Attachment 1—Landowner statement

This attachment is to be used by the environmental authority holder to attach to the final rehabilitation report or the progressive rehabilitation that accompanies an application to surrender an environmental authority or an application for progressive certification respectively. It is to also be attached to the rehabilitation report for an application to amend an environmental authority where a prescribed ERA is being removed from the environmental authority.

This form is to be used:

- To obtain a statement from the land owner of their overall satisfaction with the rehabilitation.
- If there is a proposed transfer of remaining infrastructure (e.g. a road) or remaining disturbed areas (e.g. extraction voids) to the landowner in a particular state.

The information provided on this form will be considered by the administering authority in the assessment of whether the conditions of the environmental authority have been complied with and whether the land has been satisfactorily rehabilitated. The administering authority may also conduct a field inspection and may request that further rehabilitation be undertake where relevant.

If you require assistance in answering any part of this form, or have any questions about your application, please contact Permit and Licence Management. Contact details are at the end of this form.

GUIDE

If more space is required for any responses, please attach additional information as a separate page.

Example of land description
Lot: 1
Plan: 123456
Tenure: Special Lease 12
Current usage: Reserve

Information requirements

1. Land description

LOT(S) 1
PLAN(S) OC57
TENURE Freehold
CURRENT USAGE Primary Production

2. Environmental authority number

ENVIRONMENTAL AUTHORITY NUMBER EPML00900713

Where the landowner is not an individual (e.g. a company or group), provide the name and contact details of a person who is authorised to act on behalf of the landowner.

3. Landowner

NAME OF LANDOWNER State of Queensland acting through the Department of Agriculture and Fisheries	
CONTACT NAME (IF COMPANY/GROUP ETC.) SEAN REED	
POSTAL ADDRESSS MS 99 Charters Towers 4820	
PHONE 0740918180	FACSIMILE
EMAIL sean.reed@daf.qld.gov.au	

Examples of remaining infrastructure includes roads, storage sheds etc.
Inheritance of disturbed land and infrastructure brings with it responsibilities for maintenance and management.

4. Are there any infrastructure or disturbed areas which you wish to take ownership of?

☒ Yes → Briefly described the infrastructure or areas and the status of which you would accept ownership below, then go to question 5.

☐ No → Go to question 7.

INFRASTRUCTURE/DISTURBED AREA (I.E. ROAD ALONG WESTERN BOUNDARY)	STATUS (I.E. IN ITS CURRENT STATE AS AN UNSEALED DIRT ROAD)
1. Haul Road from Gregory Developmental Road to Dingo Dam Mine site	The department has previously taken ownership of the haul road which is currently in good condition with the exception of a couple of areas that have become eroded due to impeded natural drainage paths. The department will grant approval to access the mine site via the haul road under the conditions that, at the completion of site rehabilitation works, the haul road is left in equal or better condition than at commencement of these remediation works and all watercourse crossing points are treated to provide a stable base such as rock amouring or a concrete causeway constructed to relevant civil standards to facilitate natural water flow paths and to

	provide long term protection against erosion and deterotiation.

5. Have you made an agreement with the holder of the environmental authority regarding the infrastructure or disturbed areas which you wish to take ownership of?

☒ Yes → Attach a copy of the signed agreement and fill in the table below.

☐ No → There must be an agreement in place, and details of the agreement provided to the administering authority for the application to be decided.

DATE OF AGREEMENT	NUMBER OF PAGES
03/12/2014	11

6. Are there any items of infrastructure or areas of disturbance which you believe an agreement is still required, but has not been made?

☒ Yes → Provide information of outstanding agreements required below.

☐ No

INFRASTRUCTURE/DISTURBED AREA STILL TO BE AGREED UPON

The Dingo Dam mining lease contains several areas of disturbance in various states of rehabilitation. These areas are identified as the waste dump, ROM pad, diversion bund, sediment dam, office area and residual void. The department will take ownership of each disturbance area only once the department of Environment and Science has granted rehabilitation certification for that area.

The Department of Environment and Science will only certify disturbance areas as rehabilitated once the EA holder has demonstrated those areas of the mine site are safe, stable and self-sustaining. Rehabilitation certification indicates that environmental and rehabilitation conditions and liabilities have been met to allow grazing of stock and water quality in the Pit void is suitable for stock water.

You may attach photographs or plans to illustrate any matters about which you believe are unsatisfactory. Make sure that any attachments are clearly labelled and referenced.

7. Indicate your level of satisfaction of the rehabilitation so far.

☐ Satisfactory (further comments may be provided below, if necessary)

☒ Unsatisfactory (provide further information below)

FURTHER COMMENTS

Waste Dump - To date the establishment of ground cover has not been adequately achieved and has led to runoff causing erosion gullies forming on the waste dump. The waste dump will need to be certified as rehabilitated in order to transfer the land to the department.

Diversion bund spillway – In accordance with the Dingo Dam Stormwater Management Plan, the management of clean water flowing onto the ML area will significantly reduce the Run of Mine (ROM)/stockpile catchment as captured by the diversion bund from 86.1 ha to 3.1 ha. The spillway from the rehabilitated ROM pad to sediment dam is to remain to allow for the natural flow of water. The spillway is eroded and should be repaired to prevent further erosion.

Water Management infrastructure – Construction and alteration to existing diversion bunds is required to prevent the existing clean water catchment from being diverted into the residual void, thereby minimising the mine affected water catchment and reducing the potential for contaminated water being released to the receiving environment. Modifications required to improve the water management at the site are described in the Dingo Dam Stormwater Management Plan (SWMP) (ATCW 2019) (attached) and summarised below:

1. Embankments / diversion bunds between Dingo Dam and the residual void are to be constructed to prevent releases from Dingo Dam into the pit. Refer to Features 3 and 5 in Figure 002 of the SWMP.

2. A bywash is to be constructed on Dingo Dam to allow the release of dam overflows to natural drainage paths. Refer to Feature 1 shown on Figure 002 of the SWMP.

3. A new embankment / bund is to be constructed around the northern end of the residual void to prevent the residual void from overtopping and releasing to the receiving environment. Refer to Feature 6 shown on Figure 002 of the SWMP.

4. A spillway is to be constructed on the existing diversion bund to the northeast of Dingo Dam to restore natural overland flows. Refer to Feature 2 shown on Figure 002 of the SWMP.

Privacy statement
The Department of Environment and Science (the department) is committed to protecting the privacy, accuracy and security of your personal information in accordance with the *Information Privacy Act 2009*. The department is collecting your personal information in accordance with sections 226, 262, 264, 318ZD and 318ZF of the *Environmental Protection Act 1994* in order to process your application to surrender an environmental authority or application for progressive certification. The information will only be accessed by authorised employees within the department. Information may be given to the Department of Natural Resources and Mines for the purposes of processing the application to surrender the environmental authority. Your information will not be given to any other person or agency unless you have given us permission or we are authorised or required by law. All information supplied on this form may be disclosed publicly in accordance with the *Right to Information Act 2009* and *Evidence Act 1977*. For queries about privacy matters email: **privacy@des.qld.gov.au** or

8. Landowner certification

Tick the applicable box

☒ I am the landowner for the land described in question 1.

☒ I am authorised to sign on behalf of the landowner for the land described in question 1.

Declaration

I/We declare that:

- The information provided is true and correct to the best of my knowledge. I understand that it is an offence under section 480 of *the Environmental Protection Act 1994* to give to the administering authority or an authorised person a document containing information that I know is false, misleading or incomplete in a material particular.
- I understand that all information supplied in this form may be disclosed publicly in accordance with the *Right to Information Act 2009* and the *Evidence Act 1977*.

NAME Andrew Dati	
SIGNATURE 	
POSITION OF SIGNATORY A/DIRECTOR RESEARCH INFRASTRUCTURE	DATE 6.2.2019

telephone: 13 QGOV (13 74 68).

The landowner or person authorised to act on behalf of the landowner is required to sign this form.

Further information
The latest version of this publication and other publications referenced in this document can be found at **www.qld.gov.au** using the relevant publication number (ESR/2015/1616) for this form as a search term or by contacting Permit and Licence Management.

REPORT

AUSTRALIAN MINES LTD

Lucky Break Project

Dingo Dam Stormwater Management Plan

Date: January 2019

Report Number: 118284-01R001-0

Document History and Status

Title:	Lucky Break Project – Stormwater Management Plan
Job Number/Extension:	118284.01
Document Number:	118281-01R001-0
Project Office:	Brisbane
File Path:	M:\Synergy\Projects\118\118284 Dingo Dam Lucky Break\01 Water Management Concept\Documents\R01\Text\118284-01R001-0.docx
Author:	Matthew Plucknett
Reviewer:	Thomas Rose
Job Manager:	Thomas Rose
RPEQ Certification:	Allan Watson (RPEQ no. 5721)

Rev.	Status	Issued to	Issue Date	Signatures	
				Author	Reviewer
A	Draft Issue	Hollie Dick	25/01/2019	MP	TR
0	Final Issue	Hollie Dick	31/01/2019	MP	TR

This Revision distributed To:	Hard Copy	Electronic Copy
Hollie Dick	n/a	email

IMPORTANT NOTICE

Please refer to our Conditions of Investigation and Report

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ATC Williams

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1 INTRODUCTION

1.1 Background

Australian Mines Ltd (AML) owns the Lucky Break project located approximately 120km southwest of Townsville and some 90km northwest of Charters Towers, in Northern Queensland. The Lucky Break project is an open cut nickel mine located on Gregory Development Road, encompassing two Mining Leases (ML) known as Dingo Dam (ML 10324) and Lucky Break (ML 10332). Mining operations were undertaken through use of an open-cut pit method from which approximately 114 thousand tonnes (kt) of ore was extracted, before mining ceased in July 2015. Mining was conducted only on the Dingo Dam ML, with the Lucky Break ML undisturbed. The project operates under Environmental Authority (EA) Permit No. EPML00900713 issued by the Department of Environment and Science (DES), dated 9 March 2018. It is understood that the project is currently in Care and Maintenance following mine closure and previous rehabilitation works.

It is understood that the site is currently occupied by the Spyglass Beef Research Station. Discovery of poor water quality in the void has resulted in the need to minimise surface water reporting to the void. As such, AML has commissioned ATC Williams Pty Ltd (ACTW) to develop a Stormwater Management Plan (SWMP) for the Dingo Dam site to help meet regulatory environmental compliance objectives and minimise the potential for environmental harm.

The site stormwater management strategy herein has been developed with the primary objective of minimising water reporting to the void and restoring natural drainage paths where appropriate.

1.2 Scope of Work

The scope of works for the Stormwater Management Plan are as follows:

- Review of available site data, including survey and existing site conditions;
- Review of stormwater management options;
- Development of conceptual water management design to minimise surface water reporting to a ex-mining void and restore natural drainage paths where appropriate;
- Develop peak flow estimates and indicative sizing of required hydraulic infrastructure for the proposed site configuration.

1.3 Structure of Report

The structure of the report, to meet the above scope, is as follows:

Section 2.0 - Outlines details of the site description, providing existing site conditions, topography, drainage and climate conditions.

Section 3.0 - Details the framework for the stormwater management system design, including a review of relevant conditions.

Section 4.0 - Presents the details of the conceptual stormwater model and outlines calculations.

Section 5.0 - Presents concluding statements about the SMWP and its objectives, and makes recommendations for future works as required.

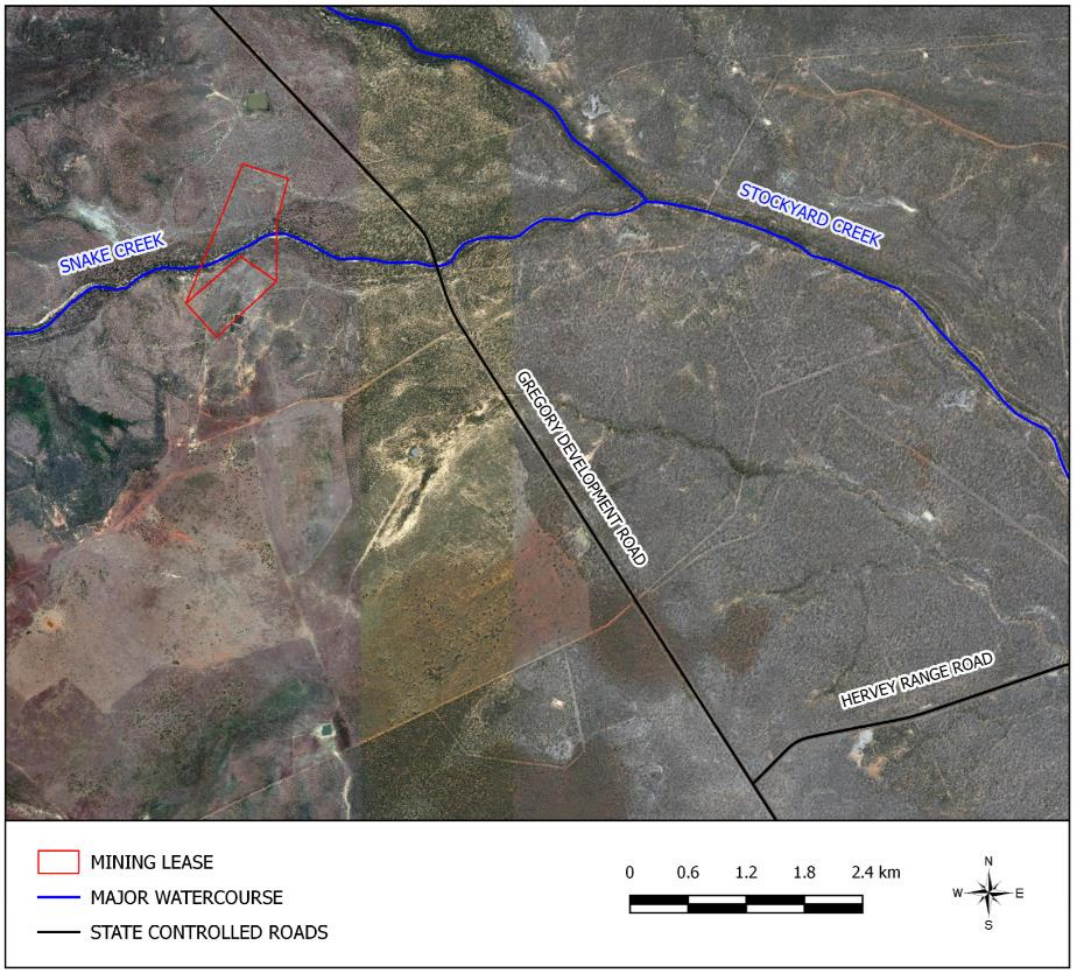
2 SITE CHARACTERISTICS

2.1 Site Description

The Lucky Break Project Site is located approximately 120km southwest of Townsville and some 90km northwest of Charters Towers, in Northern Queensland. The project site comprises of two Mining Leases known as Dingo Dam (ML 10324) and Lucky Break (ML 10332).

The site location is provided in **Plate 1**, shown below.

Plate 1
Site Location



The site is currently occupied by the Spyglass Beef Research Station with the current land use being cattle grazing. The Spyglass Beef Research Station occupies approximately 38,300 hectares, of which encompasses this site.

Key infrastructure associated with the Dingo Dam ML are shown in **FIGURE 001** and includes the following:

- Dingo Dam
- Sediment Dam
- Waste Rock Dump
- Open Cut Pit (referred to as the void)
- ROM Pad
- Various bunds

The existing catchment areas at site as shown on **FIGURE 001** are summarised in **Table 1**.

Table 1
Summary of Existing Catchment Areas

Catchment	Area (ha)
Dingo Dam	26.6
Pit Void	5.1
Pond	47.7
Sediment Dam	86.1
Total Void Catchment	79.4
Total Site to Sediment Dam	165.5

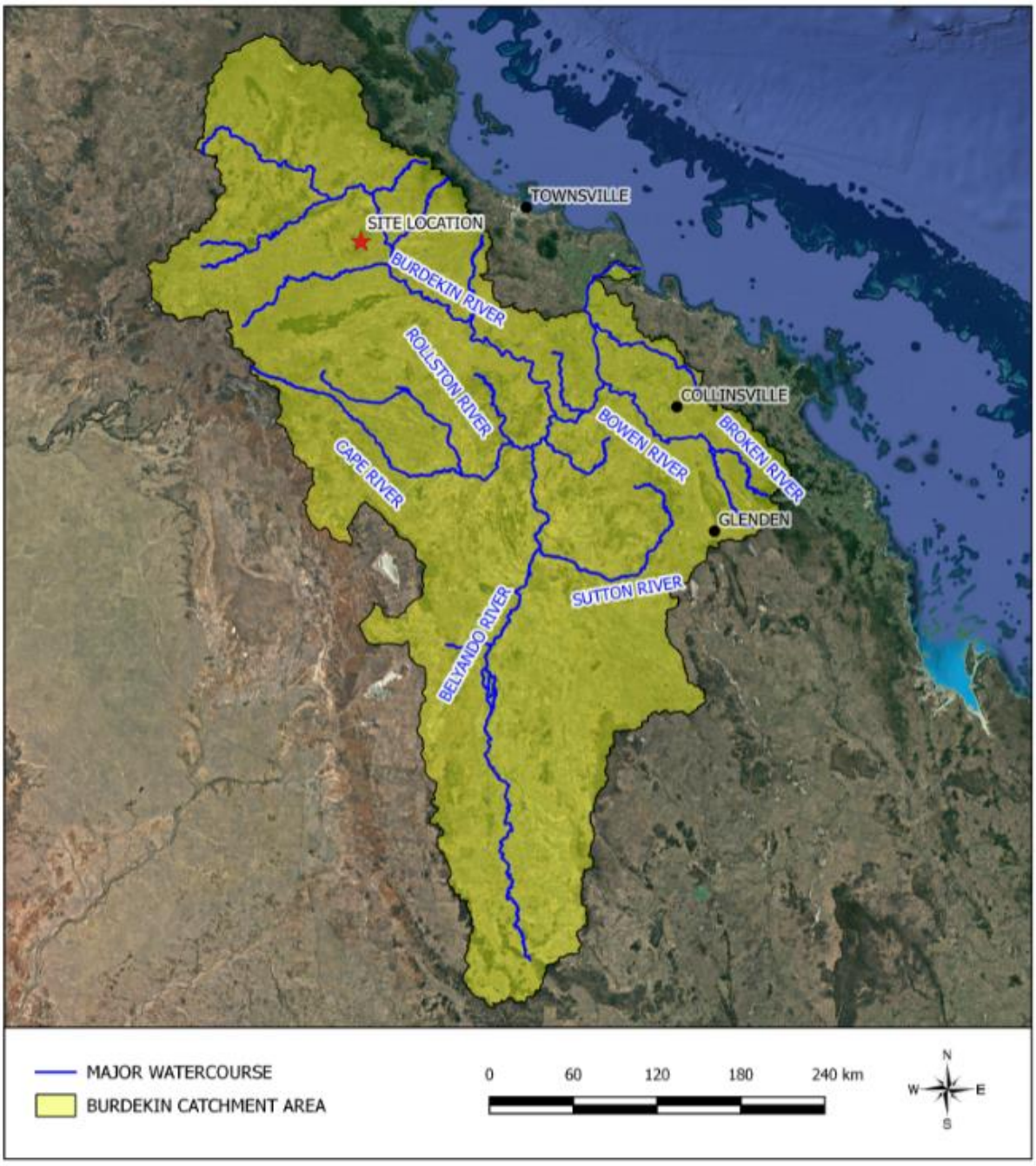
It is noted that under current site (operational) conditions, the total site, including all the sub-catchments as listed in **Table 1**, drains to the Sediment Dam.

2.2 Hydrological Characteristics and Topography

2.2.1 Regional Context

The Lucky Break project site is situated within the Burdekin River Basin (refer **Plate 2**). The site is located some 28km from the Burdekin River channel, and approximately 230km from the confluence with the Burdekin River to Dalrymple Lake (Burdekin Falls Dam). From the Burdekin Falls Dam it is approximately 160km to the Coral Sea. The Burdekin River falls some 620m over its approximately 886km length, to discharge to the Coral Sea.

Plate 2
Burdekin River Basin Catchment Map

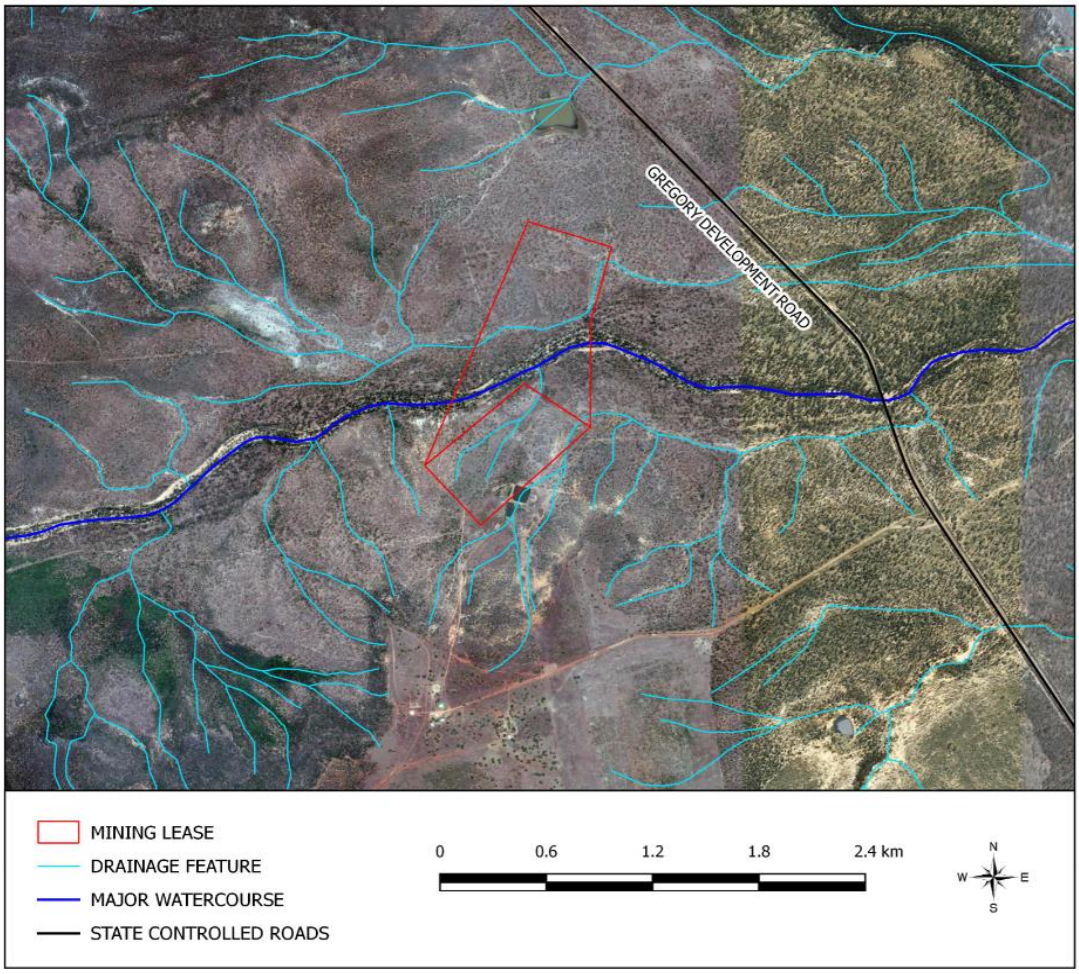


2.2.2 Site Hydrology

Locally, the Lucky Break project site is intersected through the middle of the Mining Leases by Snake Creek, a tributary of Stockyard Creek which reports to the Burdekin River to the east. The topography of the Dingo Dam ML grades away to the north, with overland flows towards Snake Creek, before subsequently joining Stockyard Creek some 4km east of the site. The highest elevation on the site is some RL 365.5m on the south-western extent of the ML, and the lowest elevation is some RL 336.0m on the north-eastern extent. The site location with respect to local hydrological features is provided on **Plate 3**, shown below.

The site is characterised by generally gentle slopes (average 2% to 3%) with overland flow paths becoming channelised upstream of the site infrastructure and subsequently transecting the site. A number of diversion bunds and dams have been previously constructed on the site which has resulted in significant alteration to the natural flow regimes.

Plate 3
Drainage System Proximate to the Project Site



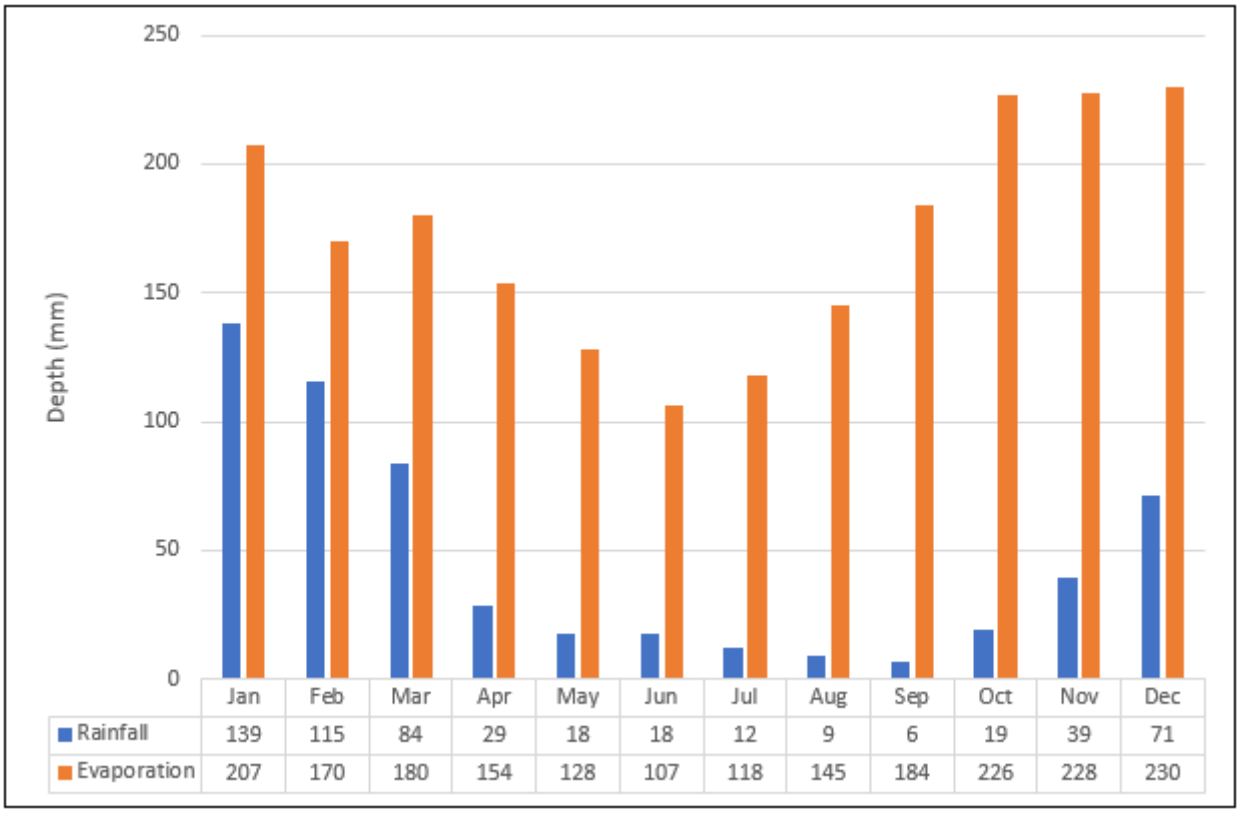
2.3 Climate and Rainfall

The project site, located in Northern Queensland, is subject to a tropical climate. This climate is associated with variable rainfall conditions; however, average values indicate a distinct seasonal pattern with lower rainfall conditions associated with winter months and higher rainfall conditions during the summer months. The wet season occurs from November to March, with 81% of mean annual rainfall occurring during these months.

The nearest meteorological station to the site, with the longest data history, is Hillgrove weather station (No. 30137), located approximately 18km to the south-east. Rainfall data from this station shows that mean annual rainfall is some 553.4mm. The month with the highest average rainfall is January, and the month with the lowest average rainfall is August. Hillgrove station does not have long term evaporation data; therefore, evaporation data has been sourced from a SILO Data Drill specific to the site location.

Plate 4 summarises the average rainfall and evaporation for all months of the year for the site. From the SILO Data series, only evaporation data ranging from 1970 to 2019 was utilized, as Class A evaporation pan data is only available in the region throughout this period.

Plate 4
Mean Rainfall and Evaporation



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	139	115	84	29	18	18	12	9	6	19	39	71
Evaporation	207	170	180	154	128	107	118	145	184	226	228	230

Source: BOM Hillgrove station (No. 30137) and SILO Data Drill requested for the site location (accessed 23 January 2019).

Plate 4 indicates that evaporation exceeds mean monthly rainfall throughout the entire year. On an average monthly basis, maximum evaporation occurs later in the year (October to December). During the dry season months, evaporation is significantly lower, with the lowest monthly total typically occurring in June.

2.4 Regional Flood Mapping

The Queensland Flood Mapping Program 2015 series provided a high-level flood mapping data set for the 1% Annual Exceedance Probability (AEP) and the Extreme Storm Event. Review of the data shows that the Dingo Dam site would not be expected to be inundated by regional storm flow from Snake Creek during the 1% AEP event, but may experience flooding up to 0.5m depth during the Extreme Storm Event.

3 SITE STORMWATER MANAGEMENT PLAN DESIGN BASIS

3.1 Assessment Framework

It is noted that currently no structures on the project site are listed as regulated structures under the site's EA. Consequently, the overarching framework for the stormwater management and design basis in relation to the site has been adopted from the 'Guideline - Stormwater and Environmentally Relevant Activities' (DEHP, 2014). This guideline does not apply to activities defined as resource activities in Schedule 2A of the EP Regulation; although does apply for activities listed under Schedule 2, including ancillary activity 33, as listed under EMPL00900713. This guideline outlines mechanisms that the site must achieve in relation to establishing environmental performance standards to help enhance or protect environmental values. These control mechanisms include the following:

- Preserving existing valuable elements of the natural stormwater system;
- Appropriate management of the quantity and quality of stormwater, at or near the source of potential contaminants;
- Using structural measures, such as treatment techniques or sediment basins, to improve water quality as appropriate; and,
- Management of the receiving water to avoid any residual impacts from stormwater pollutants or flows.

3.2 Relevant Environmental Authority Conditions

The site's EA (EPML00900713) contains a number of conditions related to stormwater management and are summarised in **Table 2**.

Table 2
Summary of Stormwater Related EA Conditions

Number	Condition
D1	**Assessment of Consequence Category (CCA)** The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635) at the following times: a) prior to the design and construction of the structure, if it is not an existing structure; or b) if it is an existing structure, prior to the adoption of this schedule; or c) prior to any change in its purpose or the nature of its stored contents.
D2	A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.
D3	Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)
Note	Conditions D4 through D22 may apply depending on the outcome of a CCA
D26	**Register of Regulated Dams** A Register of Regulated Dams must be established and maintained by the holder for each regulated dam:

Number	Condition
Note	Conditions D27 through D31 may apply depending on the outcome of a CCA
C7	**Residual Void Outcome** Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself, and subject to any other condition within this Environmental Authority
Note	A residual void assessment should be undertaken to understand the residual risk to the environment. This assessment would also form part of any CCA.
G1	**Water - General** Contaminants that will, or have the potential to cause environmental harm, must not be released directly or indirectly to any waters except as permitted under the conditions of this Environmental Authority
Note	Conditions G2 through G20 contain relevant information about monitoring of site waters and the associated analytes and trigger limits. Refer to the EA for specific details.
G21	**Water Management Plan** A Water Management Plan must be developed by an appropriately qualified person and implemented by 31 July 2016
G22	Each year the holder of the Environmental Authority must undertake a review of the Water Management Plan prior to the wet season (i.e. by 1 November) and a further review following the wet season (i.e. by 1 May the following year) to ensure that proper and effective measures, practices or procedures are in place so that the mine is operated in accordance with the conditions of this Environmental Authority and that environmental harm is prevented or minimised

There is no list of Regulated Structures within the Site's EA, and as such there is no prescribed hydraulic performance criteria under The Manual[1].

3.3 Adopted Design Basis

The SWMP is based on the design framework outlined in **Section 3.1**, and the scope of this SWMP is outlined in **Section 1.2**. The key objectives of the SWMP for the site are therefore as follows:

- To protect the receiving environment from adverse water quality impacts as a result of overtopping of the void, and
- Maintain appropriate management of peak stormwater flow releases from the site (i.e ensure that peak stormwater flows from the site will not adversely affect the receiving environment).

For the purpose of stormwater management system design, two specific types of stormwater will exist in relation to the site, as follows:

- Clean Stormwater

  Stormwater runoff derived from stabilised surfaces upstream or outside the mine affected footprint or from stabilised/rehabilitated surfaces within the footprint.

[1] Manual for assessing consequence categories and hydraulic performance of structure, Department of Environment and Heritage Protection, 2016.

- Site Stormwater

  Stormwater runoff derived from mine affected/disturbed surfaces located within the site footprint. For the context of this report, 'site stormwater' is essentially limited to the water reporting to the void.

4 STORMWATER MANAGEMENT PLAN

4.1 Stormwater Management Plan Objectives

As stated in **Section 1.2 and Section 3.1,** the objectives are summarised as follows:

- Minimise catchment areas reporting to a ex-mining void to minimise the risk of the void overtopping
- Restore natural drainage paths, where possible, to minimise impounded water
- Minimise potential for environmental harm (ie erosion)

4.2 Stormwater Management Features

The proposed site SWMP developed is presented in this section. The SWMP involves relatively minor earthworks to create new bunds/embankments, remove bunds/embankments at various locations and also locations of levelling or grading works to create new preferable flow paths.

The proposed new site infrastructure features as shown on **FIGURE 002**, are summarised in **Table 3**.

Table 3
Summary of Proposed Stormwater Management Features

Feature (as shown on FIGURE 002)	Description
1	• Cut new trapezoidal spillway/channel through Dingo Dam embankment to direct overflow toward existing natural drainage path • Invert of cut to match downstream existing ground elevation (approx. RL 345.1m) • Base width is to be minimum 8.0m • Batter slopes to be 1 (V) : 2 (H) • Revegetate with grasses
2	• Cut new trapezoidal spillway/channel through existing embankment to allow unrestricted continuation of flow toward existing natural drainage path • Invert of cut to match downstream existing ground elevation (approx. RL 339.2m) • Base width is to be minimum 40.0m • Batter slopes to be 1 (V) : 4 (H) • Revegetate with grasses
3	• Reinstate Dingo Dam embankment to match adjacent crest levels and batter slopes. • Use non-dispersive low permeability earthen fill • Revegetate with grasses
4	• Fill area between Dingo Dam and void to create unobstructed free-draining condition • Base with of area should be approximately 22m (varies) • Batter slopes to be 1 (V) : 4 (H) • Embankment/bund height either side should be minimum 0.5m from toe to crest • Use non-dispersive earthen fill • Revegetate with grasses

5	• Construct embankment/bund along eastern wall of the void • Use non-dispersive low permeability earthen fill • Revegetate with grasses
6	• Construct embankment/bund along north-western corner of the void • Use non-dispersive low permeability earthen fill • Embankment/bund height measured from north-western side should be minimum 0.5m from toe to crest • Revegetate with grasses
7	• Fill area north of the void and grade to drain to the north • Use non-dispersive earthen fill • Revegetate with grasses

Note: Table 3 is not intended to be used as a construction specification. Compaction, moisture conditioning and growth media specifications to be determined.

4.3 Proposed Catchment Conditions

Based on the proposed site configuration and the change to catchment areas, the catchment area reporting to the void has been minimised to 4.9ha, a reduction of 74.5 ha. The Feature 2 spillway is proposed to manage the clean water catchment, which currently collects stormwater from the southern bund located to the south of ML 10324 (Dingo Dam). The Pond and Dingo Dam catchment area will be directly released into Snake Creek, whilst the Pit Void catchment area will be managed within the ML area.

The proposed catchments are summarised in **Table 4** and are shown on **FIGURE 003**.

Table 4
Summary of Proposed Catchment Areas

Catchment	Area (ha)
Pit Void	4.9
Feature 1 (Dingo Dam)	26.6
Feature 2	65.0
Feature 4	47.8
ROM	3.1
Sediment Basin	21.2
Total Catchment to Sediment Basin	24.3
Total Catchment to Feature 2	139.4

4.4 Hydrological and Hydraulic Calculations

The Rational Method (Queensland Urban Drainage Manual, 2016) of peak flow estimation was used to assess flow rates at key locations of the site for the 1% Annual Exceedance Probability (AEP) and the 50% AEP storm events, commonly referred to as the 1-in-100-year and 1-in-2-year storm events, respectively. The locations of flow estimations and the catchments areas are relative to the proposed site configuration presented in this SWMP as described in **Table 3** and are shown on **FIGURE 003**.

The peak flow estimations were then utilised to calculate expected flow velocities at the key locations to assess whether an erosion risk exists. The hydraulic calculations presented are relative

to proposed site configuration and existing ground conditions (as stated). The calculations are summarised in **Table 5**, and the locations of the features are shown on **FIGURE 003**.

Table 5
Summary of Hydrological and Hydraulic Calculations at Selected Locations

Location / Feature	Peak Flow Estimation (m^3/s)		Peak Flow Velocity Estimation (m/s)		Peak Flow Depth Estimation (m)	
	Q2	Q100	Q2	Q100	Q2	Q100
Feature 1 (Proposed)	1.9	5.6	1.45	2.0	0.2	0.35
Feature 2 (Proposed)	11.5	32.2	1.48	2.25	0.2	0.4
Feature 4 (Proposed)	3.4	10.1	1.2	1.75	0.15	0.3
ROM Overflow (Existing)	0.3	0.8	0.95	1.42	0.1	0.2
Sediment Basin Overflow (Existing)	1.8	5.0	1.45	1.75	0.25	0.4

As is shown in **Table 5**, peak estimated velocities in the Q2 flow events are expected to be low (below 1.5m/s) which is generally considered to not result in erosion to surfaces with average grass cover. As the Q100 peak estimated flow velocities are between 1.42m/s and 2.25m/s, some erosion may occur during such rare flow events. However, the effect of routing attenuation (i.e. the delay of the flow wave caused by the site water storages) has not been considered in these flow estimations, meaning that these peak flow and velocity estimations are conservative. The calculated flow depths also show that none of the proposed or existing bund/embankment features are expected to overtop during the 1-in-100-year storm event.

The hydraulic calculations are provided in Appendix A.

4.5 Estimated Storage Structure Volumes

Storage volumes were calculated using the site survey data (provided by client) and are provided for information purposes in **Table 6**. The volumes shown are to estimated spillway invert of the structure.

Table 6
Summary of Proposed Catchment Areas

Storage	Spill Invert (RL m)	Volume (ML)
Dingo Dam	345.0	1.7
Void	339.5	39.1
Sediment Dam	337.3	10.3
Pond	345.7	6.6

4.6 Ex-Mining Void Overtopping

The potential for the ex-mining void to overtop has been assessed on a first principals' basis. The estimated volume of the void is 39.1ML with the proposed catchment area of 4.9ha results in a rainfall depth of some 800mm to completely fill the void, which is in excess of the mean annual rainfall value of 553.4mm as shown in **Section 2.3**. The basic calculation does not consider evaporation losses or infiltration losses. The void is thought to experience a moderate rate of infiltration losses and not hold water for extended periods of time. As such, the risk of the void overtopping is considered to be of a relatively low probability.

5 SUMMARY AND RECOMMENDATIONS

As is shown through the calculation of peak flow rate, depth and velocity estimates, presented in **Table 5**, for key locations of the proposed site configuration presented in this SWMP, it can be concluded that the overall objectives of the SWMP as outlined in **Section 4.1** have been achieved. This is a result of the combination of the catchment area reporting to the ex-mining void being reduced from 79.4 ha to 4.9 ha, and the calculation of relatively low flow depths and velocities at the assessed locations which are not expected to result in significant erosion of the site.

Beyond the scope of this SWMP and to meet the conditions of the site's EA, as shown in **Table 2,** it is recommend that AML engage a suitably qualified consultant to carry out a CCA (for relevant structures) and a residual void assessment to determine whether any of the site's structures are required to be listed as Regulated Structures on the site's EA.

REFERENCES

[1] Guideline – 'Stormwater and Environmentally Relevant Activities' (2014). Department of Environment and Heritage Protection.

[2] Queensland Regional Flood Mapping Program 2015, Queensland Reconstruction Authority https://www.qra.qld.gov.au

[3] The manual for assessing consequence categories and hydraulic performance of structures (March 2016). Department of Environment and Heritage Protection.

[4] Queensland Urban Drainage Manual, 2016. Institute of Public Works Engineers Queensland.

FIGURES

7844200N 7844900N 7845600N

362000E 362500E 363000E

NOTE: TOTAL CATCHMENT AREA REPORTING TO THE PIT VOID IS 79.4 ha, AND THE TOTAL CATCHMENT AREA REPORTING TO THE SEDIMENT DAM IS 165.5 ha.

POND CATCHMENT

DINGO DAM CATCHMENT

SEDIMENT DAM CATCHMENT

PIT VOID CATCHMENT

WASTE ROCK DUMP

ROM PAD

POND

DINGO DAM

SEDIMENT DAM

EXISTING BUND

CATCHMENT AREA	AREA (ha)
DINGO DAM	26.6
PIT VOID	5.1
POND	47.7
SEDIMENT DAM	86.1

IMAGERY SOURCED FROM GOOGLE SATELLITE

LEGEND

- 1m CONTOURS
- FLOW DIRECTION
- CATCHMENT AREAS
- MINING LEASE AREAS

ELEVATION (RL m)

335.0 345.0
337.5 347.5
340.0 350.0
342.5 352.5

SITE DEM SURVEY PROVIDED BY CLIENT, SURROUNDING SURVEY SOURCED FROM ELVIS SPATIAL CATALOGUE

FIGURE 001
AUSTRALIAN MINES LTD

LUCKY BREAK/DINGO DAM PROJECT
EXISTING SITE CONDITIONS

0 75 150 225 300 m

W S N

ATC Williams

DATE: 2019-01-29

CRS: GDA94 / MGA Zone 55

FILE PATH: M:\Synergy\Projects\118\118284 Dingo Dam Lucky Break\01 Water Management Concept\Data and Calcs\GIS\118284-01GIS.qgs

7844900N

7845600N

7846300N

362500E

362500E

375

365

370

360

355

350

345

340

340

FEATURE 1

FEATURE 2

FEATURE 3

FEATURE 4

FEATURE 5

FEATURE 6

FEATURE 7

ROM OVERFLOW

SEDIMENT BASIN OVERFLOW

LEGEND

1m CONTOURS

FLOW DIRECTION

BUND PLACEMENT

BUND REMOVAL

REGRADE AREA

ELEVATION (RL m)

335.0

337.5

340.0

342.5

345.0

347.5

350.0

352.5

IMAGERY SOURCED FROM GOOGLE SATELLITE

SITE DEM SURVEY PROVIDED BY CLIENT, SURROUNDING SURVEY SOURCED FROM ELVIS SPATIAL CATALOGUE

FIGURE 002
AUSTRALIAN MINES LTD

LUCKY BREAK/DINGO DAM PROJECT
PROPOSED STORMWATER MANAGEMENT PLAN FEATURES

0 50 100 150 200 m

W S N E

ATC Williams

DATE: 2019-01-30

CRS: GDA94 / MGA Zone 55

FILE PATH: M:\Synergy\Projects\118\118284 Dingo Dam Lucky Break\01 Water Management Concept\Data and Calcs\GIS\118284-01GIS.qgs

7844200N 7844900N 7845600N

362000E 362500E 363000E

NOTE: TOTAL CATCHMENT AREA REPORTING TO THE PIT VOID IS 4.9 ha, THE TOTAL CATCHMENT AREA REPORTING TO THE SEDIMENT DAM IS 24.3 ha, AND TOTAL CATCHMENT AREA REPORTING TO FEATURE 2 IS 139.4 ha.

FEATURE 1 CATCHMENT

FEATURE 2 CATCHMENT

FEATURE 4 CATCHMENT

SEDIMENT BASIN CATCHMENT

VOID CATCHMENT

ROM PAD CATCHMENT

CATCHMENT AREA	AREA (ha)
FEATURE 1	26.6
FEATURE 2	65
FEATURE 4	47.8
ROM	3.1
SEDIMENT BASIN	21.2
VOID	4.9

IMAGERY SOURCED FROM GOOGLE SATELLITE

LEGEND

- 1m CONTOURS
- FLOW DIRECTION
- CATCHMENT AREAS
- MINING LEASE AREAS

ELEVATION (RL m)

335.0 337.5 340.0 342.5 345.0 347.5 350.0 352.5

SITE DEM SURVEY PROVIDED BY CLIENT, SURROUNDING SURVEY SOURCED FROM ELVIS SPATIAL CATALOGUE

FIGURE 003
AUSTRALIAN MINES LTD

LUCKY BREAK/DINGO DAM PROJECT
PROPOSED CATCHMENT CONDITIONS

0 75 150 225 300 m

W S E N

ATC Williams

DATE: 2019-01-29

CRS: GDA94 / MGA Zone 55

FILE PATH: M:\Synergy\Projects\118\118284 Dingo Dam Lucky Break\01 Water Management Concept\Data and Calcs\GIS\118284-01GIS.qgs

APPENDICES

Feature 1 - Dingo Dam Outlet

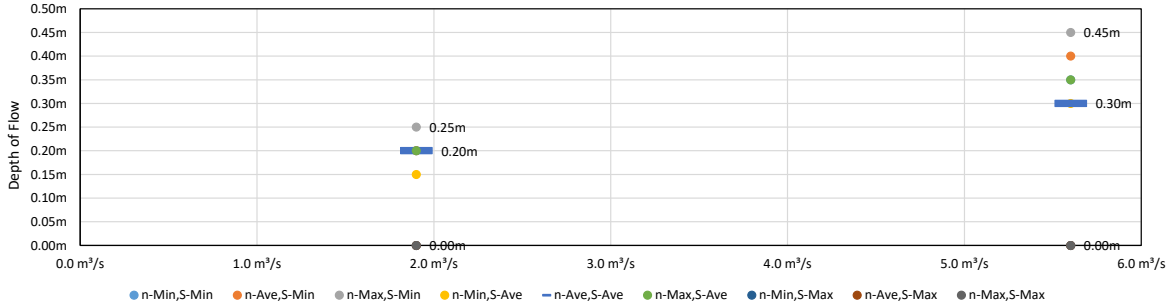
Design Event / Description	Required Discharge Rate (Q_{des})
Q2	1.9 m³/s
Q100	5.6 m³/s

Drain Roughness	Category	Excavated Channels		
	Sub Description	*Earth, straight, and uniform - with short grass, few weeds*		
Use drop down menu for Category, then Sub Description (Top Right). Do not edit the mannings values directly.	Mannings	Minimum	Normal	Maximum
		0.022	0.027	0.033

Geometry	Value
Left Batter	1(V) : 2.0(H)
Right Batter	1(V) : 2.0(H)
Base width	8.0 m
Slope	
Minimum	0.010 m/m
Average	0.020 m/m
Maximum	

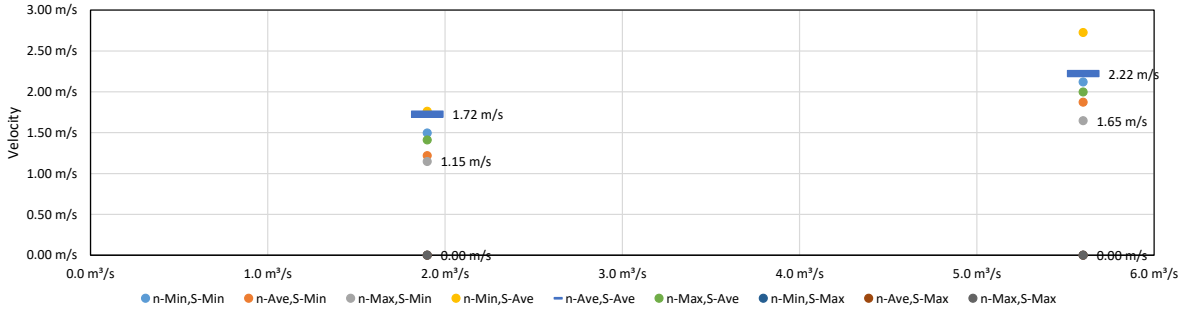
Calculations are based upon the Manning's Uniform Flow Equation. As such, they assume sufficient consistent grade for uniform flow to develop. Mannings 'n' Roughness values are adopted from Ven Te Chow's "Open Channel Hydraulics" Reference (1959).
Spreadsheet should not be used for rapidly varying flow. Calculation is innapropriate for high gradient flows, and these should be designed as chutes instead.

Results



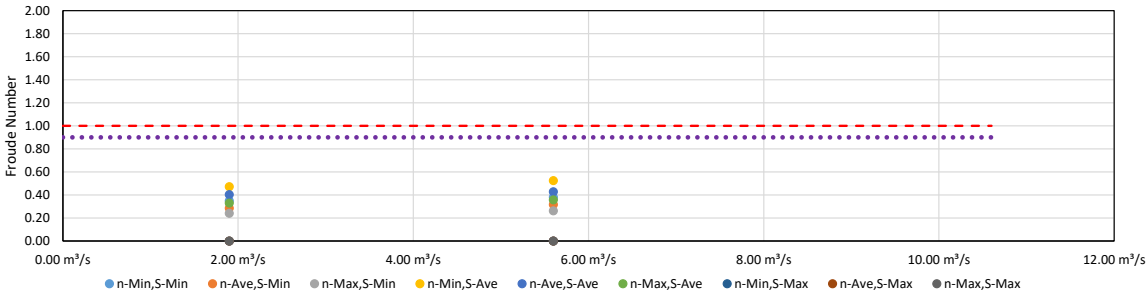
Depth vs. Discharge

Standard Uniform Flow Depth Outcomes by Mannings 'n' and Slope



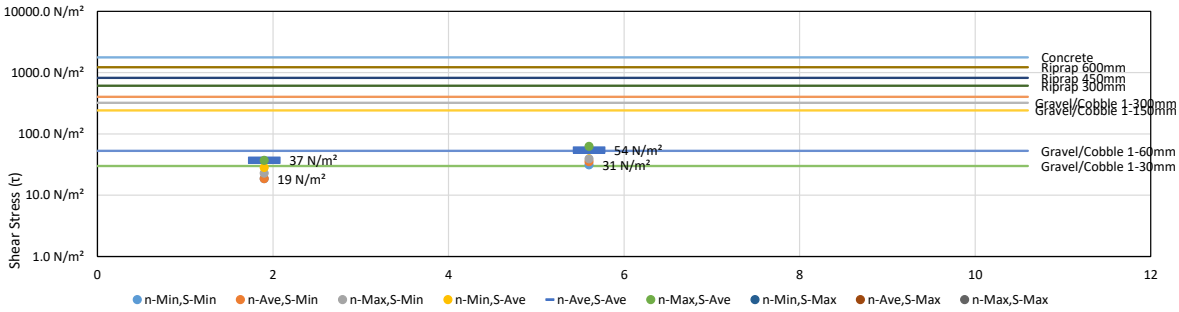
Velocity vs. Discharge

Note that the highest velocity will associate with the lowest Depth



Froude Number vs. Discharge

Note - if the Froude Number is approaching 1, then Free Standing Waves may exist - ABOVE the depth determined in the first graph.
If the Froude Number exceeds 1, then the potential for Hydraulic Jump should be considered.



Shear Stress vs. Discharge

Included to give a first pass indication of required armouring - based on shear stress potential to erode material - If a rough material is required, the mannings value adopted may need to be iterated.

Feature 2 - Break in Bund

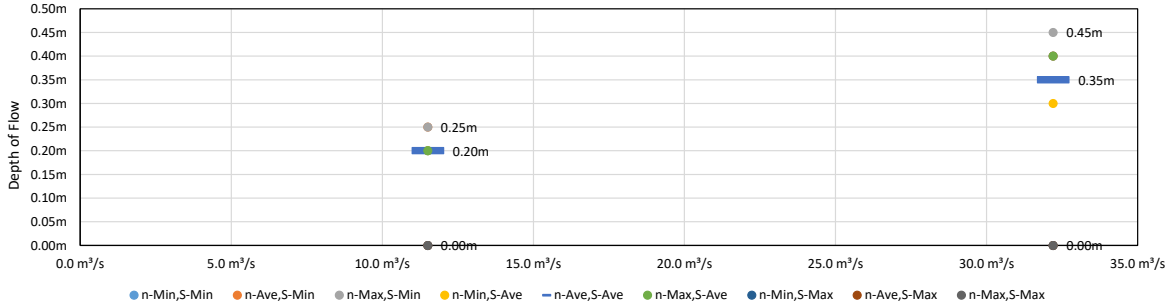
Design Event / Description	Required Discharge Rate (Q_{des})
Q2	11.5 m³/s
Q100	32.2 m³/s

Drain Roughness	Category	Excavated Channels		
	Sub Description	*Earth, straight, and uniform - with short grass, few weeds*		
Use drop down menu for Category, then Sub Description (Top Right). Do not edit the mannings values directly.	Mannings	Minimum	Normal	Maximum
		0.022	0.027	0.033

Geometry	Value
Left Batter	1(V) : 4.0(H)
Right Batter	1(V) : 4.0(H)
Base width	40.0 m
Slope	
Minimum	0.010 m/m
Average	0.020 m/m
Maximum	

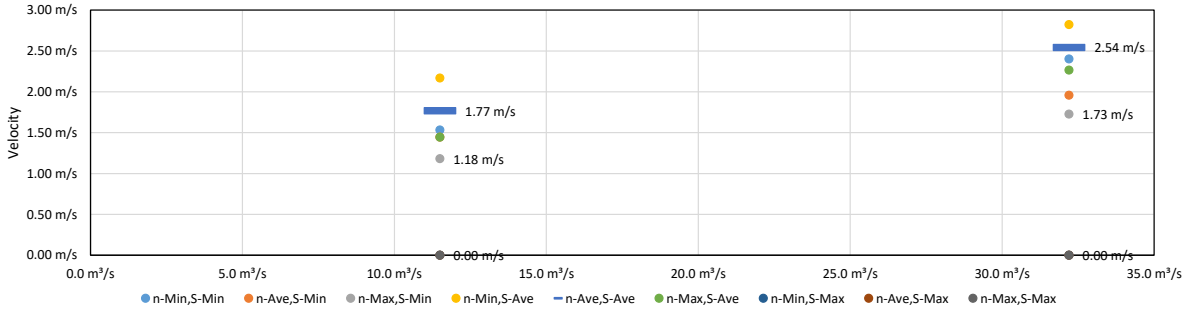
Calculations are based upon the Manning's Uniform Flow Equation. As such, they assume sufficient consistent grade for uniform flow to develop. Mannings 'n' Roughness values are adopted from Ven Te Chow's "Open Channel Hydraulics" Reference (1959). Spreadsheet should not be used for rapidly varying flow. Calculation is innapropriate for high gradient flows, and these should be designed as chutes instead.

Results



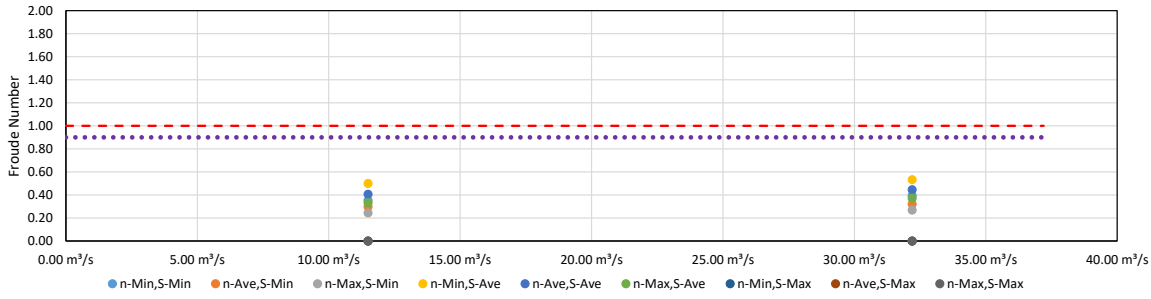
Depth vs. Discharge

Standard Uniform Flow Depth Outcomes by Mannings 'n' and Slope



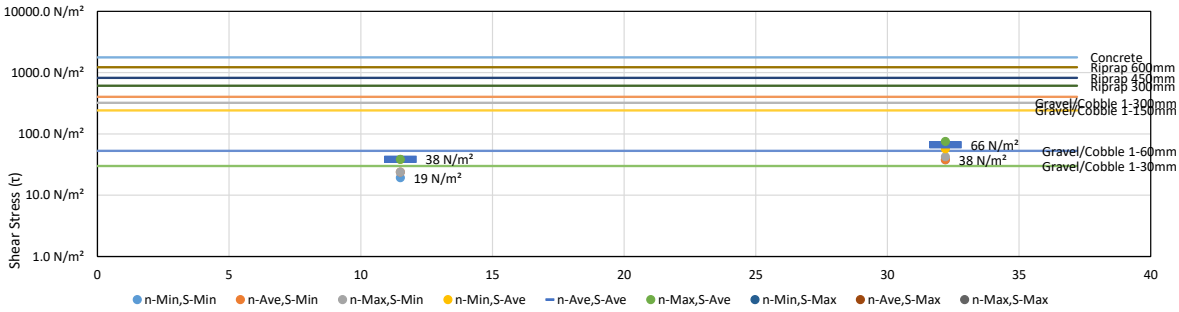
Velocity vs. Discharge

Note that the highest velocity will associate with the lowest Depth



Froude Number vs. Discharge

Note - if the Froude Number is approaching 1, then Free Standing Waves may exist - ABOVE the depth determined in the first graph. If the Froude Number exceeds 1, then the potential for Hydraulic Jump should be considered.



Shear Stress vs. Discharge

Included to give a first pass indication of required armouring - based on shear stress potential to erode material - If a rough material is required, the mannings value adopted may need to be iterated.

Feature 4 - Channel Section Between Dingo Dam and Void

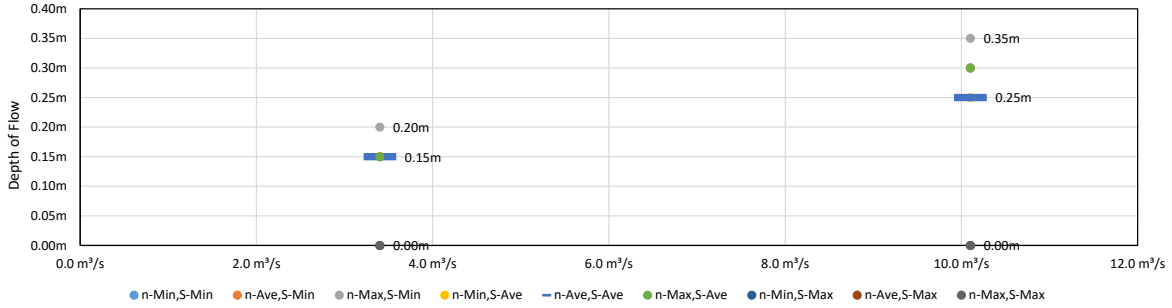
Design Event / Description	Required Discharge Rate (Q_{des})
Q2	3.4 m³/s
Q100	10.1 m³/s

Drain Roughness	Category	Excavated Channels		
	Sub Description	*Earth, straight, and uniform - with short grass, few weeds*		
Use drop down menu for Category, then Sub Description (Top Right). Do not edit the mannings values directly.	Mannings	Minimum	Normal	Maximum
		0.022	0.027	0.033

Geometry	Value
Left Batter	1(V) : 4.0(H)
Right Batter	1(V) : 4.0(H)
Base width	22.0 m
Slope	
Minimum	0.010 m/m
Average	0.020 m/m
Maximum	

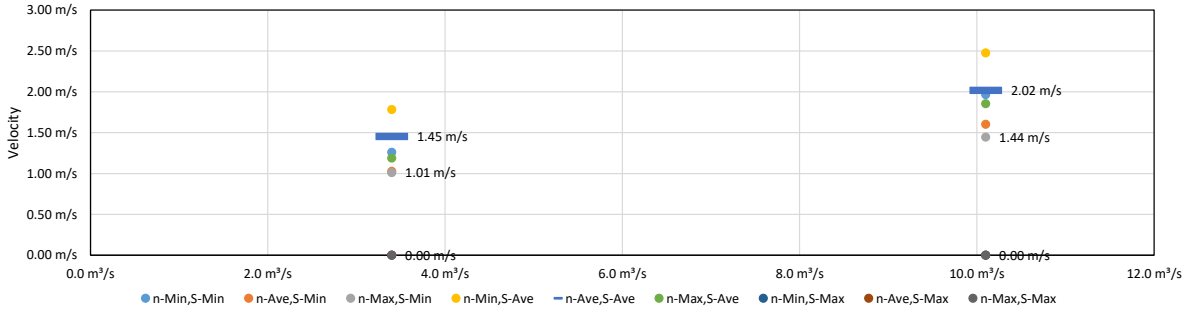
Calculations are based upon the Manning's Uniform Flow Equation. As such, they assume sufficient consistent grade for uniform flow to develop. Mannings 'n' Roughness values are adopted from Ven Te Chow's "Open Channel Hydraulics" Reference (1959). Spreadsheet should not be used for rapidly varying flow. Calculation is innapropriate for high gradient flows, and these should be designed as chutes instead.

Results



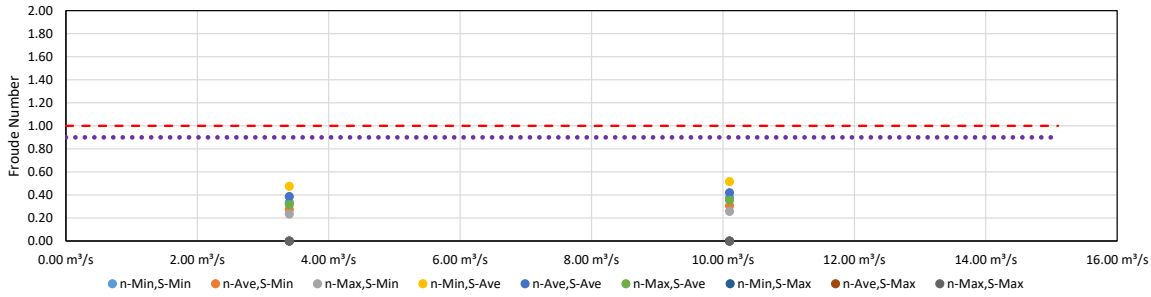
Depth vs. Discharge

Standard Uniform Flow Depth Outcomes by Mannings 'n' and Slope



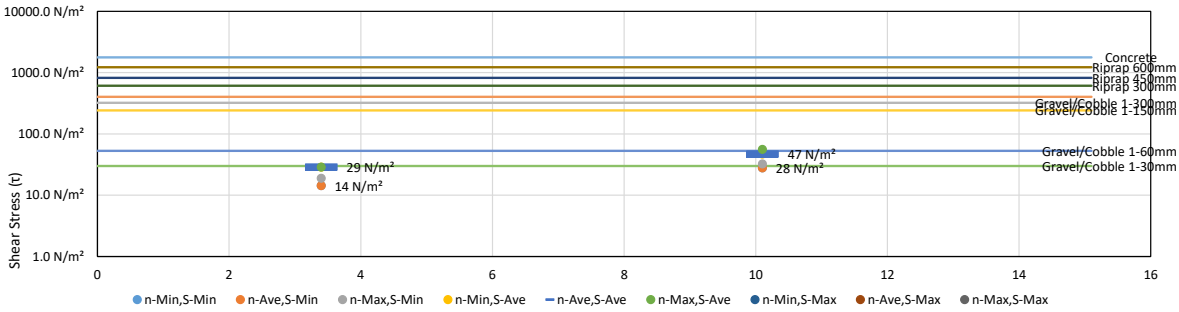
Velocity vs. Discharge

Note that the highest velocity will associate with the lowest Depth



Froude Number vs. Discharge

Note - if the Froude Number is approaching 1, then Free Standing Waves may exist - ABOVE the depth determined in the first graph. If the Froude Number exceeds 1, then the potential for Hydraulic Jump should be considered.



Shear Stress vs. Discharge

Included to give a first pass indication of required armouring - based on shear stress potential to erode material - If a rough material is required, the mannings value adopted may need to be iterated.

ROM Overflow

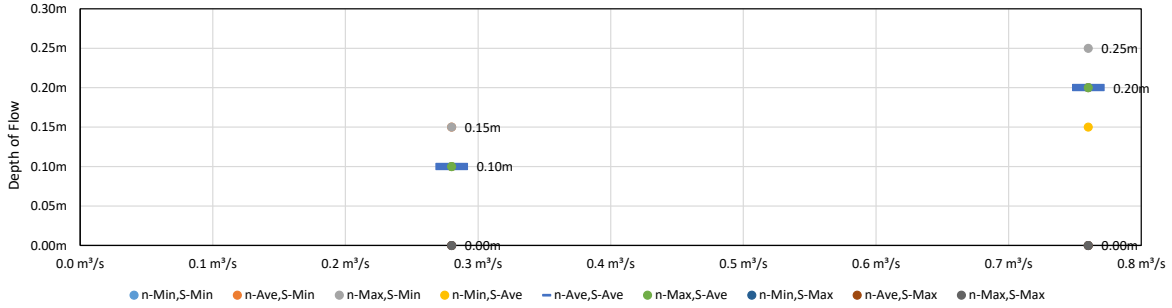
Design Event / Description	Required Discharge Rate (Q_{des})
Q2	0.3 m³/s
Q100	0.8 m³/s

Drain Roughness	Category	Excavated Channels		
	Sub Description	*Earth, straight, and uniform - with short grass, few weeds*		
Use drop down menu for Category, then Sub Description (Top Right). Do not edit the mannings values directly.	Mannings	Minimum	Normal	Maximum
		0.022	0.027	0.033

Geometry	Value
Left Batter	1(V) : 2.0(H)
Right Batter	1(V) : 2.0(H)
Base width	3.0 m
Slope	
Minimum	0.010 m/m
Average	0.020 m/m
Maximum	

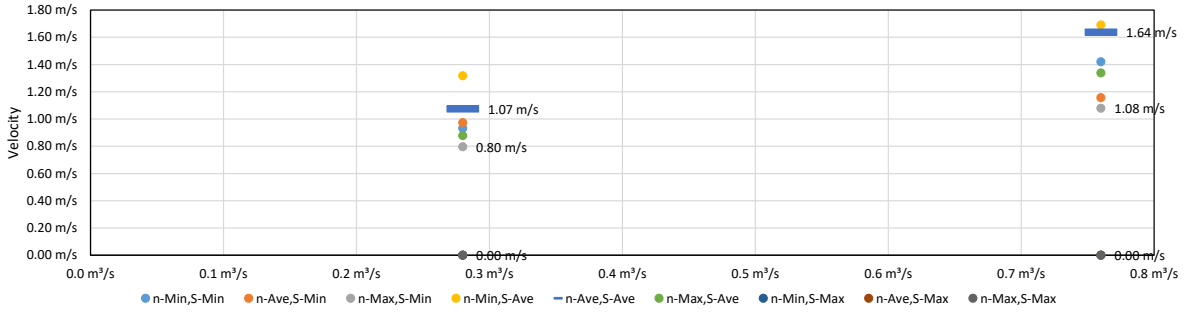
Calculations are based upon the Manning's Uniform Flow Equation. As such, they assume sufficient consistent grade for uniform flow to develop. Mannings 'n' Roughness values are adopted from Ven Te Chow's "Open Channel Hydraulics" Reference (1959).
Spreadsheet should not be used for rapidly varying flow. Calculation is innapropriate for high gradient flows, and these should be designed as chutes instead.

Results



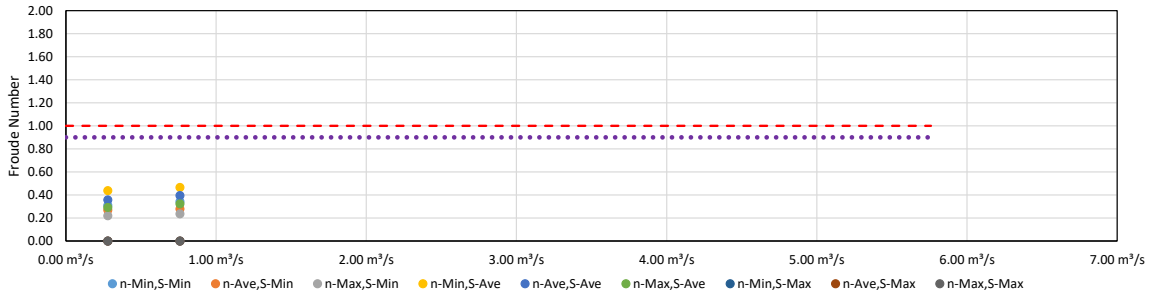
Depth vs. Discharge

Standard Uniform Flow Depth Outcomes by Mannings 'n' and Slope



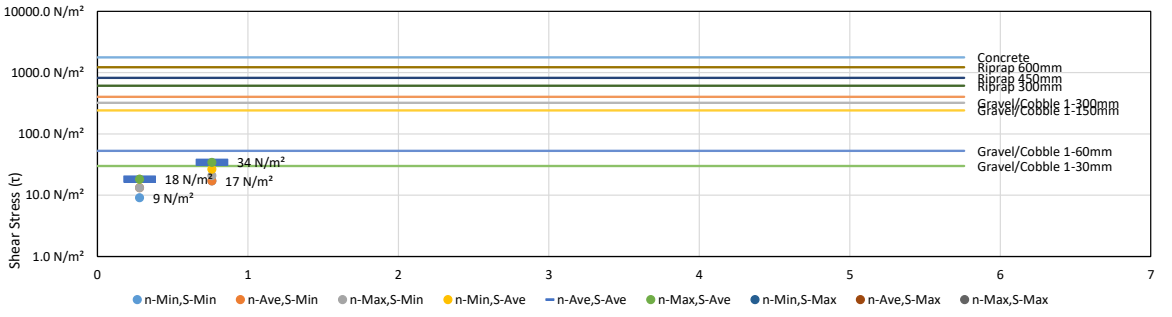
Velocity vs. Discharge

Note that the highest velocity will associate with the lowest Depth



Froude Number vs. Discharge

Note - if the Froude Number is approaching 1, then Free Standing Waves may exist - ABOVE the depth determined in the first graph.
If the Froude Number exceeds 1, then the potential for Hydraulic Jump should be considered.



Shear Stress vs. Discharge

Included to give a first pass indication of required armouring - based on shear stress potential to erode material - If a rough material is required, the mannings value adopted may need to be iterated.

Sediment Basin Outlet

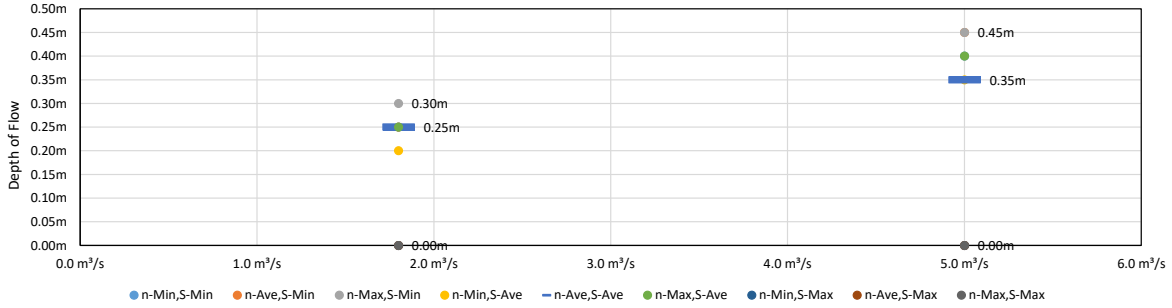
Design Event / Description	Required Discharge Rate (Q_{des})
Q2	1.8 m³/s
Q100	5.0 m³/s

Drain Roughness	Category	Excavated Channels		
	Sub Description	*Earth, straight, and uniform - with short grass, few weeds*		
Use drop down menu for Category, then Sub Description (Top Right). Do not edit the mannings values directly.	Mannings	Minimum	Normal	Maximum
		0.022	0.027	0.033

Geometry	Value
Left Batter	1(V) : 5.0(H)
Right Batter	1(V) : 15.0(H)
Base width	4.0 m
Slope	
Minimum	0.010 m/m
Average	0.020 m/m
Maximum	

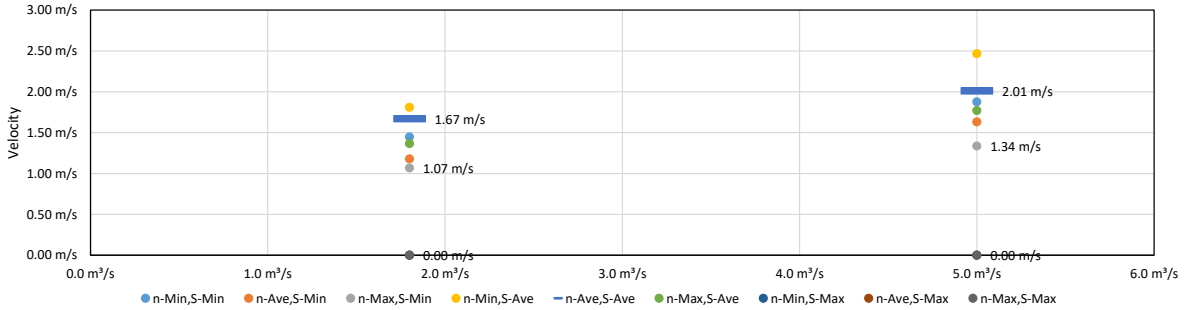
Calculations are based upon the Manning's Uniform Flow Equation. As such, they assume sufficient consistent grade for uniform flow to develop. Mannings 'n' Roughness values are adopted from Ven Te Chow's "Open Channel Hydraulics" Reference (1959).
Spreadsheet should not be used for rapidly varying flow. Calculation is innapropriate for high gradient flows, and these should be designed as chutes instead.

Results



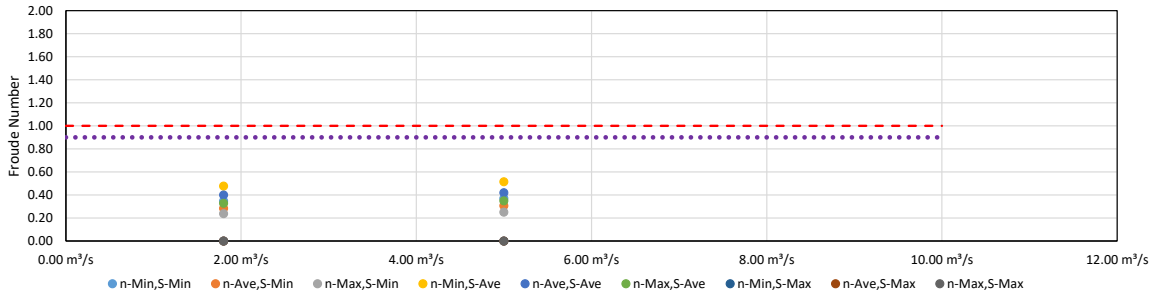
Depth vs. Discharge

Standard Uniform Flow Depth Outcomes by Mannings 'n' and Slope



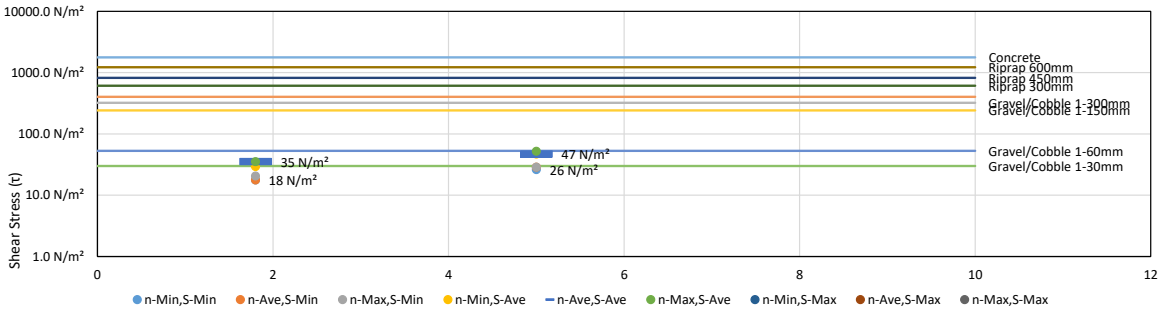
Velocity vs. Discharge

Note that the highest velocity will associate with the lowest Depth



Froude Number vs. Discharge

Note - if the Froude Number is approaching 1, then Free Standing Waves may exist - ABOVE the depth determined in the first graph.
If the Froude Number exceeds 1, then the potential for Hydraulic Jump should be considered.



Shear Stress vs. Discharge

Included to give a first pass indication of required armouring - based on shear stress potential to erode material - If a rough material is required, the mannings value adopted may need to be iterated.