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CONSTRUCTION SOIL AND WATER MANAGEMENT REPORT

ARMIDALE SECONDARY COLLEGE ARMIDALE NSW

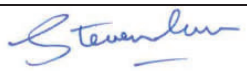
Prepared For:
Armidale Secondary College
c/- NBRS Architecture Pty Ltd
Level 3, 4 Glen Street
MILSONS POINT NSW 2061

Prepared by:
Birzulis Associates Pty Ltd
583 Darling Street
ROZELLE NSW 2039

***Rev*: B**

DOCUMENT VERIFICATION

Project Title	Construction Soil & Water Management Report
Project No.	7070
Client Contact	NBRS Architecture Pty Ltd

	Name	**Signature**
Prepared by	Steven Luu	
Checked by	Michael Grogan	
Issued by	Michael Grogan	

Document History

Date	**Revision**	**Issued to**	**No. Copies**
17 May 2019	A	NBRS Architecture Pty Ltd	PDF
27 May 2019	B	NBRS Architecture Pty Ltd	PDF
11 July 2019	C	NBRS Architecture Pty Ltd	PDF

Contents

Appendices

Appendix A – Drains Model

Appendix B – Ocean Protect – Manufacturer's Specifications & Installation

Appendix C – Armidale Flood Planning Level Map

Appendix D – Construction map during wet weather.

1 INTRODUCTION

Birzulis Associates Pty Ltd has been commissioned by NBRS Architecture Pty Ltd on behalf of Schools Infrastructure to prepare this Construction Soil and Water Management Report in support of a proposed development for the site.

The site is located on the southern side of Mann Street between Butler Street and Barry Street, Armidale, NSW. The proposed development is for a co-educational public secondary school consisting of numerous multi storey classroom buildings, office facilities and car parks.

This report provides a summary of the stormwater management design principles and planning objectives for the management of stormwater quality and quantity. The objectives for the development are to provide an appropriate and economical stormwater management system which incorporates best practice in water sensitive urban design consistent with the requirements of Armidale Regional Council's (ARC) water quality objectives.

A set of drawings have been prepared to show that the proposed stormwater quantity and quality requirements for the development can be met. These drawings cover stormwater management elements which cover surface levels and drainage layouts.

The consent authority is the Minister for Planning. The engineering and policy requirements of ARC have also been considered in the design. The stormwater management design had been discussed with the Stormwater Engineer at ARC throughout the design stages of this project. It was agreed that the use of rainwater tanks for water re-use and agricultural purposes would benefit the site, in conjunction with the use of an on-site detention tank. The proposed stormwater drainage system will also introduce the use of gross pollutant traps to treat stormwater runoff from the school site before entering water course.

There has been consultation with the Armidale Council representative, Mark Wilson (Program Leader Investigations & Design Department), who has reviewed and endorsed the soil and water management plan described in this report which is to be implemented.

This report will also provide a plan of how all construction works will be managed in wet-weather events and details of all off-site flows from the site. The measures that are to be implemented to manage stormwater and flood flows for small and large sized events will be discussed.

2 SITE CHARACTERISTICS

2.1 Site Description

The proposed development is located in the suburb of Armidale on Butler Street with an area of approximately 18.3 hectares in area, as shown in **Figure 2.1.**

The site is bounded by Mann Street to the north, arboretorium to the south and low density residential land to the east and west.

Figure 2.1 Locality Plan

2.2 Proposed Development

The proposed development is for the construction of a new secondary college.

An indicative layout of the development has been produced by NBRS Architecture and can be seen in **Figure 2.2**.

The development will include the following engineering components:

- Earthworks to provide foundation support for the classroom buildings including the excavation for underground on-site detention tanks;
- Construction of an access driveway off Butler Street;
- Maintaining the natural gradient of the site and overland flow path through the development site;

♦Stormwater drainage system based on a major/ minor design philosophy and SSD conditions B25

♦Management of stormwater quality using a treatment train approach to pollutant loads on a developed catchment in accordance with ARC's recommendations; and

♦Management of stormwater quantity by reducing post developed flow to pre-developed over the range of storms between the 1 in 5 year Average Recurrence Interval (ARI) to the 1 in 20 year ARI as per council policy and recommendations.

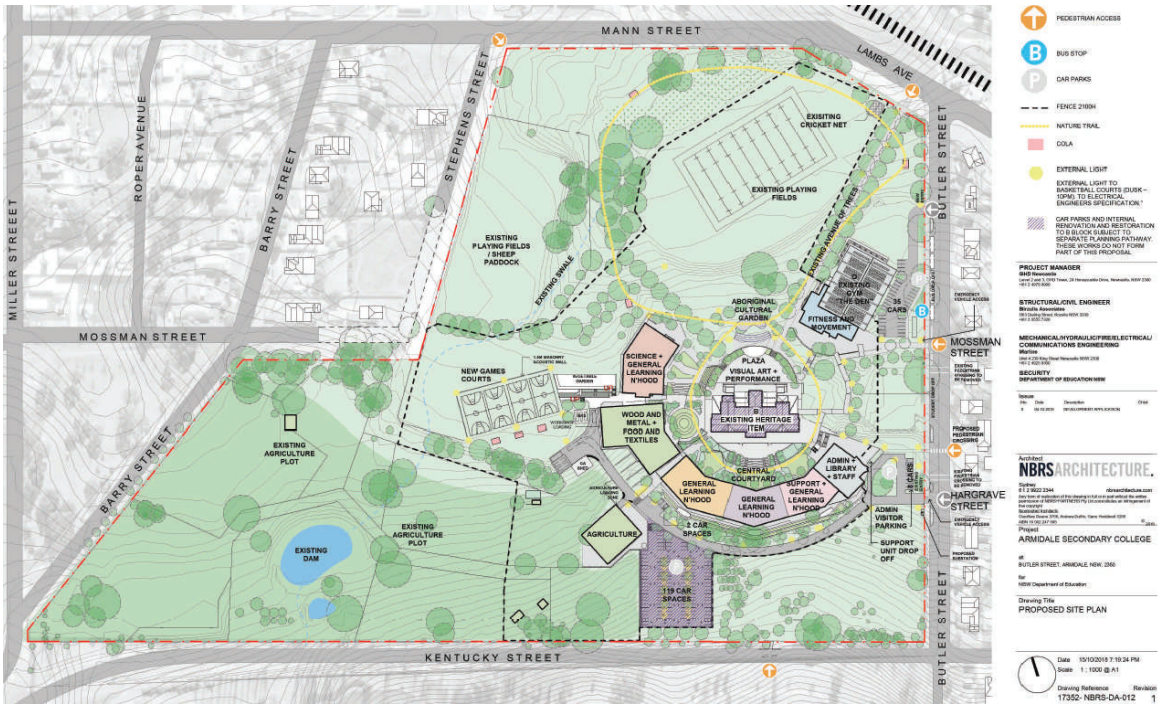
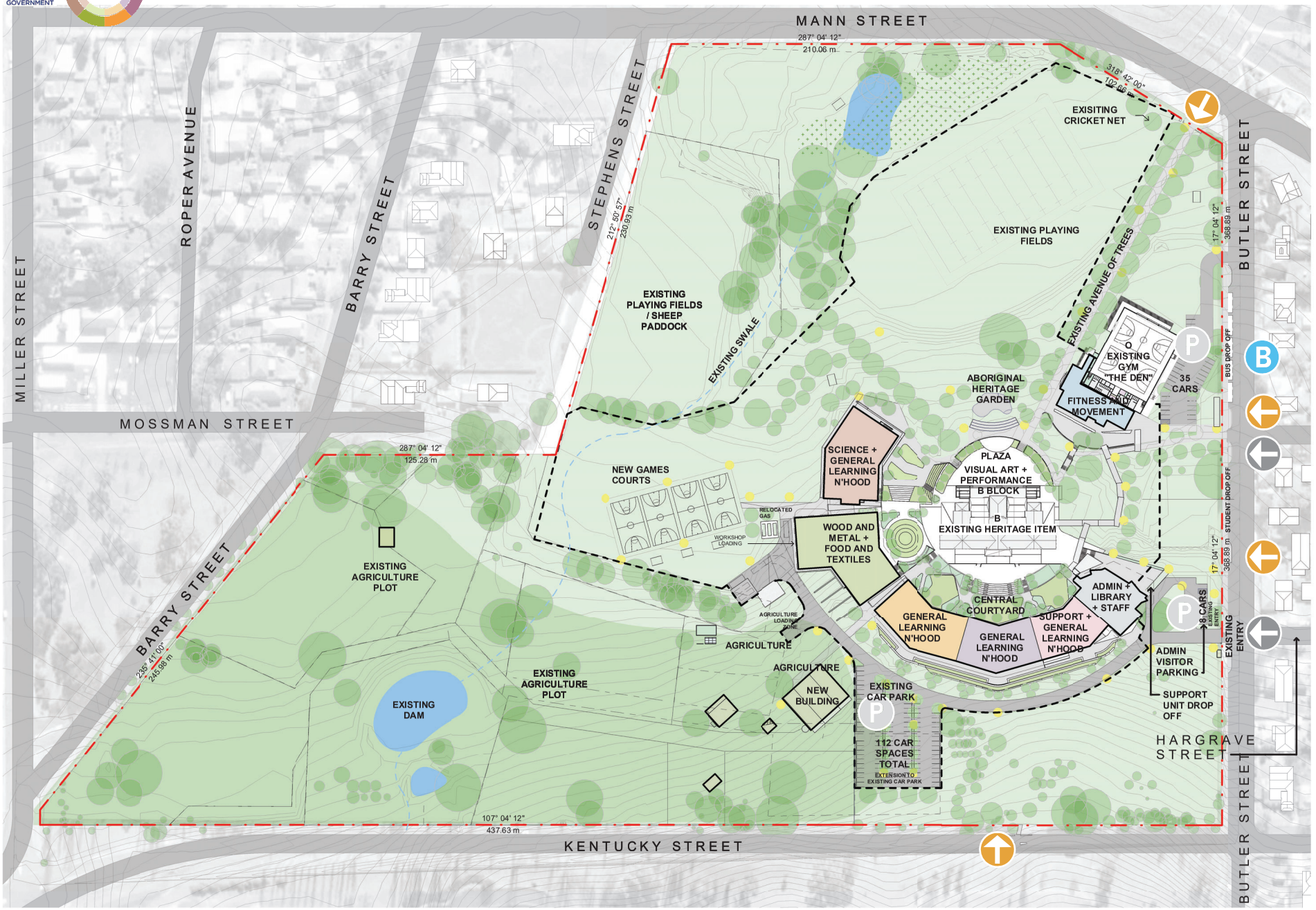


Figure 2.2 Architectural Plan (refer to next page for full size version)

NSW GOVERNMENT
LEARNING HUB

NBRSARCHITECTURE.



VEHICLE ACCESS

PEDESTRIAN ACCESS

B BUS STOP

P CARPARKING

EXTERNAL LIGHT

External light to basketball courts (Dusk – 10pm). To electrical engineers specification."

Issue

No.	Date	Description	Chkd
A	25.07.2018	FOR TENDER	

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SECURITY
DEPARTMENT OF EDUCATION NSW

Architect
NBRSARCHITECTURE.
Sydney
61 2 9922 2344 nbrsarchitecture.com

Nominated Architects: Geoffery Deane 3766; Andrew Duffin 5602; Garry Hoddinett 5286
ABN 16 002 247 565

Project
ARMIDALE SECONDARY COLLEGE

at
BUTLER STREET, ARMIDALE, NSW, 2350

for
NSW Department of Education

Drawing Title
SITE PLAN

Date JULY 2018
Scale 1000@A1 or 2000@A3

Drawing Reference 17352- NBRS-012
Revision A

0 1 2 3 4 5 6 7 8 9 10

3 STORMWATER DRAINAGE

3.1 Site Drainage

3.1.1 Existing Site Drainage

The property is currently developed as public high school with a large portion of the property utilized for agricultural purposes. All current overland flows travel towards the north of the site via a grassed channel and then into a headwall that drains under Mann Street into an underground reinforced concrete pipe approximately 1200mm diameter, travelling in a northerly direction.

3.1.2 Proposed Site Drainage

The proposed system to be completed generally in accordance with the following *general engineering practice, the guidelines of ARC and the following regime:*

As per SSD condition C29 requires written approval from Council to connect or discharge site stormwater to Council's stomwater drainage system or street gutter.

- The proposed stormwater drainage system for the development will comprise a minor and major system to safely and efficiently convey collected stormwater runoff from the development to the legal point of discharge

- The minor system is to consist of a piped drainage system which has been designed to accommodate the 1 in 5-year ARI storm event. This results in the piped system being able to convey all stormwater runoff up to and including the Q5 event. This meets the requirements of ARC stormwater criteria.

- The major system will be designed to cater for storms up to and including the 1 in 20-year ARI storm event. The major system will employ the use of defined overland flow paths, such as roads and open channels, to safely convey excess run-off from the site. Discussions were held with ARC stormwater engineer and a 1 in 20-year ARI storm event was deemed to be satisfactory due to the semi-rural nature of the site. Due to the size of the existing site, a 1-in-100 year ARI storm event was considered to be conservative and unrealistic to capture all stormwater from the entire site, hence Birzulis and Armidale Regional Council agreed a 1-in-20 year ARI storm would be adequate for stormwater design purposes. Also mentioned in councils engineering policy, the design average recurrence interval depending on the zoning of the land, the design ARI's are to be used:
  - Commercial/Industrial – 20 years
  - Residential – 5 years
  - Rural residential – 5 years
  - Parks & reserves – 1 year

- In the event of wet weather, the construction methodology may be carried out differently but in a safe manner. Refer to Appendix D for additional information.

- The design of the stormwater system for this site will be based on relevant national design guidelines, Australian Standard Codes of Practice, the standards of ARC and accepted engineering practice. Runoff from buildings will generally be designed in accordance with AS 3500.3 National Plumbing and Drainage Code Part 3 – Stormwater Drainage. Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication "Australian Rainfall and Runoff" (2016 Edition), Volumes 1 and 2 (AR&R).

- The site area taken into consideration for stormwater design is shown in **Figure 3.1**.

  Stormwater Management is required to be provided for water quantity and quality in accordance with the requirements of ARC DCP. Allowance for conveyance of the existing overland flow through the site will be required as discussed in **Section 5.2** of the report.

  Further discussion on the Stormwater Management Strategy is provided in **Section 4** and **5** of this report.

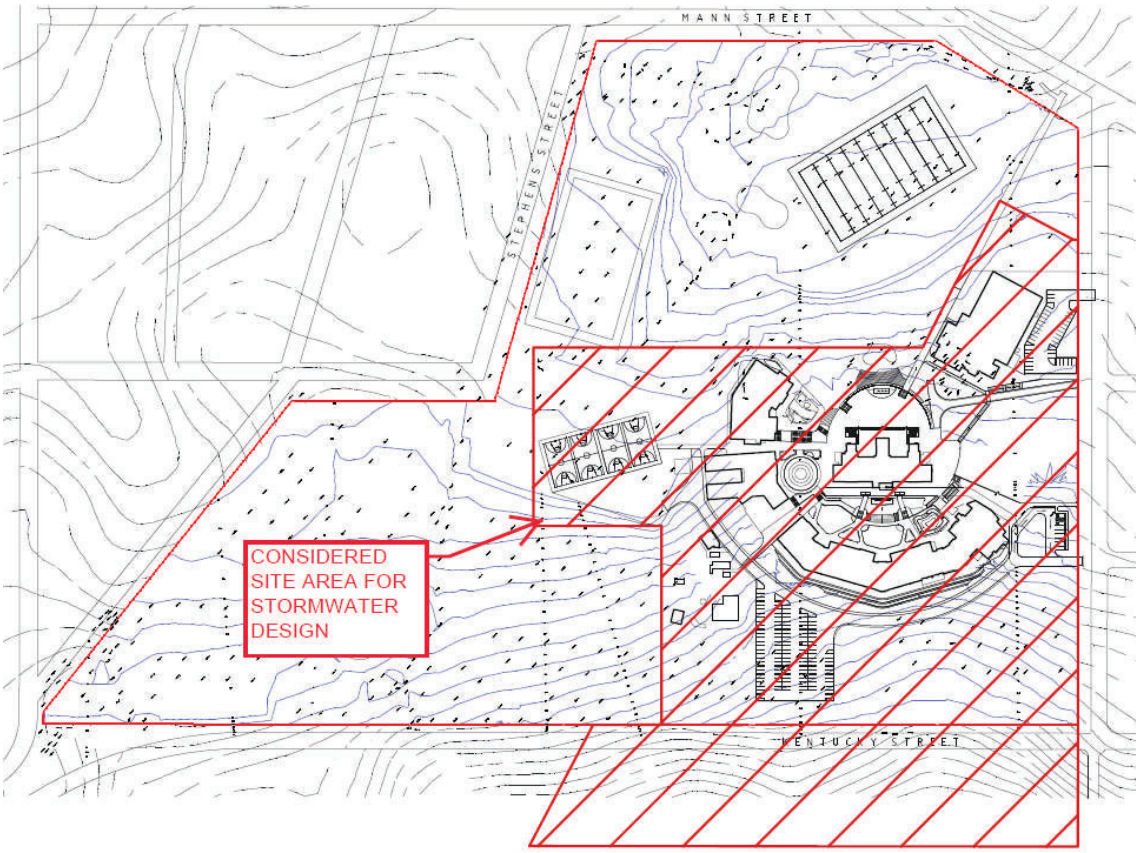

Figure 3.1. Site area taken for stormwater design.

6 IMPACT ASSESSMENT

6.1 Construction

Construction activities such as excavation, other earthworks and the use of water for construction activities may cause runoff, sedimentation and erosion impacts to the local waterways if not appropriately managed.

Potential adverse impacts would include:

- Inadequate containment of spills or leaks of fuels and/or oils from construction plant and equipment and/or from vehicle/trucks that may result in pollutants entering the local waterway;
- Excavation, vegetation clearing and grading that may cause increased sediment and pollutant load in runoff;
- Stockpiling of spoil and construction materials may lead to polluted water runoff and sedimentation of waterways;
- Uncontrolled water use for construction activities resulting in pollutants entering the receiving waterway and potential increased scour and erosion effects;
- Litter from construction activities entering waterways; and
- Exposure of soils containing acid sulphides to oxygen resulting in the production of sulfuric acid, which may negatively affect the environment and waterways.

6.2 Mitigation

Erosion and sediment control measures will be provided in accordance with the “Blue Book” – Managing Urban Stormwater – Soils and Construction (Landcom, 2004) to Development to mitigate potential impacts to the downstream water quality from construction activities.

Controls would include:

- Sediment management devices, such as fencing, hay bales or sand bags;
- Measures to divert or capture and filter water prior to discharge, such as drainage channels and first flush and sediment basins;
- Installation of measures at work entry and exit points to minimise movement of material onto adjoining roads, such as rumble grids or wheel wash bays;
- Appropriate location and storage of construction materials, fuels and chemicals, including bunding where appropriate;
- All refuelling of vehicles and equipment on site would be undertaken a minimum of 50 metres away from water bodies and surface drains, where possible and;
- Any fuel, oil or other liquids stored onsite would be stored in an appropriately sized impervious bunded area.
- Measures to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving the site. This could be the installation of an on-site vehicle wash bay prior to vehicles leaving the site.

An Erosion and Sediment Control Plan would also be prepared as part of the Construction Environmental Management Plan. Implementation of these measures would mitigate off-site impacts to the downstream water quality of the site during construction of the school.

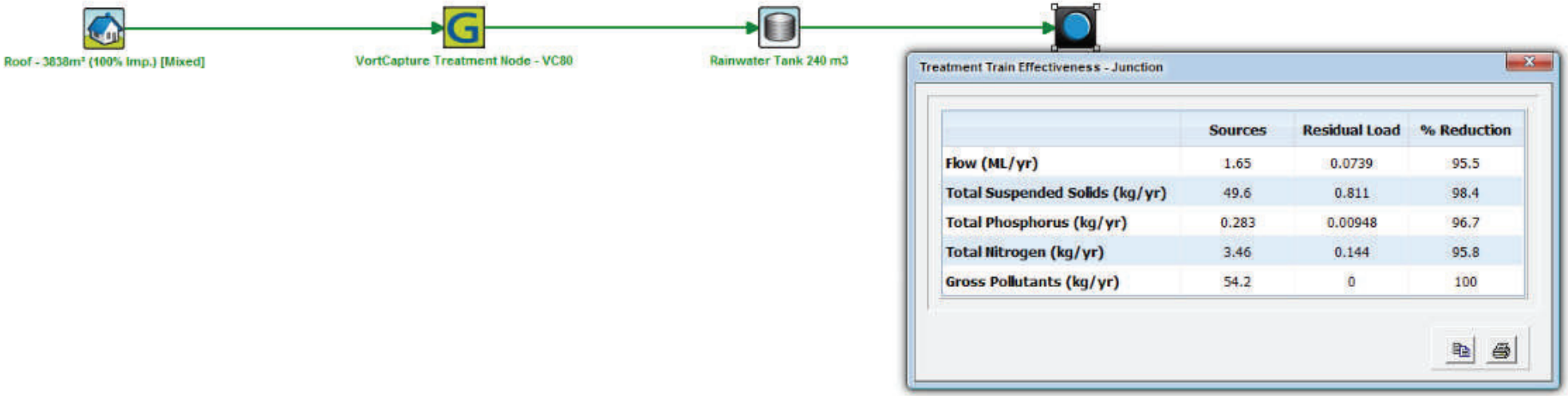

Figure 2. Results from MUSIC model

7 FLOODING & OVERLAND FLOW

The assessed site has been identified by Armidale Regional Council as being unaffected by overland flow from an external catchment. Refer to the flood map in **Appendix C** (1 in 100 year Annual Exceedance Probability, based on Armidale Flood Study 2004 and Martins Gully Update 2011) provided by Armidale Regional Council.

A flood risk assessment for this site has been prepared by Eco Logical Australia. Please refer to report 'Eco Logical Australia 2018. *Armidale Future Secondary School Redevelopment Project, Flood Risk Assessment*. Prepared for NBRS Architecture' for further information.

8 CONCLUSION

This Civil Engineering Details Report has been prepared to support the application for a proposed development at Armidale High School, Butler Street, Armidale.

A Stormwater Management strategy for the site has been developed which provides a best practice solution within the constraints of the existing landform and proposed development layout. The strategy for stormwater quantity and quality management has been developed to reduce both peak flows and pollutant loads in stormwater leaving this site. The stormwater management for the development has been designed in accordance with Armidale Regional Council's Engineering Code Design Specification D5 - Stormwater Drainage Design (Dated September 2016) and SSD conditions.

The stormwater layout for the development maintains the existing catchment breakdown and a proposed two discharge points. A hydrological assessment has been undertaken which confirms local post development flows from the site will be less than pre-development flows and demonstrates that the site discharge would not adversely affect any land, drainage system or watercourse as a result of the development. A stormwater retention system comprising an active storage of $240m^3$ is proposed to attenuate developed stormwater flows to pre-developed flows. This will be provided by an underground retention tank.

During the construction phase, an erosion and sediment control plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

During the operational phase of the development, a treatment train incorporating the use Stormwater Treatment Measures (STM's) comprising a proprietary treatment train of Enviropod pit inserts, retention tanks and SW360 stormfilters been proposed to mitigate the increase in stormwater pollutant loads generated by the development. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

9 REFERENCES

- Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC);
- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM); and
- Armidale Regional Council's Engineering Code Design Specification D5 - Stormwater Drainage Design (Dated September 2012)

From: Mark Wilson
To: "Steven Luu"; Sam Lyons
Cc: John Goodall; Michael Flynn
Subject: RE: TRIM: Armidale secondary college - construction soil and water management report - acknowledgment
Date: Monday, 22 July 2019 5:03:11 PM
Attachments: image001.png
image002.png
image003.png

Dear Steven

The submitted report for soil and water management during construction has been reviewed and is endorsed for implementation by council. Please note that in the conclusion there is a reference to SW360 Jellyfish devices. It is our understanding and it is referenced earlier in the report, that a single GPT would be installed at the outlet to the gully. Consideration was to be given to removal o the other devices originally designed to be installed in all pit. We have no objection to same but feel they are unnecessary and will become and ongoing maintenance issue for the school. Please ensure the conclusion is reflective of the intent.

Regards

Mark Wilson

Program Leader Investigations & Design

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135 Rusden Street | PO Box 75A Armidale NSW 2350

From: Steven Luu [mailto:sluu@birzulisassociates.com]
Sent: Friday, 19 July 2019 3:38 PM
To: Mark Wilson
Subject: TRIM: Armidale secondary college - construction soil and water management report

Hi Mark,

As discussed over the phone, Please find attached the construction soil and water management report for your review. If you could get back to me as soon as you can as a matter of urgency that would be appreciated. Please feel free to leave feedback or let me know if you are satisfied with the report. I look forward to hearing from you.

Kind regards,
Steven Luu
Structural Engineer

5944_BA Logo_CMYK

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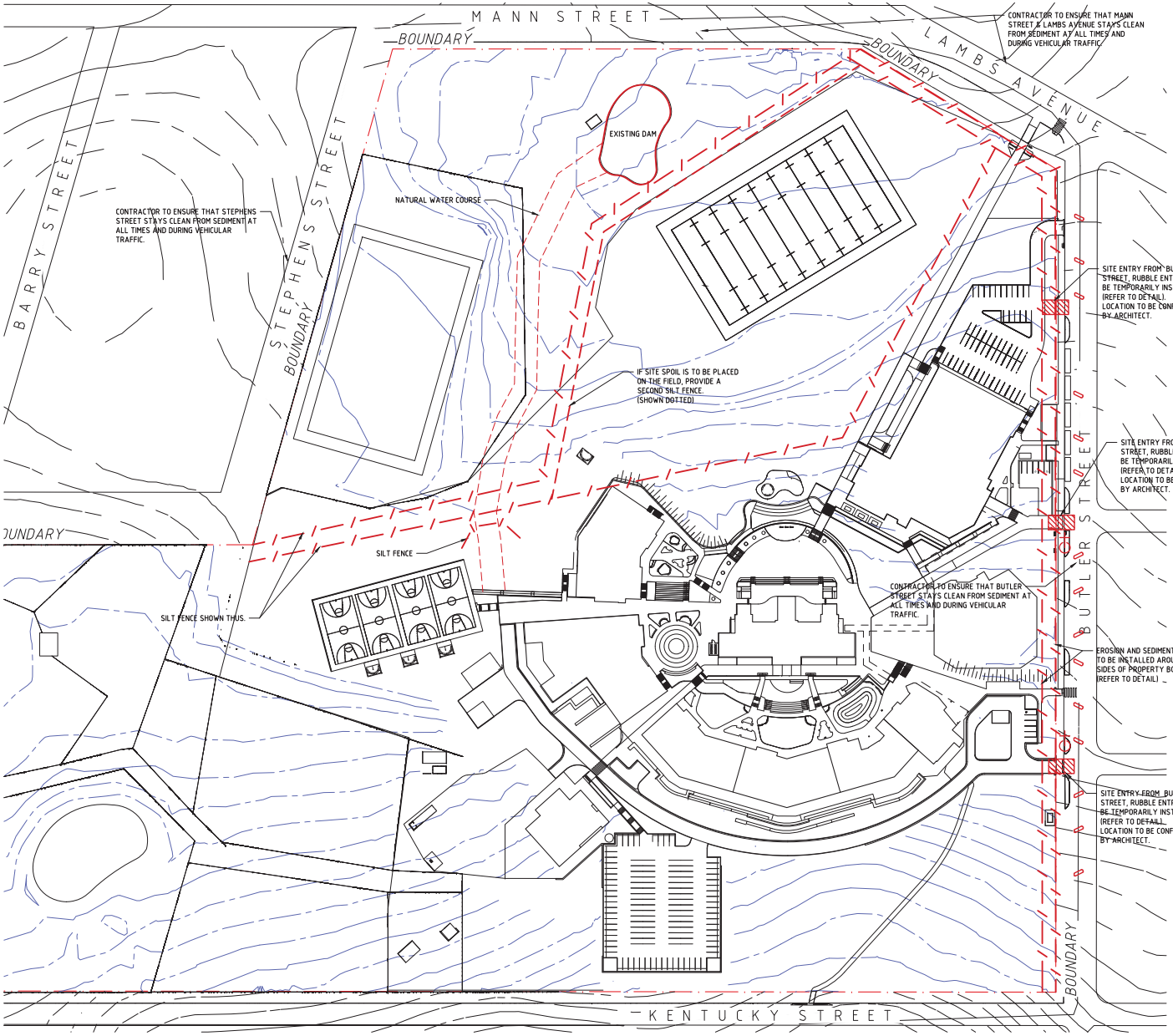
Armidale Regional Council Disclaimer



SOIL AND EROSION SEDIMENT CONTROL PLAN

SCALE 1:1000

EROSION & SEDIMENTATION CONTROL NOTES

1. CONTRACTOR SHALL PROVIDE SEDIMENT FENCING MATERIAL DURING CONSTRUCTION TO THE LOW SIDE OF THE WORKS. TIE SEDIMENT FENCING MATERIAL TO CYCLONE WIRE SECURITY FENCE. SEDIMENT CONTROL FABRIC SHALL BE AN APPROVED MATERIAL (EG. HUMES PROPEX SILT STOP) STANDING 300mm ABOVE GROUND & EXTENDING 150mm BELOW GROUND.
2. EXISTING DRAINS LOCATED WITHIN THE SITE SHALL ALSO BE ISOLATED BY SEDIMENT FENCING MATERIAL.
3. NO PARKING OR STOCKPILING OF MATERIAL IS PERMITTED ON THE LOWER SIDE OF THE SEDIMENT FENCE.
4. GRASS VERGES SHALL BE MAINTAINED AS MUCH AS PRACTICAL TO PROVIDE A BUFFER ZONE TO THE CONSTRUCTION SITE.
5. CONSTRUCTION ENTRY/EXIT SHALL BE VIA THE LOCATION NOTED ON THE DRAWING. CONTRACTOR SHALL ENSURE ALL DROPPABLE SOIL & SEDIMENT IS REMOVED PRIOR TO CONSTRUCTION TRAFFIC EXITING SITE. CONTRACTOR SHALL ENSURE ALL CONSTRUCTION TRAFFIC ENTERING & LEAVING THE SITE DO SO IN A FORWARD DIRECTION.

GENERAL NOTES.

1. THIS PLAN IS A CONCEPT PLAN ONLY FOR STORMWATER DISPOSAL & EROSION CONTROL. IT IS NOT SUITABLE FOR CONSTRUCTION. THIS PLAN SHOULD BE ADAPTED BY THE BUILDER DURING DEMOLITION, EXCAVATION & CONSTRUCTION PHASES TO ENSURE ADEQUATE PERFORMANCE.
2. ALL DRAINAGE LAYOUT & DETAILS ARE DIAGRAMMATIC & INDICATIVE ONLY. ACTUAL LOCATION, SIZES, LEVELS & GRADES MAY LATER WHEN DETAIL DESIGN WORKS ARE DOCUMENTED.

CLAY SOILS

A SYSTEM SHALL BE INSTALLED TO EITHER:

1. TRANSPORT STORMWATER RUNOFF WITH SUSPENDED SOLIDS FROM SITE VIA PUMP TRUCKS.
2. TREAT THE STORMWATER RUNOFF WITH SUSPENDED SOLIDS SO THE DISCHARGE WATER QUALITY TO COUNCIL STORMWATER DRAINAGE SYSTEM HAS A MAXIMUM CONCENTRATION OF SUSPENDED SOLIDS THAT DOES NOT EXCEED 50 MILLIGRAMS PER LITRE IN ACCORDANCE WITH THE PROTECTION OF THE ENVIRONMENT OPERATION ACT (POEO 1997) AND SHALL BE APPROVED BY THE LOCAL COUNCIL.

Issue

No.	Date	Description	CHKd
C	21.06.19	FOR CONSTRUCTION	SL
B	24.05.19	EFSG DD REVIEW	SL

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DEPARTMENT OF EDUCATION NSW

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Project
ARMIDALE SECONDARY COLLEGE

at
BUTLER STREET, ARMIDALE, NSW, 2350

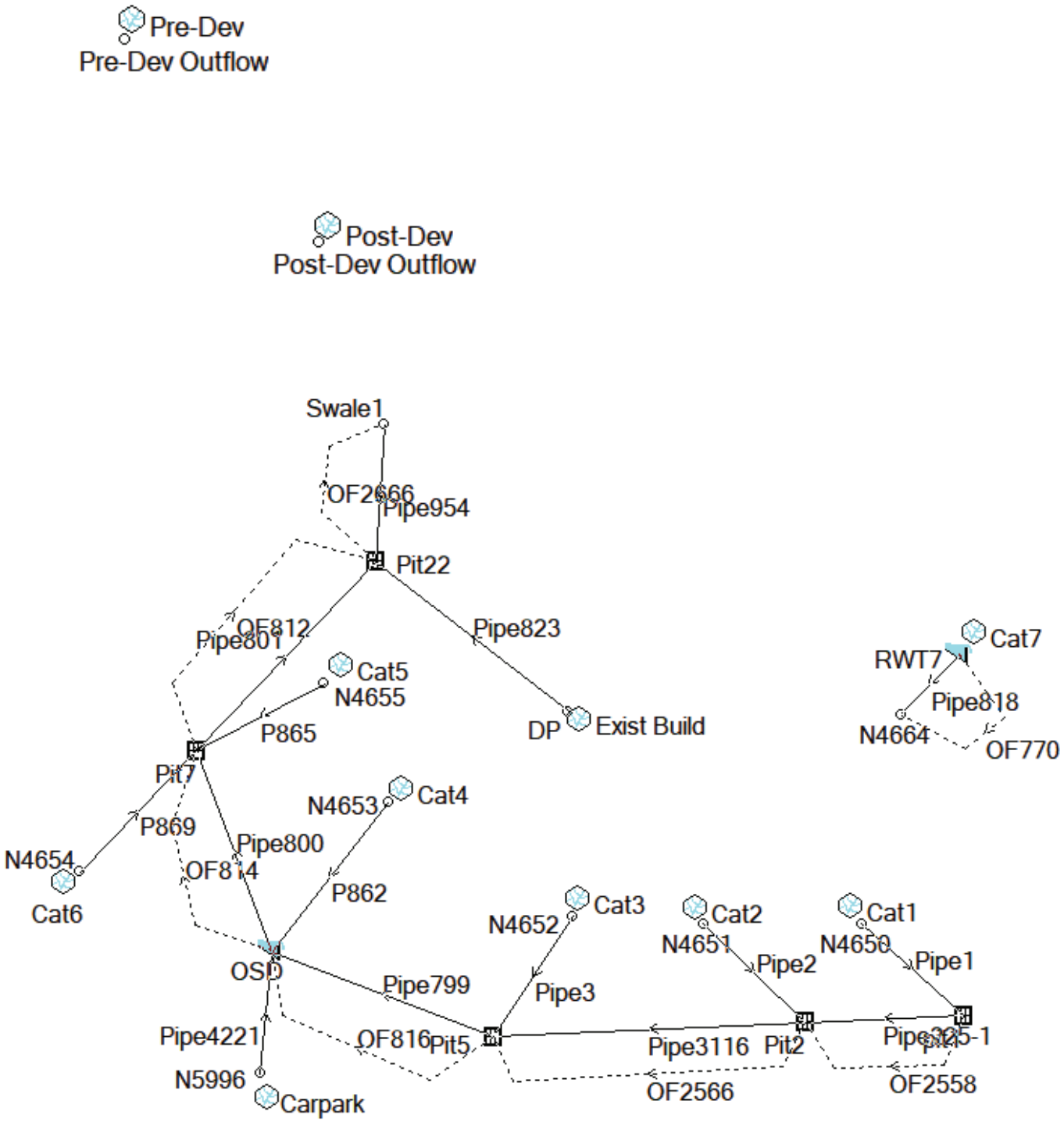
for
NSW Department of Education

Drawing Title
SOIL AND EROSION
SEDIMENT CONTROL PLAN

Date: 14/03/2018
Scale: 1:1000 @ A1

Drawing Reference: 7070-BIRZ-SW-13
Revision: C

APPENDIX A - DRAINS MODEL



DRAINS results prepared from Version

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4664	98.23		0				
DP	98.12		0.126				
Pit22	97.55		0		0.49	0	None
Swale1	96.29		0				
N4650	100.97		0.022				
pit1	100.82		0		0.93	0	None
Pit2	100.78		0		0.92	0	None
Pit5	100.48		0		0.82	0	None
Pit7	98.15		0		0.39	0	None
N4651	101.01		0.027				
N4652	101.01		0.041				
N4653	99.12		0.037				
N4654	98.78		0.023				
N4655	98.8		0.035				
N5996	100.65		0.098				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Pre-Dev	0.596	0.519	0.17	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Cat7	0.047	0.047	0	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Exist Build	0.126	0.119	0.013	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Post-Dev	0.803	0.736	0.143	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Cat1	0.022	0.022	0	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Cat2	0.027	0.027	0	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Cat3	0.041	0.041	0	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Cat4	0.037	0.037	0	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Cat6	0.023	0.023	0	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Cat5	0.035	0.035	0	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Carpark	0.098	0.094	0.005	5	10	5	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2

Outflow Volumes for Total Catchment (7.09

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 5 minutes storm, average 111	1197.05	275.87 (23.0%)	275.87 (42.0%)	0.00 (0.0%)
AR&R 5 year, 30 minutes storm, average	3086.45	1439.47 (46.6%)	1223.57 (72.3%)	215.89 (15.5%)
AR&R 5 year, 1 hour storm, average 31.5	4076.45	2128.30 (52.2%)	1720.14 (77.0%)	408.16 (22.2%)
AR&R 5 year, 2 hours storm, average 20.2	5228.1	2854.31 (54.6%)	2297.79 (80.2%)	556.52 (23.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe818	0.009	3.23	101.231	98.231	AR&R 5 year, 2 hours storm, average 20.2 mm/h, Zone 2
Pipe823	0.125	1.93	98.119	97.557	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe954	0.215	3.85	97.289	96.293	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe1	0.022	1.18	100.975	100.823	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe225-1	0.022	0.48	100.806	100.778	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe3116	0.049	1.07	100.691	100.484	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe799	0.09	2	100.192	99.728	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe800	0.041	1.27	98.26	98.15	AR&R 5 year, 1 hour storm, average 31.5 mm/h, Zone 2
Pipe801	0.09	2.42	98.047	97.588	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe2	0.027	1.46	101.009	100.778	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe3	0.041	2.2	101.009	100.484	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
P862	0.037	2	99.122	98.999	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
P869	0.023	2.59	98.775	98.15	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
P865	0.035	2.85	98.797	98.15	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2
Pipe4221	0.098	4.15	100.653	99.623	AR&R 5 year, 30 minutes storm, average 47.7 mm/h, Zone 2

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Stor
OF770	0	0	0.007	0	0	0	0	0
OF2666	0	0	0.908	0	0	0	0	0
OF2558	0	0	0.908	0	0	0	0	0
OF2566	0	0	0.908	0	0	0	0	0
OF816	0	0	0	0	0	0	0	0
OF814	0	0	0.018	0	0	0	0	0
OF812	0	0	0.007	0	0	0	0	0

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level	
RWT7	104.11	46.6	0.009	0.009	0	
OSD	99	134	0.041	0.041	0	

CONTINUITY CHECK for AR&R 5 year, 30

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Pre-Dev Outflow	482.71	482.71	0	0
RWT7	34.12	0	34.12	0
N4664	0	0	0	0
DP	94.5	94.41	0	0.1
Pit22	229.19	227.86	0	0.6
Swale1	227.86	227.86	0	0
Post-Dev Outflow	622.46	622.46	0	0
N4650	15.85	15.84	0	0.1
pit1	15.84	15.77	0	0.4
Pit2	35.29	35.3	0	0
Pit5	64.76	64.7	0	0.1
OSD	163.16	93.94	69.21	0
Pit7	136.13	134.78	0	1
N4651	19.59	19.52	0	0.4
N4652	29.42	29.45	0	-0.1
N4653	26.79	26.57	0	0.8
N4654	16.8	16.79	0	0.1
N4655	25.41	25.4	0	0.1
N5996	71.82	71.88	0	-0.1

Run Log for Armidale_OSD_v4.drn run at
No water upwelling from any pit. Freeboard
Flows were safe in all overflow routes.

DRAINS results prepared from Version 2018.05

PIT / NODE DETAILS

Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4664	98.25			0			
DP	98.19			0.188			
Pit22	97.8			0		0.24	0 None
Swale1	96.33			0			
N4650	102			0.03			
pit1	101.73			0		0.02	0 None
Pit2	101.64			0		0.06	0 None
Pit5	101.11			0		0.19	0 None
Pit7	98.18			0		0.36	0 None
N4651	102.07			0.037			
N4652	102.07			0.056			
N4653	99.65			0.051			
N4654	98.79			0.032			
N4655	98.83			0.048			
N5996	100.68			0.135			

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Pre-Dev	1.147	0.706	0.55	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Cat7	0.065	0.065	0	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Exist Build	0.188	0.162	0.034	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Post-Dev	1.345	1	0.433	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Cat1	0.03	0.03	0	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Cat2	0.037	0.037	0	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Cat3	0.056	0.056	0	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Cat4	0.051	0.051	0	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Cat6	0.032	0.032	0	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Cat5	0.048	0.048	0	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Carpark	0.135	0.128	0.009	5	10	5	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2

Outflow Volumes for Total Catchment
(7.09 impervious + 5.85 pervious =
12.9 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 155 mm/h, Zone 2	1671.56	517.82 (31.0%)	513.88 (56.1%)	3.95 (0.5%)
AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2	4192.92	2531.36 (60.4%)	1778.56 (77.4%)	752.79 (39.7%)
AR&R 20 year, 1 hour storm, average 42.3 mm/h, Zone 2	5474.08	3494.28 (63.8%)	2421.18 (80.7%)	1073.10 (43.4%)
AR&R 20 year, 2 hours storm, average 26.8 mm/h, Zone 2	6936.43	4535.00 (65.4%)	3154.67 (83.0%)	1380.33 (44.0%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe818	0.02	4.08	101.247	98.247	AR&R 20 year, 1 hour storm, average 42.3 mm/h, Zone 2
Pipe823	0.182	1.95	98.194	97.8	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe954	0.291	4.14	97.327	96.33	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe1	0.03	1.61	102.002	101.726	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe225-1	0.03	0.65	101.694	101.644	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe3116	0.067	1.45	101.485	101.11	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe799	0.122	2.65	100.574	99.742	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe800	0.048	1.3	98.282	98.181	AR&R 20 year, 1 hour storm, average 42.3 mm/h, Zone 2
Pipe801	0.114	2.66	98.062	97.8	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe2	0.037	1.99	102.065	101.644	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe3	0.056	2.99	102.067	101.11	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
P862	0.051	2.72	99.651	99.31	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
P869	0.032	2.79	98.791	98.181	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
P865	0.048	2.85	98.831	98.181	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2
Pipe4221	0.135	4.48	100.681	99.651	AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	
OF770	0	0	0.206	0	0	0	0	0
OF2666	0	0	1.479	0	0	0	0	0
OF2558	0	0	1.479	0	0	0	0	0
OF2566	0	0	1.479	0	0	0	0	0
OF816	0	0	0.288	0	0	0	0	0
OF814	0	0	0.362	0	0	0	0	0
OF812	0	0	0.206	0	0	0	0	0

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level	
RWT7	104.19	47.9	0.02	0.02		0
OSD	99.31	208.6	0.048	0.048		0

CONTINUITY CHECK for AR&R 20 year, 30 minutes storm, average 64.8 mm/h, Zone 2

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Pre-Dev Outflow	944.82	944.82	0	0
RWT7	49.59	4.16	45.43	0
N4664	4.16	4.16	0	0
DP	149.68	149.56	0	0.1
Pit22	321.15	319.41	0	0.5
Swale1	319.41	319.41	0	0
Post-Dev Outflow	1086.7	1086.7	0	0
N4650	23.04	23.04	0	0
pit1	23.04	22.96	0	0.3
Pit2	51.36	51.37	0	0
Pit5	94.17	94.02	0	0.2
OSD	238.83	111.82	127.01	0
Pit7	173.14	171.59	0	0.9
N4651	28.47	28.4	0	0.3
N4652	42.77	42.81	0	-0.1
N4653	38.94	38.72	0	0.6
N4654	24.41	24.4	0	0
N4655	36.94	36.92	0	0
N5996	105.99	106.09	0	-0.1

Run Log for Armidale_OSD_v4.drn run at 14:56:27 on 12/6/2018
No water upwelling from any pit.
Freeboard was less than 0.15m at Pit2, pit1

Flows were safe in all overflow routes.

APPENDIX B

MANUFACTURER'S SPECIFICATIONS & INSTALLATION

OCEAN PROTECT

Vortechs

Operations & Maintenance Manual

Table of Contents

Introduction

The primary purpose of stormwater treatment devices is to capture and prevent pollutants from entering waterways, maintenance is a critical component of ensuring the ongoing effectiveness of this process. The specific requirements and frequency for maintenance depends on the treatment device and pollutant load characteristics of each site. This manual has been designed to provide details on the cleaning and maintenance processes as recommended by the manufacturer.

The Vortechs system is a high-performance hydrodynamic separator that effectively removes fine sediment, oil and grease, as well as floating and sinking pollutants. Its swirl concentrator and flow control features, work together to minimise turbulence and provide stable storage of captured pollutants. The design also allows for easy inspection and unobstructed maintenance access.

Why do I need to perform maintenance?

Adhering to the maintenance schedule of each stormwater treatment device is essential to ensuring that it works properly throughout its design life.

During each inspection and clean, details of the mass, volume and type of material that has been collected by the device should be recorded. This data will assist with the revision of future management plans and help determine maintenance interval frequency. It's also essential that qualified and experienced personnel carry out all maintenance (including inspections, recording and reporting) in a systematic manner.

Maintenance of your stormwater management system is essential to ensuring ongoing at-source control of stormwater pollution. Maintenance also helps prevent structural failures (e.g. prevents blocked outlets) and aesthetic failures (e.g. debris build up).

Health and Safety

Access to a Vortechs unit requires removing heavy access covers/grates, additionally it might become necessary to enter into a confined space. Pollutants collected by the Vortechs will vary depending on the nature of your site. There is potential for these materials to be harmful. For example, sediments may contain heavy metals, carcinogenic substances or objects such as broken glass and syringes. For these reasons, all aspects of maintaining and cleaning your Vortechs require careful adherence to Occupational Health and Safety (OH&S) guidelines.

It is important to note that the same level of care needs to be taken to ensure the safety of non-work personnel, as a result it may be necessary to employ traffic/pedestrian control measures when the device is situated in, or near areas with high vehicular/pedestrian activity.

Personnel health and safety

Whilst performing maintenance on the Vortechs, precautions should be taken in order to minimise (or, when possible, prevent) contact with sediment and other captured pollutants by maintenance personnel. In order to achieve this the following personal protective equipment (PPE) is recommended:

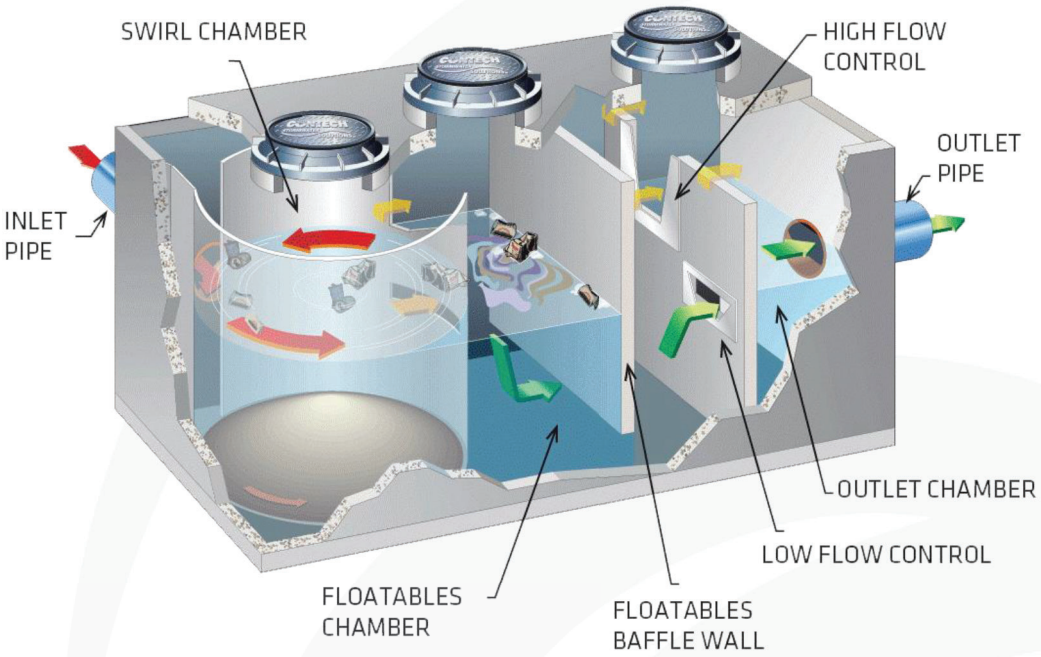
- Puncture resistant gloves
- Steel capped safety boots
- Long sleeve clothing, overalls or similar skin protection
- Eye protection
- High visibility clothing or vest

During maintenance activities, it may be necessary to implement traffic control measures. Ocean Protect recommend that a separate site specific traffic control plan is implemented as required to meet the relevant governing authority guidelines.

Whilst the minor maintenance for the Vortechs can be performed from surface level, there may be a need to enter the pit (confined space) during major services. It is recommended that all maintenance personnel evaluate their own needs for confined space entry and compliance with relevant industry regulations and guidelines. Ocean Protect maintenance personnel are fully trained and carry certification in confined space entry requirements.

How does it Work?

Stormwater enters the swirl chamber at a tangent, creating a swirling flow pattern and enhancing gravitational separation. Sinking pollutants stay in the swirl chamber while floating pollutants are stopped at the floatables baffle wall. During larger storms, the water level rises above the low flow control and begins to flow through the high flow control.



As a storm event increases in intensity, the swirling action increases proportionately, this assists in in the prevention of re-suspension. When flowing at peak capacity, the water surface in the system approaches the top of the high flow control. The Vortechs should be sized so that previously captured pollutants are retained in the system even during these infrequent events. As a storm subsides, treated runoff decants out of the Vortechs system at a controlled rate, restoring the water level to a dry-weather level equal to the invert of the inlet and outlet pipes.

Maintenance Procedures

To ensure optimal performance, it is advisable that regular maintenance is performed. Typically, the Vortechs requires a minor service every 6 months and a major service every 12 months.

Primary Types of Maintenance

The table below outlines the primary types of maintenance activities that typically take place as part of an ongoing maintenance schedule for the Vortechs.

	Description of Typical Activities	Frequency
Minor Service	Visual inspection of swirl, floatables and outlet chambers Removal of large floatable pollutants Measuring of sediment depth	At 6 Months
Major Service	Removal of accumulated sediment and gross pollutants Inspection of the swirl chamber, baffle wall and outlet controls	At 12 Months

Maintenance requirements and frequencies are dependent on the pollutant load characteristics of each site. The frequencies provided in this document represent what the manufacturer considers to be best practice to ensure the continuing operation of the device is in line with the original design specification.

Minor Service

This service is designed to assess the condition of the device and record necessary information that will inform the activities to be undertaken during a major service.

1. Establish a safe working area around the access point
2. Remove access cover over the swirl chamber
3. Visually inspect the chamber
4. Remove large floatable pollutants with a net
5. Measure and record sediment depth
6. Replace access cover
7. Repeat steps 2-6 for floatable and outlet chambers

Major Service

This service is designed to return the Vortechs device back to optimal operating performance.

1. Establish a safe working area around the access point
2. Remove access cover over the swirl chamber
3. Using a vacuum unit remove any floatable pollutants
4. Decant water until water level reaches accumulated sediment
5. Remove accumulated sediment and gross pollutants with vacuum unit (if required)
6. Repeat steps 2-5
7. Inspect the swirl chamber, baffle wall and outlet controls
8. Use high pressure water to clean sump area (if required)
9. Replace access covers

When determining the need to remove accumulated sediment from the Vortechs unit, the specific sediment storage capacity for the size of unit should be considered (see table below).

Vortechs Model	Swirl Chamber Diameter (m)	Sediment Storage Capacity (m^3)
VX1000	0.9	0.5
VX2000	1.2	0.9
VX3000	1.5	1.4
VX4000	1.8	1.8
VX5000	2.1	2.4
VX7000	2.4	3.1
VX9000	2.7	3.7
VX11000	3.0	4.3
VX16000	3.7	5.4

Additional Types of Maintenance

The standard maintenance approach is designed to work towards keeping the Vortechs operational during normal conditions. From time to time, events on site can make it necessary to perform additional maintenance to ensure the continuing performance of the device.

Hazardous Material Spill

If there is a spill event on site, the Vortechs unit that potentially received flow should be inspected and cleaned. Specifically, all captured pollutants and liquids from within the unit should be removed and disposed in accordance with any additional requirements that may relate to the type of spill event.

Blockages

In the unlikely event that flooding occurs upstream of the Vortechs system, the following steps should be undertaken to assist in diagnosing the issue and determining the appropriate response.

1. Inspect the upstream diversion structure (if applicable) ensuring that it is free of debris and pollutants
2. Decant water from Vortechs unit in preparation for confined space entry
3. Inspect the high flow and low flow control elements as well as both inlet and outlet pipes for obstructions, if present remove any built up pollutants or blockages.

Major Storms and Flooding

In addition to the scheduled activities, it is important to inspect the condition of the Vortechs after a major storm event. The focus is to inspect for higher than normal sediment accumulation that may result from localised erosion, where necessary accumulated pollutants should be removed and disposed.

Disposal of Waste Materials

The accumulated pollutants found in the Vortechs must be handled and disposed of in a manner that is in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. If the system has been exposed to any hazardous or unusual substance, there may be additional special handling and disposal methods required to comply with relevant government/authority/industry regulations.

Maintenance Services

With over a decade and a half of maintenance experience Ocean Protect has developed a systematic approach to inspecting, cleaning and maintaining a wide variety of stormwater treatment devices. Our fully trained and professional staff are familiar with the characteristics of each type of system, and the processes required to ensure its optimal performance.

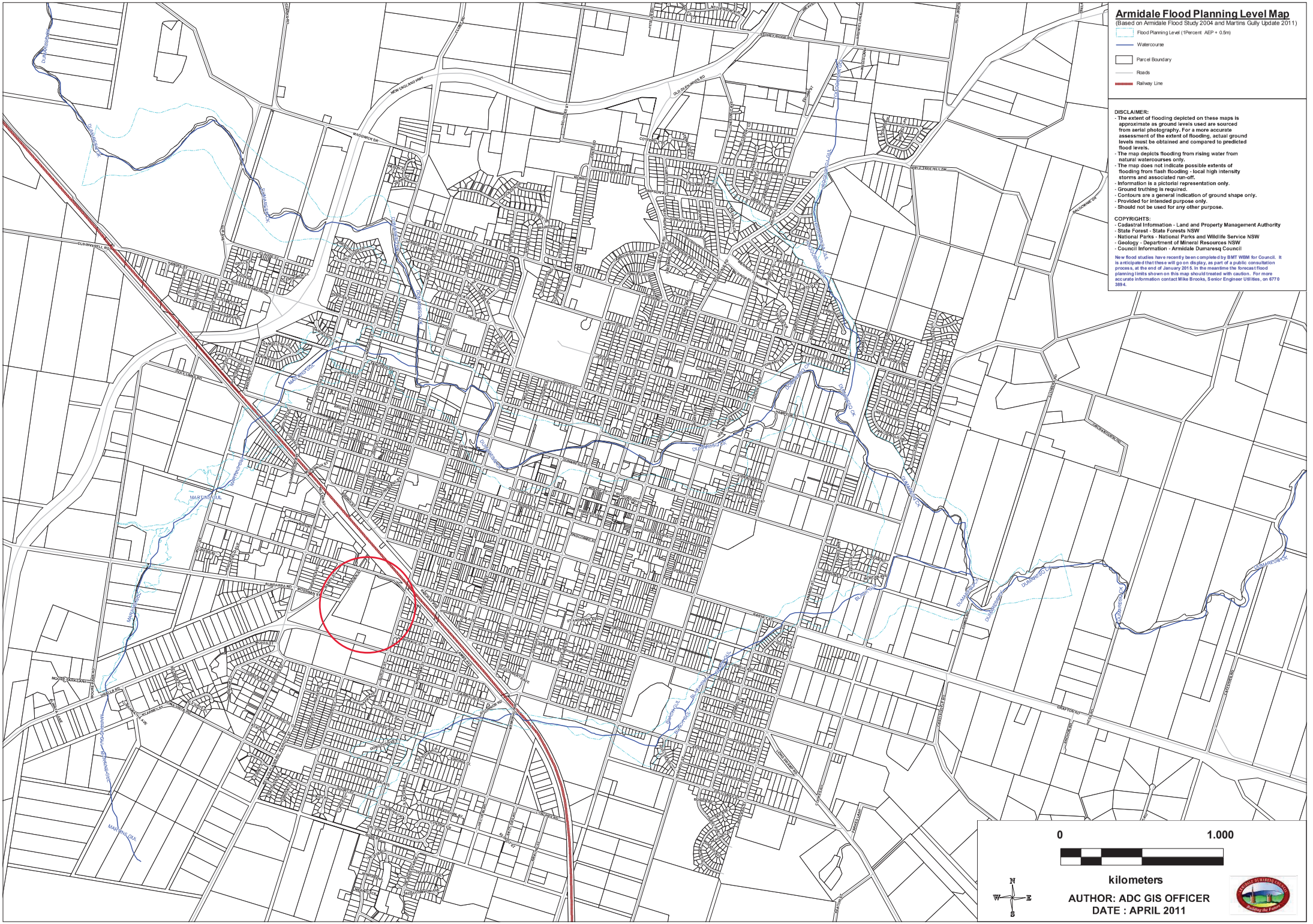
Ocean Protect has several stormwater maintenance service options available to help ensure that your stormwater device functions properly throughout its design life. In the case of our Vortechs system we offer long term pay-as-you-go contracts and pre-paid once off servicing.

For more information please visit www.OceanProtect.com.au

APPENDIX C

FLOOD PLANNING LEVEL MAP

ARMIDALE REGIONAL COUNCIL


Armidale Flood Planning Level Map
(Based on Armidale Flood Study 2004 and Martins Gully Update 2011)
Flood Planning Level (1Percent AEP + 0.5m)
Watercourse
Parcel Boundary
Roads
Railway Line
DISCLAIMER:
- The extent of flooding depicted on these maps is approximate as ground levels used are sourced from aerial photography. For a more accurate assessment of the extent of flooding, actual ground levels must be obtained and compared to predicted flood levels.
- The map depicts flooding from rising water from natural watercourses only.
- The map does not indicate possible extents of flooding from flash flooding - local high intensity storms and associated run-off.
- Information is a pictorial representation only.
- Ground truthing is required.
- Contours are a general indication of ground shape only.
- Provided for intended purpose only.
- Should not be used for any other purpose.
COPYRIGHTS:
- Cadastral Information - Land and Property Management Authority
- State Forest - State Forests NSW
- National Parks - National Parks and Wildlife Service NSW
- Geology - Department of Mineral Resources NSW
- Council Information - Armidale Dumaresq Council
New flood studies have recently been completed by BMT WBM for Council. It is anticipated that these will go on display, as part of a public consultation process, at the end of January 2015. In the meantime the forecast flood planning limits shown on this map should treated with caution. For more accurate information contact Mike Brooks, Senior Engineer Utilities, on 6770 3894.
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W
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AUTHOR: ADC GIS OFFICER
DATE : APRIL 2011

APPENDIX D

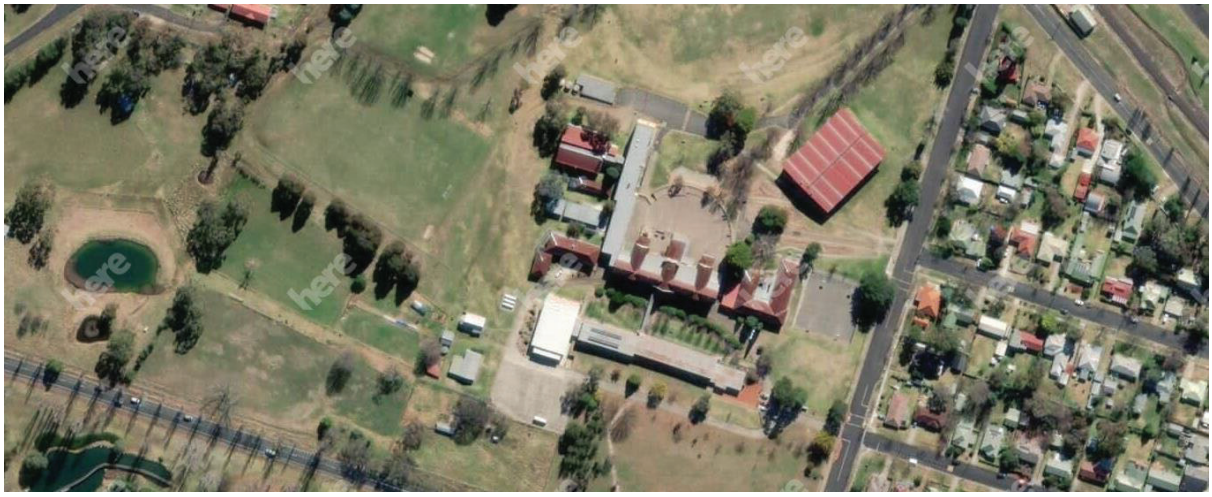
CONSTRUCTION MAP DURING WET WEATHER


After wet weather events the Site Manager & WHS&E Advisor will complete a site walk to review how construction works will be completed and if changes are required.
In addition a Geotechnical engineer will be on site weekly and will review all steep batters and cut areas to ensure they are stable.
Weekly walks are completed to review all sediment controls and decisions will be made on what is required to be reinstated, repaired or where additional sediment controls are required.
Truck Wash Down Area
Site sheds, amenities & storage containers. Which have covered walk ways with temporary Geohex & DGB paths for access. All sheds and containers are raised to prevent any water access. This area has a natural fall, so in the event of heavy rain the water will not pool. In addition there are silt fences surrounding the site compound to catch any sediment run off.
Site parking,using an old basketball slab and the extension made from crushed concrete
28 Apr
skyviewaerial.com.au

Appendix J – Unexpected Finds Protocol

UNEXPECTED FINDS PROCEDURE (ASBESTOS)

Armidale High School



PREPARED FOR:

DEMEX
Demolition | Excavation | Asbestos
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Client: Demex

Project: Armidale High School

Title: Unexpected Finds Procedure

Reference: 156675_UFP_RS_01052019

Status: Final

Report Date: 1st May 2019

Document Production Record

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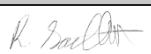
Prepared By		Richard Southam	
Checked By		Richard Southam	
Approved By		Matt Campbell	

Document Revision Record

Issue Number	Date	Revision Details
1	1st May 2019	Issued for site use

SERS
Site Environmental and Remediation Services

CONTENTS

1. Purpose of the Unexpected Finds Procedure

Following the frequent discovery of potential Asbestos Containing Materials (PACM) onsite at Armidale High School, DEMEX requested SERS develop an Unexpected Finds (UF) Procedure.

The purpose of this procedure is to ensure that all DEMEX operatives and subcontractors are aware of the correct method of dealing with PACM finds during works processes onsite and the steps to follow to mitigate risk to unprotected personnel.

2. Initiation of the Unexpected Finds Procedure.

If PACM are uncovered during works, it is the responsibility of the staff member to report this find immediately to the Demex Site Supervisor or onsite management. Works must be halted within the vicinity of the PACM. If the location can be safely marked and barricaded, this should be carried out. If not, it is advised that the staff member exit the immediate area, remain within 10 metres of the potential ACM to warn other staff of the risk and to await further instruction or assistance from the management team. The management team and site supervisors will then exclude the area until the onsite Licensed Asbestos Assessor (LAA) can conduct a suitable investigation.

To re-iterate the key points above, upon discovery of PACM the following should be carried out:

1. Stop work and inform management or site supervisor of the PACM.
2. Egress from immediate area and warn other staff to stay clear of the area.
3. Barricade the area if possible or await further assistance.
4. Management will exclude the area and re-direct staff to other tasks.
5. Onsite LAA will attend to conduct assessment.

Once Demex have been made aware of the unexpected find, they must notify a staff member of RCC. RCC will then witness the unexpected find with Stuart Collett and document the required information. From this an early warning is sent to Stuart Collett from RCC containing, Images, a completed unexpected find form an any other relevant information.

3 Initial Investigation by Licensed Asbestos Assessor

Once the area has been excluded, the LAA will attend to determine the risk posed by the PACM, the PPE/RPE required for the investigation, the extent of the potential contamination, whether further works or equipment are required to delineate the extent, the likely quantities of materials and to help develop an appropriate remediation strategy. Should the LAA require assistance in the investigation, it is highly advised that assisting staff are trained as Licensed Asbestos Removalists (LAR).

If contamination is observed to be of a significant level (ie. Greater than $5m^3$) soil sampling must be conducted to the appropriate levels for delineation and waste classification as per the WSP Remedial Action Plan (RAP) for the site:

- Volumes up to $200m^3$ require one sample per every $25m^3$ of soil;
- From $200m^3$ to $3000m^3$, 10 samples are required;
- Levels greater than $3000m^3$ require a sample to be taken every $250m^3$

The following steps should be carried out by the LAA prior to entry to the potentially ACM impacted area:

1. Selection and usage of PPE/RPE appropriate to the task.
2. Visual observation of the barricade boundary to ensure it encompasses all of the contamination readily identified. Redefining boundary as required.
3. Conduct visual assessment throughout the barricaded area to identify the extent of the material, type, friability and condition.
4. Determine if additional materials must be removed to categorise the extent of the contamination by removing walls, flooring, soils etc.
5. Sampling of all different types of PACM and estimated quantities.
6. Log location of UF area and capture photographic record.
7. Send sample to NATA accredited laboratory for analysis.

4 Awaiting Results

While the sampling results are pending, all UF areas must be treated as containing Asbestos. Any unauthorised entry in these areas must be prohibited. If entry to an UF area must be gained, then it is a requirement that the entrant should follow all entry procedures as advised by the LAA.

Disturbance of any kind within the UF area can result in potential fibre release or the unintentional contamination of adjacent areas. As such, entry to the UF area should be kept to a minimum.

5 Reporting Results

Once NATA Accredited sample results have been received, it is the responsibility of the LAA to present the information in a clear and concise way. The most appropriate measure is the development of mapping, detailing the sampling locations of the materials, the presence of ACM, the friability and the likely extent and providing a photographic record of the material types sampled.

Alongside the mapping, the LAA should assist Demex with appropriate remediation strategies to successfully remove the risk from the area. The LAA should provide multiple options, as far as reasonably practicable, to the client. These remediation strategies should be considered in conjunction with the RAP and the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia May 2009.

At the conclusion of Step 5, the following tasks should have been completed:

1. Sampling results provided to client with appropriate report.
2. Mapping and/or photographs provided detailing at minimum the Asbestos Containing Materials identified and if it is friable.
3. Provide assistance in the development of suitable remediation methods

6 Approval of UF and remediation works

Once remediation of the UF is approved and prior to commencement of the remediation works, the LAA should determine the risk of fibre release during the removal works, the proximity of other trades operating in the vicinity and if there are any potential impacts to the public.

The need for respirable fibre air monitoring or an enclosure will be determined by the LAA. The PPE/RPE requirement will be specified by the Licensed Asbestos Removalist Supervisor prior to the commencement of works. If a spotter needs to be engaged for the works, it is recommended that the spotter be a Licensed Asbestos Removalist. During soil removal works, the spotter can situate themselves closer to the excavated area, potentially identifying any additional materials being unearthed and assisting the LAA to expand the area if required.

Soil remediation works must be conducted in conjunction with the remediation methods outlined in the RAP which can be found in **Appendix A** at the end of this document

1. LAA to determine the risks to staff and institute controls or monitors as required.
2. LAR supervisor to determine appropriate PPE/RPE and decontamination needed for the task.
3. LAR spotter to be engaged for ACM impacted soil works.
4. LAA to regularly attend area to assess progress and inspect for hot spots.
5. Once works are complete, LAR supervisor to advise LAA to attend for clearance or validation purposes.

7 Clearance or Validation Procedure

Once notified by the LAR supervisor that they are confident the area is successfully remediated, the LAA will attend to conduct a visual inspection, prior to demobilisation of staff or equipment.

The LAA will visually inspect all areas immediately surrounding the UF barricaded area to determine if cross contamination has occurred. The LAA will then enter the UF area and visually assess for the presence of Asbestos. If the remediation of the work area is not to a satisfactory standard, the LAA will instruct the LAR supervisor that additional removal works need to occur, and the LAR staff will continue until it is to a satisfactory standard.

Once the area is considered to be of satisfactory standard, the LAA will carry out soil validation samples or clearance air monitoring as deemed necessary by the LAA. Clearance air monitoring is a mandatory requirement for all friable removal works and will be carried out in all cases.

Validation soil sampling will be carried out in accordance with NEPM Schedule B2 guidelines, or in accordance with *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia May 2009.*

8 Relevant Legislation and Guidelines

In dealing with hazardous containing materials generally the following pieces of Legislation, Codes of Practice and Guidance Notes are required to be adhered to by all stakeholders within New South Wales:

- *Work Health and Safety Act 2011 (New South Wales);*
- *Work Health and Safety Regulation 2011 (New South Wales);*
- *Contaminated Land Management Act 1997 (New South Wales);*
- *AS 2601-2001 Demolition of Structures;*
- *Code of Practice – How to Safely Remove Asbestos (Safe Work Australia, 2016);*
- *Code of Practice – How to Manage and Control Asbestos in the Workplace (Safe Work Australia, 2016);*
- *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC:3003(2005)];*
- *Adopted National Exposure Standards for Atmospheric Contaminates in the Occupational Environment [NOHSC:1003(1995)];*
- *Atmospheric Contaminates in the Occupational Environment [NOHSC:1003(1995)];*
- *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia May 2009;*
- *NEPM Schedule B1 and B2 - Guideline on site characterisation*

9 Disposal Of Material

Any material contaminated material to be removed from site, will require the below information to be submitted to the Planning Secretary:

- -Disposal
- -Location
- Results of testing

This information is required to be submitted to Planning prior to the removal of the contaminated material from site.

When waste is being removed from site it must secured and maintained at all times. Concrete waste and rinse water from the contamination are not to be disposed of on site or enter any natural or artificial watercourse.

Appendix A: Soil Remediation Guidelines

REMEDIATION METHODOLOGY	DESCRIPTION	ASSESSMENT	RECOMMENDATION
Treatment	Treatment technologies are used to permanently and significantly reduce the toxicity, mobility or volume of contaminated wastes. Generally, treatment technologies may be targeted towards in situ or ex situ remediation and include biological, thermal and physical/chemical treatment and containment.	For the contamination identified at the site, asbestos and PAHs, treatment technologies are minimal and not considered practical.	Not recommended
Removal to landfill	Removal to landfill involves physically moving impacted soil to an off-site location for storage, treatment or disposal. If the chemical concentrations of the impacted soil exceed the landfill criteria stipulated within the NSW EPA (2014) *Waste Classification Guidelines*, treatment of the soil material may be required prior to disposal. Excavation and disposal will remove impacted material and subsequently any ongoing liability or need for any long-term management.	Based on the soil results obtained during the soil assessments, material to be excavated from the site is likely to be a mixture of general solid waste and special waste (asbestos), with the possibility that some material may also be classified as restricted solid waste. Disposal costs can vary depending on quantity of material requiring disposal, disposal facility selection, and changes in government environmental levies.	Recommended

REMEDIATION METHODOLOGY	DESCRIPTION	ASSESSMENT	RECOMMENDATION
Physical barrier systems	Physical barrier systems (or capping) limit access to the impacted material, mitigate surface water infiltration through the underlying material, and control or reduce migration of the substances into the surrounding environment. This option can include creating barriers around and on top of the impacted material in place, or relocating the impacted material to a constructed encapsulation area. In addition, the barrier may also be used to control the emission of odours and gases/vapours, reduce erosion and improve aesthetics.	The impacts identified at the site are present in the surface 0.2 mBGL of soil; which makes capping impractical. The cap would need to be built on top of the existing ground surface, and would therefore be unsightly and difficult to maintain. In addition, some of the impacts will be excavated as part of the redevelopment works.	Not recommended
Institutional controls	Institutional controls include measures such as land use restriction through zoning, site management and access restrictions, restrictions on intrusive works, and relocation of receptors. Although exposure can be reduced by these means, the impacted media are not directly affected or treated. Institutional controls are sometimes used in conjunction with other remedial options in order to manage potential risks from residual materials.	Changing the use of the site is not practical and would not meet the goals of the client, and therefore this strategy on its own is not considered an appropriate option.	Not recommended

REMEDIATION METHODOLOGY	DESCRIPTION	ASSESSMENT	RECOMMENDATION
No action	No remediation is undertaken, and soil impacts remain in place.	The elevated concentrations of contaminants present an unacceptable potential risk to human under the proposed future land use for the site. Therefore, taking no action to address the identified contamination is considered inadvisable and has not been considered in further detail.	Not recommended

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