Rustler's Roost & Quest 29 Open-Cut Mine Redevelopment

Erosion and Sediment Control Plan
Volume 4: Appendix D.1 to Appendix H.1
September 2021

RELIANCE, USES and LIMITATIONS

This study, report and analyses have been based on the information available to Surface Water & Erosion Solutions and Elder Enviro Pty Ltd at the time of preparation. Surface Water & Erosion Solutions and Elder Enviro Pty Ltd accepts responsibility for the report and its conclusions to the extent that the information was sufficient and accurate at the time of preparation. Surface Water & Erosion Solutions and Elder Enviro Pty Ltd do not take responsibility for errors and omissions due to incorrect information or information not available at the time of preparation of the study, report, or analyses.

Photograph Cover Sheet: Rustler's Roost Pit looking north July 2021. Photograph: K Evans 2021

ACRONYMS & ABBREVIATIONS

BOM	Bureau of Meteorology
CPEng	Chartered Professional Engineer
CPESC	Certified Professional in Erosion and Sediment Control
EMSP	Environmental Management System and Plans
ESCP	Erosion and Sediment Control Plan
IECA	International Erosion Control Association
LOM	Life of Mine
ML	Mineral Lease
MMP	Mining Management Plan
NT	Northern Territory
RR	Rustler's Roost
TSF	Tailing Storage Facility
WMP	Water Management Plan
WRD	Waste rock dump

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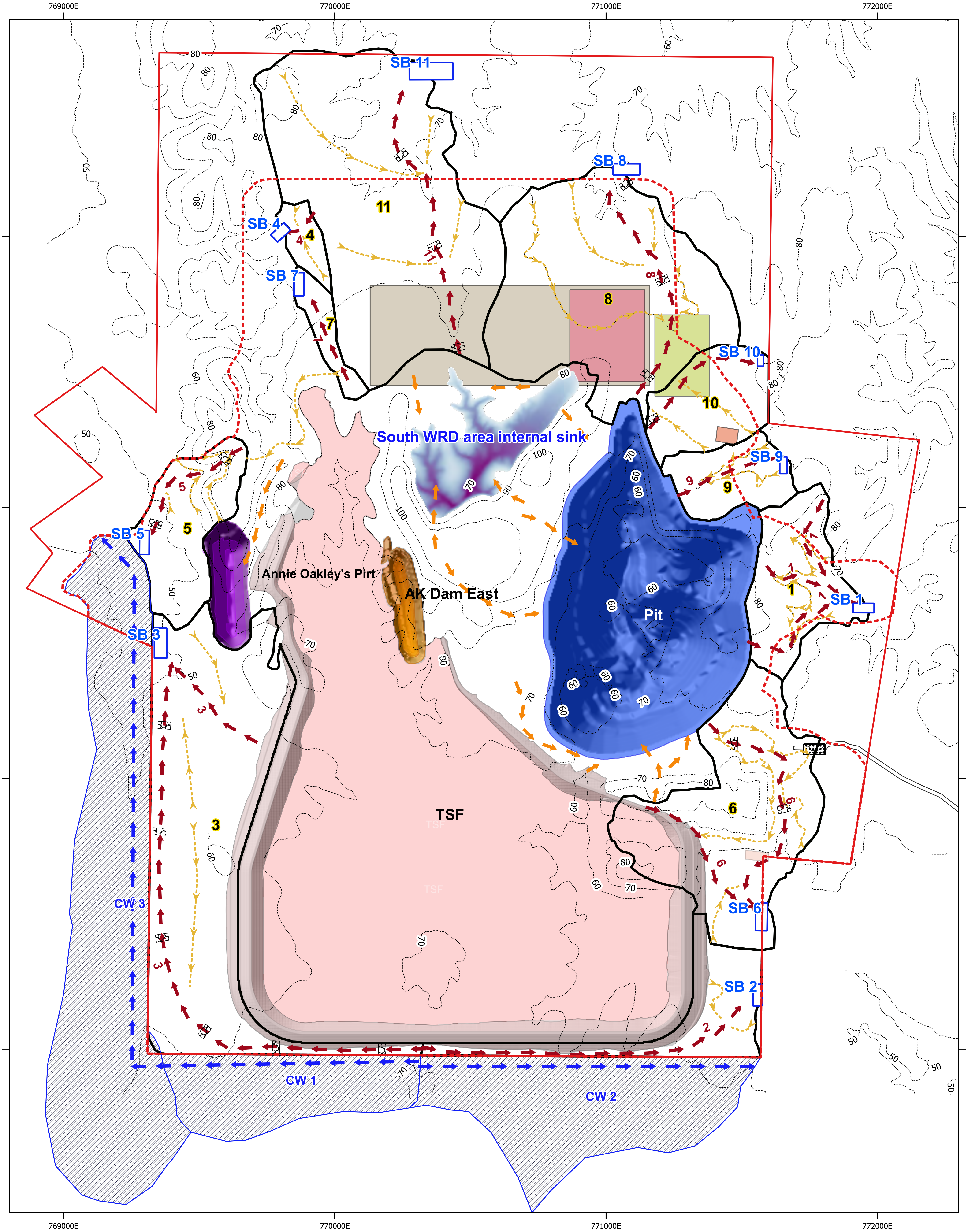
Appendix D.1 RR Catchments and Drainage at Stage 1



Legend

Construction Exit	Diversion Bunds/Graded Banks	Diversion Channels	Clean_water	ROM
Haul Road	Temporary Check Dams	Flow Diversion Bunds	Clean Water Channels	Lay down
	Mineral Lease Disturbed Area	Catch drains	Closure Catchments	Administration Office
		Internal flow paths	GRES Plant Area	

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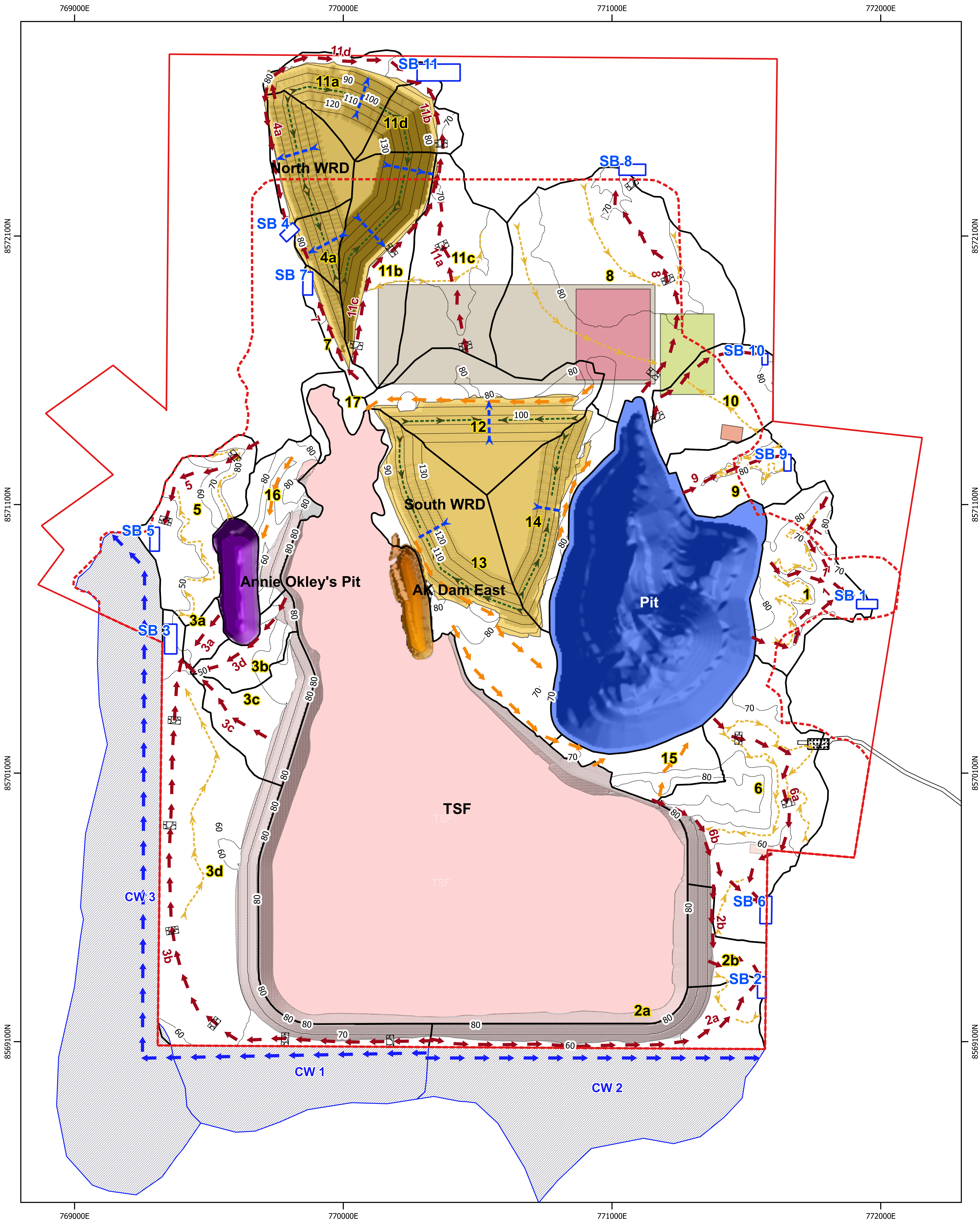
Appendix D.1		Project	Title	Designed / Drawn / Checked / Sheet Size A3
		Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment - Erosion & Sediment Control Plan	RR Catchments and Drainage at Stage 1	Date / Sheet No.

Appendix D.2. RR Catchments and Drainage at Closure



Legend

- Construction Exit
- Haul Road
- Diversion Bunds/Graded Banks
- Temporary Check Dams
- Mineral Lease Disturbed Area
- Diversion Channels
- Flow Diversion Bunds
- Catch drains
- Internal flow paths
- Clean_water
- Clean Water Channels
- Closure Catchments
- GRES Plant Area
- ROM
- Lay down
- Administration Office

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Appendix D.2	Surface Water & Erosion Solutions / elder enviro	Project: Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment - Erosion & Sediment Control Plan	Title: RR Catchments and Drainage at Closure	Designed	Drawn	Checked	Sheet Size: A3
20				Date			Sheet No.

Appendix D.3. Flow Diversion Bank Calculations RR

Offsite Clean Water Diversion Banks												
Basin	Catchment Area (ha)	Time of Concentration (min)	Rainfall Intensity (mmh^{-1})	C10 Runoff Coefficient	Design Flows (m^{3}s^{-1})	Bottom Width (m)	Depth (m)	Freeboard (m)	Total Depth (m)	Bed Slope (m/m)	Channel Side Slopes	
											Upstream (1:H)	Downstream (1:H)
CW 1	10.6	19	134	0.5	2	0	0.29	0.15	0.44	0.003	125	4
CW 2	39.9	32	104	0.5	5.8	0	0.56	0.15	0.71	0.011	30	4
CW 3	23	26	115	0.5	3.7	0	0.37	0.15	0.52	0.008	71	4
CW 4	73.4	41	91.5	0.5	9.3	0	0.68	0.15	0.83	0.007	37	4

Across Grade Flow Diversion Banks												
Basin	Average Area (ha)	Average Catchment Slope %)	Bank Spacing (m)	10-year, tc flow (m^{3}s^{-1})	Bottom Width (m)	Depth (m)	Freeboard (m)	Total Depth (m)	Velocity (ms^{-1})	Bed Slope (1:H) (m)	Channel Side Slopes	
											Upstream (1:H) (m)	Downstream (1:H) (m)
1	1.6	12.87	50	0.56	0	0.67	0.15	0.82	0.21	500	8	4
2	3.8	9.21	59	1.23	0	0.82	0.15	0.97	0.25	500	11	4
3	14.3	6.09	73	3.77	0	1.12	0.15	1.27	0.30	500	16	4
4	0.9	11.83	52	0.36	0	0.57	0.15	0.72	0.19	500	8	4
5	1.6	11.4	53	0.56	0	0.65	0.15	0.8	0.21	500	9	4
6	5.4	10.3	56	1.65	0	0.94	0.15	1.09	0.27	500	10	4
7	1.8	12.0	52	0.64	0	0.70	0.15	0.85	0.22	500	8	4
8	6.8	5.2	79	2.01	0	0.85	0.15	1	0.25	500	19	4
9	4.7	7.5	66	0.19	0	0.40	0.15	0.55	0.15	500	13	4
10	6.8	1.4	153	2.01	0	0.54	0.15	0.69	0.19	500	72	4
11	8.9	5.5	77	2.53	0	0.90	0.15	1.05	0.26	500	18	4

Offsite Clean Water Flow Diversion Banks

1. See Appendix D.1 for location.
2. The design storm is the 10% AEP event derived from BOM IFDs.
3. There are 4 offsite catchments where water may flow onto the site and mix with mine site water.
4. Diversion banks should be constructed to divert the clean water away from the site.
5. A Manning's n = 0.04 was applied for the natural site.
6. The upstream side slope given in the table are those of the natural surface.
7. The bank should be constructed from the mine site so that the offsite catchment is not disturbed.
8. These calculation and bank requirements should reassess once operations commence and a definite timetable of disturbance is available.

Across Flow Diversion Banks for Stage 1

1. Across flow diversion banks were design based on the current slope of the catchment and assuming the whole catchment will be disturbed.
2. The design storm is the 10% AEP event derived from BOM IFDs.
3. The upstream channel side slope in the table is the same as the current grade taken from the available digital elevation model (DEM).
4. A 0.2% grade was applied to the longitudinal flow direction of the bank.
5. A Manning's n of 0.06 was applied in determining bank dimensions to reflect large rock fragments that my be present.
6. These calculation and bank requirements should reassess once operations commence and a definite timetable of disturbance is available.
7. The outflow of the banks should enter the diversion channels conveying drainage downslope.
8. For installation, maintenance and removal details see IECA standard drawing Flow Diversion Banks DB-01 https://austieca.com.au/documents/item/86

Flow Calculations									
Catchment	Catchment Area (ha)	Time of Concentration (min)	Rainfall Intensity (mmh^{-1})		C10 Runoff Coefficient	Frequency Factor		Design Flows (m^{3}s^{-1})	
			10-year, tc	50-year, tc		10-year, tc	50-year, tc	10-year, tc	50-year, tc
1	17.9	24	119.9	146.5	0.9	1	1.15	5.4	7.6
2	16.3	23	122.8	150	0.9	1	1.15	5.0	7.0
3	66.3	39	94.3	114.4	0.9	1	1.15	15.6	21.8
4	3.5	13	154.8	188.8	0.9	1	1.15	1.4	1.9
5	16.8	23	122.8	150	0.9	1	1.15	5.2	7.2
6	42.5	33	102.8	124.8	0.9	1	1.15	10.9	15.3
7	4.3	14	150.4	183.4	0.9	1	1.15	1.6	2.3
8	56.3	37	100	121.3	0.9	1	1.15	14.1	19.6
9	10.5	19	134.4	164	0.9	1	1.15	3.5	4.9
10	14.3	22	125.2	153.5	0.9	1	1.15	4.5	6.3
11	72.1	40	92.9	112.7	0.9	1	1.15	16.8	23.4

Diversion Channel Calculations															
Catchment	Area (ha)	Length (m)	10% AEP Peak Discharge (m^{3}s^{-1})	Side Slope (V:H) (m)	Design Bedslope (m/m)	Bed Width (m)	Flow Depth (m)	Velocity (ms^{-1})	Freeboard (m)	Total Depth (m)	Maximum Velocity (ms^{-1})	Manning's n	Median Rock Size (m)	No. of check dams
1	17.92	472	5.4	4	0.015	2	0.73	1.53	0.15	0.88	2.00	0.06	0.20	9
2	16.26	1263	5.0	4	0.012	2	0.8	1.16	0.15	0.95	2.00	0.06	0.20	1
3	66.29	2349	15.6	6	0.009	4	1.17	1.23	0.15	1.32	2.00	0.06	0.20	0
4	3.5	337	1.4	3	0.032	1	0.46	1.28	0.15	0.61	2.00	0.06	0.20	0
5	16.78	561	5.2	8	0.055	6	0.36	1.64	0.15	0.51	2.00	0.06	0.20	16
6	42.48	1037	10.9	5	0.014	5	0.87	1.37	0.15	1.02	2.00	0.06	0.20	0
7	4.3	331	1.6	3	0.023	1	0.53	1.17	0.15	0.68	2.00	0.06	0.20	0
8	56.3	910	14.1	6	0.014	4	0.99	1.44	0.15	1.14	2.00	0.06	0.20	1
9	10.46	383	3.5	4	0.017	1	0.74	1.22	0.15	0.89	2.00	0.06	0.20	0
10	14.3	259	4.5	4	0.013	1	0.87	0.87	0.15	1.02	2.00	0.06	0.20	0
11	72.1	998	16.8	6	0.016	3	1.11	1.59	0.15	1.26	2.00	0.06	0.20	0

Flow Calculations for Stage 1 ESCP

1. Flow calculations were conducted using the Rational Formula and the methods in IECA (2008).
2. Catchment areas where taken of the DEM for the current RRPA site conditions.
3. These calculation and bank requirements should be reassessed once operations commence and a definite timetable of disturbance is available.

Diversion Channel Calculations

1. The design storm peak discharge is for the 10% AEP event derived using the Rational Formula (IECA 2008)
2. These calculation and bank requirements should be reassess once operations commence and a definite timetable of disturbance is available.
3. For installation, maintenance and removal details see IECA standard drawing Diversion Channels DC-01 https://austieca.com.au/documents/item/83

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Appendix D.3

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Project: Rustler's Roost Project Area Erosion & Sediment Control Plan.

Title: **RRPA Flow Diversion Bank Calculations**

Designed	Drawn	Checked	Sheet Size
KGE	KGE	KGE	A3
Date:			Sheet No

Appendix D.4. Q29 Flow Diversion Bank Calculations at Closure

Flow Calculations - Closure ESCP

Catchment	Area (ha)	Time of Concentration (min)	Rainfall Intensity (mmh^{-1})		C10 Runoff Coefficient	Frequency Factor		Design Flows (m^3s^{-1})	
			10-year, tc	50-year, tc		10-year, tc	50-year, tc	10-year, tc	50-year, tc
Externally Draining Catchments									
1	17.9	24	119.9	146.5	0.9	1	1.15	7.6	10.0
2	22.6	26	115.0	140.4	0.9	1	1.15	6.5	10.5
3	75.6	41	91.5	110.9	0.9	1	1.15	17.3	13.1
4	15.1	22	125.7	153.5	0.9	1	1.15	4.8	9.8
5	16.7	23	122.8	150	0.9	1	1.15	5.1	10.0
6	35.5	31	102.78	124.8	0.9	1	1.15	9.1	11.0
7	4.3	14	150.4	183.4	0.9	1	1.15	1.6	7.3
8	56.3	37	97.2	117.9	0.9	1	1.15	13.7	12.4
9	10.4	19	134.4	164	0.9	1	1.15	3.5	9.1
10	14.3	22	125.7	153.3	0.9	1	1.15	4.5	9.6
11	62.1	38	95.7	116.1	0.9	1	1.15	14.9	12.7
Internally Draining Catchments									
12	25.8	27	95.7	116.1	0.9	1	1.15	6.2	8.6
13	36.1	31	102.78	124.8	0.9	1	1.15	9.3	12.9
14	17.4	23	122.8	150	0.9	1	1.15	5.4	7.5
15	8.5	18	137	168	0.9	1	1.15	2.9	4.1
16	10.2	19	134.4	164	0.9	1	1.15	3.4	4.8
17	3.0	12	159	194	0.9	1	1.15	1.2	1.7

Flow Calculations for the Closure Landform

1. Flow calculations were conducted using the Rational Formula and the methods in IECA (2008).
2. Catchment areas where taken of the DEM for the final landform.
3. These calculations should be reassessed for each updated ESCP thoughout the LOM.

Diversion Channel Calculations at Closure

Catchment	Area (ha)	Length (m)	10% AEP Peak Discharge (m^3s^{-1})	Side Slope (V:H) (m)	Design Bedslope (m/m)	Bed Width (m)	Flow Depth (m)	Velocity (ms^{-1})	Freeboard (m)	Total Depth (m)	Maximum Velocity (ms^{-1})	Manning's n	Median Rock Size (m)	No. of check dams
1	17.92	501	5.4	4	0.024	3	0.6	1.50	0.15	0.75	2.00	0.06	0.20	0
2a	16.081	1304	4.9	4	0.012	2	0.8	1.16	0.15	0.95	2.00	0.06	0.20	0
2b	6.4996	480	2.3	4	0.009	1	0.72	0.84	0.15	0.87	2.00	0.06	0.20	0
3a	2.4843	160	1.0	4	0.017	1	0.43	0.88	0.15	0.58	2.00	0.06	0.20	0
3b	6.2132	2250	1.9	4	0.009	1	0.66	0.80	0.15	0.81	2.00	0.06	0.20	0
3c	12.127	406	4.0	4	0.009	2	0.81	0.96	0.15	0.96	2.00	0.06	0.20	0
3d	54.752	430	13.5	6	0.035	3	0.79	1.90	0.15	0.94	2.00	0.06	0.20	11
4a	4.1002	482	1.5	4	0.013	1	0.55	0.87	0.15	0.70	2.00	0.06	0.20	0
4b	11.033	79	3.6	4	0.050	2	0.51	1.79	0.15	0.66	2.00	0.06	0.20	4
5	16.705	519	5.1	6	0.052	3	0.49	1.78	0.15	0.64	2.00	0.06	0.20	21
6a	21.023	920	6.2	4	0.013	2	0.89	1.25	0.15	1.04	2.00	0.06	0.20	0
7	4.3101	354	1.6	4	0.023	1	0.5	1.10	0.15	0.65	2.00	0.06	0.20	0
8	56.347	910	13.7	4	0.014	3	1.15	1.57	0.15	1.30	2.00	0.06	0.20	0
9	10.442	383	3.5	4	0.017	1	0.74	1.22	0.15	0.89	2.00	0.06	0.20	0
10	14.291	493	4.5	4	0.008	2	0.87	0.97	0.15	1.02	2.00	0.06	0.20	0
11a	11.736	745	3.9	4	0.011	1	0.85	1.00	0.15	1.00	2.00	0.06	0.20	0
11b	17.445	318	5.4	4	0.032	2	0.68	1.69	0.15	0.83	2.00	0.06	0.20	0
11c	22.85	854	6.6	4	0.014	2	0.91	1.29	0.15	1.06	2.00	0.06	0.20	0
11d	7.1644	617	2.5	4	0.029	1	0.58	1.36	0.15	0.73	2.00	0.06	0.20	0
12	25.8	839	7.3	6	0.001	4	1.47	0.39	0.15	1.62	2.00	0.06	0.20	0

Diversion Channel Calculations

1. The design storm peak discharge is for the 10% AEP event derived using the Rational Formula (IECA 2008)
2. These calculation and channel requirements should be reassessed once operations commence and with each update of the ESCP.
3. For installation, maintenance and removal details see IECA standard drawing Diversion Channels DC-01 https://austieca.com.au/documents/item/83

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Appendix D.4	Project	Title	Designed	Drawn	Checked	Sheet Size
24	Rustler's Roost Project Area Erosion & Sediment Control Plan.	**RRPA Flow Diversion Bank Calculations at Closure**	KGE	KGE	KGE	A3
			Date:			Sheet No

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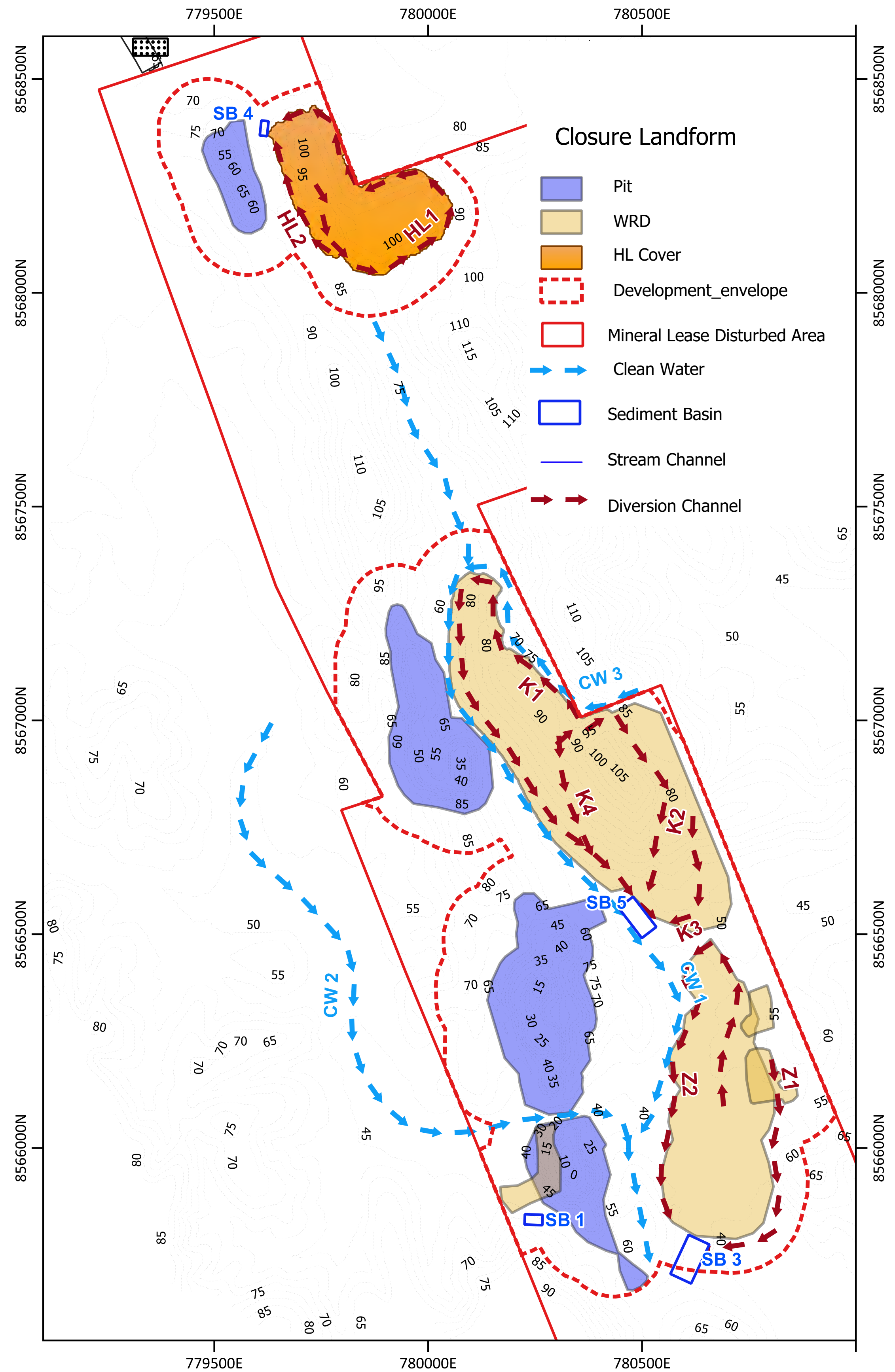
Appendix D.5. Quest 29 Conceptual Drainage Layout at closure



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Flow Calculations Q29

Catchment	Catchment Area	T of C (min)	Rainfall Intensity (mmh^{-1})		C10 Runoff Coefficient	Frequency Factor		Design Flows (m^3s^{-1})	
			10-year, tc	50-year, tc		10-year, tc	50-year, tc	10-year, tc	50-year, tc
HL Cover	8.8	18	137.3	167.5	0.9	1	1.15	3.5	4.3
Koolpin WRD	23.0	26	115.0	140.4	0.9	1	1.15	6.6	9.3
Zamu WRD	14.1	22	125.7	153.5	0.9	1	1.15	4.4	6.2
Taipan WRD	1.2	8	180	219.4	0.9	1	1.15	0.5	0.8

Flow Calculations for the Closure Landform

1. Flow calculations were conducted using the Rational Formula and the methods in IECA (2008).
2. Catchment areas where taken of the DEM for the final landform.
3. These calculations should be reassessed for each updated ESCP thoughout the LOM.

Quest 29 Diversion Channel Calculations

Catchment	Area (ha)	Length (m)	10% AEP Peak Discharge (m^3s^{-1})	Side Slope (V:H) (m)	Design Bedslope (m/m)	Bed Width (m)	Flow Depth (m)	Velocity (ms^{-1})	Total Depth (m)	Maximum Velocity (ms^{-1})	Manning's n	No. of check dams
HL1	6.3	952	2.3	4	0.006	1	0.8	0.73	0.95	2.00	0.06	0
HL2	2.5	441	0.9	4	0.034	1	0.35	1.11	0.50	2.00	0.06	0
K1	9.7	1399	3.3	4	0.029	1	0.65	0.84	0.80	2.00	0.06	0
K2	5	600	1.8	4	0.045	1	0.45	1.47	0.60	2.00	0.06	23
K3	3.6	305	1.4	4	0.090	1	0.35	1.80	0.50	2.00	0.06	11
K4	4.1	259	1.5	4	0.090	1	0.36	1.80	0.51	2.00	0.06	8
Z1	9.7	577	3.3	6	0.008	1	0.75	0.82	0.90	2.00	0.06	0
Z2	14.7	1130	4.6	4	0.001	1	1.4	0.39	1.55	2.00	0.06	0

Diversion Channel Calculations

1. The design storm peak discharge is for the 10% AEP event derived using the Rational Formula (IECA 2008)
2. These calculation and channel requirements should be reassessed once operations commence and with each update of the ESCP.
3. For installation, maintenance and removal details see IECA standard drawing Diversion Channels DC-01 https://austieca.com.au/documents/item/83

Quest 29 Clean Water Diversion Channels

Basin	Area (ha)	T of C (min)	Rainfall Intensity (mmh^{-1})	C10 Runoff Coefficient	Design Flows (m^3s^{-1})	Bottom Width (m)	Depth (m)	Freeboard (m)	Total Depth (m)	Bed Slope (1:H)	Channel Side Slopes	
											Upstream (1:H)	Downstream (1:H)
CW 1	25.17	27	113	0.5	4.0	2	1	0.15	1.15	107.1	4	4
CW 2	275.3	67	70	0.5	26.8	10	1.6	0.15	1.75	66.1	6	6
CW 3	11.6	20	131	0.5	2.1	2	0.56	0.15	0.71	17.7	4	4

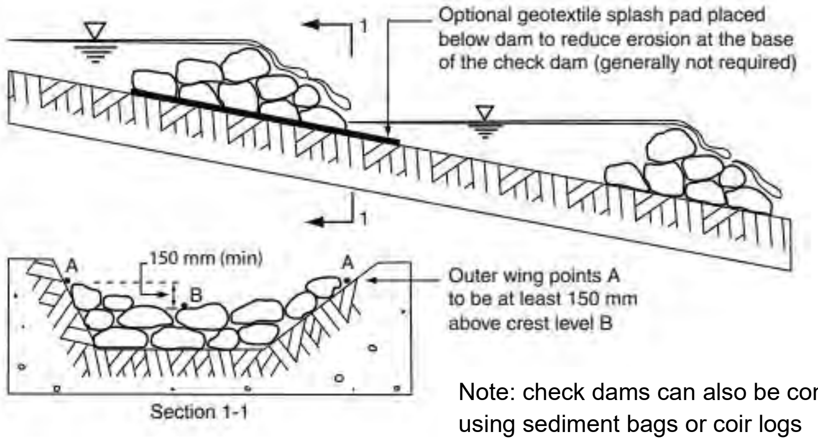
Clean Water Flow Diversion Banks

1. The design storm is the 10% AEP event derived from BOM IFDs.
2. There are 4 off-site catchments where water may flow onto the site and mix with mine site water.
3. For installation, maintenance and removal details see IECA standard drawing Flow Diversion Banks DB-01 https://austieca.com.au/documents/item/86
4. These calculation and bank requirements should reassess once operations commence and a definite timetable of disturbance is available.

Appendix D.5	Project	Title	Designed	Drawn	Checked	Sheet size
26	Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment - Erosion & Sediment Control Plan	Quest 29 Conceptual Drainage Layout	Date		Sheet No.	
					Sheet of	

Appendix D.6 Typical ESC Designs

TYPICAL ESC DESIGNS



Note: check dams can also be constructed using sediment bags or coir logs

Fig A. Rock check dam (IECA 2021)

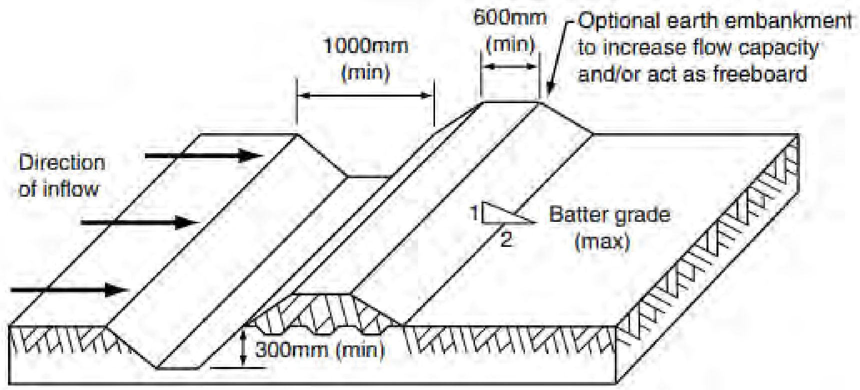


Fig B. Diversion channel (IECA 2021)

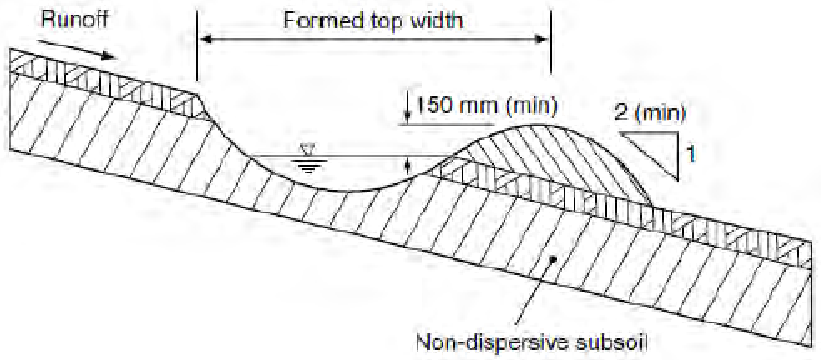


Fig C. Parabolic catch drain (IECA 2021)

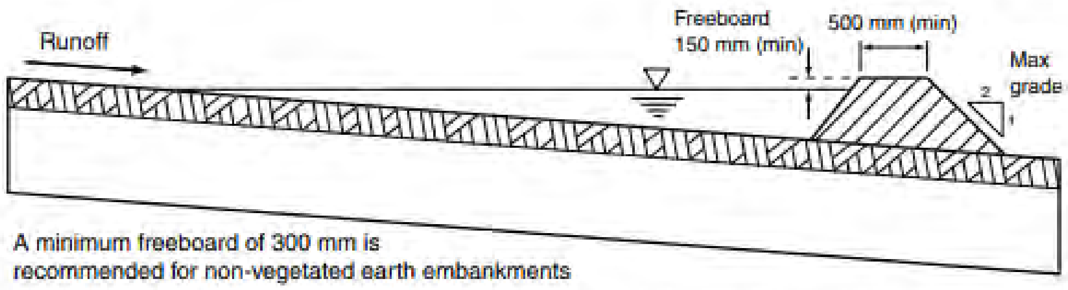


Table 1 - Recommended dimensions of flow diversion banks

Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms
Height (min)	500 mm	500 mm	300 mm	N/A
Top width (min)	500 mm	500 mm	100 mm	N/A
Base width (min)	2500 mm	2500 mm	600 mm	N/A
Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A
Freeboard	300 mm	150 mm	100 mm	50 mm

Fig D. Flow diversion bank (IECA 2021)

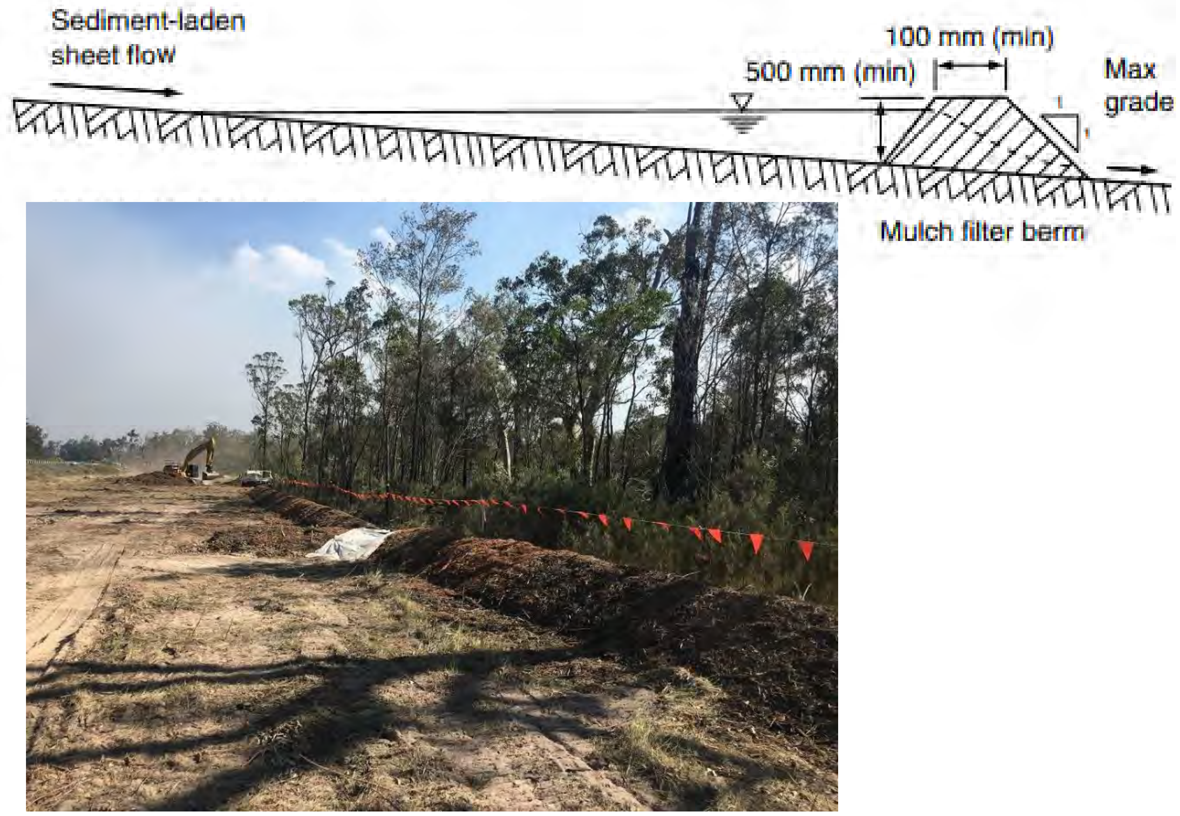


Fig E. Mulch berm (IECA 2021) with lined overtopping point

Revision	Date	Drawn	Approved	Description
0	11/08/2021	TE		DRAFT

Tim Elder #4399

PREPARED BY:

PREPARED FOR:

QUEST 29 PROJECT

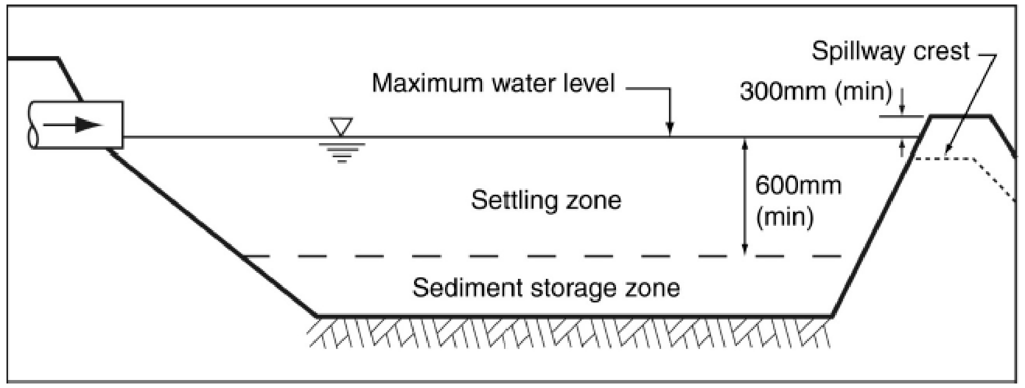
EROSION & SEDIMENT CONTROL PLAN

TYPICAL ESC DESIGNS

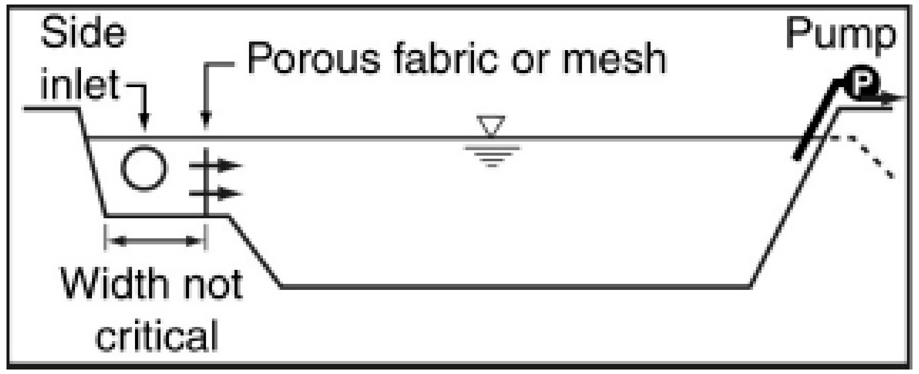
Appendix D.6

NOT TO SCALE	APP B: ESC – Q29	REVISION: 0

Appendix E.1 Sediment Basin Type D Detail.



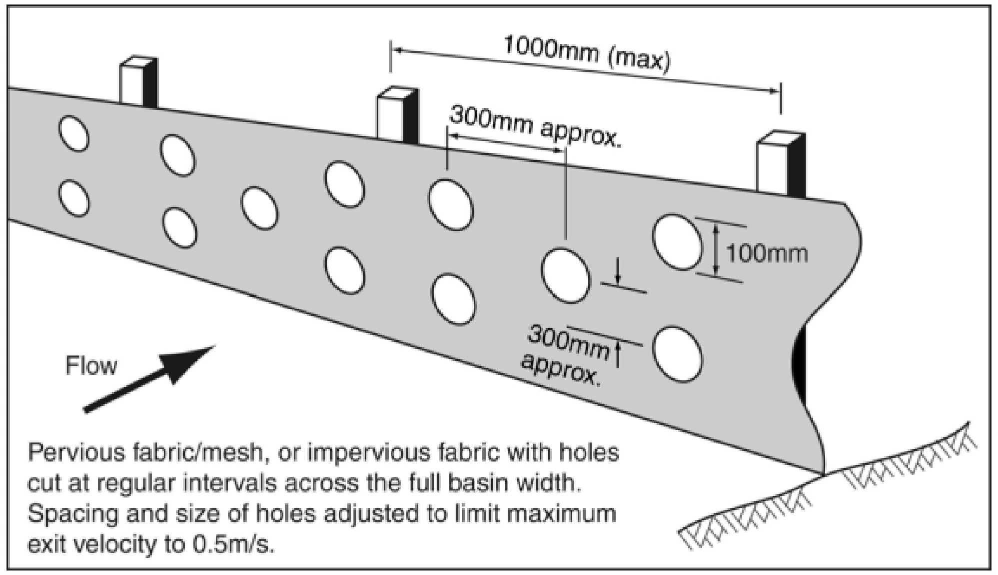
Above: Long section through type D sediment basin with pipe inlet showing the settling zone and sediment storage zone. (See figure B.25(b) IECA, 2018)



Above: Longitudinal section through type D sediment basin with side inlet and porous barrier. The length to width ration of the basin is 3:1 and the internal wall slopes are 2:1 (H:V). An energy dissipater should be used at the inlet to the basin. For plan view see Figure (d1) Appendix E.3 with with side inlet and porous barrier (IECA 2018). The length to width ration of the basin is 3:1 and the internal wall slopes are 2:1 (H:V). An energy dissipater should be used at the inlet to the basin. The external wall slopes are a minimum 5:1 (H:V).

Notes

1. The sediment basin dimensions in the main report are designed in accordance with Appendix B. Sediment basin design and operation IECA (2018)
2. Sediment basin construction should be completed prior to the wet season after the first disturbance. The basins can be implemented sequentially depending on the catchment disturbed area.
3. Final basin size can be adjusted depending on the final disturbance area.
4. This is a preliminary plan and should be updated throughout the mine life.
5. Type D basins usually require a pumped discharge system. If a piped gravity or siphon outlet exists then a flow control valve is required to allow full control of the basin discharge.
6. When de-watering the basin there must not be any resuspension of previously settled sediment. Intake pipes must be housed in an appropriate flow control chamber and must not be allowed to rest on the bottom of the basin or any location that will entrain settled sediment.
7. An alternative is suspension of the inlet pipe on a floating raft.
8. The type D sediment basin is designed to retain the water for up to 5 days and the basin must be fully drained between storm events.
9. Settled sediment must be removed regularly to provided sufficient volume for the next rainfall runoff event.
10. The basins require regular maintenance during the wet season and the need for deflocculation of suspended fine sediment must be tested.
11. No geotechnical investigations were conducted for this study and the basins have not been geotechnically designed.

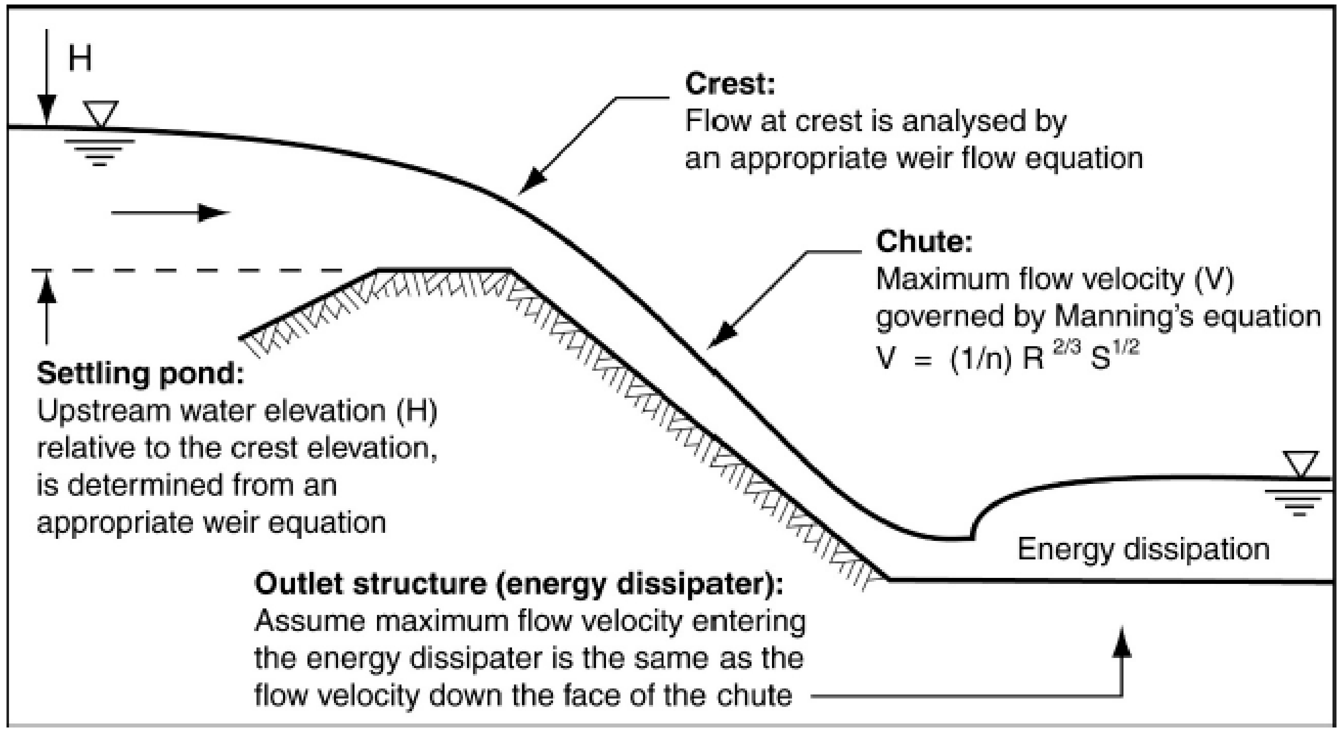


Above: Example arrangement of perforated fabric inlet baffle (Figure B28, IECA 2018)

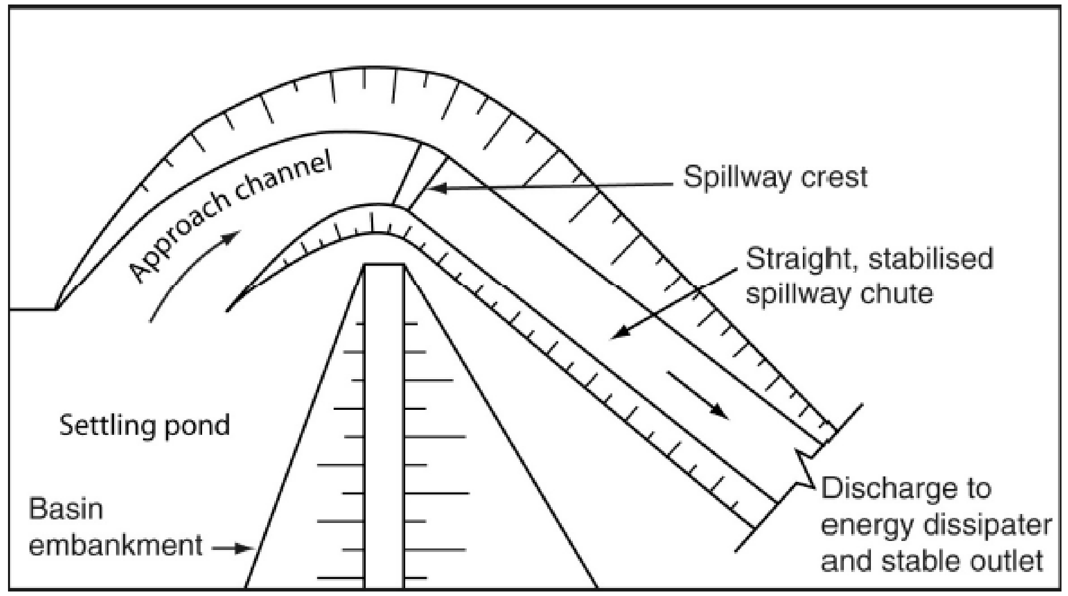
CPESC	Tim Elder #4399

Appendix E.1		Project	Title	Designed	Drawn	Checked	Sheet Size
30	Surface Water & Erosion Solutions; elder enviro	Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment - Erosion & Sediment Control Plan	Sediment Basin Type D Detail	IECA 2018	KGE	TE	A3
				Date:			Sheet No

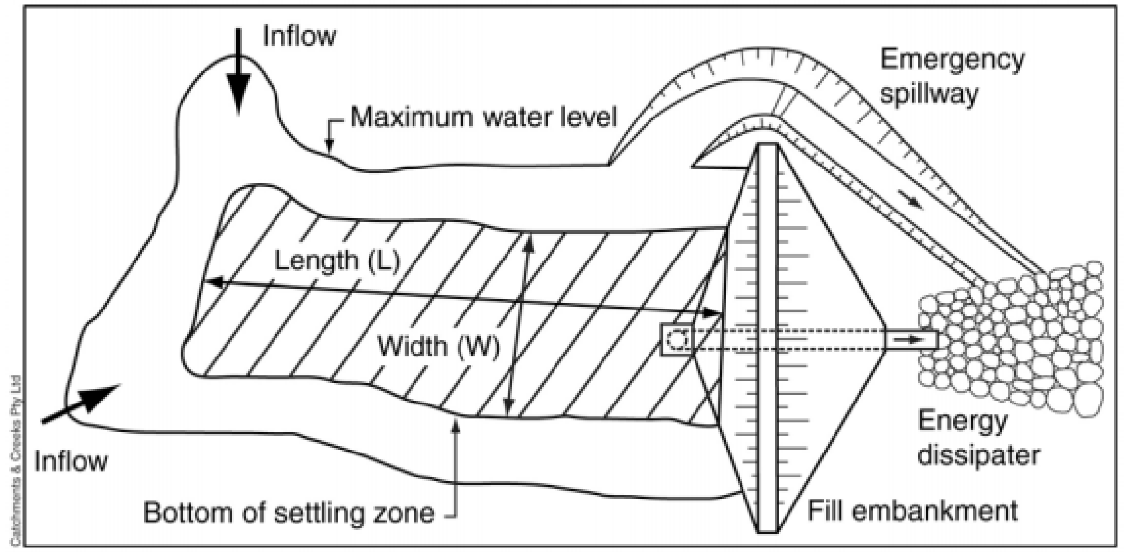
Appendix E.2 Sediment Basin Emergency Spillway Detail



Sediment basin type D exit spillway (Figure B36 IECA, 2018). See Appendix E.3 for energy dissipaters and drainage chutes.



Plan view layout of the emergency spillway to be designed to a 2% AEP event as the basins design life is > 12 months. Construction, maintenance and removal detail are available in in Drawing CH-06 (IECA, 2008), https://austieca.com.au/documents/item/80.



Relationship between the emergency spillway and the energy dissipater for a Type C sediment basin which can similarly apply to the type D sediment basin (Figure B9, IECA, 2008).

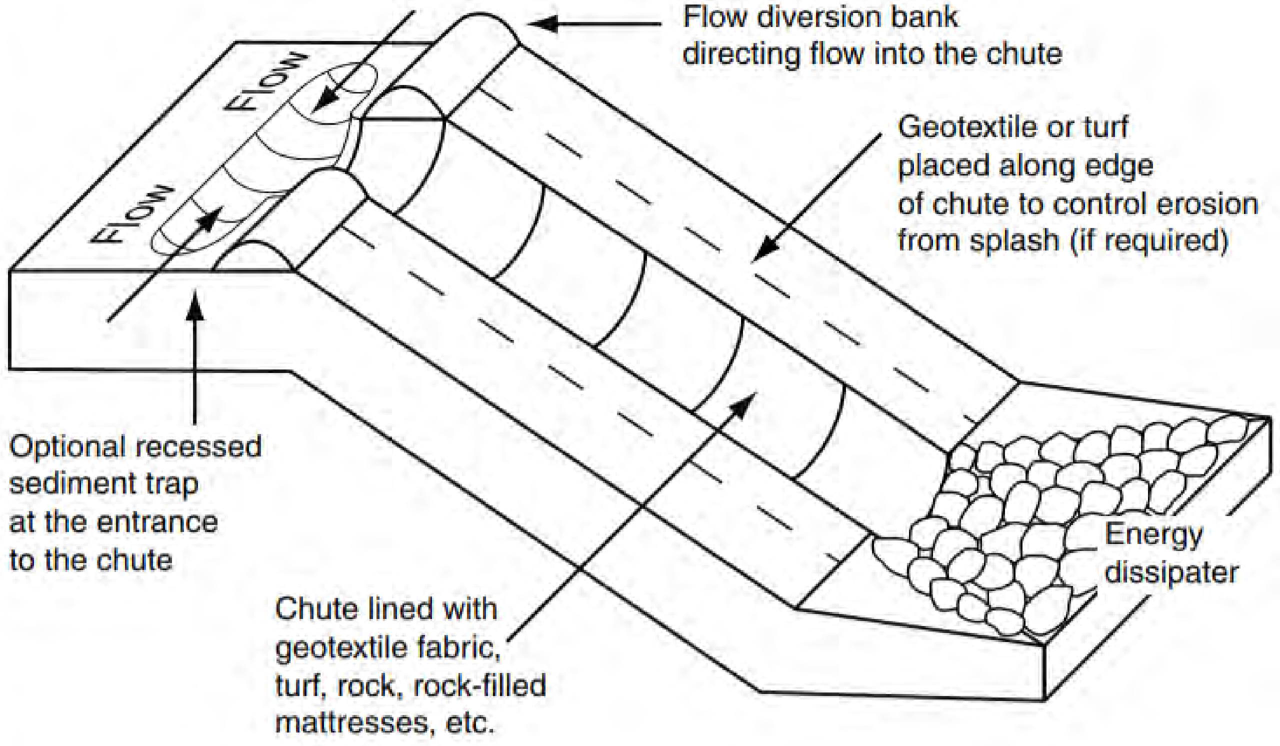
Notes

1. The emergency spillway has a trapezoidal profile.
2. See Main report sediment basin size schedule for emergency spillway design parameters.
3. The design storm is the 2% AEP event peak discharge determine from BOM IFDs in accordance with IECA (2008) guidelines.

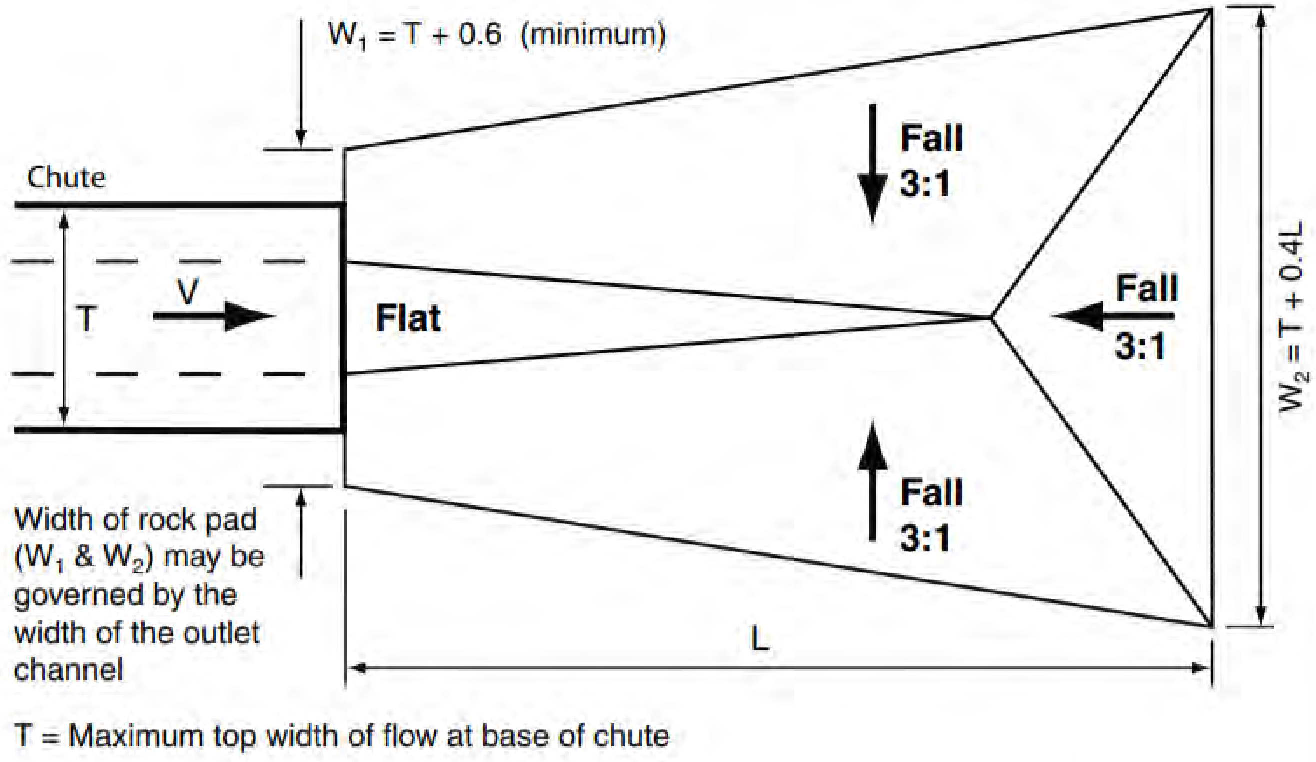
CPESC
Tim Elder #4399

Appendix E.2 32	Surface Water & Erosion Solutions / elder enviro	Project: **Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment - Erosion & Sediment Control Plan**	Title: **Sediment Basin Emergency Spillway Detail**	Designed: KGE	Drawn: KGE	Checked: KGE	Sheet Size: A3
				Date:			Sheet No

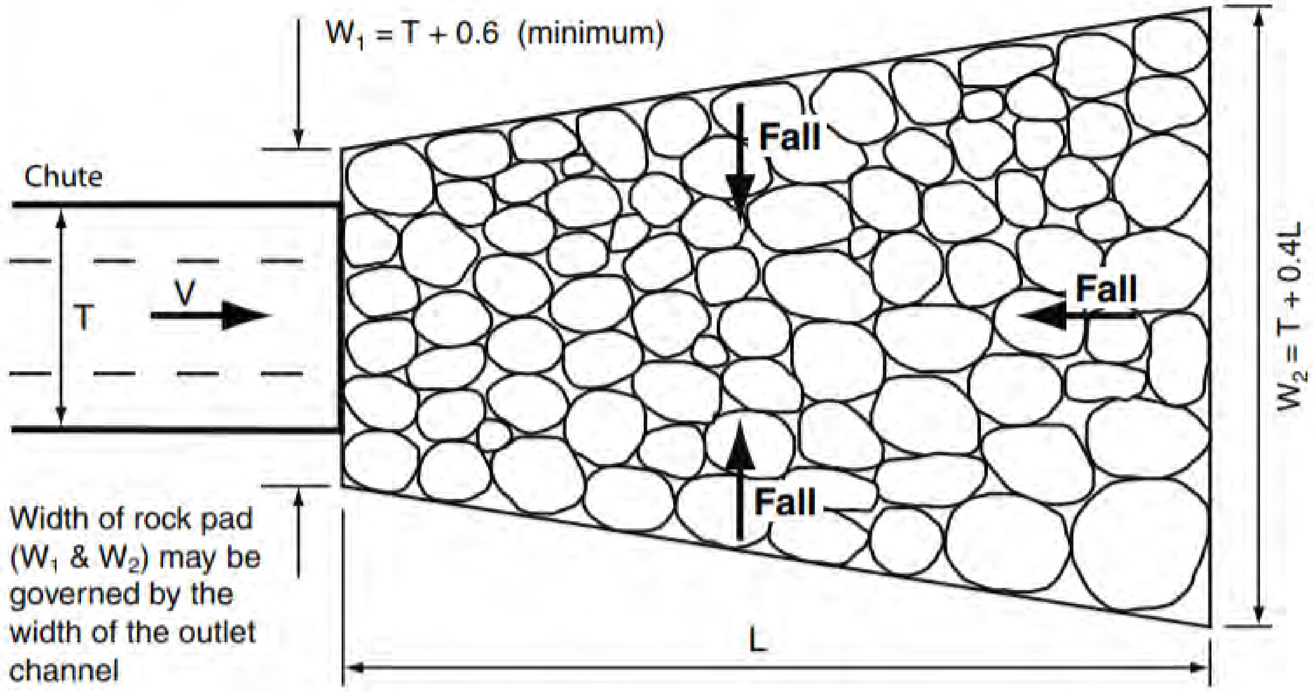
Appendix E.3 Standard Drawing Chute and Energy



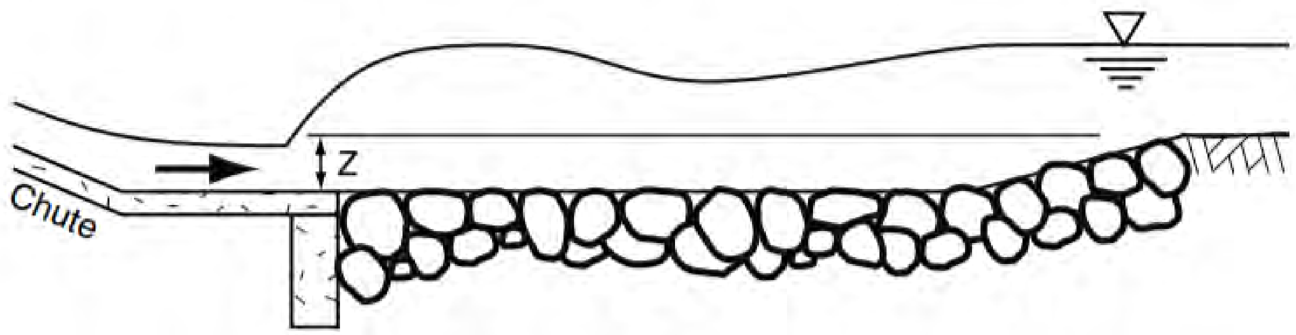
(a) Temporary drainage chute with rock pad outlet structure



(b) Typical layout of an outlet energy dissipater for a drainage chute



(c) Typical layout of a rock pad outlet structure for a drainage chute



(d) Typical profile of a rock pad outlet structure for a drainage chute

Notes:

1. Drawings applicable to temporary drainage chutes, **not** basin spillways.
2. A rock pad outlet structure is just one option for the design of the outlet energy dissipater.

Drawn:	Date:		
GMW	Dec-09	Chutes - General	CH-01

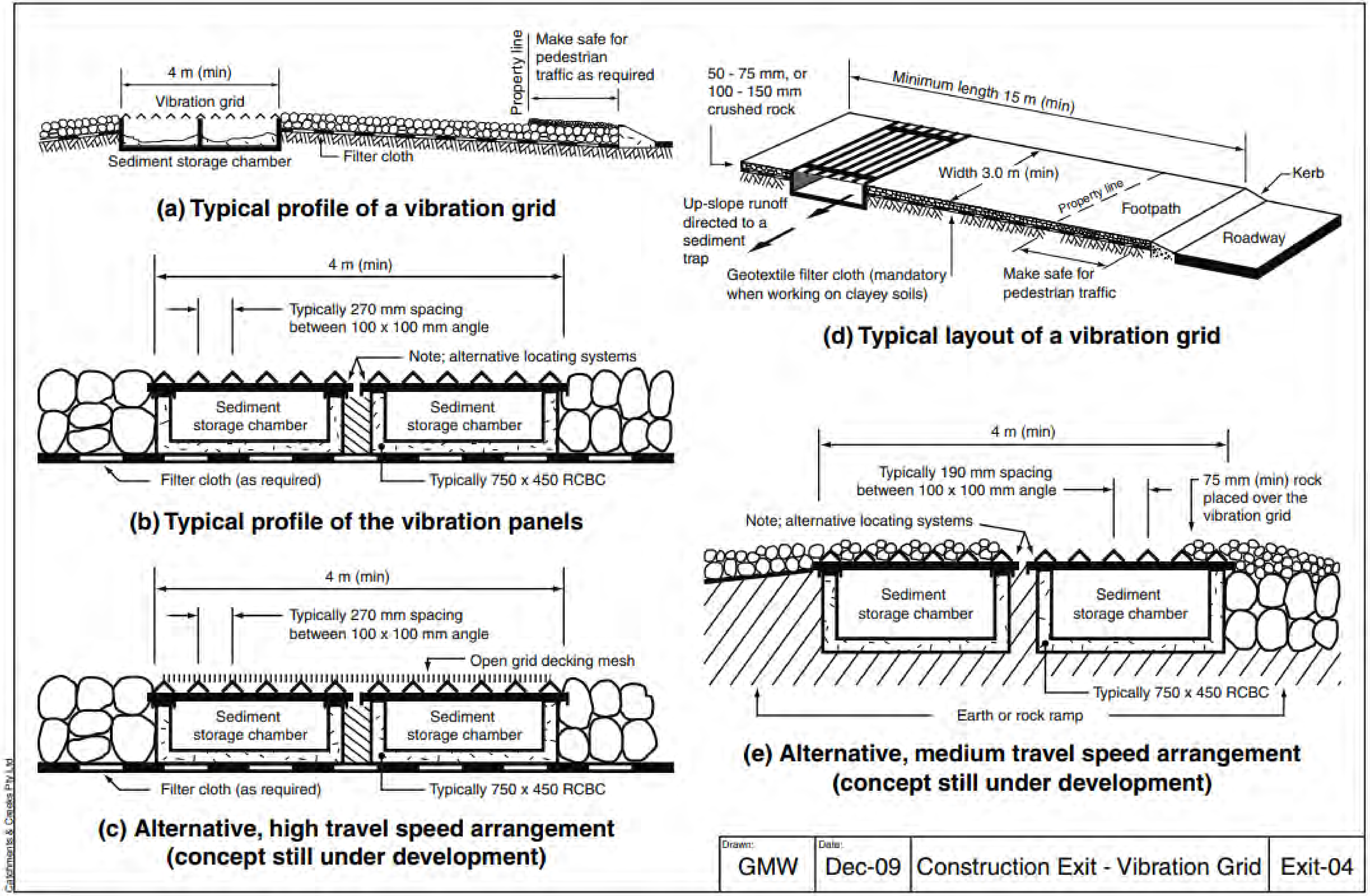
Appendix E.3

Surface Water & Erosion Solutions

elder enviro

Project	Title	Designed	Drawn	Checked	Sheet Size
Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment - Erosion & Sediment Control Plan	Standard Drawing Chute and Energy Dissipater detail (IECA 2009)	KGE	KGE	KGE	A3
		Date:			Sheet No

Appendix F.1 Construction Exit Grid Detail - IECA 2009



Appendix F.1	Surface Water & Erosion Solutions / elder enviro	Project: Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment - Erosion & Sediment Control Plan	Title: Construction Exit Grid Detail - IECA 2009	Designed	Drawn	Checked	Sheet Size: A3
36				Date:			Sheet No

Appendix G.1 Collected soil samples and laboratory analysis

Table G.1 RR Sample locations and descriptions

		**Site: RR WRD 1** Easting (m), Northing (m): 770589 mE, 8570700 mN Description: Waste rock material on the southern area of the Rustler's Roost WRD. Emerson Class 8 22 June 2021
		**Site: RR WRD 2** Easting (m), Northing (m): 770458 mE, 8570832 mN Description: Waste rock material on the southwestern area of the Rustler's Roost WRD. Emerson Class 8 22 June 2021
		**Site: RR WRD 3** Easting (m), Northing (m): 770458 mE, 8571168 mN Description: As above Emerson Class 8 22 June 2021

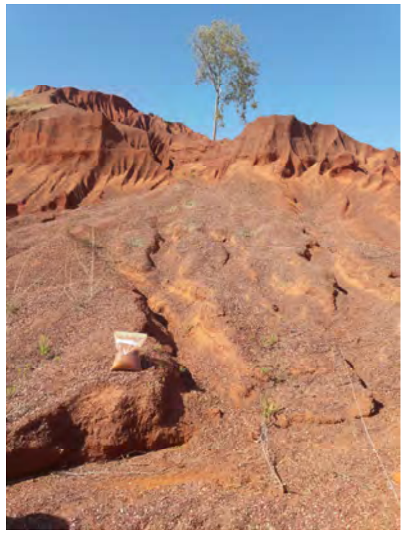
		**Site: RR HLP 1** Easting (m), Northing (m): 770902 mE, 8570101 mN Description: Gravel sized material from the northwest corner of the heap leach pad Emerson Class 8 High levels of carbonate and gypsum present. 22 June 2021
		**Site: RR HLP 2** Easting (m), Northing (m): 771363 mE, 8569713 mN Description: Gravel sized material from the southeast of the heap leach pad 22 June 2021
		**Site: Rustler's Roost existing pit looking north** Easting (m), Northing (m): 770953 mE, 8570225 mN 22 June 2021

Table G.2 Q29 Sample locations and descriptions

<table>
<tr><td colspan="2"></td><td rowspan="2">Site: Q29 HLP 1 & 2
Easting (m), Northing (m):
779756 mE, 8568170 mN
Description:
Q29 Heap Leach pad. Looking across HLP toward sample location HLP
Emerson Class 8
22 June 2021</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td></td><td></td><td>Site: Q29 HLP 3
Easting (m), Northing (m):
779755 mE, 8568187 mN
Description:
BHS Heal Leach Pad. Sample Q29 HLP 1 & 2 combined with Q29 HLP 3 for laboratory analysis
Emerson Class 8
22 June 2021</td></tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>Site: Q29 Zamu WRD 3&4
Easting (m), Northing (m):
780759 mE, 8566164 mN
Description:
Current Zamu WRD. Samples combine for analysis
Emerson Class 5
22 June 2021</td>
</tr>
<tr>
<td colspan="2"></td>
<td>Site:Zamu Pit
Easting (m), Northing (m):
780715 mE, 8566317 mN
Description:
Current Zamu Pit Looking West.
22 June 2021</td>
</tr>
</table>

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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 272772

Client Details

Client	Douglas Partners NT
Attention	Clare Whelan
Address	PO Box 36858, Winnellie, NT, 0821

Sample Details

Your Reference	**206279.00**
Number of Samples	4 soil
Date samples received	29/06/2021
Date completed instructions received	29/06/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	06/07/2021
Date of Issue	06/07/2021

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Results Approved By
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil					
Our Reference		272772-1	272772-2	272772-3	272772-4
Your Reference	UNITS	Q29 WD2	Q29 WD1	RRWD	RRHLP
Type of sample		soil	soil	soil	soil
Date prepared	-	01/07/2021	01/07/2021	01/07/2021	01/07/2021
Date analysed	-	01/07/2021	01/07/2021	01/07/2021	01/07/2021
pH 1:5 soil:water	pH Units	5.5	8.3	5.8	9.4
Electrical Conductivity 1:5 soil:water	µS/cm	6	91	6	61
Estimated Salinity*	mg/kg	22	310	22	210
Organic Matter (Combustion)	%	0.2	2.0	0.2	0.2

CEC					
Our Reference		272772-1	272772-2	272772-3	272772-4
Your Reference	UNITS	Q29 WD2	Q29 WD1	RRWD	RRHLP
Type of sample		soil	soil	soil	soil
Date prepared	-	02/07/2021	02/07/2021	02/07/2021	02/07/2021
Date analysed	-	02/07/2021	02/07/2021	02/07/2021	02/07/2021
Exchangeable Ca	meq/100g	0.2	6.6	0.3	19
Exchangeable K	meq/100g	<0.1	<0.1	<0.1	<0.1
Exchangeable Mg	meq/100g	0.29	0.15	0.36	0.12
Exchangeable Na	meq/100g	<0.1	0.18	<0.1	<0.1
Cation Exchange Capacity	meq/100g	<1	7.0	<1	19

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-034	Soil samples are extracted and measured using a conductivity cell and dedicated meter.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			01/07/2021	1	01/07/2021	01/07/2021		01/07/2021	[NT]
Date analysed	-			01/07/2021	1	01/07/2021	01/07/2021		01/07/2021	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	5.5	[NT]		100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	6	[NT]		103	[NT]
Estimated Salinity*	mg/kg	5	Inorg-034	<5	1	22	[NT]		[NT]	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	1	0.2	0.2	0	118	[NT]

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			02/07/2021	[NT]	[NT]	[NT]	[NT]	02/07/2021	[NT]
Date analysed	-			02/07/2021	[NT]	[NT]	[NT]	[NT]	02/07/2021	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	83	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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Geotechnics / Environment / Groundwater

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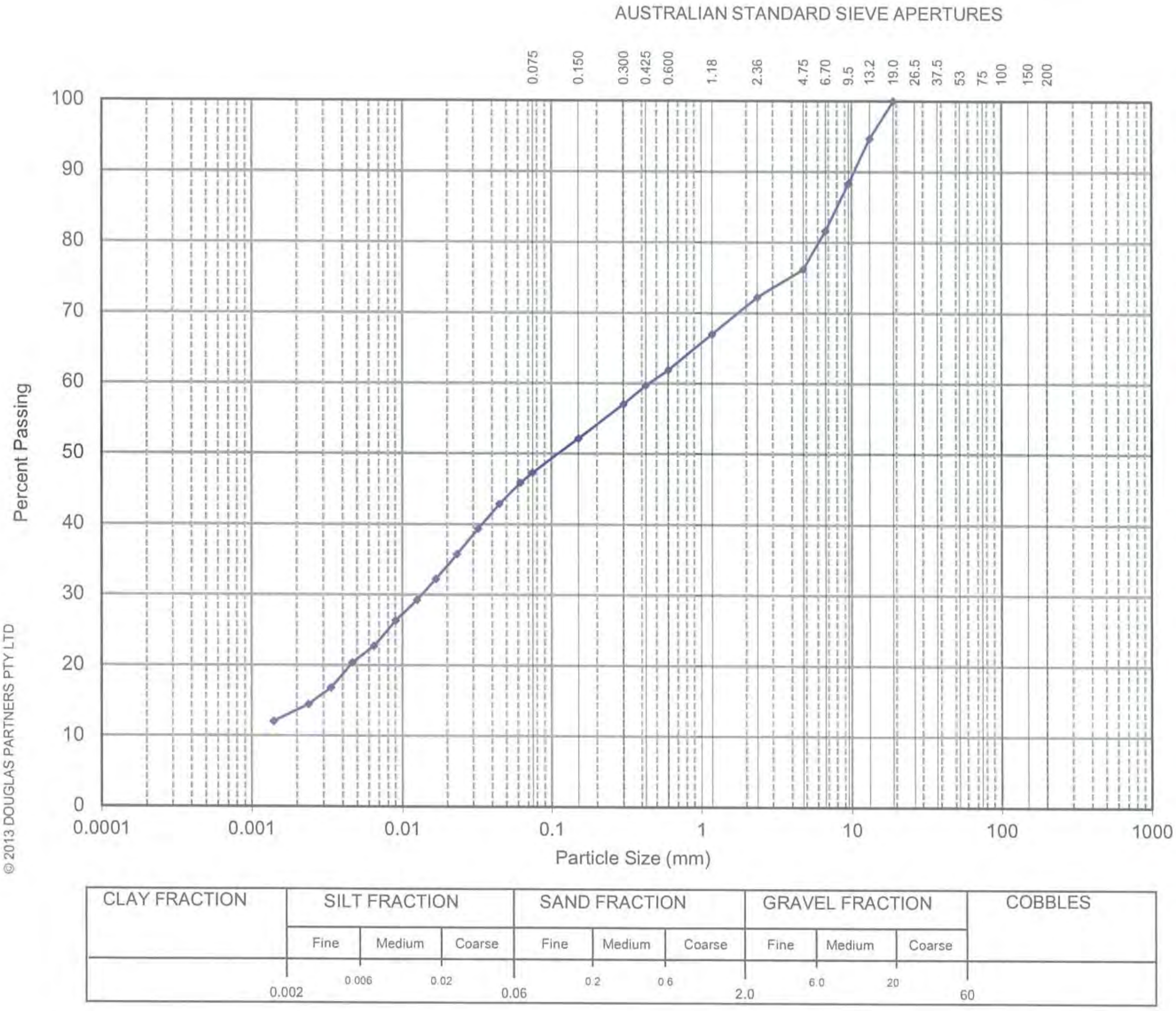
Fax (07) 3237 8999

Results of Particle Size Distribution (Hydrometer)

Client :	Surface Water & Erosion Solutions	**Project No. :**	206279
		Report No. :	206279.00-2
Project :	Analysis Testing	**Report Date :**	03.08.2021
Location :	.	**Date Sampled:**	22.06.2021
Test Location:	Q29 WD2	**Date of Test:**	27.07.2021
Depth / Layer:	-	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	~
53.0	~
37.5	~
26.5	~
19.0	100%
13.2	95%
9.5	88%
6.7	82%
4.75	76%
2.36	72%
1.18	67%
0.600	62%
0.425	60%
0.300	57%
0.150	52%
0.075	47%
0.045	43%
0.032	39%
0.023	36%
0.017	32%
0.013	29%
0.009	26%
0.007	23%
0.005	20%
0.003	17%
0.002	14%
0.001	12%

Description: SILT with clay, sand and gravel

Test Method(s): AS 1289.3.6.1, 3.6.3

Sampling Method(s): Sampled by client

Remarks:

Loss in pretreatment: 0%

Type of Hydrometer: g/l

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number: 828
Accredited for compliance with ISO/IEC 17025 - Testing

Tested:	AC
Checked:	AC

Aimee Cartwright
Lab Technician

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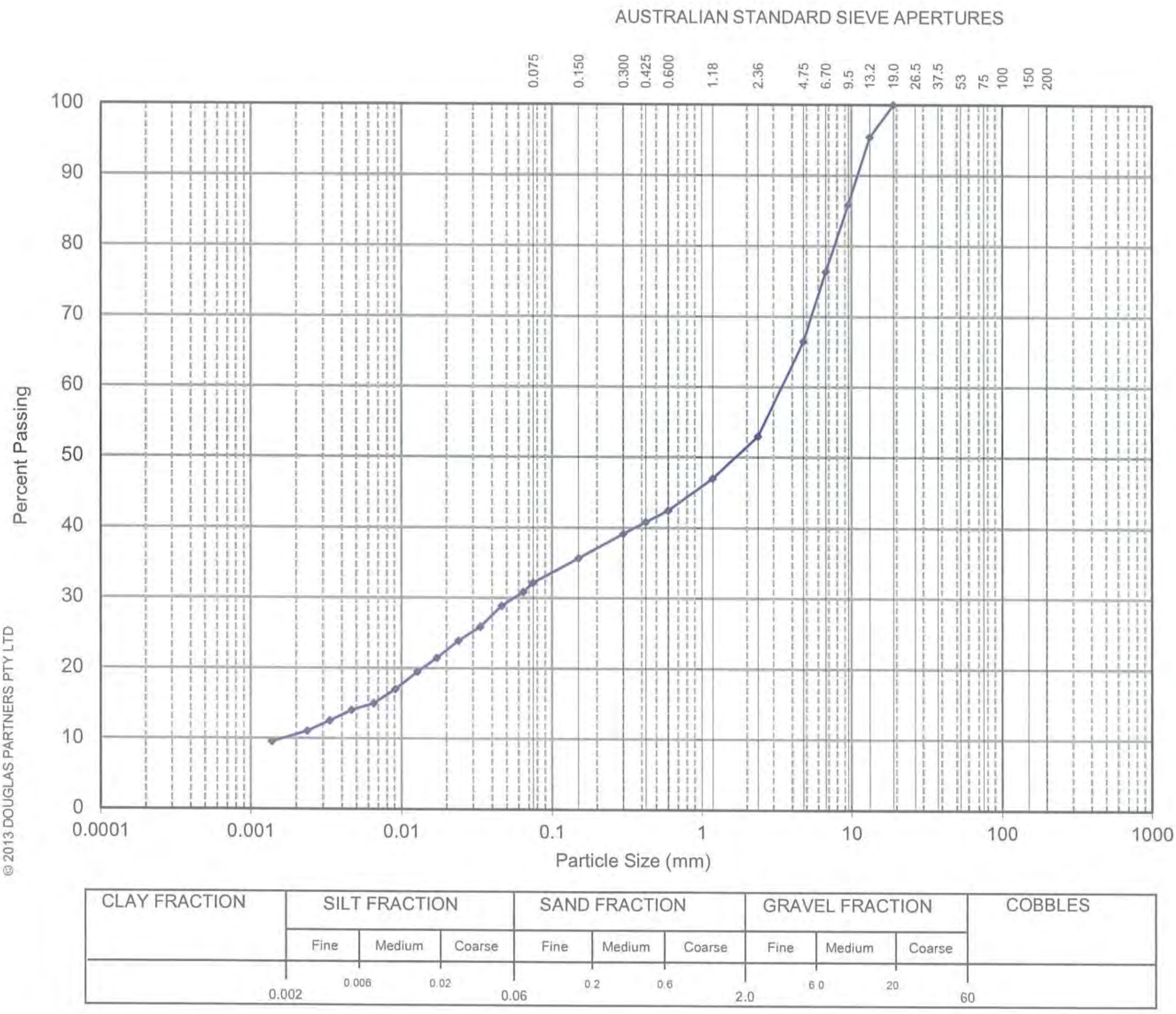
Results of Particle Size Distribution (Hydrometer)

Client :	Surface Water & Erosion Solutions	**Project No. :**	206279
		Report No. :	206279.00-2
Project :	Analysis Testing	**Report Date :**	03.08.2021
Location :	.	**Date Sampled:**	22.06.2021
Test Location:	Q29 WD1	**Date of Test:**	27.07.2021
Depth / Layer:	-	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	~
53.0	~
37.5	~
26.5	~
19.0	100%
13.2	95%
9.5	86%
6.7	76%
4.75	66%
2.36	53%
1.18	47%
0.600	42%
0.425	41%
0.300	39%
0.150	36%
0.075	32%
0.046	29%
0.033	26%
0.024	24%
0.017	21%
0.013	19%
0.009	17%
0.007	15%
0.005	14%
0.003	13%
0.002	11%
0.001	10%

Description: Silty GRAVEL with sand and clay

Test Method(s): AS 1289.3.6.1, 3.6.3

Sampling Method(s): Sampled by client

Remarks:

Loss in pretreatment: 0%

Type of Hydrometer: g/l

NATA Accredited Laboratory Number: 828
Accredited for compliance with ISO/IEC 17025 - Testing

WORLD RECOGNISED ACCREDITATION

Tested:	AC
Checked:	AC

Aimee Cartwright
Lab Technician

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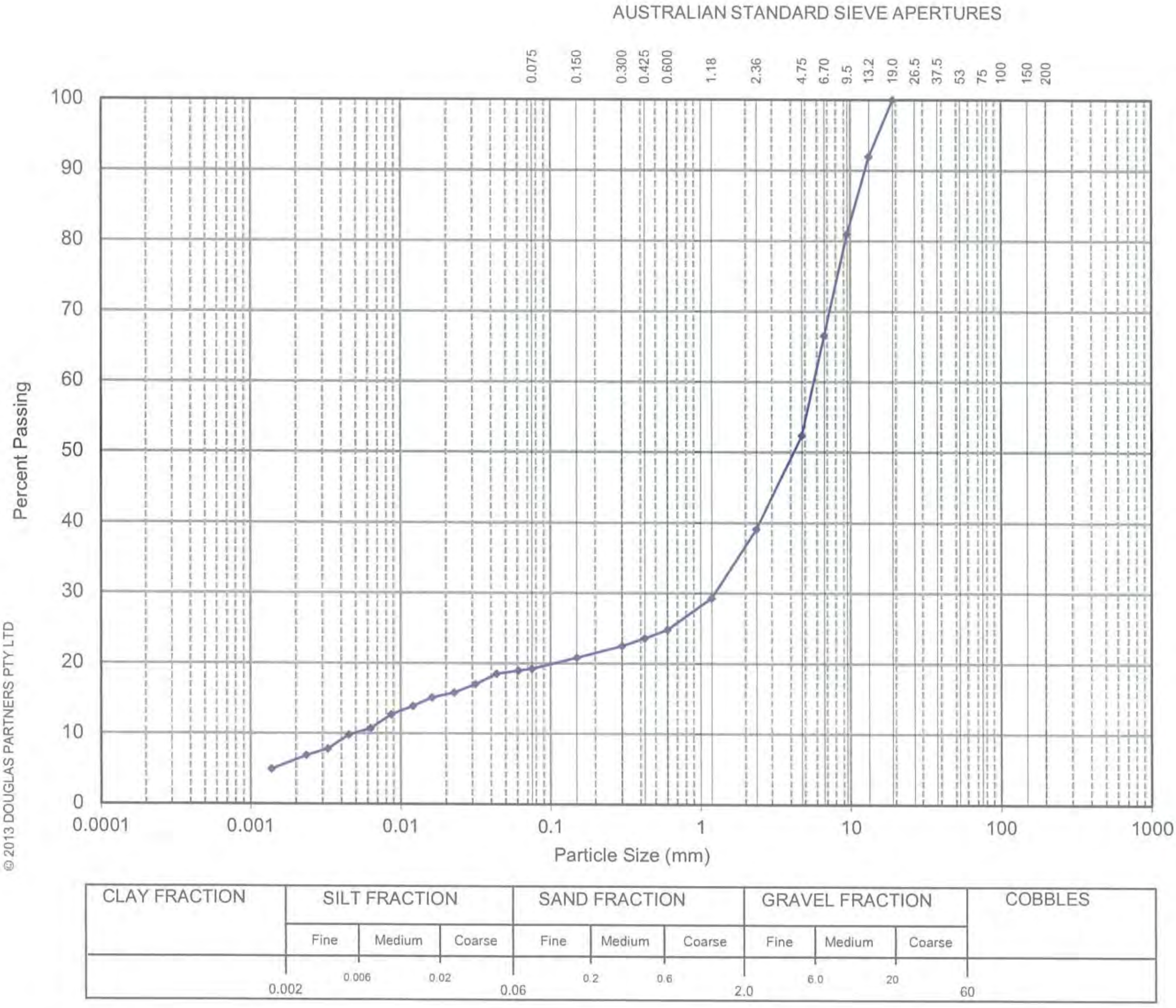
Fax (07) 3237 8999

Results of Particle Size Distribution (Hydrometer)

Client :	Surface Water & Erosion Solutions	**Project No. :**	206279
		Report No. :	206279.00-2
Project :	Analysis Testing	**Report Date :**	03.08.2021
Location :	.	**Date Sampled:**	22.06.2021
Test Location:	RRWD	**Date of Test:**	27.07.2021
Depth / Layer:	-	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	~
53.0	~
37.5	~
26.5	~
19.0	100%
13.2	92%
9.5	81%
6.7	67%
4.75	52%
2.36	39%
1.18	29%
0.600	25%
0.425	24%
0.300	22%
0.150	21%
0.075	19%
0.043	18%
0.031	17%
0.023	16%
0.016	15%
0.012	14%
0.009	13%
0.006	11%
0.004	10%
0.003	8%
0.002	7%
0.001	5%

Description: GRAVEL with sand, silt and clay

Test Method(s): AS 1289.3.6.1, 3.6.3

Sampling Method(s): Sampled by client

Remarks:

Loss in pretreatment: 0%

Type of Hydrometer: g/l

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number: 828
Accredited for compliance with ISO/IEC 17025 - Testing

Tested:	AC
Checked:	AC

Aimee Cartwright
Lab Technician

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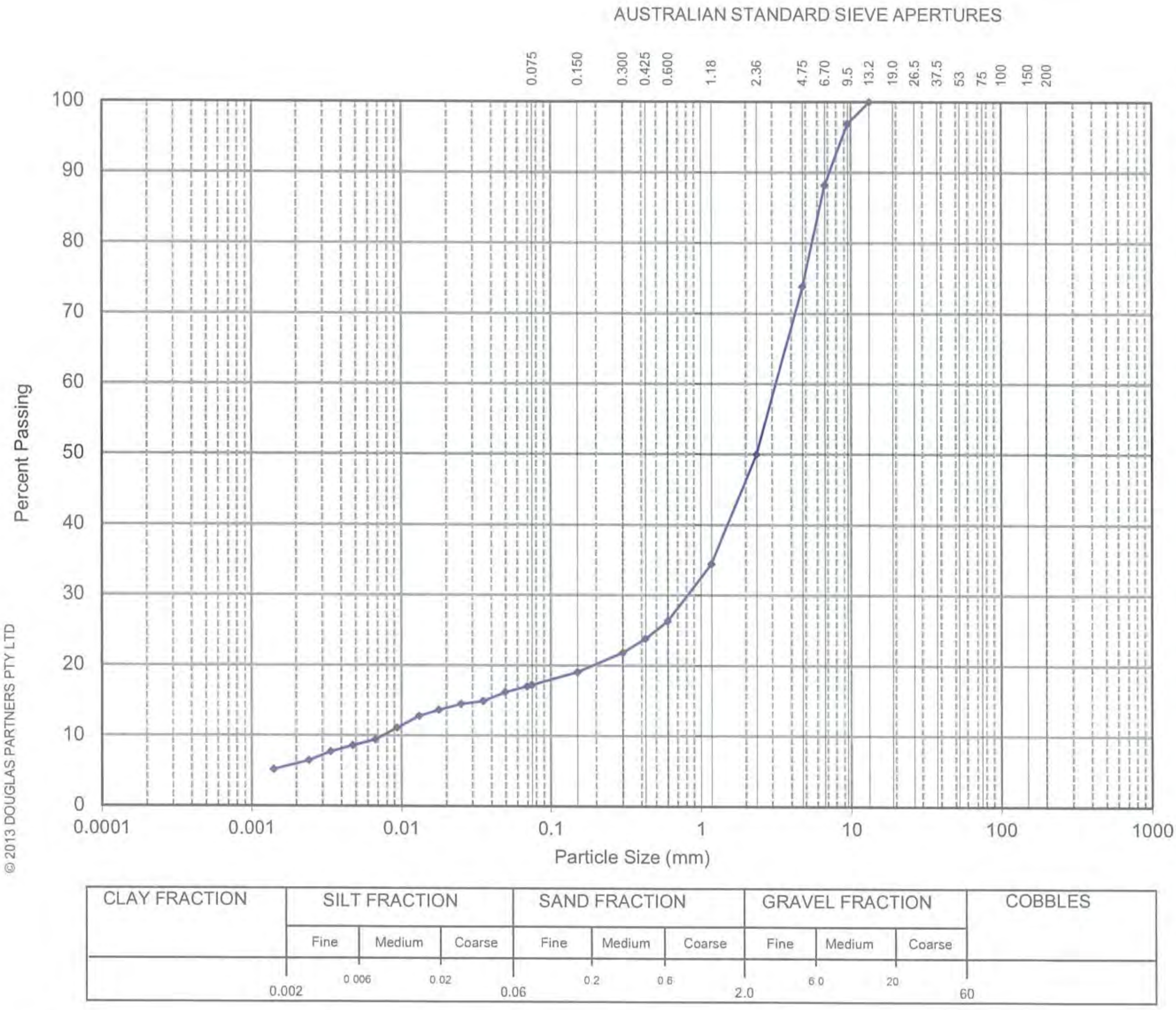
Results of Particle Size Distribution (Hydrometer)

Client :	Surface Water & Erosion Solutions	**Project No. :**	206279
		Report No. :	206279.00-2
Project :	Analysis Testing	**Report Date :**	03.08.2021
Location :	.	**Date Sampled:**	22.06.2021
Test Location:	RRHLP	**Date of Test:**	27.07.2021
Depth / Layer:	-	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	~
53.0	~
37.5	~
26.5	~
19.0	~
13.2	100%
9.5	97%
6.7	88%
4.75	74%
2.36	50%
1.18	34%
0.600	26%
0.425	24%
0.300	22%
0.150	19%
0.075	17%
0.050	16%
0.035	15%
0.025	14%
0.018	14%
0.013	13%
0.009	11%
0.007	9%
0.005	9%
0.003	8%
0.002	6%
0.001	5%

Description: Sandy GRAVEL with silt and clay

Test Method(s): AS 1289.3.6.1, 3.6.3

Sampling Method(s): Sampled by client

Remarks:

Loss in pretreatment: 0%

Type of Hydrometer: g/l

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number: 828

Accredited for compliance with ISO/IEC 17025 - Testing

Tested:	AC
Checked:	AC

Aimee Cartwright
Lab Technician

Appendix H.1 Site Inspection Checklist - IECA 2008

Site Inspection Checklist

LOCATION OF DEVELOPMENT . . . .

. . . .

. . . .

INSPECTION OFFICER . . . . **DATE** . . . .

SIGNATURE . . . .

N/A – not applicable

 – acceptable controls adopted

 – measures are not acceptable, or a potential problem exists

Part A: Initial site inspection

Item	Consideration	Assessment
1	Has an Erosion and Sediment Control Plan (ESCP) been approved for the site?	. . . .
2	Have all necessary development approvals been obtained?	. . . .
3	Are site conditions consistent with those assumed within the approved ESCP?	. . . .
4	Are environmental values being adequately protected?	. . . .
5	Are all ESC-related development conditions being satisfied?	. . . .
6	Was the full perimeter of the work site inspected?	. . . .
7	Are all reasonable and practicable measures being taken to minimise environmental harm?	. . . .

Part B: Site inspection and monitoring

Item	Consideration	Assessment
8	Appropriate in-house site inspections of ESC practices are being carried out such that all control measures are being maintained.	. . . .
9	Site inspections and monitoring are being carried out at appropriate times and intervals.	. . . .

Part C: Site establishment

Item	Consideration	Assessment
10	Site access is controlled and the number of access points minimised.	....
11	Adequate drainage and sediment controls exist at site entry/exit points.	....
12	Adequate drainage, erosion and sediment controls have been placed around the site compound.	....
13	Office compound area and car park gravelled/stabilised where necessary to control erosion and mud generation.	....
14	Appropriate drainage and sediment controls are installed prior to new areas being cleared or disturbed.	....

Part D: Site and vegetation management

Item	Consideration	Assessment
15	Vegetation Management Plan (VMP) and/or landscape plan has been prepared.	....
16	VMP and/or landscape plan is being appropriately implemented.	....
17	Site personnel appear to be aware of ESC requirements and have ready access to the Erosion and Sediment Control Plan.	....
18	ESC measures are being installed in accordance with the approved *Installation Sequence*.	....
19	Adequate supplies of ESC materials stored on-site: such as straw bales, wire, stakes, sediment fence fabric, filter cloth, clean aggregate.	....
20	Temporary access roads are stabilised where appropriate.	....
21	Permanent roads are programmed to be sealed as soon as reasonable and practicable.	....
22	Sediment deposition is not observed on external roads.	....
23	Adequate records are being kept on chemical dosing of sediment basins, site inspections and site maintenance.	....
24	The site is adequately prepared for the anticipated weather conditions.	....
25	“Witness Points” and “Hold Points” are being appropriately managed and adhered to.	....
26	Adequate protection provided for non-disturbance areas, buffer zones, protected trees.	....
27	Disturbances removed from the drip line of protected trees.	....
28	Brick-, masonry-, concrete-, and tile-cutting activities not carried out within road reserves (if possible) and all liquid waste is fully contained on-site or behind bunds.	....

Part E: Material and waste management

Item	Consideration	Assessment
29	Chemicals and petroleum products appropriately stored on site.	....
30	Emergency spill response plan has been prepared for the site.	....
31	Oil/petroleum spill containment/response kits available on-site where appropriate.	....
32	Adequate litter and waste receptors exist on-site.	....
33	Waste receptors for concrete, paints, acid washing, litter and building waste are being maintained.	....
34	Cement-laden liquid waste and wash-off is prevented from entering waterways and stormwater systems.	....
35	Waste water from construction activities such as wash water, de-watering operations, and dust control is being captured and treated.	....
36	On-site mortar/cement/concrete mixing is carried out behind earth bunds, or other such measures employed to fully contain cement-laden waste and spills.	....
37	Appropriate wash-down facilities provided from concrete trucks, mixing and pumping equipment.	....

Part F: Soil management

Item	Consideration	Assessment
38	Topsoil stripped and stockpiled prior to major earthworks.	....
39	Stockpiles located at least 5m away from top of watercourse banks.	....
40	Long-term soil stockpiles adequately protected against wind and rain.	....
41	Adequate sediment controls placed down-slope of stockpiles.	....
42	Stockpile sediment control (*Filter Fence* or *Sediment Fence*) is appropriate for the soil type and site conditions.	....
43	Adequate drainage controls placed up-slope of stockpiles.	....
44	Soil stockpiles do not encroach upon protected vegetation.	....
45	Subsoils adequately scarified prior to topsoil placement.	....
46	Topsoil is being replaced at an adequate depth.	....

Part G: Drainage controls

Item	Consideration	Assessment
47	Construction Drainage Plans (CDPs) are consistent with actual site conditions (i.e. current stage of works).	....
48	Drainage Control measures are consistent with the ESCP.	....
49	Drainage Control measures are being adequately maintained in proper working order at all times.	....
50	Adequate diversion/management of up-slope stormwater.	....
51	Up-slope "clean" water is being appropriately diverted around/through the site in a non-erosive manner.	....
52	Stormwater runoff diverted away from unstable slopes.	....
53	Flow diversion channels/banks stabilised against erosion.	....
54	Flow <u>not</u> unlawfully discharged onto an adjacent property.	....
55	Spacing of cross drainage (e.g. *Catch Drains* or *Flow Diversion Banks*) down long slopes is sufficient to prevent "rill" erosion.	....
56	Earth batters are free of "rill" erosion.	....
57	**Catch Drains:**	
	(a) Adequate depth/width.	....
	(b) Adequate flow capacity is being maintained.	....
	(c) Stabilised against soil scour.	....
	(d) Clear of sediment deposition.	....
	(e) Appropriate grass length is being maintained.	....
	(f) Water discharges via a stable outlet.	....
58	**Channel Linings (mats):**	
	(a) Lining is well anchored.	....
	(b) Mats overlap in direction of flow.	....
	(c) Lining is appropriate for flow conditions.	....
	(d) No damage to the mat by lateral inflows.	....
59	**Check Dams:**	
	(a) Flow is passing <u>over</u> the dams and not around them.	....
	(b) Check Dams are <u>not</u> causing excessive channel restriction.	....
	(c) Rock Check Dams are not used in shallow drains.	....
	(d) Check Dams are appropriately spaced down the drain.	....
60	**Chutes (rock):**	
	(a) Geotextile filter cloth is installed under the rock.	....
	(b) Rock placement has <u>not</u> reduced chute flow capacity.	....
	(c) Rock size appears adequate for expected flow velocity.	....
	(d) Water discharges via a stable outlet.	....

61 **Chutes (geotextile):**

(a) Lining is well anchored. . . . .

(b) Mats overlap in direction of flow. . . . .

(c) Lining is appropriate for flow conditions. . . . .

(d) Water discharges through a stable outlet. . . . .

62 **Level Spreaders:**

(a) Outlet weir is level and undamaged. . . . .

(b) No sediment deposition within *Level Spreader*. . . . .

(c) Discharges “sheet” flow to a stable, well-grassed outlet. . . . .

63 **Slope Drains:**

(a) Adequate erosion/sediment controls at pipe inlet. . . . .

(b) Pipes are well anchored. . . . .

(c) No obvious water leaks. . . . .

(d) Water discharges via a stable outlet. . . . .

64 **Stormwater Outlets:**

(a) Energy dissipation is appropriate for the conditions. . . . .

(b) Rock size is greater than 200mm. . . . .

(c) Soil erosion is being controlled. . . . .

65 **Temporary Watercourse Crossings:**

(a) Crossing type is appropriate for the stream conditions. . . . .

(b) Sediment runoff from the approach roads is controlled. . . . .

(c) Likely damage to the crossing and the stream caused by possible overtopping flows is considered acceptable. . . . .

Part H: Erosion controls

Item	Consideration	Assessment
66	Erosion control standard is consistent with requirements of regulatory authority.	....
67	Soil erosion is being controlled to a standard consistent with the level of environmental risk.	....
68	Erosion Control measures are consistent with the approved ESCP.	....
69	Disturbance to existing ground cover is being delayed as long as possible.	....
70	Raindrop impact erosion is being adequately controlled.	....
71	Earth batters are free of "rill" erosion.	....
72	Dust problems are being adequately controlled.	....
73	Erosion Control measures are being adequately maintained in proper working order at all times.	....
74	All disturbed areas are adequately stabilised given:	
	(a) Erosion hazard risk.	....
	(b) Degree of downstream sediment control.	....
	(c) Days since earthworks were finalised.	....
	(d) Days before any soil disturbance will be re-worked.	....
75	**Erosion Control Blankets:**	
	(a) Blankets are well anchored.	....
	(b) Blankets overlap in direction of stormwater flow.	....
	(c) Blanket strength is appropriate for site conditions.	....
	(d) Synthetic blanket reinforcing will not endanger wildlife.	....
	(e) Blankets not damaged by lateral inflows.	....
	(f) Blankets protected against movement by winds.	....
76	**Mulching (light):**	
	(a) Minimum 70% coverage of soil surface.	....
	(b) Suitable tackifier used on steep slopes.	....
	(c) Drainage controls preventing mulch displacement.	....
77	**Mulch (heavy):**	
	(a) Minimum 100% coverage of soil.	....
	(b) Minimum depth adequate to control weeds.	....
	(c) Drainage controls preventing mulch displacement.	....
78	**Soil Binders:**	
	(a) No adverse environmental impacts observed.	....
	(b) No obvious over-spray.	....
	(c) Soil binders applied during appropriate weather conditions.	....

Part I: Sediment controls

Item	Consideration	Assessment
79	Sediment is being controlled to a standard consistent with legislative requirements and the level of environmental risk.	. . . .
80	Sediment Control is consistent with the approved ESCP.	. . . .
81	Sediment Control is appropriate for the soil type.	. . . .
82	No sub-catchment relies solely on “supplementary” sediment control traps.	. . . .
83	Sediment Control measures are being adequately maintained in proper working order at all times.	. . . .
84	Sediment control *Buffer Zones* are protected from traffic and are free of excessive sediment deposits.	. . . .
85	Straw bales are not being used for sediment control, unless justified by exceptional circumstances.	. . . .
86	Neighbouring properties are being adequately protected from sedimentation.	. . . .
87	Collected sediment is being disposed of in an appropriate manner.	. . . .
88	**Entry/Exit Points:**	
	(a) Control measures are appropriate for the site conditions.	. . . .
	(b) Control measures are constructed to appropriate standards.	. . . .
	(c) Excessive sediment removed from sediment traps.	. . . .
	(d) Excessive sedimentation is not evident on roadway.	. . . .
	(e) Stormwater drainage is controlled such that sediment is not being washed onto the adjacent roadway.	. . . .
89	**Field (Drop) Inlet Controls:**	
	(a) Inlet control measures allow adequate ponding around stormwater inlets to capture sediment.	. . . .
	(b) The sediment control measures do not simply divert sediment-laden water downstream to an uncontrolled inlet.	. . . .
	(c) Sediment control measures will not cause a safety or local flood hazard.	. . . .
	(d) Sediment traps are appropriate for site conditions.	. . . .
	(e) Excessive sediment deposition is removed from all traps.	. . . .
90	**Gully Inlet Controls:**	
	(a) Sediment traps are appropriate for the type of gully inlet, either “sag” or “on-grade” inlet.	. . . .
	(b) Sediment traps allow adequate ponding around or up-slope of stormwater inlets to capture sediment.	. . . .
	(c) Sediment traps do not simply divert sediment-laden water downstream to an uncontrolled inlet.	. . . .
	(d) Sediment control measures will not cause a safety, traffic or local flooding hazard.	. . . .
	(e) Excessive sediment deposition is removed from all traps.	. . . .

91 **Table drain sediment traps:**

(a) Choice of sediment trap is appropriate for flow conditions. ....

(b) Excessive sediment is removed from all traps. ....

(c) Spill-through weir is set to an appropriate elevation. ....

(d) Spill-through weir has adequate width. ....

(e) Sediment Fence traps are formed in a tight U-shape that adequately prevents water bypassing the traps. ....

92 **Sediment Fences:**

(a) Choice of fabric is appropriate. ....

(b) Bottom of fabric is securely buried. ....

(c) Fabric is appropriately overlapped at joints. ....

(d) Fabric is appropriately attached to posts. ....

(e) Support posts are at correct spacing (2m or 3m with backing). ....

(f) Sediment Fence does <u>not</u> cause flow diversion/bypass. ....

(g) Sediment Fence has regular returns. ....

(h) Lower end(s) of fence is/are returned up the slope. ....

(i) Sediment Fences are free of damage. ....

(j) All fences are free of excessive sediment deposition. ....

(k) Fences are adequately spaced from toe of fill banks. ....

93 **Filter Tube Sediment Traps:**

(a) Geometry and layout match design details. ....

(b) Sediment-laden water cannot bypass the filtration system. ....

(c) Filter Tubes do <u>not</u> need replacement. ....

(d) Filter Tubes and embankment are free of damage. ....

94 **Rock Filter Dams (Sediment Traps):**

(a) Geometry and layout match design details. ....

(b) Excessive sediment removed from up-slope of all traps. ....

(c) The filtration system is free from sediment blockage. ....

(d) Rock Filter Dam and spillway are free of damage. ....

95 **Sediment Weirs:**

(a) Geometry and layout match design details. ....

(b) Excessive sediment removed from up-slope of all traps. ....

(c) The filtration system is free from sediment blockage. ....

(d) Sediment Weir and splash pad (if any) are free of damage. ....

96 **Sediment Trench:**

(a) Trench geometry and layout match design details. ....

(b) Excessive sediment removed from the trench. ....

(c) Outlet structure (if any) is free from sediment blockage. ....

(d) The open trench does <u>not</u> represent a safety hazard. ....

97 **Sediment Controls for Non-Storm Runoff**

(a) Choice of sediment trap is appropriate for the site conditions and level of environmental risk. ....

(b) All sediment is being contained within trap. ....

98 **Sediment Basin (1): Location . . . .**

(a) Basin geometry and layout match design details. . . . .
(b) "As constructed" plans have been prepared. . . . .
(c) The basin does not represent a safety risk. . . . .
(d) De-watering is conducted in accordance with best practice. . . . .
(e) Excessive sediment removed from basin. . . . .
(f) Sediment depth marker is installed and maintained. . . . .
(g) Primary outlet structure is free from sediment blockage. . . . .
(h) Flow conditions are not compromised across the spillway. . . . .
(i) Emergency spillway has adequate scour control. . . . .
(j) Adequate quantities of flocculant (if required) exist on-site. . . . .
(k) Soil erosion is adequately controlled at inlet points. . . . .
(l) The settled sediment layer is clearly visible through ponded water prior to discharge such water. . . . .

99 **Sediment Basin (2): Location . . . .**

(a) Basin geometry and layout match design details. . . . .
(b) "As constructed" plans have been prepared. . . . .
(c) The basin does not represent a safety risk. . . . .
(d) De-watering is conducted in accordance with best practice. . . . .
(e) Excessive sediment removed from basin. . . . .
(f) Sediment depth marker is installed and maintained. . . . .
(g) Primary outlet structure is free from sediment blockage. . . . .
(h) Flow conditions are not compromised across the spillway. . . . .
(i) Emergency spillway has adequate scour control. . . . .
(j) Adequate quantities of flocculant (if required) exist on-site. . . . .
(k) Soil erosion is adequately controlled at inlet points. . . . .
(l) The settled sediment layer is clearly visible through ponded water prior to discharge such water. . . . .

100 **Sediment Basin (3): Location . . . .**

(a) Basin geometry and layout match design details. . . . .
(b) "As constructed" plans have been prepared. . . . .
(c) The basin does not represent a safety risk. . . . .
(d) De-watering is conducted in accordance with best practice. . . . .
(e) Excessive sediment removed from basin. . . . .
(f) Sediment depth marker is installed and maintained. . . . .
(g) Primary outlet structure is free from sediment blockage. . . . .
(h) Flow conditions are not compromised across the spillway. . . . .
(i) Emergency spillway has adequate scour control. . . . .
(j) Adequate quantities of flocculant (if required) exist on-site. . . . .
(k) Soil erosion is adequately controlled at inlet points. . . . .
(l) The settled sediment layer is clearly visible through ponded water prior to discharge such water. . . . .

101 **Other Sediment Trap (1): Type . . . .**

(a) Choice of sediment trap is appropriate for the site conditions and level of environmental risk. . . . .

(b) The sediment trap allows adequate ponding to capture coarse sediment (Type 2 and Type 3 Sediment Traps). . . . .

(c) The sediment trap allows adequate filtration to capture fine sediment (Type 2 Sediment Traps). . . . .

(d) The sediment trap does not simply divert sediment-laden water downstream to an uncontrolled outlet. . . . .

(e) The sediment trap does not cause a safety, traffic or local flood hazard. . . . .

(f) Excessive sediment deposition is removed from all traps. . . . .

102 **Other Sediment Trap (2): Type . . . .**

(a) Choice of sediment trap is appropriate for the site conditions and level of environmental risk. . . . .

(b) The sediment trap allows adequate ponding to capture coarse sediment (Type 2 and Type 3 Sediment Traps). . . . .

(c) The sediment trap allows adequate filtration to capture fine sediment (Type 2 Sediment Traps). . . . .

(d) The sediment trap does not simply divert sediment-laden water downstream to an uncontrolled outlet. . . . .

(e) The sediment trap does not cause a safety, traffic or local flood hazard. . . . .

(f) Excessive sediment deposition is removed from all traps. . . . .

103 **Other Sediment Trap (3): Type . . . .**

(a) Choice of sediment trap is appropriate for the site conditions and level of environmental risk. . . . .

(b) The sediment trap allows adequate ponding to capture coarse sediment (Type 2 and Type 3 Sediment Traps). . . . .

(c) The sediment trap allows adequate filtration to capture fine sediment (Type 2 Sediment Traps). . . . .

(d) The sediment trap does not simply divert sediment-laden water downstream to an uncontrolled outlet. . . . .

(e) The sediment trap does not cause a safety, traffic or local flood hazard. . . . .

(f) Excessive sediment deposition is removed from all traps. . . . .

104 **Other Sediment Trap (4): Type . . . .**

(a) Choice of sediment trap is appropriate for the site conditions and level of environmental risk. . . . .

(b) The sediment trap allows adequate ponding to capture coarse sediment (Type 2 and Type 3 Sediment Traps). . . . .

(c) The sediment trap allows adequate filtration to capture fine sediment (Type 2 Sediment Traps). . . . .

(d) The sediment trap does not simply divert sediment-laden water downstream to an uncontrolled outlet. . . . .

(e) The sediment trap does not cause a safety, traffic or local flood hazard. . . . .

(f) Excessive sediment deposition is removed from all traps. . . . .

Part J: Instream works

Item	Consideration	Assessment
105	All necessary State and local government approvals have been obtained.	. . . .
106	*Temporary Watercourse Crossings* (e.g. construction access) have been reduced to the minimum practical number.	. . . .
107	Instream disturbance is limited to the minimum necessary to complete the proposed works.	. . . .
108	Timing and staging of instream works will minimise exposure of the site to storm and/or stream flows.	. . . .
109	Instream works are occurring at a time of the year that will minimise overall potential environmental harm:	
	(a) avoiding seasonal high flows;	. . . .
	(b) avoiding periods of likely fish migration;	. . . .
	(c) avoiding active bird migration periods (Ramsar wetlands).	. . . .
110	Instream structures are not located on, or adjacent to, unstable or highly mobile channel bends.	. . . .
111	Construction works are not unnecessarily disturbing instream or riparian vegetation.	. . . .
112	Overbank disturbances are limited to only one bank wherever reasonable and practicable.	. . . .
113	Stormwater runoff moving towards the channel from adjacent areas is being appropriately diverted around soil disturbances.	. . . .
114	Erosion is not occurring as a result of stormwater passing down channel banks.	. . . .
115	Normal channel flows are being diverted around in-bank disturbances as appropriate for the expected weather and channel flow conditions.	. . . .
116	Appropriate temporary erosion control measures are being applied to disturbed areas.	. . . .
117	Synthetic reinforced erosion control blankets/mats are not being used where there is a potential threat to wildlife.	. . . .
118	Adopted instream sediment control measures are appropriate for the expected site and channel conditions.	. . . .
119	*Sediment Fences* have not been placed in areas of actual or potential concentrated flow.	. . . .
120	Appropriate material (spoil) de-watering procedures have been adopted.	. . . .
121	Site stabilisation and rehabilitation is occurring as soon as practicable.	. . . .
122	Appropriate site rehabilitation measures are being adopted.	. . . .

Part K: Site stabilisation/revegetation

Item	Consideration	Assessment
123	Site stabilisation/rehabilitation plan has been prepared.	....
124	Site stabilisation/revegetation is occurring in accordance with approved Plans and/or programming.	....
125	Exposed areas are adequately stabilised given the site conditions, environmental risk, and construction schedule.	....
126	Soil surfaces are suitably roughened prior to revegetation.	....
127	Excessive soil compaction is amended prior to revegetation.	....
128	Seedlings are appropriately stored prior to planting.	....
129	Seedlings are <u>not</u> excessively mature for their pot/tube size.	....
130	Drill seeding (if any) is being applied across the slope (not up and down the slope).	....
131	Newly seeded areas are developing an appropriate grass cover (not just strike rate), density and grass type.	....
132	No newly seeded areas require reseeding.	....
133	Soil erosion within revegetated areas is being adequately controlled (i.e. mulching) during the plant establishment phase.	....
134	Grass turfing is <u>not</u> being placed directly on compacted soil.	....
135	Water application is appropriate for the site conditions and water conservation requirements.	....
136	Soils are being appropriately prepared (i.e. pH, nutrients, and so on) prior to revegetation.	....
137	Revegetation is controlling soil erosion as required.	....
138	Newly seeded areas have been lightly mulched as specified.	....
139	Adequate heavy mulching placed around seedlings.	....
140	Newly established plants are being adequately maintained.	....
141	Weeds and grasses are being controlled around the base of newly established trees and shrubs.	....
142	Plants damaged by traffic or wind-rock are adequately supported or replaced.	....
143	Dead or severely damaged plants have been replaced.	....

Part L: Action summary

Item	Consideration	Yes or No
	Answer "Yes" if further action is required on site	
144	Do any existing control measures require modification?	....
145	Are additional ESC measures required on the site?	....
146	Are alternative ESC measures required on the site?	....
147	Is a revised ESCP required for the site?	....
148	Is further water quality monitoring required?	....
149	Do any ESC measures need repairs or de-silting?	....
150	Is additional erosion control (minimum 70% cover) required?	....
151	Will the underlying cause of any non-compliance need further investigation?	....
152	Will it be necessary for the site to adopt an alternative Code of Practice better suited to the site conditions or work activities?	....
153	Will further site inspections be required?	....

Notes:

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