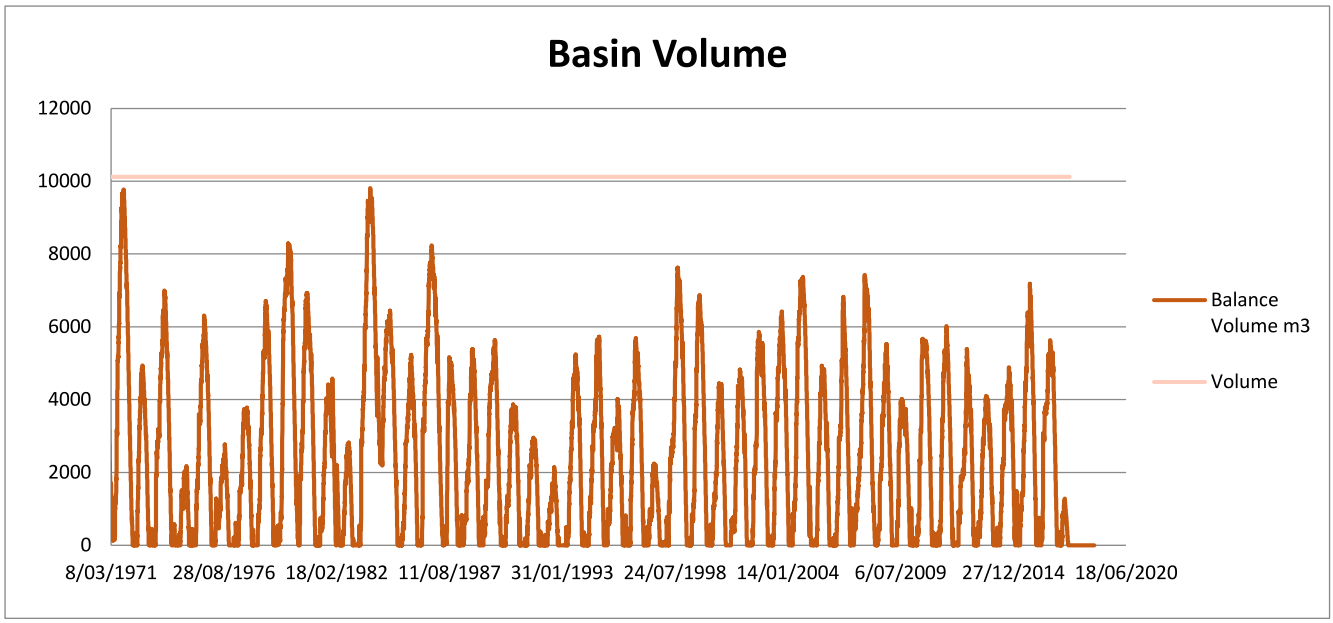
Peak Flow

ARI	20	*yr*
C	0.501386139	
A	50,500	*m2*
Q20 peak	80.0	*mm*
Evap Bed		
A	10,200	*m2*
d	1.1	*m*
Volume	10,119	*m3*

Mean daily evaporation (mm)	
Jan	8
Feb	7.6
Mar	5.4
Apr	3.8
May	2.4
Jun	1.7
Jul	1.8
Aug	2.3
Sep	2.9
Oct	4
Nov	5.3
Dec	7.1

Period over which rainfall was measured	Date	Month	Rainfall	Runoff	Evaporation	Infiltration	Inflow	Balance Volume
days			*mm*	*m3*	*m3*	*m3*	*m3*	*m3*
	1/01/1900	Jan	0	0	81.6	-	- 82	0
	2/01/1900	Jan	0	0	81.6	-	- 82	0
	3/01/1900	Jan	0	0	81.6	-	- 82	0
	4/01/1900	Jan	0	0	81.6	-	- 82	0
	5/01/1900	Jan	0	0	81.6	-	- 82	0
	6/01/1900	Jan	0	0	81.6	-	- 82	0
	7/01/1900	Jan	0	0	81.6	-	- 82	0
	8/01/1900	Jan	0	0	81.6	-	- 82	0
	9/01/1900	Jan	0	0	81.6	-	- 82	0
	10/01/1900	Jan	0	0	81.6	-	- 82	0
1	11/01/1900	Jan	3	75.96	81.6	-	- 6	0
	12/01/1900	Jan	0	0	81.6	-	- 82	0
	13/01/1900	Jan	0	0	81.6	-	- 82	0
	14/01/1900	Jan	0	0	81.6	-	- 82	0
	15/01/1900	Jan	0	0	81.6	-	- 82	0
	16/01/1900	Jan	0	0	81.6	-	- 82	0
	17/01/1900	Jan	0	0	81.6	-	- 82	0
1	18/01/1900	Jan	4.1	103.812	81.6	-	22	22.212
	19/01/1900	Jan	0	0	81.6	-	- 82	0
1	20/01/1900	Jan	2.3	58.236	81.6	-	- 23	0

Note: This is just a snippet of the rainfall data and water balance spreadsheet as there is over 100 years of daily data.


Basin Volume
12000
10000
8000
6000
4000
2000
0
8/03/1971
28/08/1976
18/02/1982
11/08/1987
31/01/1993
24/07/1998
14/01/2004
6/07/2009
27/12/2014
18/06/2020
Balance Volume m3
Volume

Stormwater Wetland Detention

Area to wetland 6.6 ha with 0.5 ha vegetation.

Method 1 : 2% of catchment Impervious Area.

E.I.A. = 0.75 × 6.1
= 4.575

2% 0.02 × 4.575 = 0.0915 ha ⇒ 915 m²

Method 2 : 1 year runoff volume

$Q = CIA$ ($I_{1yr\ 30min} = 18.5$ mm/h)

$= \frac{0.9 \times 18.5 \times 6.66}{360}$

$= 0.308\ m^3/s$

$= 308\ L/s$

$V = 308 \times 30 \times 60 = 554{,}400\ L \Rightarrow 554.4\ m^3$

Assuming 0.5m depth

$A = \frac{554.4}{0.5} = 1108.8\ m^2$

Method 3 : Generic Curve Method

Assuming 2% impervious catchment at 0.5m depth

TSS = 77% Target not achieved
TP = 60% Target achieved
TN = 42% Target not achieved

For all targets to be achieved approximately 2.3% of the impervious area is required.

$V = 0.023 \times 61600\ m^2 = 1416.8\ m^3$

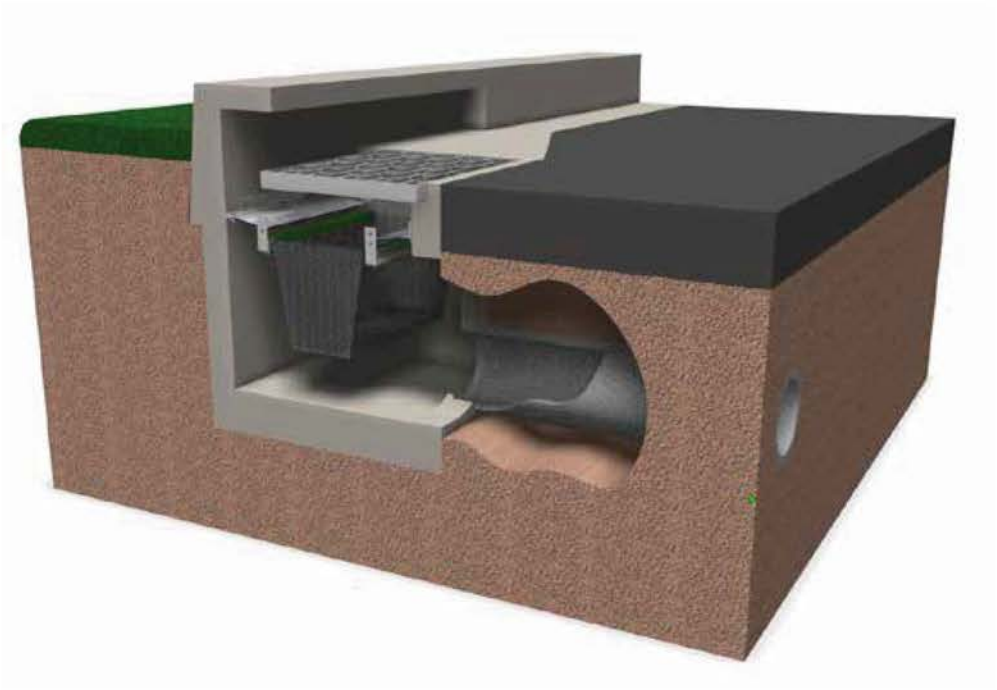
$A = \frac{1416.8}{0.5}$

$= 2833\ m^2$

APPENDIX C

LITTER TRAP AND GROSS POLLUTANT TRAP / OIL WATER SEPARATOR

Ecosol™ Litter Basket Technical Specification



environmentally engineered
for a better future

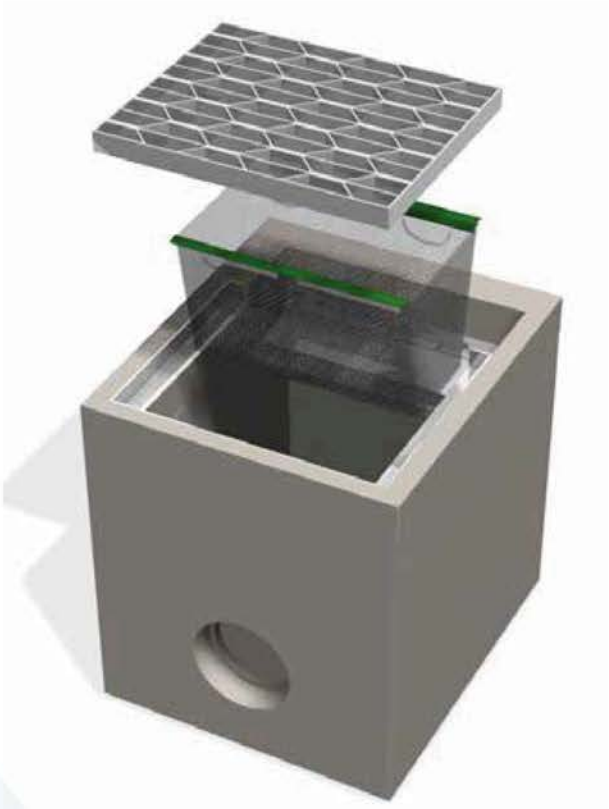
Ecosol™

CONTENTS

1.0 Introduction

Increasingly stringent environmental best management practice requires planners and developers to apply a fit-for-purpose treatment train approach to stormwater treatment to achieve today's water quality objectives (WQOs). An integral element to any good WSUD design is primary treatment or pre-screening of stormwater flows to remove coarse sediment and gross pollutants prior to downstream secondary or tertiary treatment systems such as bio retention filters or wetlands.

The Ecosol™ Litter Basket provides effective primary treatment of stormwater flows at point of source. For many years the Ecosol™ Litter Basket has been seen as the industry standard for at-source filtration with its effectiveness proven over time both in the field and under strict laboratory conditions.



The system has been designed to provided robust and durable cost effective at-source primary treatment system that captures and retains solid pollutants at drainage entry points.

In developing this innovative stormwater treatment system careful consideration has been given to durability, longevity, cost and maintainability. Key commercial technical features include:

- low visual impact and energy footprint;
- designed hydraulics with proven performance and longevity;
- scalable design; and
- cost effective maintenance regime.

This technical manual describes the operation and performance characteristics of the system.

1.1 How and Why the Ecosol™ Litter Basket Works

The Ecosol™ Litter Basket captures pollutants at drainage entry points and consists of a capture basket and an overflow by-pass flap(s). The basket is fitted below the invert of the gutter and inside the drainage inlet pit and importantly does not obstruct flow in the outlet pipe. Solid pollutants enter the Ecosol™ Litter Basket with the stormwater from roadside or other run-off areas, such as car parks. The incoming flow and the pollutants aquaplane across the flap(s) into the capture basket. The filtered stormwater then passes into the drainage network without any head/hydraulic loss through the unit.

As the basket approaches 90% full, the by-pass flap(s) begins to open in response to the incoming flow. Once the basket is 100% full the pressure of the incoming flow forces open the by-pass flap(s), allowing the excess flow, to enter the drainage system through the by-pass openings. This effectively eliminates the likelihood of flooding, a common fault with other at-source systems. Even when in by-pass, the captured pollutants are not remobilised and are retained in the capture basket.

2.0 Ecosol™ Litter Basket Credentials

Ecosol has commissioned a range of tests to confirm not only product performance but also to help with further research and development work. In 1996, the University of South Australia, a National Australian Testing Authority (NATA)-approved testing body, tested the Ecosol™ Litter Basket. Its full-size Roadway Surface Drainage Rig was used to carry out a series of tests in two stages on the Ecosol™ Litter Basket. These tests measured the capture performance of the unit in both on-grade and sag situations for a range of flows containing full-size, real-life solid pollutants. The testing confirmed the unit's ability to capture 97% of pollutants greater than the filtration mesh size.

The testing also focused on determining whether the unit had any hydraulic impact on the flows entering the pit. It found that the Ecosol™ Litter Basket did not reduce the pit's inlet capacity, a key benefit, especially as the unit is often installed in road side entry pits where any level of flooding would be unacceptable. The Ecosol™ Litter Basket also has a by-pass overflow that effectively eliminates the risk of flooding.

In 2012 Ecosol engaged the the University of Adelaide (ENGTEST The school of civil, environmental and mining engineering) to undertake further independently laboratory hydraulic and capture efficiency testing on the improved Ecosol™ Litter Basket design. Additional they also undertook a comprehensive peer review of all prior and current Ecosol™ Litter Basket field and laboratory testing reports to comprehensively determine its performance specification. Reference – "Performance Review of the Ecosol Litter Basket at- source solid pollutant filter (report dated 9 May 2013).

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3.0 Warranty and Life Expectancy

The Ecosol™ Litter Basket has a one- year warranty covering all components and workmanship. Ecosol will rectify any defects that fall within the warranty period. The warranty does not cover damage caused by vandalism and may be invalidated by inappropriate cleaning procedures or where the unit is not cleaned within the recommended frequency. The Ecosol™ Litter Basket is designed to meet strict engineering guidelines and manufacturers guarantees and is one of the most durable at-source treatment systems available. The stainless steel components have a life expectancy of 15 years while the filtration bag has a life expectancy of 5 years providing appropriate maintenance practices are employed.

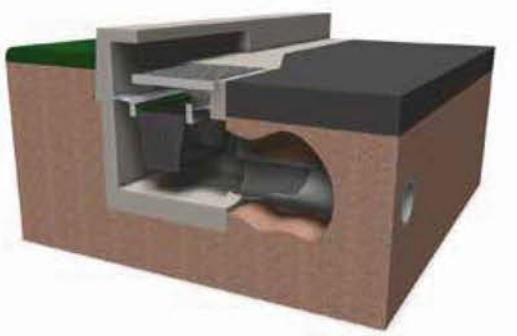
Ecosol™

4.0 Key Features and Benefits

The Ecosol™ Litter Basket captures and retains a range of pollutants at entry points to the drainage network. Easily installed into most types of side entry pits, also known as gully pits or catchpits, it retains more than 97% of pollutants greater than 600µm and in the field it has been found to collect much smaller particles, including fine sediments.

For many years the Ecosol™ Litter Basket has been seen as the industry standard for at-source filtration with its effectiveness proven over time both in the field and under strict laboratory conditions. Consisting of a capture basket, reusable liner, and overflow bypass flap(s) the Ecosol™ Litter Basket is fitted below the invert of the gutter inside the drainage pit and, importantly, does not obstruct flow into the outlet pipe. The liner is easily removed and emptied during maintenance and comes in a range of filtration fabric sizes from 100µm to 3000µm, depending on the site requirements.

Key Features	Benefits
Hydraulics	• Minimal head/hydraulic loss • Does not affect stormwater inlet capacity • Treats 100% of incoming flow
Pollutant Capture and Retention	• Unique by-pass overflow eliminates flooding risk • More than 97% of solid pollutants > 600µm • Significant amounts of sediment and more than 40% TSS • No remobilisation of captured pollutants
Design	• Different sizes of filter media available for targeted pollutant capture • Able to be retro-fitted into existing pits or supplied in its own pit • Easily installed
Cleaning and Maintenance	• Dry storage of pollution thereby reducing risk of toxic fermentation • Pollutants not handled during cleaning
Environmental Impact	• Re-usable filter liner is easily removed for manual cleaning • Reduces sedimentation build-up • Visually unobtrusive



5.0 Key Dimensions

The Ecosol™ Litter Basket can be fitted to new and existing side entry pits (whether single, double, or triple in size), including those with non-standard inlets, outlets, and junctions. The table below shows the approximate dimensions and holding capacities for the most typical Ecosol™ Litter Basket applications. Holding capacities, treatable flow rates and by-pass capacities vary dependent on the site-specifics.

Stormwater Inlet Pit Description	Dimensions (Length x Width)[3]		Holding Capacity (typical basket depth 450mm)[1]	Treatable Flow Rate (L/s)[2]		By- pass Capacity	Static Head in By-pass
	Pit	Litter Basket	(m^3)	200µm mesh	1.5mm mesh	L/s	mm
Drainway	600 x 595	600 x 445	0.120	53	106	110	150
Single Grated Kerb Inlet (with Lintel)	600 x 600	600 x 450	0.121	53	106	110	150
	900 x 750	900 x 450	0.182	83	167	215	150
	900 x 900	900 x 600	0.243	83	167	215	150
Double Grated Kerb Inlet (with Lintel)	1200 x 600	2 x 600 x 450	0.243	103	212	220	150
	1200 x 900	2 x 600 x 600	0.324	103	212	430	150
	1800 x 600	2 x 900 x 450	0.364	106	220	230	150
	1800 x 900	2 x 900 x 600	0.496	106	220	440	150
Single Side Kerb Inlet (with Lintel - no grate)	600 x 660	600 x 450	0.121	53	106	110	150
	900 x 750	900 x 450	0.182	83	167	215	150
	900 x 900	900 x 600	0.243	83	167	215	150
Double Side Kerb Inlet (with Lintel - no grate)	1200 x 600	2 x 600 x 450	0.243	103	212	220	150
	1200 x 900	2 x 600 x 600	0.324	106	220	430	150
	1800 x 600	2 x 900 x 450	0.364	106	220	230	150
	1800 x 900	2 x 900 x 600	0.486	106	220	440	150
Grated Field Inlet (no Kerb or Lintel)	600 x 600	600 x 450	0.121	53	106	110	150
	900 x 750	900 x 450	0.182	83	167	215	150
	900 x 900	900 x 600	0.243	83	167	215	150
Circular Inlet	600	437 x 437	0.085	54	108	120	150
	750	558 x 558	0.140	92	184	172	150
	900	680 x 680	0.208	103	212	225	150
	1050	801 x 801	0.228	103	212	225	150

[1]Holding capacities are largely determined by the existing inlet pit dimensions and the outlet pipe diameter but typically ranges from 120 - 364Kg at 100% full.

[2]The TFR varies dependent on the size of the Litter Basket , mesh appetures and percentage of fill for the individual baskets. For the purpose of providing indicative TFR's we have assumed a minimum 375mm diameter outlet and empty litter baskets.

[3]All Ecosol™ Litter Baskets installed in pits larger than 600mm in width are fitted with flow plates, removable capture baskets, optyional hydrocarbon socks and include by-pass openings to cater for peak flow conditions.

6.0 Collection and Removal Efficiencies

Stormwater treatment is best when distributed across the catchment treating stormwater pollutants as close as possible to their point of source. The Ecosol™ Litter Basket provides a cost effective and efficient solution at point of source and has the highest treatable flow rate of any comparable system. In order to determine a meaningful characterisation of the Ecosol™ Litter Basket collection efficiency, an extensive verification phase was undertaken by Avocet Consulting Pty Ltd, Ecosol Pty Ltd and EngTest (The University of Adelaide). To best summarise the capture efficiency results of extensive product testing a regression of the data points using a sigmoidal regression curve was selected as it provided a conservative fit to the wide scatter of data collected. Refer to figures 1 & 2 for testing results. Table 1 summarises these results

6.1 Particle Size Distribution Collection Efficiency

Pollutant Capture Efficiency PSD		
Sieve Size (micron)	Capture Efficiency (200µm Filter Bag)	Capture Efficiency (1500µm Filter Bag)
2000 - 6000	97%	97%
600 - 2000	97%	77%
200 - 600	86%	37%
60 - 200	35%	8%
20 - 60	4%	1%

Table 1 – Ecosol™ Litter Basket typical particle size distribution results at designed Treatable Flow Rates.

6.2 Laboratory Testing Collection Efficiency Sigmoidal Regression Lines

In 1996, the University of South Australia tested the Ecosol™ Litter Basket. These tests measured the capture efficiencies of the unit in both on-grade and sag situations for a range of flows containing full-size, real-life solid pollutants. In 2012 the University of Adelaide (Engtest Civil, Environmental and Mining) completed further measurements of the products capture efficiency at varying flow rates and compiled comprehensive product performance report (Performance Review of the Ecosol Litter Basket) reviewing both past and present field and laboratory testing data. The below graphs summarise this data.

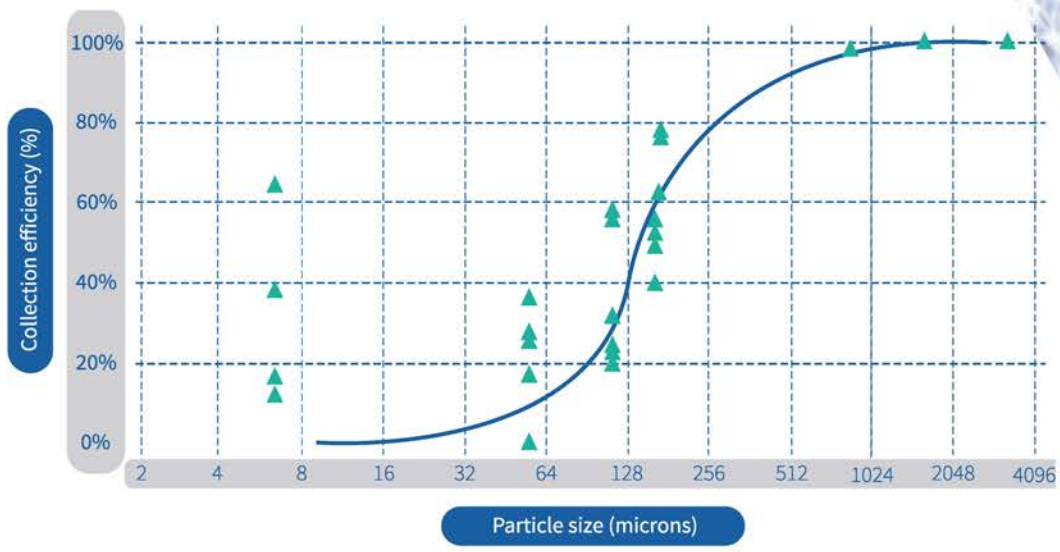


Figure 1 - Sigmoidal regression line for the Ecosol™ Litter Basket, with a 200 micron filtration bag indicating high capture efficiencies for a range of particle sizes.

6.2 Laboratory Testing Collection Efficiency Sigmoidal Regression Lines continued

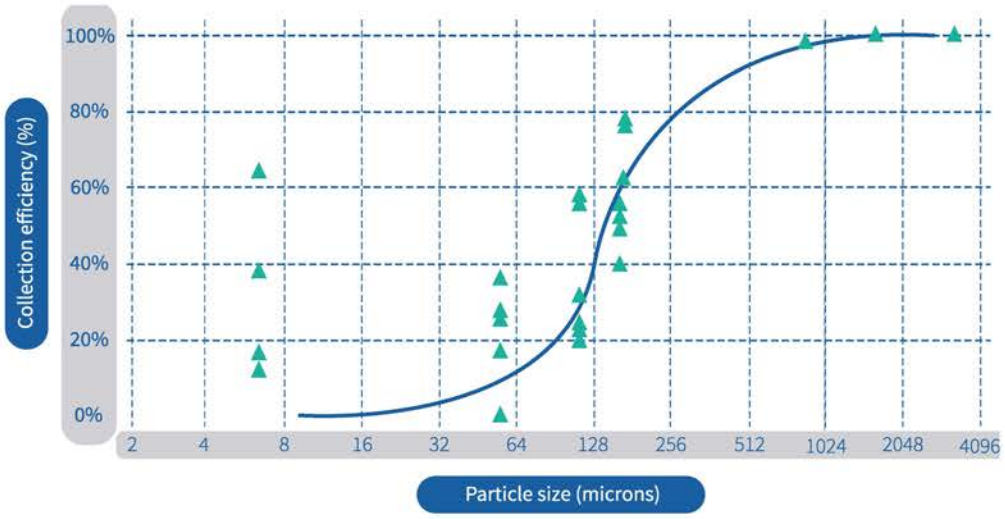


Figure 2 - Sigmoidal regression line for the Ecosol™ Litter Basket, with a 1500 micron filtration bag indicating high capture efficiencies for a range of particle sizes.

6.3 Field Testing Particle Size Distribution Data

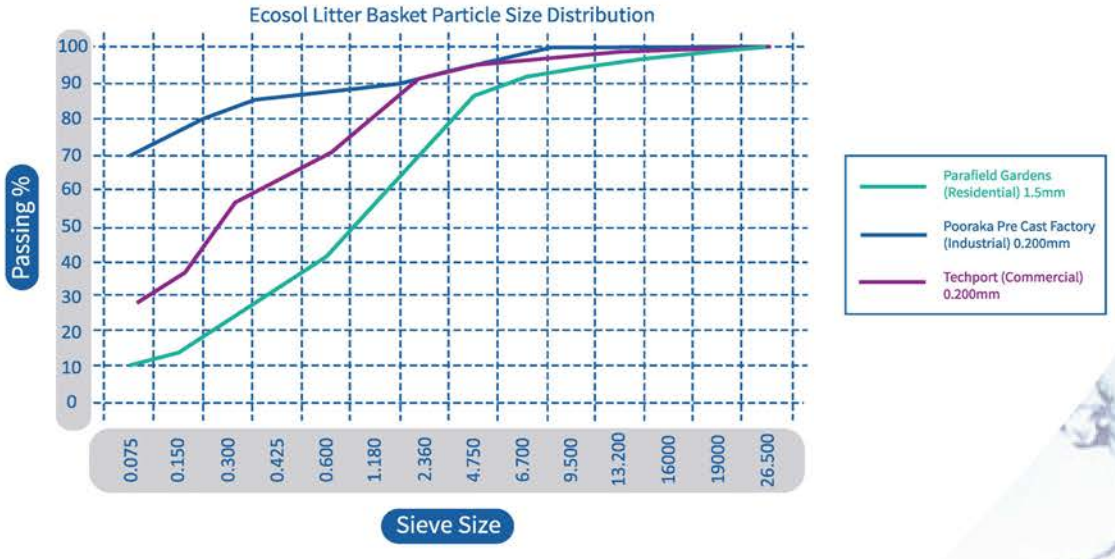


Figure 3 - Field testing Particle size distribution data for three separate product installations.

6.4 Summary Product Collection Efficiency Data

In recent years modern Water Sensitive Urban Design (WSUD) objectives and principles now applied to most urban development's require more onerous water quality objectives (WQOs) specifically targeting the removal of suspended solids, nitrogen, phosphorus and heavy metals. The Ecosol™ Litter Basket is an integral part of the treatment train providing essential pre-screening of stormwater flows, and when used in conjunction with other treatment measures such as swales or sand filters will achieve target water quality objectives.

Performance Criteria[1]	Capture Efficiency (Up to) (200µm Filter Bag)	Capture Efficiency (Up to) (1500µm Filter Bag)
Gross Pollutants (>600µm)	97%	77%
Total Suspended Solids (TSS) (20 - 600µm)	41%	15%
Total Phosphorous (TP)	39%	15%
Total Nitrogen (TN)	11%	4%
Heavy Metals	6%	2%
Total Petroleum/Hydrocarbon	20%	7%

[1] Figures quoted are mean collection efficiency statistics based on available product testing data. It is important to note that the water quality CE values are indicative of potential field CEs given that Ecosol™ Litter Basket provides physical screening and the removal of chemical constituents is therefore largely dependent on the chemical composition of the particles and the bonding of these chemical constituents to the surface of the particles.

6.5 Products Options

To enhance the product capture efficiencies other filter medias can be incorporated into the design.

Hydrocarbon booms installed within the Ecosol™ Litter Basket will provide additional protection against oil or fuel spills in wet conditions.

Reactive filtration media pillows installed at the base of the basket will provide improved capture efficiencies for heavy metals, total nitrogen, total phosphorous, turbidity and suspended solids.

7.0 MUSIC Modelling Guidelines

These guidelines provide instruction to the creation and application of a treatment node for the Ecosol™ Litter Basket for the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The Ecosol™ Litter Basket can be modelled in MUSIC using the Generic Treatment node to represent the results derived from independent laboratory testing and field testing by the University of South Australia and the University of Adelaide (ENGTEST The school of civil, environmental and mining engineering). The guidelines apply to the creation of the treatment node within MUSIC v6.0.4

Insert a GPT treatment node into your model by selecting "GPT" under the treatment nodes menu. When the node is created the node properties dialog is displayed. There are several changes that need to be made in this dialog.

- Adjust the text in the Location box to read "Ecosol Litter Basket" plus any other relevant information (200µm or 1500µm).
- Adjust the low flow bypass to refect any flow (m3/sec) diverted away from the unit before treatment (usually zero).
- Adjust the high flow bypass to reflect the treatable flow rate (TFR values are detailed in page 6) (L/Sec) any higher flows will bypass treatment

NOTES: Can be used to describe assumptions or location of reduction values for authority approvals

Adjust the transfer function for each pollutant selecting the pollutant and editing (right click on the function point)the input and output values on the graph below to reflect the capture efficiencies (ce) of the treatment device. Table 2 provides the input and output values for the Ecosol™ Litter Basket based on the use of a 200µm-filter liner. Table 6 provides the input and output values for the Ecosol™ Litter Basket based on the use of a standard 1500µm filter liner

Pollutant	Removal Rate (%)	Entered Input Value	Entered Output Value
Total Suspended Solids (20 - 600µm)	41	1000	590
Total Phosphorus	39	1000	610
Total Nitrogen	11	1000	890
Gross Pollutants (>600µm)	97	1000	30
Heavy Metals	6	n/a	n/a
Total Petroleum/Hydrocarbons	20	n/a	n/a

Table 2 - Ecosol Litter Basket - 200 µm Filter liner, input and output values.

7.0 MUSIC Modelling Guidelines Continued

Pollutant	Removal Rate (%)	Entered Input Value	Entered Output Value
Total Suspended Solids (20 - 600µm)	15	1000	850
Total Phosphorus	15	1000	850
Total Nitrogen	4	1000	960
Gross Pollutants (>600µm)	77	1000	230
Heavy Metals	2	n/a	n/a
Total Petroleum/Hydrocarbons	7	n/a	n/a

Table 3 - Ecosol Litter Basket -1500 µm Filter liner, input and output values.

Once the transfer functions have been defined for each of the pollutants the node has been fully defined. When completed the properties window can be closed by clicking the "Finish" button.

For further assistance in sizing or specifying a system for your next project please complete the form in Appendix 1 and forward to your local Ecosol representative

8.0 Monitoring

Under normal weather and operating condition your Ecosol™ Litter Baskets should be checked a minimum of every two - three months depending on the quality and quantity of the inflow to the unit and immediately following a major storm event. Initially, Ecosol recommends that monitoring is undertaken monthly. Once the unit has been in operation for an extended period of time (say, 24 months) then the monitoring schedule can be adjusted to reflect the actual operating conditions specific to the catchment.

9.0 Cleaning and Maintenance

During the first two years of operation it is important to regularly monitor and maintain each unit to better determine long-term maintenance regimes. All elements within the Ecosol™ Litter Basket have been designed for easy safe and cost efficient cleaning by either manual basket removal or vacuum method. Please refer to the product maintenance guide for full cleaning and maintenance procedures.

The figures in the table below give a broad guideline about the optimal catchment size,and the number of cleans required annually based on typical expected urban pollutant loads.

Optimal Catchment Size (Ha)	Recommended cleaning frequency based on optimal catchment sizes and typical pollutant loads (per annum)
	Typical Developed Urban Catchment
Up to 0.2	2
Up to 0.3	2-3
Up to 0.5	3-4

One of the key advantages of the Ecosol™ Litter Basket is that it can be cleaned by vacuum method using streetsweeping vehicles. This is safe and cost efficient.

10.0 Applications and Configurations

The Ecosol™ Litter Basket is an at-source filtration system that is ideal for capturing solid pollutants in a variety of locations but is especially effective in built-up areas, so-called "hot spots" such as shopping precincts and restaurant strips.

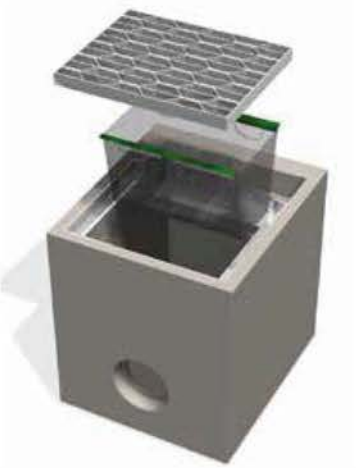
The ability to retro-fit the Ecosol™ Litter Basket into existing pits means that drainage lines serving pollutant-generating catchments, such as schools, shopping precincts, and central business districts, can be targeted for treatment cost efficiently.

Shopping Centre

Residential Development

Treatment-train Approach

As no one measure can treat all of the pollutants generated from a typical development a treatment-train approach to stormwater management is always preferable. This involves using a range of treatment measures, working together, to achieve improved water quality. The Ecosol™ Litter Basket operating as a pre-screening system in a treatment train provides essential primary treatment thereby enhancing the operating life of secondary and tertiary treatment systems.



11.0 Turnkey Services

Ecosol's design and estimating staff provide a dedicated management approach towards your project. In addition all staff are capable of liaising with the client, the consulting engineer, the contractor, and all other interested third parties to achieve a successful outcome.

Given the wide range of pit types, sizes, and configurations, Ecosol provide a complete turnkey service inclusive of site measure, manufacture and installation on-site to suit each individual stormwater inlet pit. This flexibility, when compared to other off-the-shelf, supply-only products, means the client can be assured of a unit that not only has proven performance but also one that is ideally suited to the particular needs of the site. The unit's unique design enables it to maximise holding capacities for the many different types of pits without impeding on the hydraulic design characteristics of the inlet pit.

Ecosol has a very competitive cleaning service. After each clean we provide a report detailing the volume and type of pollutants removed. We believe that it is in your best interests for Ecosol staff to clean and maintain the unit, not only because we are specialists, but also because proper monitoring and maintenance enhances the unit life significantly.

Should you use another company to clean the unit, or undertake this work yourself, we request that it be conducted according to Ecosol's specifications. Otherwise, you may invalidate your warranty, as damage caused by inappropriate cleaning procedures is not covered. The advantages of using Ecosol to clean and maintain your unit are that you get:

- regular inspections of your unit;
- a comprehensive cleaning service with removal and disposal of all captured pollutants;
- a detailed report provided on completion of each clean;
- trained and experienced staff; and remedial work completed, if required.

12.0 Accreditation

Ecosol is accredited to AS/NZS ISO 1400 (Environment) and AS/NZS 9001 (Quality). Our commitment to continuously improving our products and services is demonstrated by our ongoing accreditation for Quality and Environmental Management. Ecosol is also committed to a safe environment for its employees. We are fully third-party accredited to AS/NZS 4801.

13.0 Suppiler and Technical Product Contact Details

For any maintenance or technical product enquiries please contact:
Ecosol Pty Ltd
Tel: 1300 706 624
Fax: 1300 706 634
Email: info@ecosol.com.au

Appendix 1

Ecosol™ Litter Basket Essential Information Form

To ensure your system is appropriately designed for its intended application and meets local water quality objectives it is essential that the following minimum information is provided:

Customer Details

Asset Owner:

Asset ID:

Unit Location :

Ecosol Ref:

Date:

Time:

Product Code: Ecosol™ Litter Basket

Inspected By:

Project and Site Information

Project Name:

Project Address:

Type of Development/Catchment Type

Pollutant Removal Targets (%):
Site Water Quality Objectives (WQO's)

- Gross Pollutants (>2000µm)
- Total Suspended Solids (20 – 2000µm)
- Total Phosphorus
- Total Nitrogen
- Heavy Metals
- Total Petroleum/ Hydrocarbon
- Other

Local Authority:

Proposed Number of Ecosol™ Litter Baskets required:

Inlet pit type & typical dimensions
(e.g. Grated side entry pit 900 x 600mm)

Other essential design or site relevant information

Please forward the above information for your next project to your local Ecosol representative. On receipt Ecosol will model and design the most appropriately sized system to suit your application to assist you achieve the project Water Sensitive Urban design objectives. - Email: info@ecosol.com.au - Fax: 1300 706 634

Appendix 2

References

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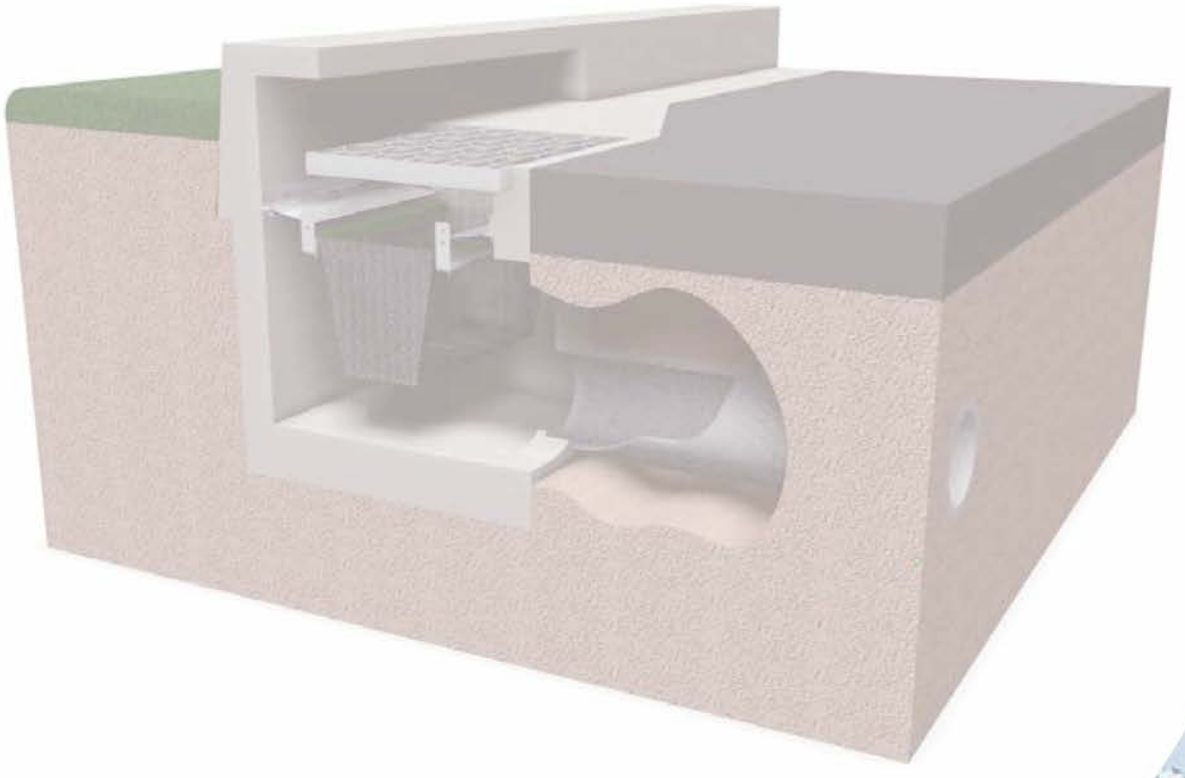


Ecosol™

SPEL ECOCEPTOR

In-line Gross Pollutant Trap (GPT)

SPEL Ecoceptor is a vertically configured gross pollutant trap, sediment and light liquids separator suitable for low risk applications. Manufactured from fibreglass or polyethylene to enable lightweight construction, "the Ecoceptor is designed for use in stormwater drains.

Flow rates on standard units of up to 1400 LPS and can fit pipe sizes from 225mm to 1350mm (other sizes available on request.)

APPLICATIONS

- Shopping Precincts
- Commercial Zones
- Recreational Grounds
- Light Industrial Areas
- Beaches & Parks

Independently tested for reducing

- ✓ Total suspended solids (TSS)
- ✓ Gross pollutant solids (GP)
- ✓ Light liquids (low risk only, incidental & occasional oil leaks)
- ✓ Total phosphorous

SPEL ECOCEPTOR

In-line Gross Pollutant Trap (GPT)

Overview

The SPEL Ecoceptor is a hydrodynamic in-line Gross Pollutant Trap (GPT) that has a unique treatment action producing low velocity conditions resulting in discharge water quality outcomes complying to statutory guidelines across Australia.

It separates and captures sediments, silt, total suspended solids, and oil and grease. Oil & grease rise to the "oil-capture" zone of the treatment chamber and are contained in all flow events.

Areas with a high fraction of impervious surfaces,including car parks, ports, streeetscapes, roads, subdivisions and industrial estates that require stormwater treatment are ideal for the SPEL Ecoceptor. MUSIC node is available on request.

The one-piece, self-contained fibreglass construction , is lightweight and yet robust in strength making it simple and cost-effective when performing installations.

The SPEL Ecoceptor is delivered to site fully assembled saving on installation time and crane costs. The SPEL Ecoceptor fibreglass GPT can be installed in all types of trafficable zones, including vehicular truck (Class D).

The cylindrical shape of the SPEL Ecoceptor with its sloped cone-configured base ensures sediment accretes at the centre of the Ecoceptor's base facilitating easy and simple cleaning.

The poly/fibreglass construction ensures that oil and grease are removed without sticking to the sides of the internal walls.

Flow rates on standard units of up to 1400 LPS and can fit pipe sizes from 225mm to 1350mm (other sizes available on request).

SPEL ECOCEPTOR

In-line Gross Pollutant Trap (GPT)

Maintenance

Inspection and Cleaning

The regularity of inspections of the SPEL Ecoceptor is contingent on the features and properties of the catchment area.

SPEL recommends inspection of the Ecoceptor one month after installation to determine the volume of trapped silt and pollutants.

Information sourced can be useful in factoring the frequency of on-going inspections or cleaning operations.

In the event of excessive rain or an oil spill, an inspection is recommended immediately.

Ascertain silt depth and if build-up is evident, then a vacuum-loader truck should be engaged for the cleaning of the tank.

SPEL Ecoceptor cleaning procedure is simple, by lifting the external lid (two persons may be required), resting it securely in a safe manner and then inserting suction hose into the chamber.

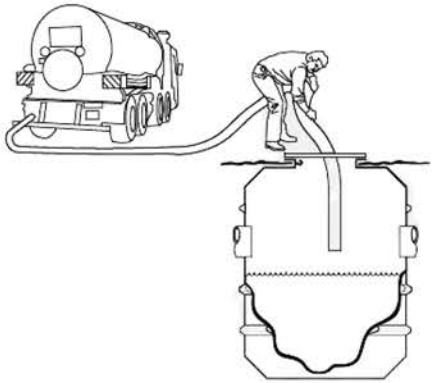
Ensure that the chamber is thoroughly cleaned of all refuse and debris before accessing the chamber - if required.

The chamber is cleaned by inserting the suction hose through the manhole at ground level.

Always commence cleaning from the inlet side of the chamber and ensure on completion of the cleaning operation that the lid is secured to its normal position (and locked if necessary) before departing the site.

Important

SPEL Environmental takes safety seriously and recommends that prior to the entry of any of its devices, that maintenance personnel undertake relevant safety checks and use appropriate safety equipment. SPEL devices are considered confined spaces and should only be entered by appropriately trained and certified personnel with the necessary safety equipment.



SPEL ECOCEPTOR

In-line Gross Pollutant Trap (GPT)

Class 3 Ecoceptor

"Class 3 Ecoceptor" act as gross pollutant traps and at the same time improves stormwater quality.

They separate and capture gross pollutants, sediments and silt. Light liquids (petroleum hydrocarbons) rise to the top of the lower chamber while sludge settles on the bottom.

Features

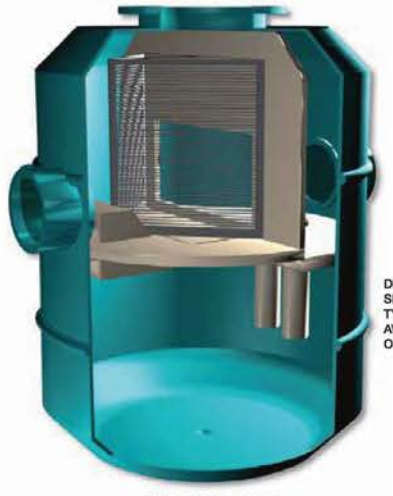
- Unique "V-screen" collects gross pollutants
- Easy access to all parts for desludging and oil removal
- Can handle high flows
- By-pass operation when very heavy rain persists, preventing "back up'
- Units are factory-made to suit any application
- Fibreglass construction
- Minimum on-site labour costs
- Flow rates up to 1400 LPS

Options:

- Trafficable lid types
- Different pipe configurations and sizes
- Manhole risers
- Larger tanks

APPLICATIONS

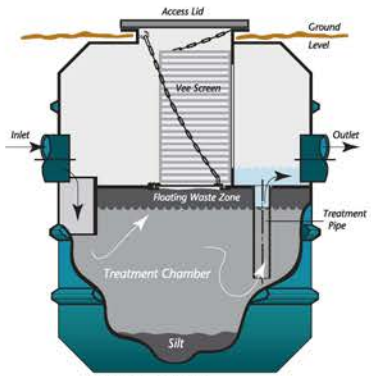
Car Parks
Industrial Estates
Town Houses



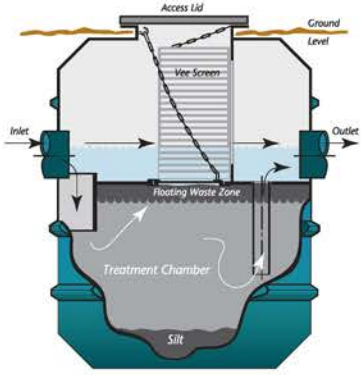
DIFFERENT SIZES & TYPES AVAILABLE ON REQUEST

CLASS 3 ECOCEPTOR

VIEW OF V-SCREEN THROUGH MANHOLE



FIRST FLUSH FLOW



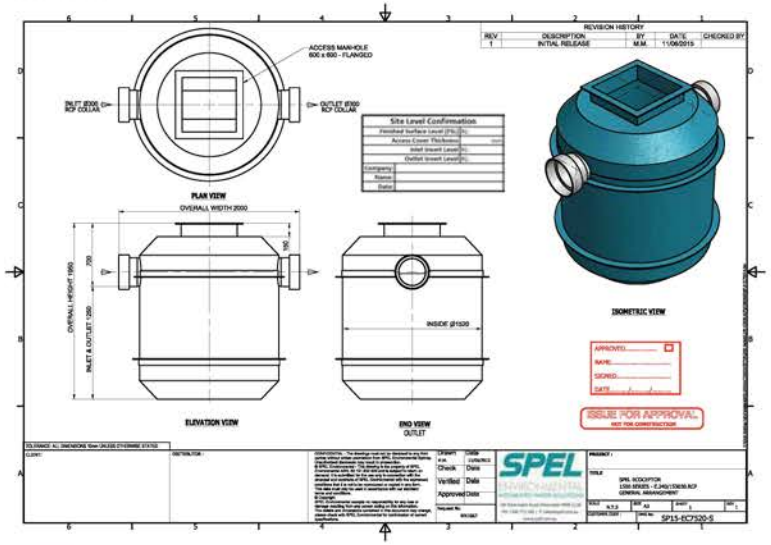
FULL TREATMENT FLOW

SPEL ECOCEPTOR

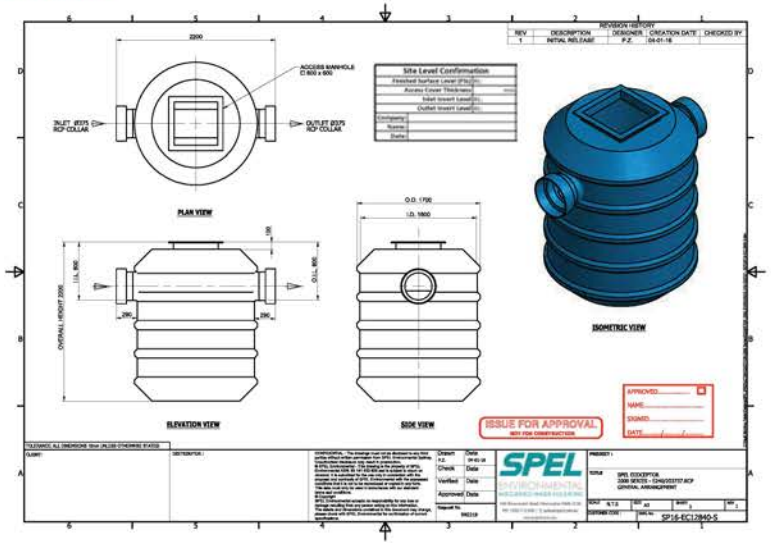
In-line Gross Pollutant Trap (GPT)

Technical Drawings

1500 Series



2000 Series

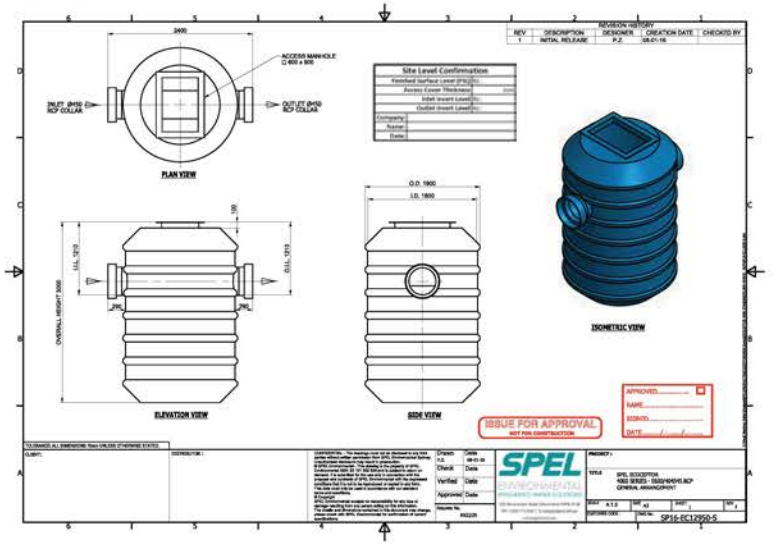


SPEL ECOCEPTOR

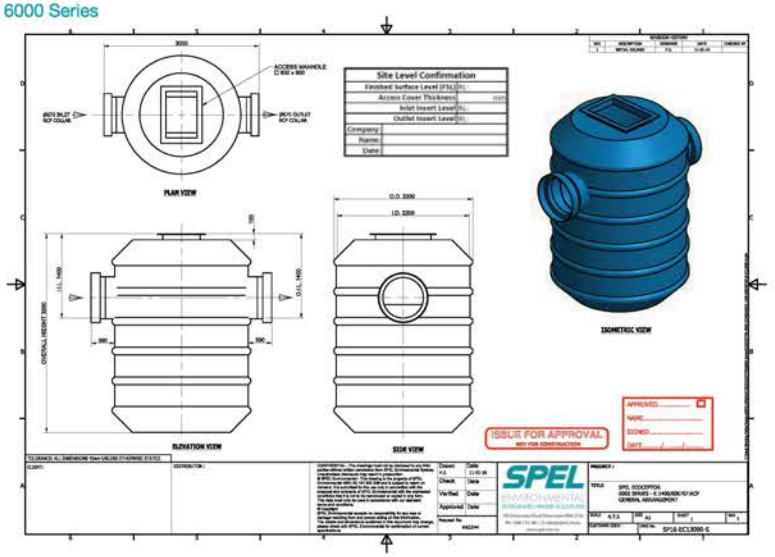
In-line Gross Pollutant Trap (GPT)

Technical Drawings

4000 Series

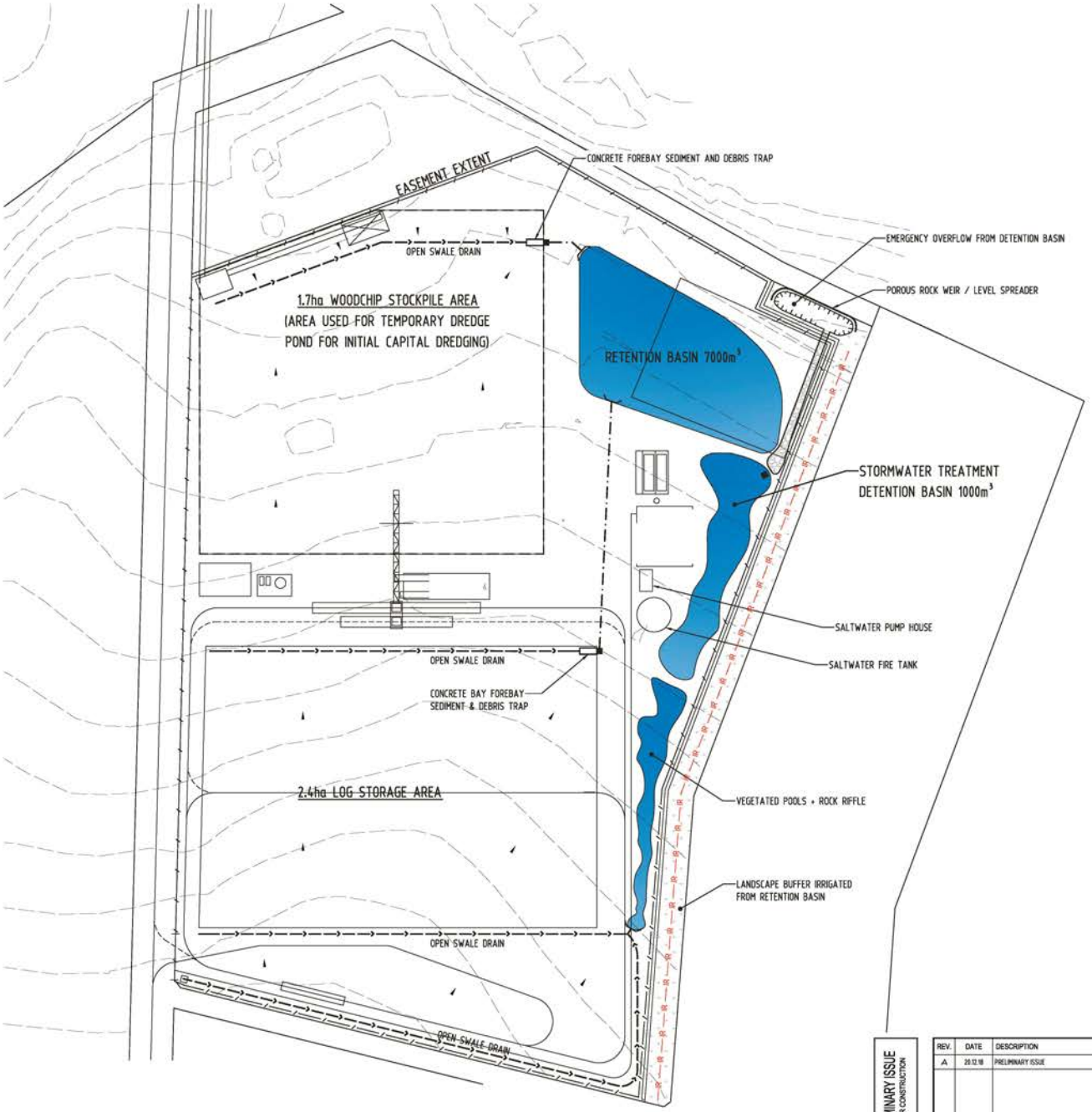


6000 Series



APPENDIX D

STORMWATER MANAGEMENT STRATEGY



LEGEND:

- EXISTING LEVELS
- EXISTING CONTOURS
- STORMWATER PIPE
- SWALE
- FENCE
- IRRIGATION
- DIRECTION OF FALL TO NEW SURFACE
- GRATED INLET PIT (GI)
- JUNCTION BOX (JB)
- NATIVE VEGETATION BUFFER

PROJECT NORTH

20 10 0 20 40
SCALE BAR (m)

When sheet printed full size, the scale bar is 100mm.
0 50 100mm

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	DRAFT	ENG.	CHKD
A	20.12.18	PRELIMINARY ISSUE	JJF	JL	JL

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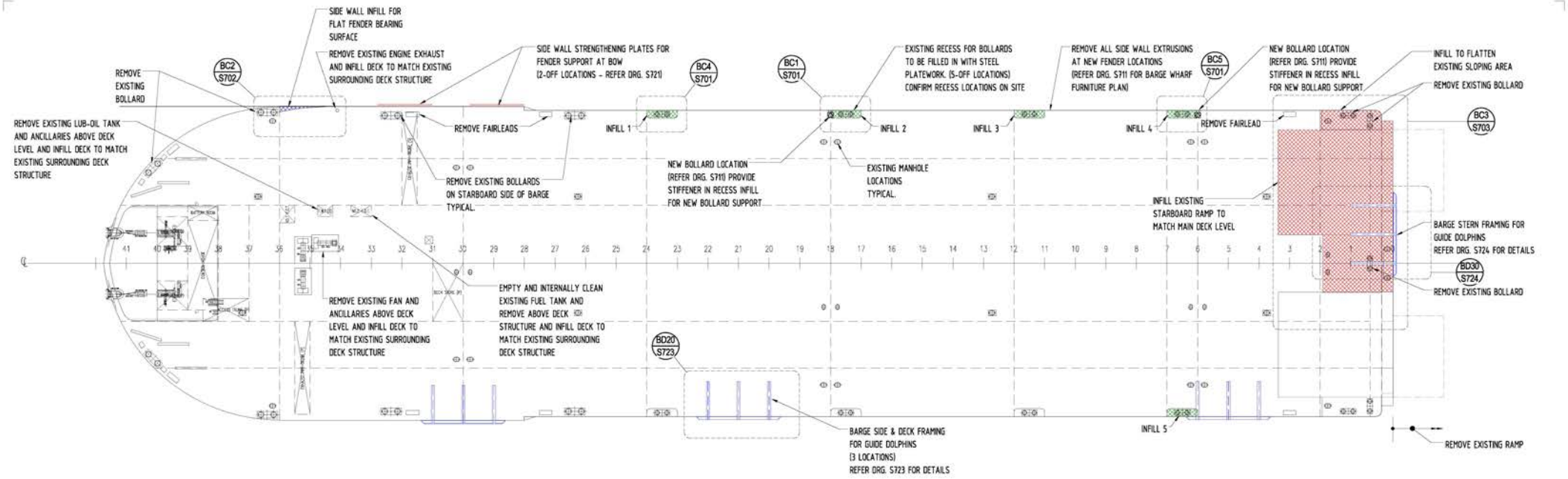
K.I. PLANTATION TIMBERS
TEMPORARY BARGE STORAGE LOCATION
CASTING BASIN, BUNBURY PORT, WA
ONSHORE STORMWATER MANAGEMENT STRATEGY

A1
DOCUMENT NUMBER
Project Number AAD140132-C01 Sheet No. Rev. A

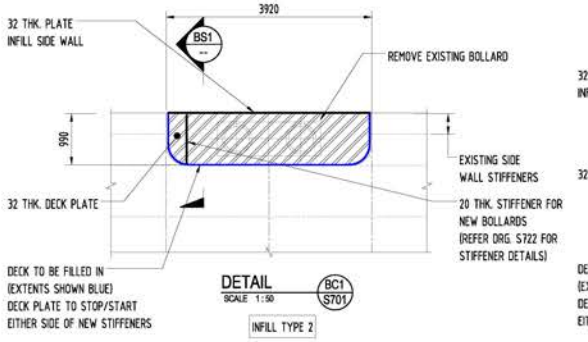
Design JL Drawn JJF

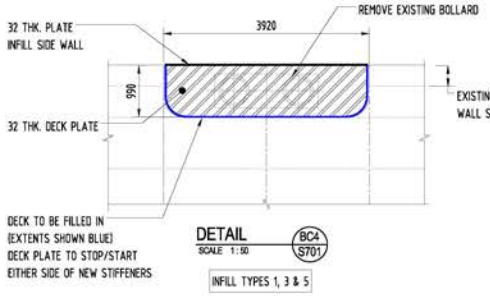


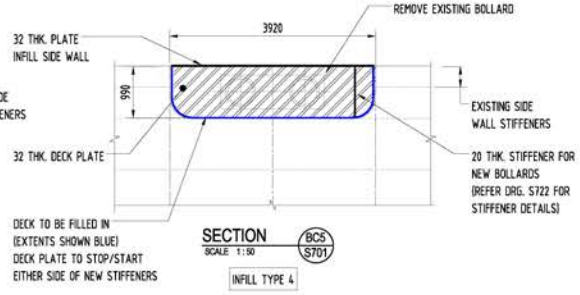
BARGE DECK & SIDE WALL MODIFICATIONS PLAN

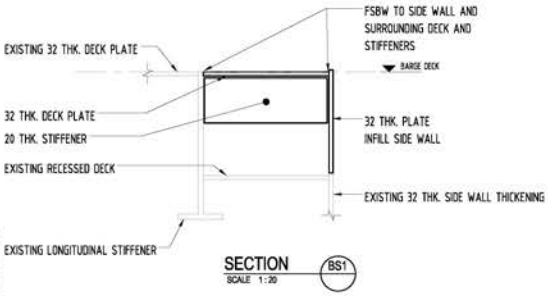
SCALE 1:250

NOTE:
- REMOVE ALL BALLAST TANK VENTS AND FILL IN DECK PENETRATION WITH PLATE TO MATCH SURROUNDING DECK (BUTT WELD ALL ROUND TO SURROUNDING DECK PLATE)
- DECOMMISSION MAIN BALLAST SYSTEM AND SEAL CAP PLATE ALL INLETS AND OUTLETS WITH 16 THK. PLATE (FSBW)









STEELWORK NOTES

- S1 ALL WORKMANSHIP AND MATERIALS INCLUDING THE SUPPLY, FABRICATION AND ERECTION SHALL CONFORM WITH THE SPECIFICATION, AS4100 AND RELEVANT CODES.
- S2 ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH DETAILS PROVIDED ON THE DRAWINGS AND UNLESS OTHERWISE DIRECTED BY WGA.
- S3 CONNECTIONS AND JOINTS SHALL BE AS DETAILED, WHERE NOT DETAILED, OBTAIN PRIOR ADVICE FROM WGA.
- S4 FABRICATION AND WELDING SHALL BE IN ACCORANCE WITH ABS RULES.
- S5 STEEL GRADES SHALL BE AS FOLLOWS (UNO):
  - FOR ALL STEELWORK: GRADE "A" ORDINARY STRENGTH STRUCTURAL STEEL (235MPa YIELD) TO ABS MATERIAL AND WELDING RULES (2018) PART 2 (CHAPTER 1, SECTION 2)
- S6 ALL EDGES AND CORNERS TO HAVE MINIMUM 3mm RADIUS TO ENSURE PAINT THICKNESS IS ACHIEVED U.N.O.
- S7 ALL LIFTING LUGS TO BE STAMPED WITH WLL.
- S8 ALL BOLTS TO BE GRADE 8.8/S TO AUSTRALIAN STANDARD AS1252 U.N.O. REFER TO TABLE S3 FOR BOLT TYPES.
- S9 ALL BOLTS SHALL HAVE AT LEAST ONE FULL THREAD EXPOSED BEYOND THE NUT AFTER TIGHTENING.
- S10 PROVIDE AT LEAST ONE WASHER UNDER THE NUT IN ALL SITUATIONS.
- S11 ALL PROPRIETARY CLASS 8.8 BOLTS, CLASS 8 NUTS, AND ASSOCIATED WASHERS SHALL COMPLY WITH AS/NZS 1252.
- S12 THE FABRICATOR SHALL PROVIDE THE ENGINEER WITH BOTH A MANUFACTURER'S TEST CERTIFICATE PREPARED BY AN ACCREDITED TESTING ORGANISATION IN THE COUNTRY OF MANUFACTURE, TOGETHER WITH A CERTIFICATE OF COMPLIANCE PREPARED BY AN INDEPENDENT NATA-ACCREDITED TESTING LABORATORY VERIFYING COMPLIANCE OF EACH BATCH OF BOLTS TO THE ABOVE AUSTRALIAN STANDARD.
- S13 THE CERTIFICATE OF COMPLIANCE MUST BE FULLY TRACEABLE TO INDIVIDUAL BATCHES OF BOLTS, AND ADDRESS CHEMICAL, MECHANICAL, AND DIMENSIONAL COMPLIANCE.
- S14 ANY BOLTS NOT MEETING THE REQUIREMENTS OF AS/NZS 1252 WILL BE REJECTED.
- S15 BOLTS NOT POSSESSING BOTH A MANUFACTURER'S TEST CERTIFICATE AND CERTIFICATE OF COMPLIANCE WITH AS/NZS 1252 WILL BE REJECTED.
- S16 SURFACE PREPARATION AND PRIMING OF SURFACES SHALL CONFORM WITH THE SURFACE PROTECTION SPECIFICATION.
- S17 WELD ELECTRODE TO HAVE A MINIMUM TENSILE STRENGTH OF 580MPa.
- S18 ALL WELDING AND TESTING TO BE CARRIED OUT TO ABS MATERIAL AND WELDING RULES (2018) PART 2 (CHAPTER 1, SECTION 2)

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When sheet printed full size, the scale bar is 1:1 (100mm).
0 50 100mm

KANGAROO ISLAND PLANTATION TIMBERS

MARITIME CONSTRUCTIONS

CONSTRUCTION ISSUE

REV.	DATE	DESCRIPTION	DRAFT.	ENG.	CHKD.
0	30/01/18	ISSUED FOR CONSTRUCTION	BL	JJ	DM
1	02/02/18	ISSUED FOR CONSTRUCTION	BL	JJ	DM
2	13/02/18	ISSUED FOR CONSTRUCTION	BL	JJ	DM
3	19/02/18	ISSUED FOR CONSTRUCTION	BL	JJ	DM
4	11/04/18	ISSUED FOR CONSTRUCTION	BL	JJ	DM

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KANGAROO ISLAND, SA
K.I PLANTATION TIMBERS
PROPOSED EXPORT FACILITY AT SMITH BAY

BARGE MODIFICATIONS PLAN

A1

DRAWING NUMBER
Job Number AAD140132 Sheet No. S701 Rev. 4

Design JJ Drawn BL

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