DATE: 1 NOVEMBER 2017
OUR REF: 16_115

CARLY GREIG
DEPARTMENT OF ENVIRONMENT AND HERITAGE PROTECTION
LEVEL 10
445 FLINDERS STREET
TOWNSVILLE QLD 4810

RE: HIGHWAY REWARD - TRANSITIONAL ENVIRONMENT PROGRAM - MAN17020 - PERFORMANCE REPORT

Dear Carly,

I refer to the amended Transitional Environmental Program (TEP) MAN17020 approved by the Department of Environment and Heritage Protection (EHP) and issued to the Mt Windsor Joint Venture partners of Thalanga Copper Mines Pty Ltd (MWJV) on 14 September 2017.

This letter addresses the fifth task of the TEP, required to be completed by 1 November 2017.

Task Five involves the completion report of an earthworks undertaken, included the anticipated success of earthworks. Major components of this action is to ensure that "contaminated" water is captured on site and directed away from SW6 or managed to ensure it does not reach SW6. "Clean" water is to be appropriately diverted and managed effectively and major erosion gullies determined to be a source of contamination are repaired.

Earthworks completed

During the term of the TEP, the MWJV commissioned earthworks to contain potentially contaminated stormwater on site. As detailed in the 30 May 2017 TEP milestone reporting, this successfully prevented the discharge of contaminants off site during the 2016 / 2017.

Since the 30 May 2017 TEP milestone update, additional activities have been undertaken to evaluate site drainage requirements and additional earthworks activities (if any) as required. Mining One Consultants were commissioned by the MWJV to develop a drainage design report with recommendations regarding future earthworks and drainage requirements.

The following recommendations are provided by Mining One Consultants:

- Commonly located areas showing signs of scalding make it impractical to construct drains separating contaminated to non-contaminated run-off.
- Existing drop structures can be supplemented with new drains to convey contaminated water of the western catchments of the Highway waste rock dump to the pit. The design discharges and the drain slopes allow for effective erosion protection through rock riprap and grout mattresses.
- In order to meet the short-term requirements of the TEP, it is proposed to obstruct the flow currently channelled by the main drain with a series of bunds and drains and redirect it to the pit.

- The long-term option of capping the scalding areas that can contaminate surface water with good quality soil shall be assessed.
- Another effective long term option would be the bunding of specific areas of the site to retain surface water runoff for subsequent evapotranspiration, in addition to the discharge to the pit. This option would mainly be effective at locations where discharge to the pit is not practical.

Attachment 1 includes *Highway Reward Mine Interim Drainage Infrastructure Design Memorandum 2017* as provided by Mining One Consultants. Inclusive in the memorandum is above recommendations and additional detail regarding design requirements for additional diversion of surface water to the pit.

Attachment 1 has been utilised by the MWJV for the basis of commissioning earthworks activities.

Required earthworks

Outcomes of the *Highway Reward Mine Interim Drainage Infrastructure Design Memorandum* (Mining One, 2017) include the recommendation to divert additional surface water flows to the pit. An additional bund is proposed and detailed in Figure 1 below and Figure 2 of the memorandum.

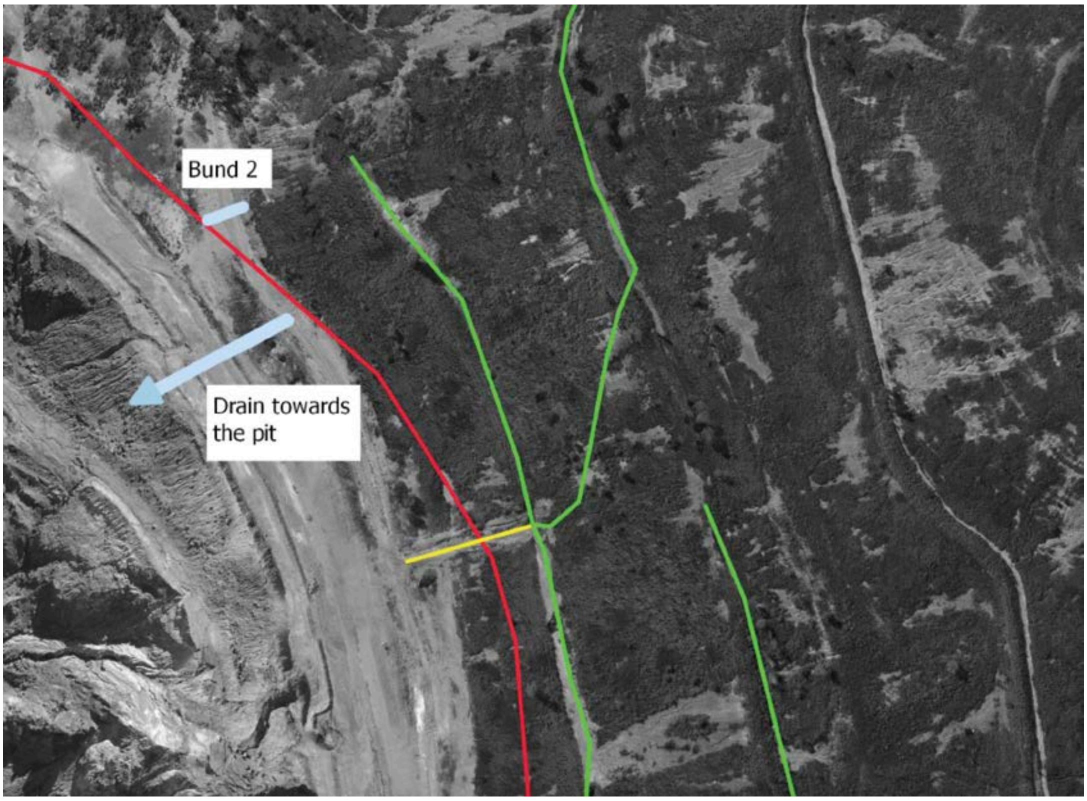

Figure 1: Excerpt of Figure 2 – Highway waste rock dump proposed bunds (Mining One, 2017)

Program of Works

MWJV confirm the commissioning of earthworks activities to divert additional surface water to the pit. Assessment of geotechnical data and drainage modelling for the site (including the development of bund and drain cross sections and erosion and sediment controls) limited the ability to obtain quotes for implementation of earthworks to late October. On this basis Table 1 provides a revised Program of Works for completion of earthworks activities by 24 December 2017.

Table 1: Revised Program of Works for earthworks.

ITEM	ACTION	DEADLINE	STATUS
1	Earthworks design, including bund cross section and erosion control.	25 August 2017	Complete
2	Recalibrated surface water model.	8 September 2017	Complete
3	Quotes to complete earthworks in question.	7 November 2017	In progress
4	Earthworks commissioning.	15 November 2017	Pending
5	Earthworks activities.	30 November 2017	Pending
6	Follow up inspection and progress report to EHP.	24 December 2017	Pending

Following completion of the earthworks, a progress report confirming activities completion will be provided to EHP.

Sincerely,

Marty Costello
Principal Environmental Scientist

ATTACHMENT 1

HIGHWAY REWARD MINE

INTERIM DRAINAGE INFRASTRUCTURE DESIGN MEMORANDUM

For

MT WINDSOR JOINT VENTURE

Job No.	2332_G	Mining One Pty Ltd
Doc No.	5173v1.docx	Level 9, 50 Market Street
Date:	October 2017	Melbourne VIC 3000
Prepared by:	A. Valenza	Ph: 03 9600 3588
	N. Cheema	Fax: 03 9600 3944

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FINAL REPORT

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1 INTRODUCTION

1.1 SITE HISTORY

The Highway Reward mine is located approximately 35 km south west of Charters Towers and has been the site of copper and gold mining since 1953. Open-cut mining ceased in February 2002 and was followed by underground mining, accessed from within the pit, until June 2005. The mine site was decommissioned and rehabilitated in 2005

The site is managed by Mt Windsor Joint Venture partners, Thalanga Copper Mines Pty Ltd (TCM) and Grange Resources Ltd (MWJV).

A Transitional Environmental Program (TEP), approved by the Department of Environment and Heritage Protection (DEHP), was developed in 2009 to address sources of potential contamination from acid rock drainage observed across the site.

An amended TEP (MAN17020) was issued to MWJV on 19 October 2016, focusing on the installation of interim earthwork measures to treat or capture all water on site and prevent a release to the environment. The amended TEP and the remediation works are managed by Northern Resource Consultants (NRC).

NRC and MWJV are currently implementing works to bring the mine to a permanent closure state consistent with the requirements of EHP.

This Interim Drainage Infrastructure Design Memorandum is a technical report on the design of the proposed surface water drainage of the Highway and Reward waste rock dumps oriented towards the pit. This work is within the context of a greater study on surface water flow, catchment areas, inflows to the pit and the pit's own capacity for a period up to 100 years.

1.2 PROJECT BACKGROUND

A description of the hydrogeological and hydrological studies completed to date is available in Mining One's May 2017 report (Ref. 1). The following is a summary of the work completed to date:

- Development of a preliminary groundwater model (Environmental, Ground, Water & Air Consultants Pty Ltd - EGC, April 2008). The primary objective of the groundwater model was to predict the likelihood of contaminants migrating off-site.
- Collection of groundwater and surface water monitoring data and update of the groundwater model from 2013 by Mining One (Ref. 2) to confirm the hydrodynamics and water quality of the pit and surrounding aquifers.
- Installation of two automatic surface water flow monitoring gauges, SF1 & SF2 (2013), monitoring of pit level water and groundwater levels from 2013 to 2017 and recalibration of the groundwater model assessing impact of the pit on surrounding aquifer and groundwater contribution in the overall water balance.
- Develop a surface water model (Ref. 3). The primary objectives of the surface water model were to determine the catchment delineation and the yearly inflow rates of surface water to the pit. This study also focused on identifying potential locations and size for

bunds and drains to contain overland flow within the study area and identify locations for monitoring overland flow.

- Completion of a 2014 (Ref. 4), 2015 (Ref. 5) and 2016 (Ref. 6) annual monitoring report collating all the data collected from 2009 to 2017 at the site in preparation for the Stage 2A&B study. Calibration of the groundwater and surface flow model (Stage 2A) and completion of a Preliminary pit water balance (Stage 2B) issued by Mining One in May 2017 (Ref. 7).

1.3 SCOPE OF WORK

This interim memorandum covers the design of the proposed surface water drainage infrastructure with the main focus on the western catchments of the Highway waste rock dump and the northern catchment of the Reward waste rock dump. The main objective of this interim design is to capture runoff currently channelled through the "main drain" and direct it to the pit.

This interim design is consistent with the short-term (interim) scenario developed by Mining One (Ref. 1), to maximize the capture of potentially contaminated overland flow to the pit.

A report addressing the long-term drainage design and management options (covering the entire site, including capping and ponding options) will be produced at a later stage, as additional field information regarding water quality and scalding area surveys are completed.

The design produced in the following figures is a concept design. The drain junctions, particularly where steep drains join, are likely to require treatment (erosion protection), which shall be covered in the construction drawings.

2 SITE OBSERVATIONS

2.1 WATER QUALITY RECORDS

Water quality observations by NRC on 17th of February 2017 for water ponding and overland flow were analysed. The observations were made at the twelve (12) locations presented in the NRC document reproduced in Figure 2-1.

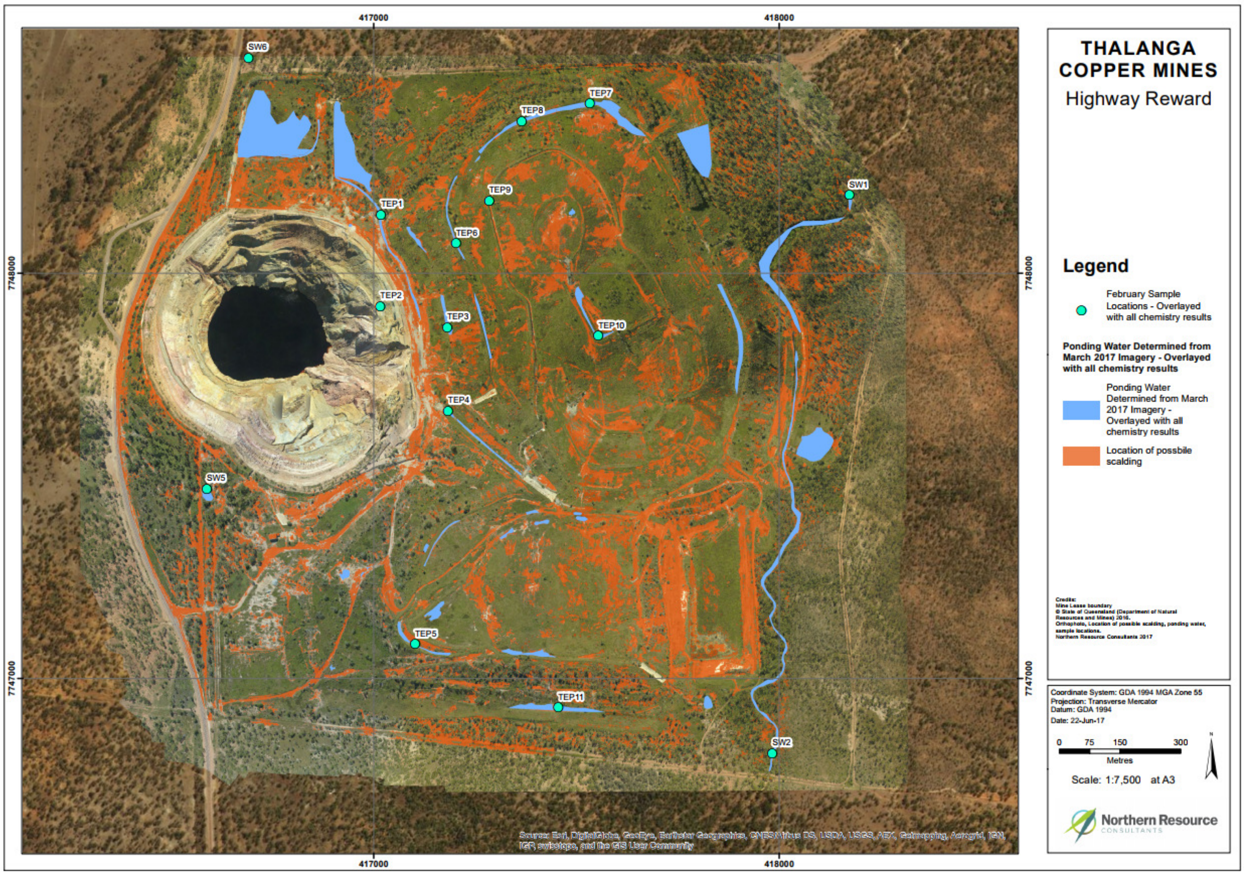


Figure 2-1: Water Sampling & Ponding Water Locations and Potential Scalding Areas (NRC 2017)

The locations of observation points of water quality presented in Figure 2-1 also shows possible scalding locations. The data was collected from water ponding at depressions.

The feasibility of separating drains into “good” and “poor” quality surface water categories from separate areas of the waste dump has been examined. The following points have been considered with reference to Figure 2-1:

1. The recorded observations are at depressions where surface water accumulates after a rainfall event except for the two sampling locations SW1 and SW2, which are situated in a local creek that drains a larger catchment;
2. The signs of scalding are so widely spread that sheet flow of surface runoff from each specific area cannot be practically isolated;

3. Separating drainage of “good” quality surface water, for instance, would require the following:
   a. Obstructing surface flow from these areas to the surrounding lands showing signs of scalding;
   b. Connecting outflows from these areas through a network of surface drains that do not pass through lands with signs of scalding; and
   c. Conveying these flows to the site boundary through drains that do not pass through the lands with signs of scalding and also avoid existing overland flow paths observed to be the sources of “poor” quality surface water.
4. As a consequence, separating drainage of “good” quality work is impractical, mainly because of items 3 b) and c), unless pipes replace the surface drains, which would make the arrangement technically and maintenance-wise unpractical and economically prohibitive.

2.2 VISUAL INSPECTION OF EXISTING DROP STRUCTURE AND DRAINS

A visual inspection of the existing drain and drop structure was completed on the 5th October 2017 by NRC. The graphical outputs of the survey are provided in Appendix A.

An analysis of the dimensions and condition of the structures was completed to confirm the adequacy of the as-built with the proposed design.

Generally speaking, the design of the existing structure is conservative and their condition satisfying. It is expected that minimal re-work will be required outside for the connection points with the newly built structures.

A redesign of the drains situated on the western sub-catchments of the Highway waste rock dump was completed following the inspection, to account for these structures in the overall design.

3 PROPOSED INTERIM DESIGN

3.1 INTERIM DRAINS DESIGN

The proposed drains and bunds are presented in Figure 1 and Figure 2, Appendix B. The drains' alignments follow the natural slope and are consistent with the flowpaths identified by MWJV (a map of the observed flowpath was provided to Mining One for QA/QC purpose).

The existing drain EDW1 can effectively handle flows from DW1. Similarly, existing drain EDW2 and EDW3 can carry flow from DW2 and DW5 respectively.

Drains DW1, DW2, DW5 and DW6 will effectively perform the designed function. Drains DW3 and DW4, essentially located on a topographic flat, intersect the sheet flow and direct it to the existing drop structure.

Technically speaking, the absence of these two drains will not make a material difference in the overland flow in this part of the dump. However, impact of erosion of the downgradient slope may be a concern if these drains were not installed. We, therefore consider DW3 and DW4 to be optional as long as the long-term design is implemented within 2 to 5 years.

The geometry of the proposed drains, presented in Figure 1, Appendix B, is summarised in Table 3-1.

Table 3-1: Waste Rock Dumps Drain Details

Distance from U/S End (m)	Natural Surface Level (m)	Natural Surface Slope (m/m)	Hec-RAS Chainage (m)	Drain Bed Level (m)	Drain Bed Slope (m/m)
Drain DW1					
0	354.5		494	354	
152	354.5	0	342	353.5	0.00329
208.6	351.5	0.053	285.4	351	0.04417
319.6	349.5	0.01802	174.4	349	0.01802
383.7	349.47	0.00047	110.3	348.97	0.00047
494	336.5	0.11759	0	336	0.11759
Drain DW2					
0	350.5		261	350	
126	349.5	0.00794	135	349	0.00794
261	347	0.01852	0	346.5	0.01852

Table 3-1: Waste Rock Dumps Drain Details (continued)

Distance from U/S End (m)	Natural Surface Level (m)	Natural Surface Slope (m/m)	Hec-RAS Chainage (m)	Drain Bed Level (m)	Drain Bed Slope (m/m)
Drain DW3					
0	336.5		186	336	
156	336.5	0	30	335.75	0.0016
186	336	0.01667	0	335.5	0.00833
Drain DW4					
0	337		185	336.5	
116	337	0	69	336.25	0.00216
174	336.5	0.00862	11	336	0.00431
185	336	0.04545	0	335.5	0.04545
Drain DW5					
0	340.5		194	340	
92	338.5	0.02174	102	338	0.02174
139	337.75	0.01596	55	337.25	0.01596
194	336	0.03182	0	335.5	0.03182
Drain DW6					
0	343.5		304	343	
100	336	0.075	204	335.5	0.075
200	331	0.05	104	330.5	0.05
250	330	0.02	54	329.5	0.02
304	329	0.01852	0	328.5	0.01852
Drain EDW1					
0	336		58	335.5	
22	333	0.13636	36	332.5	0.13636
40	330	0.16667	18	329.5	0.16667
58	328.5	0.08333	0	328	0.08333

Table 3-1: Waste Rock Dumps Drain Details (continued)

Distance from U/S End (m)	Natural Surface Level (m)	Natural Surface Slope (m/m)	Hec-RAS Chainage (m)	Drain Bed Level (m)	Drain Bed Slope (m/m)
Drain EDW2					
0	336		44	335.5	
22	333	0.13636	22	332.5	0.13636
44	330.5	0.11364	0	329.5	0.13636

3.2 DRAIN SIZES AND EROSION PROTECTION

3.2.1 DRAINAGE CATCHMENTS

The sub-catchments draining into the proposed drains are presented in Figure 3, Appendix B. Industry Standard software 12d was used to delineate these catchments. DTM contours and flow arrows generated from the Triangulated Irregular Network (TIN) in 12d were used to delineate the sub-catchments of Highway and Reward waste rock dumps.

Catchments 1 to 6 feed drains DW1 to 6 respectively. The catchment areas and peak flows have been listed in Table 3-2.

Table 3-2: Waste Rock Dumps Catchments Areas and Peak Flows

Catchment ID	Area (ha)	Q_{50} (m^3/s)
1	6.25	0.252
2	8.56	0.297
3	1.25	0.033
4	2.62	0.068
5	3.9	0.157
6	15.23	0.704

The total area covered by the proposed drains is approximately 37.8 ha.

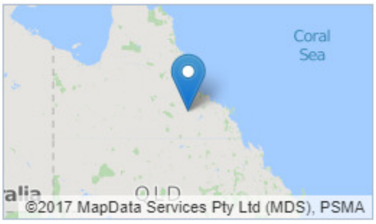
3.2.2 DESIGN DISCHARGES

Two events were considered to determine design discharge for the proposed drains, one in twenty and one in fifty year Average Recurrence Interval (ARI) events. It was observed that the one in fifty ARI events only required minor changes to the drains dimensions, and was therefore adopted for a better capacity drainage system.

The Intensity Frequency Duration (IFD) data was collected from the Bureau of Meteorology (BOM) web site (Figure 3-1).

Location

Label: HRMineSite
Latitude: 20.36 [Nearest grid cell: 20.3625 (S)]
Longitude:146.199 [Nearest grid cell: 146.1875 (E)]



IFD Design Rainfall Depth (mm)

Issued: 27 September 2017

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

Table | Chart

Unit: mm

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	2.17	2.48	3.40	3.98	4.53	5.21	5.70
2 min	3.72	4.26	5.85	6.86	7.81	8.93	9.72
3 min	5.24	5.99	8.22	9.65	11.0	12.6	13.7
4 min	6.67	7.61	10.4	12.2	13.9	16.0	17.5
5 min	7.99	9.12	12.5	14.7	16.7	19.1	20.9
10 min	13.4	15.3	20.9	24.5	27.8	32.0	35.1
15 min	17.3	19.8	27.0	31.7	36.0	41.4	45.4
30 min	24.9	28.4	38.9	45.6	51.8	59.6	65.2
1 hour	32.7	37.3	51.2	60.1	68.4	78.7	86.2
2 hour	40.2	45.9	63.0	74.1	84.7	98.0	108
3 hour	44.5	50.7	69.7	82.3	94.3	110	121
6 hour	52.0	59.3	82.1	97.4	112	132	148
12 hour	60.8	69.5	97.3	116	136	162	183
24 hour	72.2	83.0	118	143	168	203	231
48 hour	87.3	101	146	179	212	257	293
72 hour	97.9	114	166	204	242	292	332
96 hour	106	124	181	222	263	316	358
120 hour	112	131	192	235	277	332	375
144 hour	117	138	201	244	287	343	386
168 hour	122	143	208	251	293	349	392

Figure 3-1: Intensity Frequency Duration Data from Bureau of Meteorology

The runoff coefficient was computed in accordance with the Australian Rainfall Runoff Manual applicable to Queensland. The corresponding design discharges for all catchments are presented in Table 3-2 above.

3.2.3 HYDRAULIC ASSESSMENT AND DRAIN SIZES

Hydraulic analysis of the proposed drains was carried out using the industry standard software package HEC-RAS. Typical cross-sections considered for the hydraulic analysis are presented in Figure 3-2.

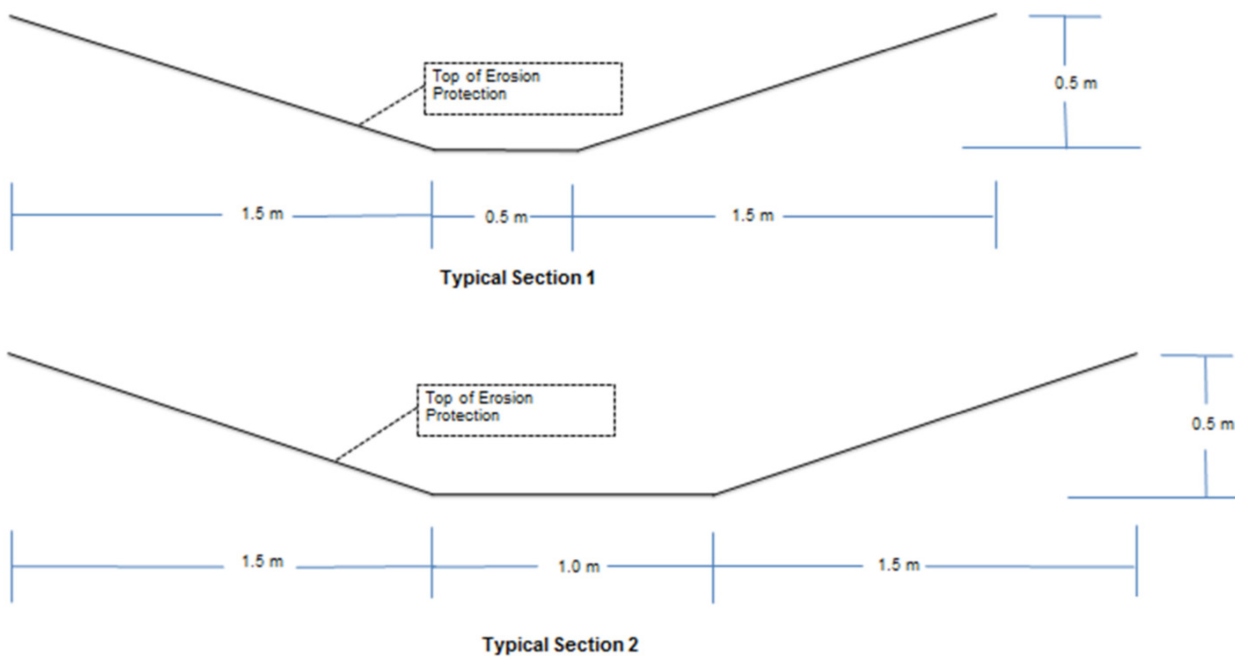


Figure 3-2: Typical Cross-Sections of the Proposed Drains DW1 to DW 6

The cross-section types used for the various drains are listed in Table 3-3.

Table 3-3: Cross-Section Types for Drains

Drain	Cross-section Type
DW1 (First 152 m from Top)	Type 1
DW1(Remaining length 342m)	Type2
DW2	Type 2
DW3	Type 1
DW4	Type 1
DW5	Type 2
DW6	Type 2
EDW1	Type 2
EDW2	Type2

The output of the hydraulic model consists of, amongst other parameters, the flow velocities, flow depth and flow widths. **The output shows that the proposed cross-sections are adequate to convey the designed discharge.** The respective output parameters were used to compute bed shear for appropriate design of the erosion protections.

3.2.4 EROSION PROTECTION

The hydraulic assessment indicates that rock riprap is adequate to resist erosion of the beds and sides of the designed drains.

However, considering that the site has limited resource of suitable rocks, MWJV may decide to use similar protection products used at the site in the past (grout filled erosion control mattresses) where appropriate.

The design of the grout filled erosion control mattresses or similar measures shall be designed by the supplier. Where rock riprap is adopted for erosion protection of the drains and drop structures, the following design criteria has been applied.

The riprap size was determined from the initiation of motion of sediment particle in the influence of shear force. Two approaches, namely Shields and Meyer-Peter (Ref. 9) were used and the one predicting larger rock size was adopted.

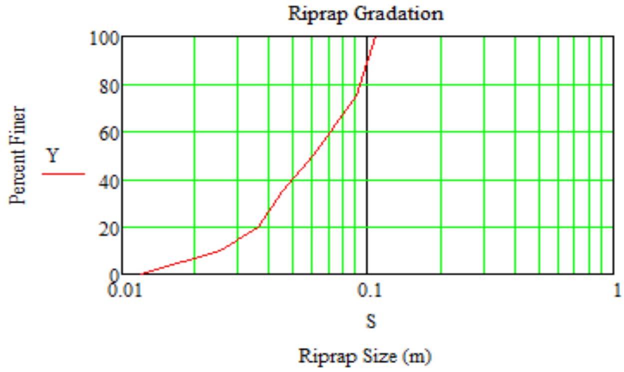
For each drain, d_{50}, the rock size that 50% of the designed riprap sizes are finer than, were computed. Three riprap types were selected to cover the proposed drains. Riprap gradation for Types 1 to 3 have been presented in Figure 3-3 overleaf.

Table 3-4 lists the drain locations where each riprap type is recommended.

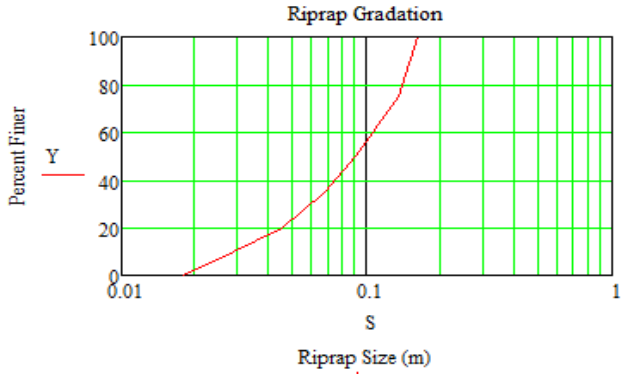
Table 3-4: Erosion Protection Types

Drain	Designed D50 (mm)	Bed Protection		Side Protection	
		Type	Thickness (mm)	Type	Thickness (mm)
DW1 (First 152 m from Top)	60	Type 1	100	Type 1	100
DW1 (from 384 m to 494 m)	160	Type 3	200	Type 2	150
DW1 (Remaining length)	90	Type 2	150	Type 2	150
DW3	60	Type 1	100	Type 1	100
DW4	60	Type 1	100	Type 1	100
DW5	90	Type 2	150	Type2	150
DW6	160	Type 3	250	Type 2	150
EDW1	160	Type 3	250	Type 2	150
EDW2	160	Type 3	250	Type2	150

Type1 Gradation	
Perecentage	Size Finer than (mm)
0	12
10	25
20	36
35	45
50	60
75	90
100	108



Type2 Gradation	
Perecentage	Size Finer than (mm)
0	18
10	29
20	45
35	68
50	90
75	135
100	162



Type3 Gradation	
Perecentage	Size Finer than (mm)
0	32
10	51
20	80
35	120
50	160
75	240
100	288

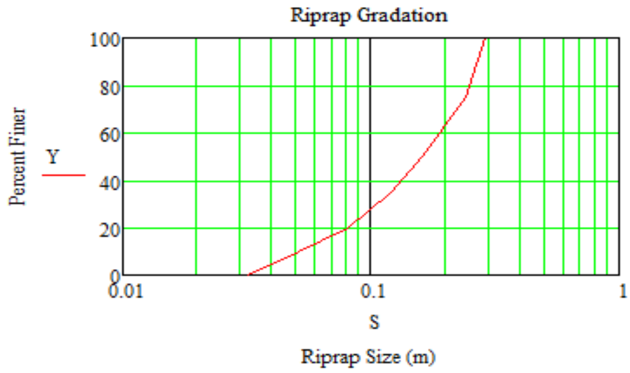


Figure 3-3: Erosion Protection Types and Gradation

3.3 INTERCEPTION OF THE FLOW AND REDIRECTION TO THE PIT

In order to meet the short-term requirements of the TEP, MWJV has proposed that the flow currently channelled by the main drain is captured by a series of bunds and drains and redirected to the pit. Based on a suggestion by MWJV, Mining One has assessed a suitable location for these structures, which are presented in Figure 2, Appendix B.

The survey data shows an existing obstruction that would stop the flow towards the North from DW6 and EDW2 (Figures 1 and 2, Appendix B). In the presence of this obstruction, Bund 1 would not be required.

However, considering that the survey may be locally inaccurate and the obstruction partial, it is advised Bund 1 be constructed at the location indicated on Figure 2, Appendix B. This bund should have a top level of 330.38 mAHD, top width shall be no less than 1m, average depth of about 1.7 m and side slopes of 1 vertical to 3 horizontal. The side slopes are recommended to be protected by Type 1 Erosion Protection (Figure 3-3).

Bund 2 should be built to a top level of 328.4 mAHD, with average depth of about 2m. Its top width shall be no less than 1 m and side slopes 1 vertical to 3 horizontal. The sides will have Type 1 Erosion Protection (Figure 3-3).

The Drain towards the pit initiates at Level 326.9 mAHD from inside the flow path and ends at Level 325 mAHD towards the pit. Its length should be approximately 73.8 m, with a bed slope of 0.0257. The drain will have Type 2 section (Figure 3-2) and Type 2 Erosion protection (Figure 3-3) on the bed and sides.

4 CONCLUSIONS AND RECOMMENDATIONS

This interim memorandum covers the design of the proposed surface water drainage infrastructure and focuses on the western catchments of the Highway waste rock dump and the northern catchment of the Reward waste rock dump. The main objective of this interim designs is to capture runoff currently channelled through the “main drain” and direct it to the pit.

This interim design is consistent with the short-term (interim) scenario developed by Mining One (Ref. 1), to maximize the capture of potentially contaminated overland flow to the pit.

It integrates the long-term pit shape design, and provides the design of drains, bunds and related drainage elements including their erosion protection.

The design produced is a concept design. The drain junctions, particularly where steep drains join, are likely to require treatments (erosion protection), which shall be covered in the construction drawings.

The main findings from this interim hydraulic assessment are summarised below:

1. Commonly located areas showing signs of scalding make it impractical to construct drains separating contaminated to non-contaminated runoff.
2. The existing drop structures and drains presented in Figure 1, Appendix A, can be supplemented with new drains to convey contaminated water of the western catchments of the Highway waste rock dump to the pit. The design discharges and the drain slopes allow for effective erosion protection through rock riprap or grout mattresses.
3. In order to meet the short-term requirements of the TEP, it is proposed to obstruct the flow currently channelled by the main drain with a series of bunds and drains and redirect it to the pit. (Figure 2, Appendix B).
4. The long-term option of capping the scalding areas that can contaminate surface water with good quality soil shall be assessed.
5. Another effective long-term option would be the bunding of specific areas of the site, to retain surface water runoff for subsequent evapotranspiration, in addition to the discharge to the pit. This option would mainly be effective at locations where discharge to the pit is not practical.

5 REFERENCES

1. Mining One Pty Ltd (May. 2017), Mt Windsor Joint Venture -Highway Reward mine. Water Balance Review Preliminary Report. Ref 5006v1.
2. Mining One Pty Ltd (March 2013), Mt Windsor -Highway Reward mine. Groundwater modelling report for Grange Resources. Ref 3269v2.
3. Mining One Pty Ltd (August 2013), Mt Windsor - Highway Reward mine surface water modelling report for Mt Windsor Joint Venture. Ref 3616v5
4. Mining One Pty Ltd (Feb. 2015), Mt Windsor - Highway Reward Mine, Annual Report 2014, Ref. No. 4163v1
5. Mining One Pty Ltd (April. 2016), Mt Windsor - Highway Reward Mine, Annual Report 2015, Ref. No. 4510v1
6. Mining One Pty Ltd (May. 2017), Mt Windsor - Highway Reward Mine, Annual Report 2016, Ref. No. 5011v1
7. Mining One Pty Ltd (May. 2017), Mt Windsor Joint Venture -Highway Reward mine. Water Balance Review Preliminary Report. Ref 5006v1
8. Mining One Pty Ltd (May 2012), Mt Windsor - Highway Reward geotechnical stability report for Copper Mines of Tasmania. Ref 3137.
9. Simons and Senturk. Sediment Transport Technology.

Appendix A

Drainage Infrastructure Inspection

THALANGA COPPER MINES

HIGHWAY REWARD DRAIN MEASUREMENTS

Legend

Drain measurement points

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 06-Oct-17

0 50 100 200
Metres

N

Scale: 1:6,500 at A3

Northern Resource CONSULTANTS

File Note

SUBJECT: **TCM engineered drop structures**

DATE: September 2017 **REF:**

Main drain, east of pit. Rock filled gabion mattresses

Drop structures in main drain, rock filled gabions

As above

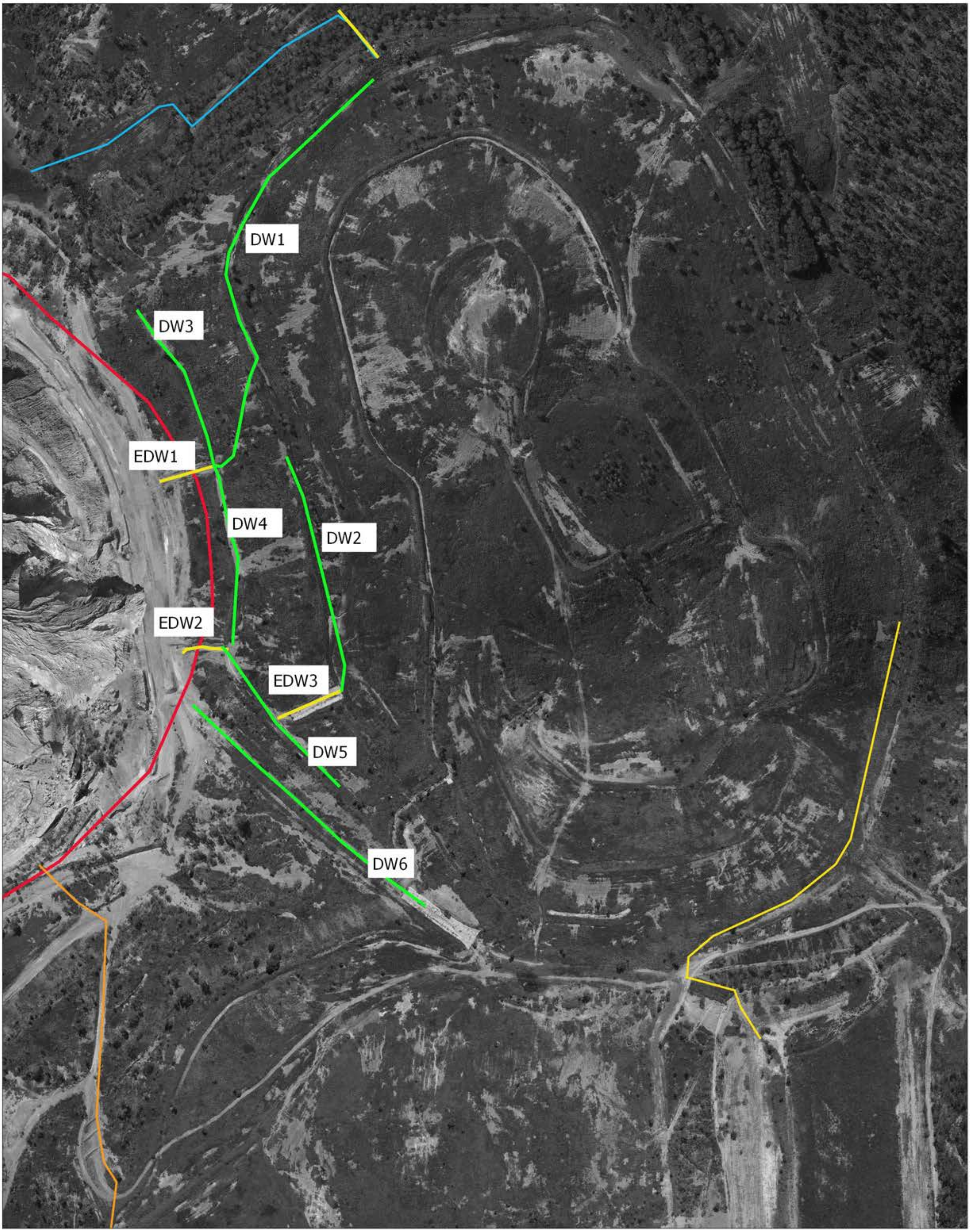
Entry to main drain, recent revetment mattress protection

Grout filled revetment mattress, top end main drain.

Grout filled revetment mattress, southeast Reward dump drop structure

Appendix B

Figures



Legend:

- Proposed Drains North
- Proposed Drains South
- Drains Existing
- Proposed Drains
- Proposed Drains East
- Long Term Pit Boundary

75 0 75 150 225 m

Drawn: FJ, 16/10/17
Checked: AV, 16/10/17
Project: AU0305
Doc No:
Client: Highway Reward

References:
Coordinate System: GDA 1994 MGA Z55
Project Location : Mt Windsor, Queensland

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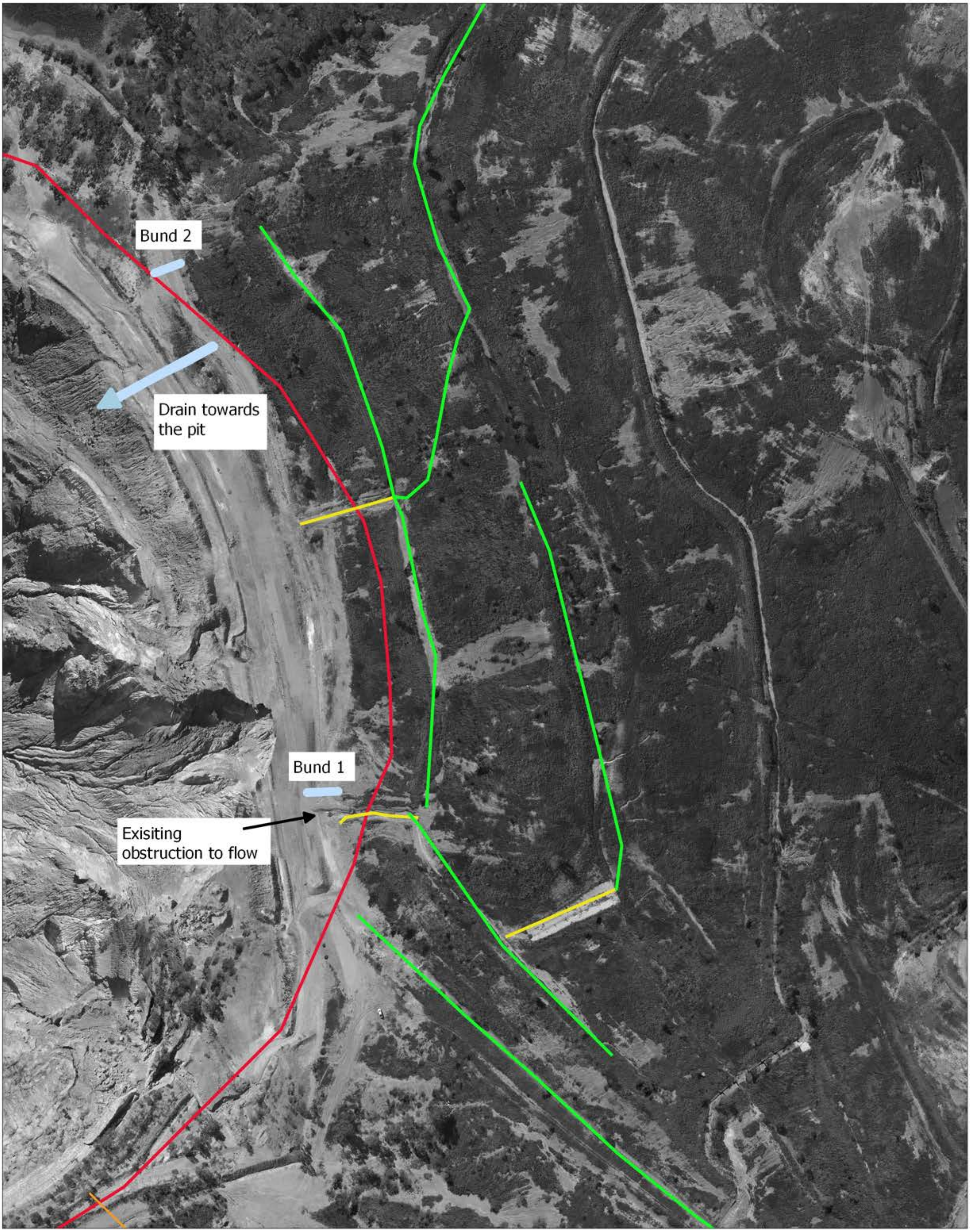
FIGURE 1: Highway waste rock dump proposed drainage infrastructure



Legend:

Proposed Drains North	Proposed Drains South	Proposed Bunds	Proposed Drains
Proposed Drains East	Long Term Pit Boundary	Drains Existing	

0 50 100 150 m

Drawn: FJ, 16/10/17
Checked: AV, 16/10/17
Project: AU0305
Doc No:
Client: Highway Reward

References:
Coordinate System: GDA 1994 MGA Z55
Project Location : Mt Windsor, Queensland

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FIGURE 2: Highway waste rock dump proposed bunds

Legend:

- Proposed Drains North
- Proposed Drains South
- Drains Existing
- Sub catchment
- Proposed Drains East
- Long Term Pit Boundary
- Proposed Drains

75 0 75 150 225 m

Drawn: FJ, 16/10/17
Checked: AV, 16/10/17
Project: AU0305
Doc No:
Client: Highway Reward

References:
Coordinate System: GDA 1994 MGA Z55
Project Location : Mt Windsor, Queensland

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FIGURE 3: Highway Reward waste rock dumps internal subcatchments

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Version	Description of changes/amendments	Author (s)	Date
1	Final Report	A Valenza Dr N Cheema	27/10/17

DOCUMENT REVIEW AND SIGN OFF

Version	Reviewer	Position	Signature	Date
1	Kevin Dugan	Principal Geotechnical Engineer	K. Dugan	27/10/17