





Prepared for:
Nozala Coal (Pty) Ltd

Contact person:
Mike Wright

Tel: 083) 440 6945
Fax: (072) 281 9758
Email: MichaelW@rsvenco.com

NOZALA COAL

GRUISFONTEIN MINE RESIDUE DESIGN AND LINING SPECIFICATION

DRAFT REPORT
REVISION 01

SEPTEMBER 2019

Prepared by:
Delta Built Environment Consultants (Pty) Ltd

Contact person:
Piet de Wet

Tel: (012) 368 1850
Fax: (012) 348 4738
Email: piet.dewet@deltabec.com

DELTA
built environment consultants

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PREPARED BY:	Diogo Borges	Civil Technologist	
REVIEWED BY:	Bongani Matshazi	Civil Engineer	
APPROVED BY:	Piet de Wet	Pr. Eng. (Civil)	
DISTRIBUTION LIST:	**COMPANY**	**NAME & SURNAME**	
	RSV ENCO Consulting	Mike Wright	
		Sharline van der Merwe	

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00	Draft	Issued for comments	03/09/2019
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1.1 PURPOSE OR REPORT

This report aims to provide some technical specifications and assumptions made by Delta Built Environment Consultants (Delta BEC) in order to comply with the specifications set-out by the Department of Water and Sanitation (DWS) as well as the following regulations (all pertaining to the National Environmental Management: Waste Act 59 of 2008):

- Regulations regarding the planning and management of residue stockpiles and residue deposits (GNR 632)
- National Norms and Standards for The Assessment of Waste for Landfill Disposal (GNR 635)
- National Norms and Standards for Disposal of Waste to Landfill (GNR 636).

1.2 INTRODUCTION

The Gruisfontein project will produce solid discard material with a probable size distribution of 0.2 to 50 mm. It is not envisaged that slurry will be produced from the wash plant. A short-term discard dump will be located north-west of the coal handling and processing plant (CHPP) and utilised for the first three years of the life of mine (LoM). After the initial three years, three long-term discard dumps will then be established, that is the soft overburden, hard overburden and carbonaceous material discard dumps.

These three discard dumps have been strategically placed to the north-east of the mine as indicated in Figure 1, taking into consideration the predominant wind direction as well as areas of no coal. The sites are easily accessible with an intended continuous increase in size from south to north as the lifetime of the mine increases.

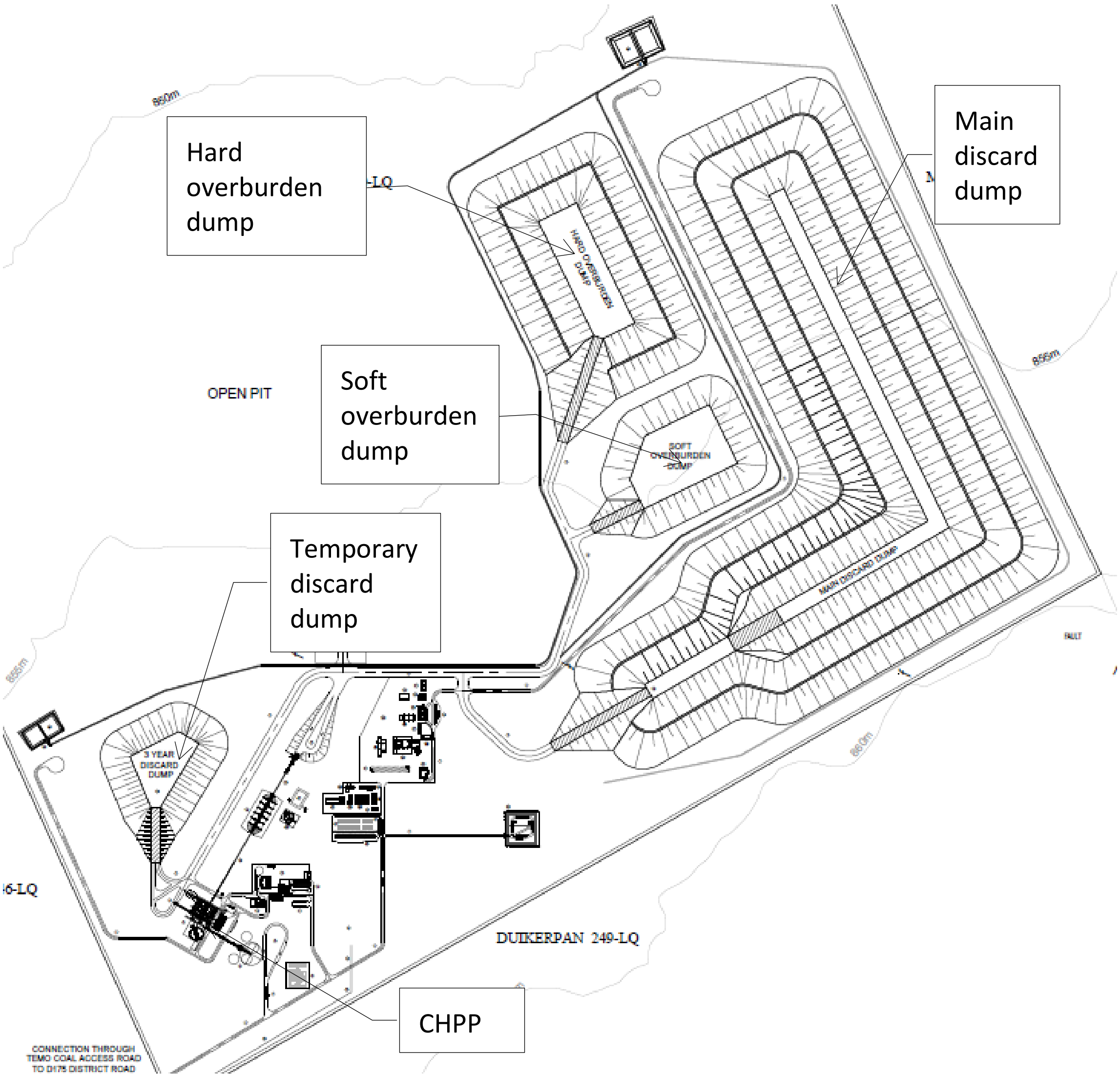


Figure 1: Discard dump location layout

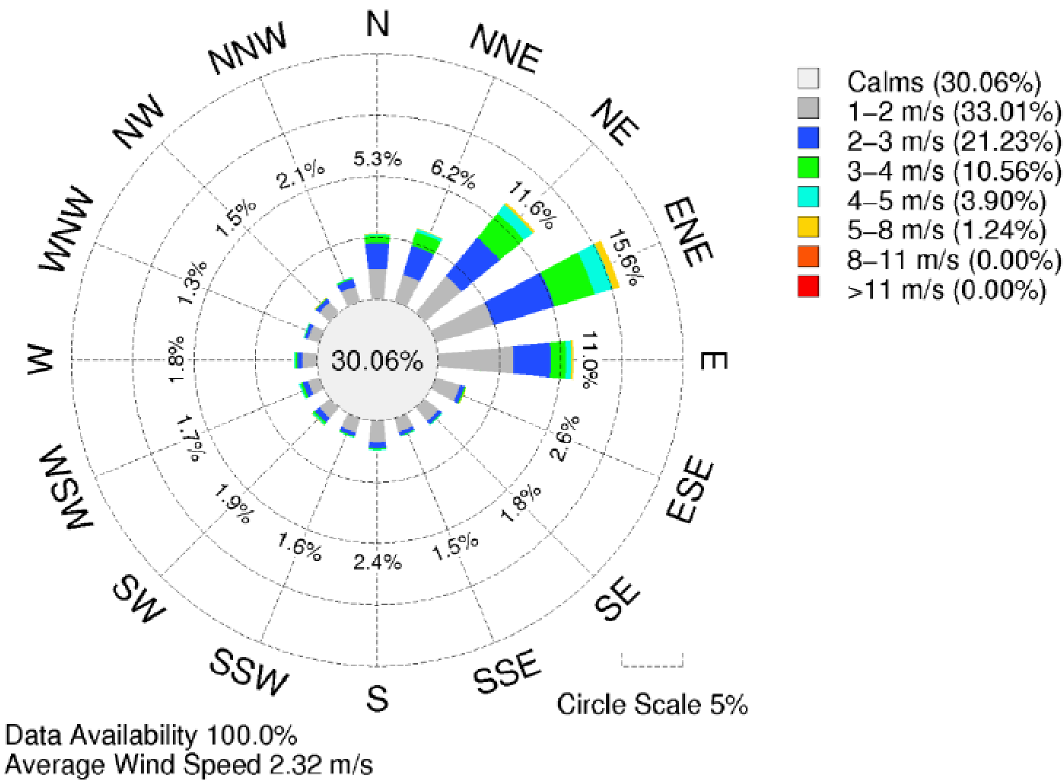


Figure 2: A wind rose of the recorded average hourly winds at the South Africa Weather Service automatic weather station located in Lephalale between 1993 and 2005

The LoM is expected to be approximately 16 years with a 1 year build-up period of 91.8 million tonnes ROM and estimated product tonnes of 46.1 million tonnes. The remaining 49.8 % solids will be discarded as waste. The expected discard and material characteristics are:

- A peak feed of approximately 6 767 058 tonnes per annum in year 4
- An average feed of approximately 5 739 497 tonnes per annum
- Moisture to feed, approximately 5.0 % by mass
- An expected solids density is 1 750 kg/m^3.

The total discard produced per annum is illustrated in Figure 3. The annual discard produced together with the expected material characteristics was applied to determine the overall storage volume for the LoM.

For the purposes of this design, it has been assumed that there will be no in-pit backfilling and all waste material from the open-pit will be stockpiled in the discard dumps. The mine plan will be optimised to create sufficient space for in-pit backfilling in the next phase of the feasibility study. The current design size of the discard dumps will therefore be substantially reduced.

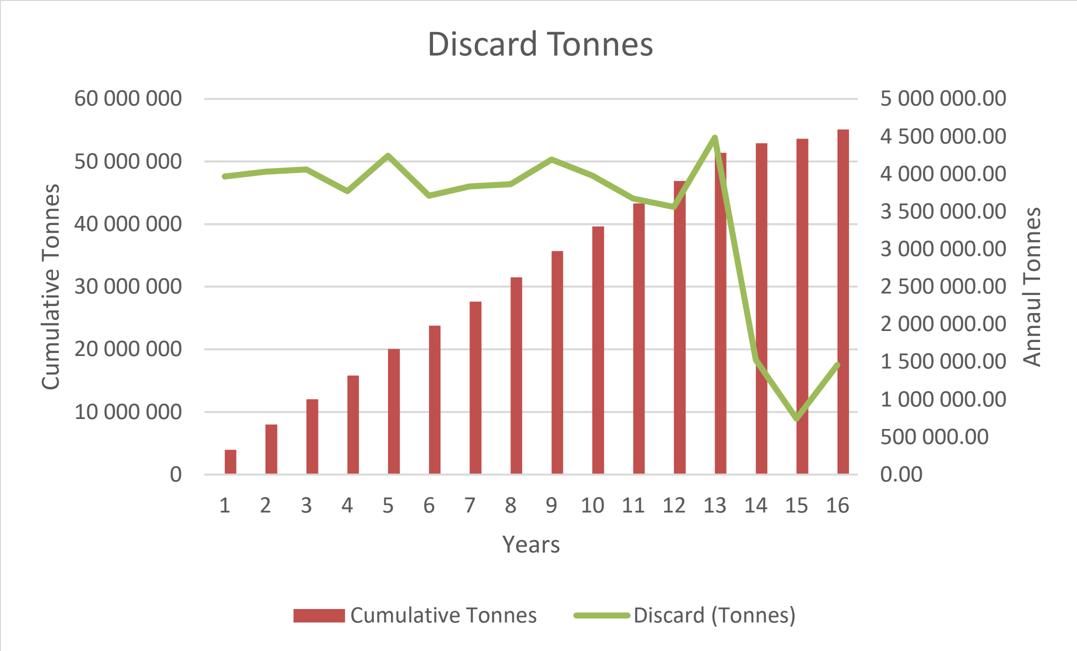


Figure 3: Annual Discard Tonnes Produced

1.3 DISCARD MATERIAL PROPERTIES

Assumptions were made in terms of the expected material properties of the discard produced. The properties are summarised in Table 1.

Table 1: Discard Material Properties

MATERIAL PROPERTY	DISCARD
Topsoil/Soft overburden	
Unit Weight	15.5 kN/m³
Basic angle of friction	33°
Cohesion	0 kPa
Hard overburden	
Unit Weight	16 kN/m³
Basic angle of friction	25°
Pore pressure	60 kPa
Carbonaceous material	
Unit Weight	16 kN/m³
Basic angle of friction	25°
Cohesion	60 kPa
Porosity	0.3
Founding material (mudstone)	
Unit Weight	24.5 kN/m³
Basic angle of friction	23°
Cohesion	43.677 kPa

1.4 DISCARD DUMP STORAGE

The discard facility design follows a 2-stage approach:

- Storage volume for first three years
- Storage volume for the LoM.

From the mining schedule and the raw coal washability, the average yield is approximately ("~") 50 % thus 50 % of the RoM will be discarded. The storage volume required for the first three years of the mine is ~12.0 million tonnes with an expected LoM volume of ~ 55.1 million tonnes. This results in the required storage of:

- First three years of the mine – 5.2 million cubes
- LoM – 23.7 million cubes.

It was therefore a primary consideration to ensure that the infrastructure for the first three years of the mine life was constructed, subsequent to which infrastructure for the life of mine will be constructed as and when required. The total footprint of the short-term discard dump is approximately 124 150 m² and that of the soft overburden, hard overburden and carbonaceous material is approximately 161 968 m², 384 615 m² and 1 487 197 m² respectively. The areas as well as the final volumes are discussed later in this chapter as slope stability and constructability were also considered during the design.

The heights of each discard dump are as follows:

- Temporary discard dump – 5.0 m
- Long-term carbonaceous (discard) – 90.0 m
- Soft overburden – included in carbonaceous dump, 30% used for berms, height of 5.0 m
- Hard Overburden – included as cladding for carbonaceous dump – Height 15.0 m.

The long-term carbonaceous dump will be constructed in paddocks configuration, compartmentalised with soft and hard overburden to eliminate the risk of spontaneous combustion. Three 30.0 m high layers will be constructed resulting in a final stockpile height of 90.0 m.

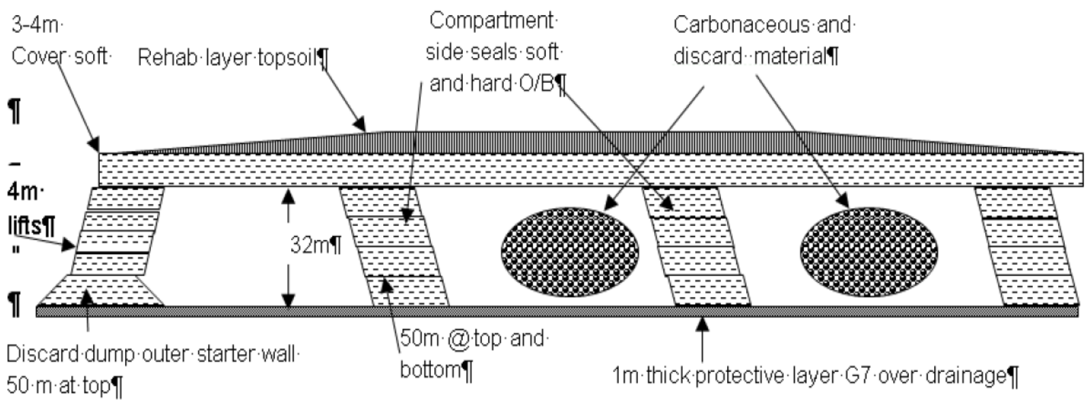


Figure 4: Carbonaceous dump cross-section

Topsoil and soft overburden, which will not be used for the construction of the carbonaceous dump, will be used for the construction of water diversion berms to a maximum height of 5.0 m. This material will then be used at the end of the life of mine for final layer works after backfilling of the pit with waste material.

1.5 WASTE CLASSIFICATION

Results of the material handled on site indicates a Type 3 waste and as such a Class C liner or equivalent must be implemented in accordance with the regulations. Based on the regulations and the waste classification the following barrier system is specified by Delta BEC. The liner detail is outlined in Table 2.

Table 2: Discard Dump Liner detail

ID	Layer Depth	Description
A	0-500 mm	Sacrificial layer 500 mm thickness, consisting of fine to medium sandy or similar suitable material. The sacrificial layer is placed to cover the HDPE geomembrane (GM), which will aid in protecting the GM from mechanical damage.
B	500mm	A robust 2.0 mm thick HDPE geomembrane laid in direct contact with the clay layer (Layer C). The HDPE liner exceeds the minimum requirement of a class C liner, mainly due to the potential of mechanical damage.
C	500-850 mm	A 300 mm thick compacted clay layer. The layer must be compacted to a minimum density of 95 % Standard Proctor maximum dry density at a moisture content of 0 to +2 % of the optimum moisture content in layers not exceeding 150 mm. The permeability of this layer should be lower than 1 x 10^{-9} m/s.
D	850-1 000 mm	This is a base preparation layer consisting of a rip and re-compacted layer of in-situ material for a depth of approximately 150 mm (no less). The layer must be compacted to a minimum density of 95 % Standard Proctor maximum dry density at a moisture content of 0 to +2 % of the optimum moisture. The permeability of this layer should be lower than 1 x 10^{-9} m/s.

ID	Layer Depth	Description
E	1 300-1 500 mm	Subsoil drainage system with leak detection pipe approximately 500mm below the pond bed level. Testing of the installed liner detail will be done after each layer is constructed.

1.6 POLLUTION CONTROL DAM LINER DETAIL

It is anticipated that the pollution control dam will comply with that of a Type 3 waste and as a result a Class C liner detail as outlined in the Table 3.

Table 3: Pollution Control Dam Liner detail

ID	Layer Depth	Description
A	2.0 mm	80 % Black Woven Shade Netting
B	2.0-4.0 mm	A 2.0 mm thick HDPE geomembrane (GM)
C	4.0-10.0 mm	A5 BIDIM or similar approved product
D	10.0 mm-160.0 mm	A 150 mm G7 material compacted to 93 % MOD AASHTO density
E	160.0 mm-310.0 mm	A 150 mm rip and compacted layer compacted to 93 % MOD AASHTO density
F	1 000.0-1200.0 mm	Subsoil drainage system with leak detection pipe approximately 500 mm below the pond bed level. Testing of the installed liner detail will be done after each layer is constructed.

As far as reasonably possible the design is aimed at keeping the standard barrier designs outlined in the regulations, an alternative design is included however should the compacted clay liner not be readily available on site or deemed to be an excessive increase in construction cost.

1.7 HDPE LINE PROTECTION

Hyson cells filled with concrete in fill are used to provide ad-hoc access to the submersible pumps situated in the pollution control dams. The Hyson cells concrete wearing course surface protect the liner from damage as a result from routine maintenance of the pumps, this is illustrated on the pollution control pond drawings.

1.8 STORAGE VOLUME

Subsequent to the determination of the side slopes of the facility to ensure the mitigation of spontaneous combustion and slope stability, the footprint of the discard dump could be established. The footprint takes into consideration the side slope angles as well as the setback length to ultimately meet the required storage volume.

As stated previously it has been assumed that all waste material is stored in the discard dumps and there is no provision for in-pit backfilling.

Figure 5 illustrates graphically the total storage required and the total storage area. The total storage volume for the LoM was estimated to be ~ 23.7 million cubes.

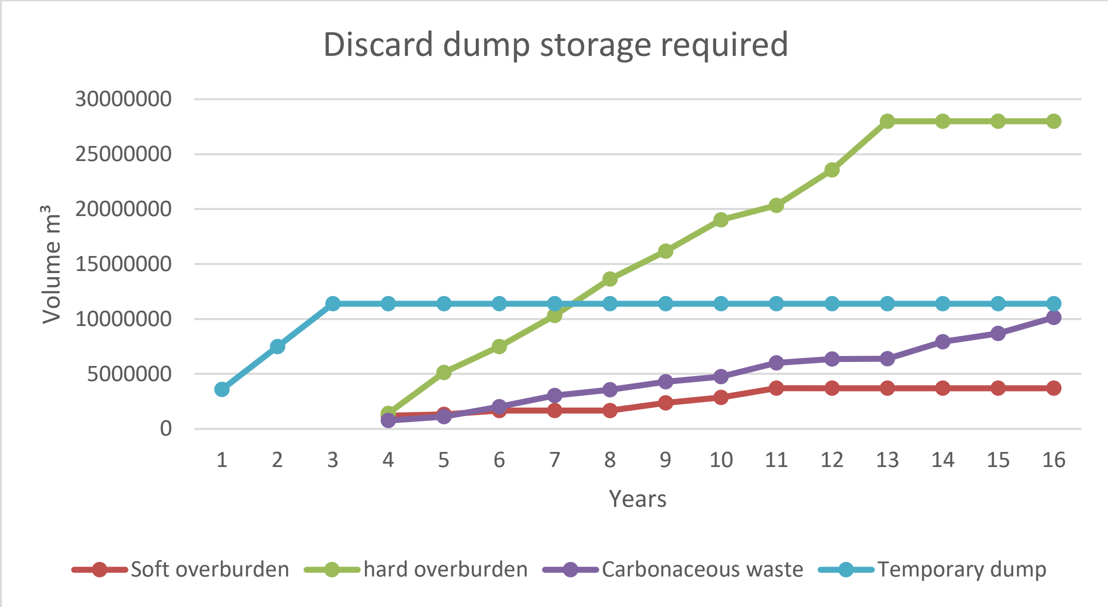


Figure 5: Discard Dump Storage Volume Required

The discards are placed and compacted in layers not exceeding 200 mm and compacted with side slopes of 3.5 m horizontal to every 1.0 m vertically. For the main discard dump, a setback of 5.0 m is provided at every 30.0 m height interval. The storage facility final design height is 90.0 m. The typical detail for the main discard dump and the soft and hard overburden dump is indicated in Figure 6 and figure 7 respectively

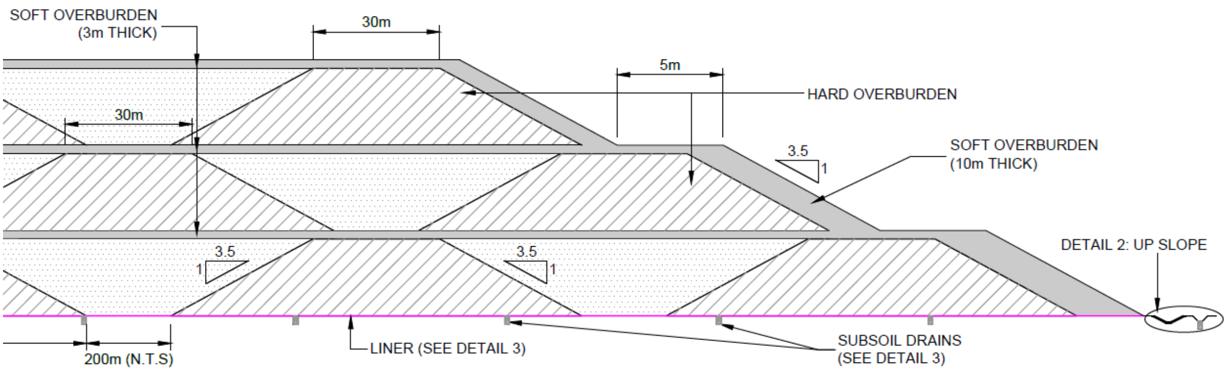


Figure 6: Main Discard Dump Side Slopes and Set-back.

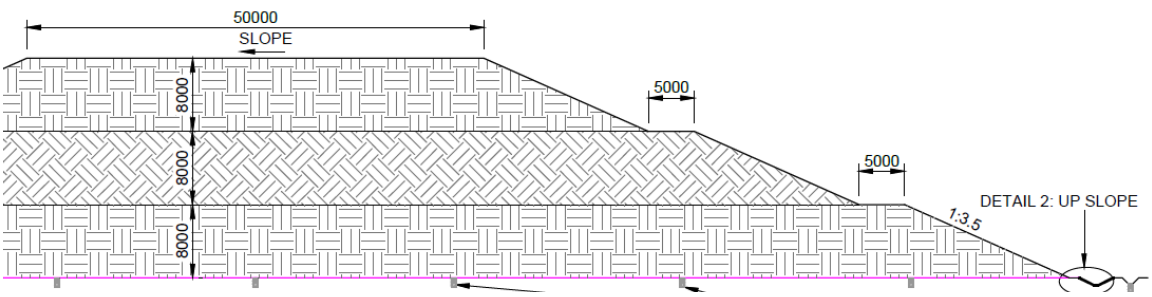


Figure 7: Soft & Hard Overburden Dump

1.9 SERVICE LIFE

The mine has a relatively short lifespan which is anticipate to be 16 years. It would sensible to ensure that the waste lining system has a service life exceeding the 16 years as well as another 20 to 30 years for pollution control monitoring. It would thus be expected that the lining system should have a service life in excess of approximately 46 years.

The life expectancy of HDPE liners is dependent upon the environment in which it is installed. Exposure to high temperatures, certain chemicals, constant loads and adverse site conditions shorten the life of liners. In buried applications such as a solid waste landfill, the life expectancy can be up to 200 years. In an exposed application, the life expectancy can reach 15 years. The lining system will be replaced every 7 years, this is done to take the half-life (approximately 7 years) of the lining as this is the time to reach the service life, specified as the 50 % degradation point (half-life) of geomembranes.

From Rowe (2005) an expected service life can be determined by considering the internal temperature and the subsequent temperature of the lining system. For a service life of 50 years the lining system should not experience temperatures in excess of 50°C. The expected lining temperature will be between 35°C to 40°C and as such the lining system should have sufficient service life for the duration of both the life of mine as well as the pollution control monitoring period.

1.10 TOTAL SOLUTE SEEPAGE

The total annual evaporation in the area exceeds the annual precipitation and therefore the area is not classified as a leachate generating catchment.

1.11 ALLOWABLE AND ACTION LEAKAGE RATES

As part of the waste licence application acceptable and allowable leakage rates need to be motivated, although no actual rates are specified in the guidelines, the designer must motivate and show that due diligence has been done in determining these rates.

The US Environmental Protection Agency indicates that acceptable leakage rates are in the order of 50-200 litres per hectare per day. As a guideline the following leakage rates were used:

- Acceptable Leakage Rate – 200 L/ha/day
- Acton Leakage rates – 500 L/ha/day

Various literature exists that outline formulas for calculating leakage rates with various assumptions. Although more detailed design information is required for the calculation of leakage rates, the liner should limit leakage rates to those outlined, and is expected to be less than 40 L/ha/day.

1.12 CATION EXCHANGE CONSIDERATIONS

Cation exchange considerations were evaluated for an alternative to the clay liner namely geosynthetic clay liner (GCL). The evaluation however confirmed that cation exchange cannot be mitigated with the use of this liner and as such equivalent performance cannot be proven. Reference should be made to the drawings for detailed liner details.

1.13 STANDARDS FOR CONSTRUCTION

The Standard Specifications forming part of this contract will be followed to cover all phases of work for the pollution control dam linings and discard dump. The construction specification which must be adhered to will be as indicated in Table 4.

Table 4: Specifications

Description	Specifications
Topsoil removal and stockpiling	Construction environmental management plan
Clear and Grub	SANS 1200C – Site Clearance
Bulk Earthworks	SANS 1200D - Earthworks
HDPE liner conformance	SANS 1526:2015
HDPE liner installation	SANS 10409:2003

1.14 QUALITY ASSURANCE

It is essential that Construction Quality Control and Assurance take place during the installation of the lining system. These are defined as the following:

- Construction Quality Control: A planned system of inspections that is used to directly monitor and control the quality of construction. Construction Quality Control shall be performed by the Lining Contractor or for natural soil materials by the Earthworks Contractor, and is necessary to achieve quality in the constructed or installed system. Construction Quality Control refers to measures taken by the installer or Contractor to determine compliance with the requirements for materials and workmanship as stated in the Drawings and Project Specifications. The quality control procedure for liner installation is fully described in SANS 10409:205 Design, selection and installation of geomembranes.
- Construction Quality Assurance: A planned system of activities that provides the Employer, Engineer and Permitting Authorities assurance that the facility was constructed as specified in the design. Construction Quality Assurance includes inspections, verifications, audits and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. Construction Quality Assurance refers to measures taken by the Engineer to assess if the Lining Contractor is in compliance with the Drawings and Project Specifications. An independent

third-party Construction Quality Assurance inspector may be appointed should any ambiguities result during construction.

1.15 SLOPE STABILITY

Another important factor that needed to be considered in delineating the discard dump footprint as well as the zone of influence was the angle of the side slopes so to ensure an adequate safety factor in terms of the slope stability. With the aid of GeoStudio the following parameters for the discard facility was established (it was considered that a 1.5 factor of safety would be sufficient):

- Side slopes of the discard material are done on layers not exceeding 200 mm
- Compaction to be in line with National Institute for Coal Research (Coal 8615, ISBN: 0 7988 3490 0)
- Side slopes are 3.5 m horizontal to 1 m vertical
- Set-backs of 5.0 m are provided for every 30.0 m
- Total height of the facilities:
    - Temporary discard dump – 5.0 m
    - Long-term carbonaceous (discard) – 90.0 m
    - Soft overburden – included in carbonaceous dump, 30% used for berms, height of 5.0 m
    - Hard Overburden – included as cladding for carbonaceous dump – Height 15.0 m.

Two failure types were modelled namely:

- Deep failure
- Shallow failure.

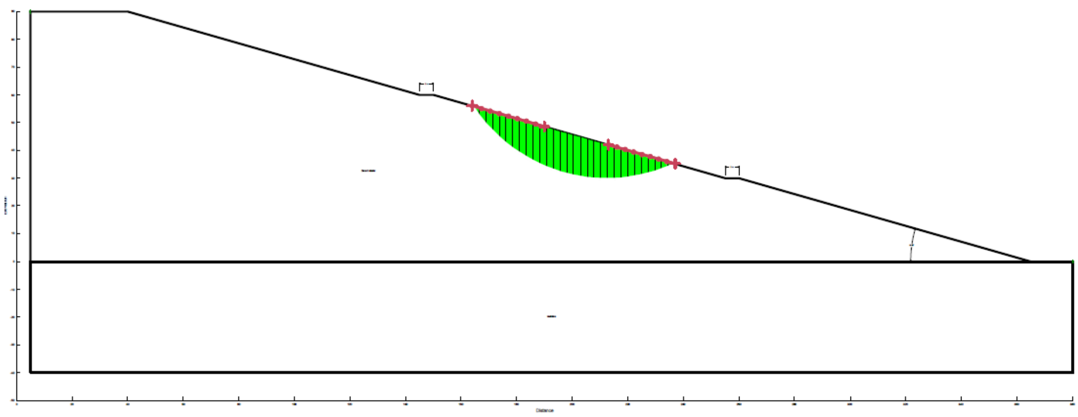


Figure 8: Main discard dump shallow failure (FOS = 1.864)

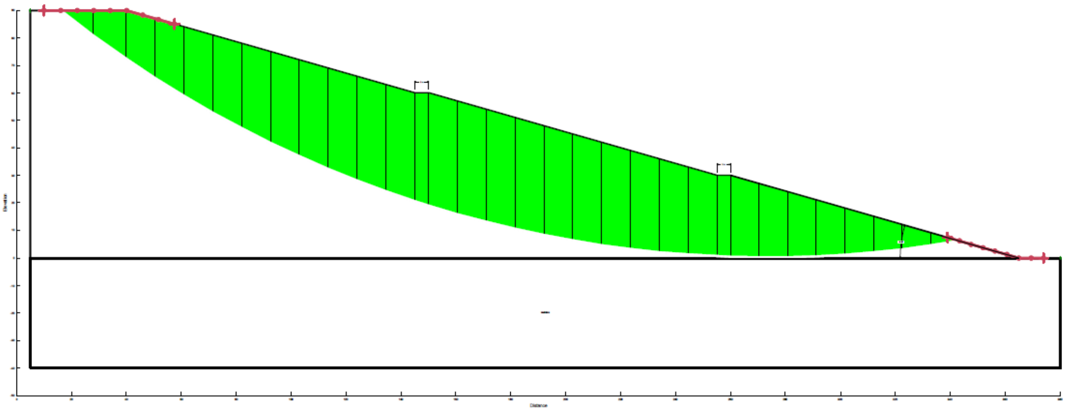


Figure 9: Main discard dump deep failure (FOS 3.169)

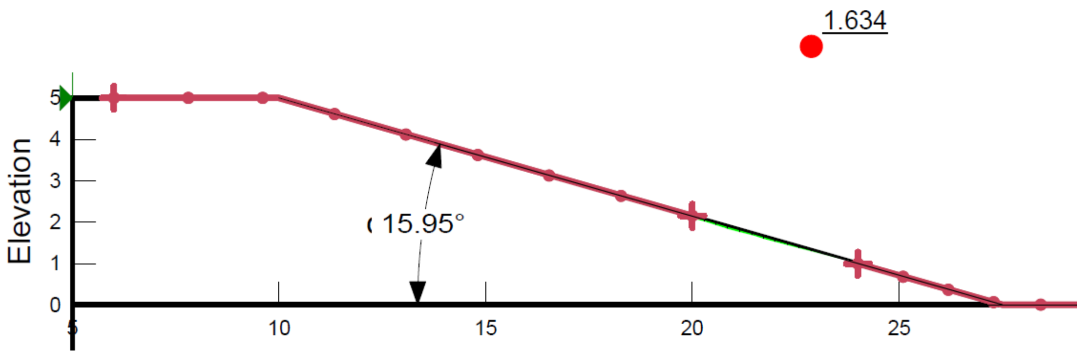


Figure 10: Temporary discard dump deep failure (FOS 1.634)

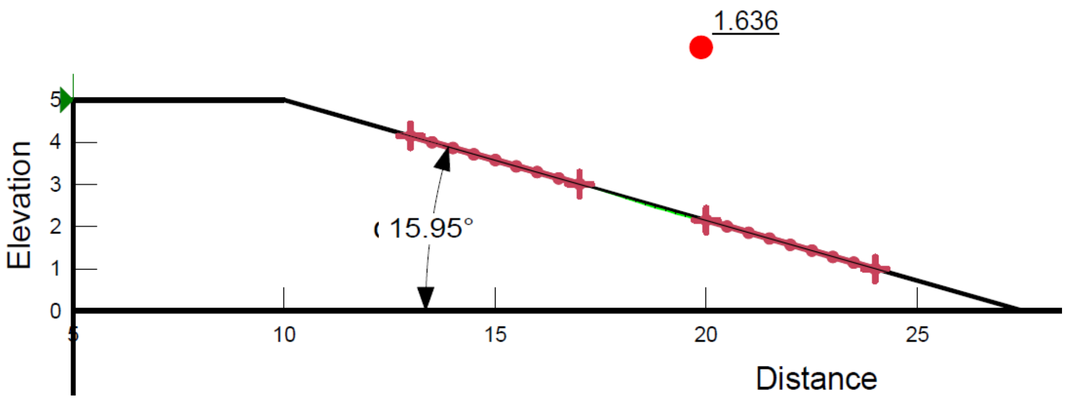


Figure 11: Temporary discard dump shallow failure (FOS 1.636)

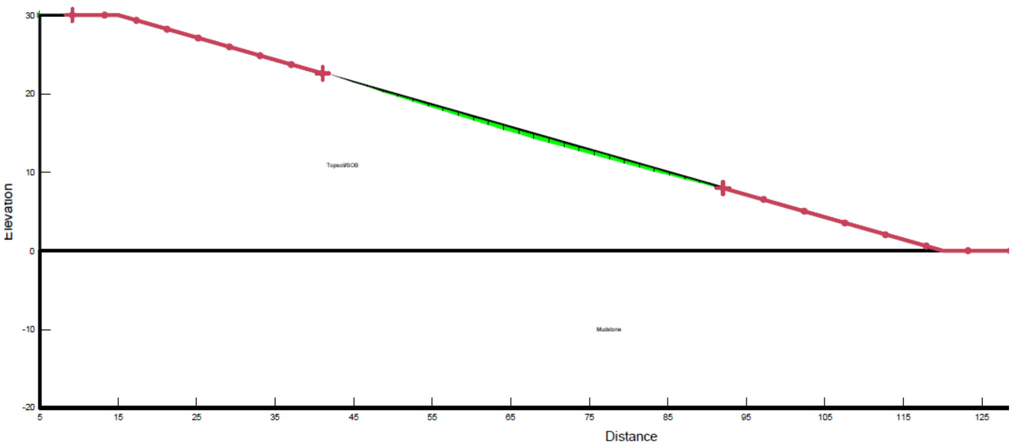


Figure 12: Soft overburden discard dump deep failure (FOS 2.275)

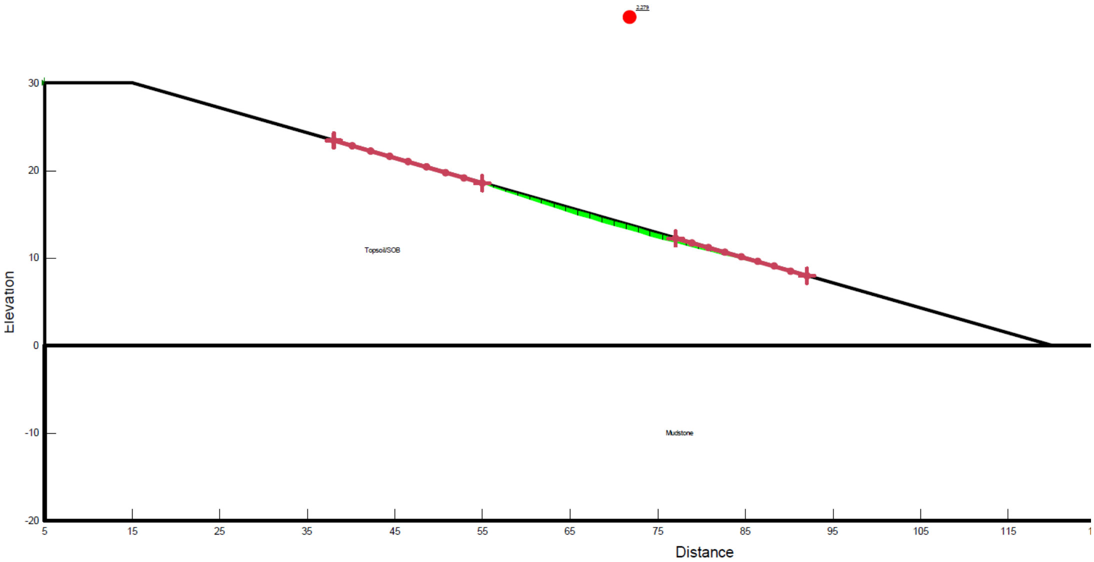


Figure 13: Soft overburden discard dump shallow failure (FOS 2.279)

The results indicate that the geometry is at optimum design in terms of lift heights, slope batter and bench width. A 1V:3.5H is therefore considered safe and optimum.

The internal shear strength along the potential failure plane are an important consideration to determine the FOS at any part of the sliding surface. An interface is a connection face between two materials that is characterized by Coulomb sliding and/or tensile and shear bonding. Using the interface element modelling, the FOS at any part of the sliding surface (slip slice) can be obtained. The global FOS of a slope is given by the weighted average of shear strength to shear stress in the overall sliding direction, which can estimate the global stability of the slope. The slip slice free body diagrams utilised in determining the global shallow and deep failure FOS and given in Appendix A.

1.16 HYDROLOGY AND SURFACE WATER MANAGEMENT

The discard dump facilities are surrounded on the upstream side by means of clean water earth drains with subsoil drainage systems so to ensure that clean water is conveyed around the facility, this ensures that clean water stays unpolluted.

The discard dump facilities are surrounded with concrete trapezoidal drains around their footprints with internal subsoil drainage systems, both discharge into pollution control dams via silt traps. The infrastructure therefore ensures that the runoff conforms to the requirements of regulation 704 of the National Water Act.

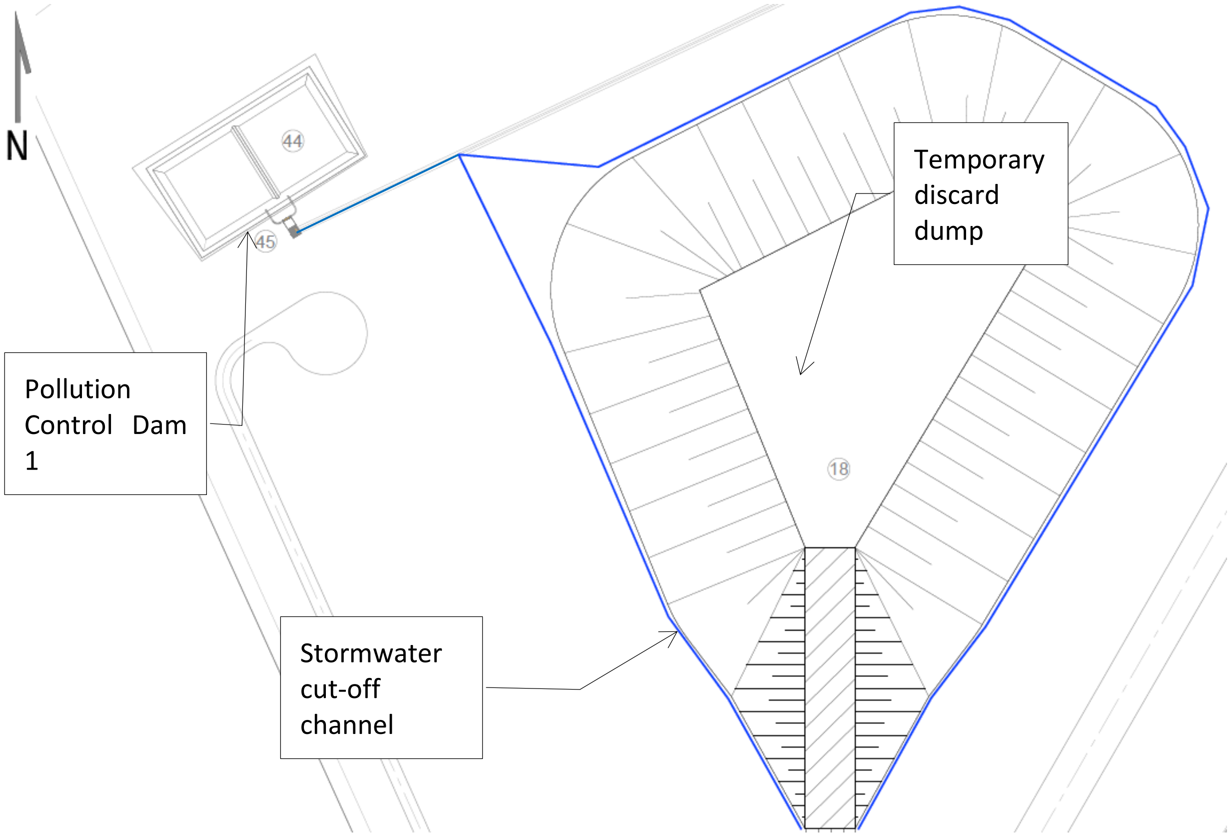


Figure 14: Temporary Discard Dump Layout

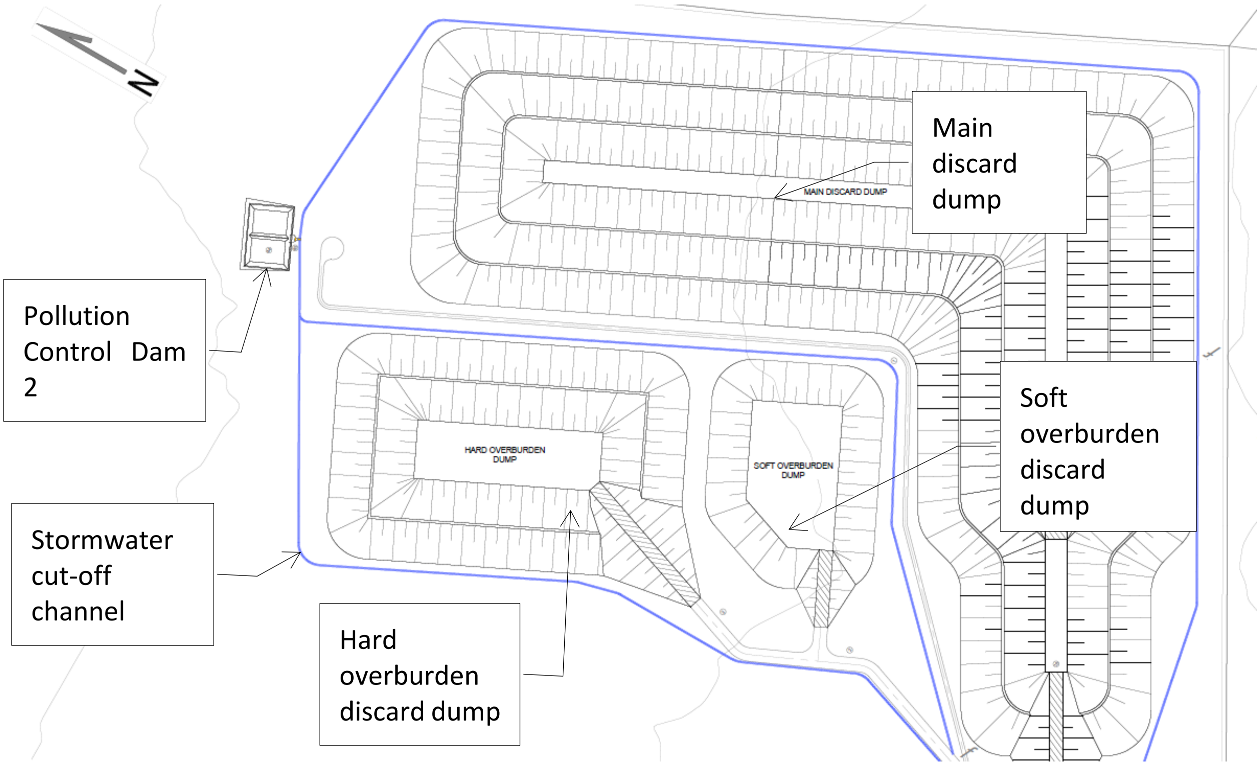


Figure 15: Long-term discard dumps layout

The Project stormwater management plan is discussed in detail in separate chapter of the feasibility study, reference is made to the stormwater around the discard facility. Calculations have been carried out for the site to estimate runoff volumes and maximum likely discharge rates for a range of recurrence intervals and event durations.

Pollution Control Dam 1 and Pollution Control Dam 2 have been designed to contain 116.1 Mℓ/annum and 176.4 Mℓ/annum of water respectively. The pollution control dam has sufficient storage capacity to accept and retain the expected volumes of surface water runoff from the discard disposal facility for a storm event not exceeding the 50-year flood recurrence interval.

1.17 SAFETY/RISK CLASSIFICATION

The safety classification of the facility has been carried out in accordance with the requirements of SABS 0286:1998: Code of Practice for Mine Residue. The safety classification system serves to provide consistent means of differentiating between high, medium and low hazard deposits on the basis of their potential to cause harm to life or property. The classification system furthermore provides a basis for the implementation of safety management practices for specified stages of the life cycle of mine residue disposal facilities. The code prescribes the aims, principles and minimum requirements that apply to the classification procedure and the classification in turn gives rise to minimum requirements for investigation, design, construction, operation and decommissioning.

The approximate area that may be affected by a flow slide originating from a residue deposit is usually determined based on the guideline values from the Code of Practice and the topography of the area. Based on the nature of the discards however, it is not expected that the facility would ever be subject to a flow slide and the associated release of discards. It is not expected therefore that the zone of influence would extend beyond the perimeter road of the facility. Based on the zone of influence as defined and the criteria specified in the code, the discard disposal facility has been classified as a low hazard facility.

Table 5: Discard Disposal Facility - Safety Classification

CRITERIA 1	CRITERIA 2	CRITERIA 3	CRITERIA 4	CRITERIA 5
No. of residents in zone of influence	No. of worker in zone of influence	Value of 3rd party property in zone of influence	Depth to underground mine workings	Classification
0	<10	0 – R 2m	> 200m	low hazard

1.18 ENVIRONMENTAL CLASSIFICATION

The environmental impacts associated with the development, operation and closure of mine residue disposal facilities relates to:

- Their potential to contaminate surface water resources due to uncontrolled runoff of water from their side slopes or releases of water from their return water systems
- Their potential to contaminate groundwater due to seepage
- Their potential to cause contamination of soils
- The change in land use associated with the development of the facility
- Their potential to generate dust
- Their aesthetic impact on their surroundings.

These risks are discussed below, with specific reference to the potential impacts associated with the development and operation of the Gruisfontein Discard Disposal facility and the mitigation measures required to ameliorate those risks.

1.18.1.1 Surface Water

Surface water runoff from the surface of the facility will be intercepted to prevent the water reporting to north of the site. A channel which collect and divert the surface water to Pollution Control Dam 1 and Pollution Control Dam 2. The impacts on the surface water environment are expected to be of moderate severity, limited to the area immediately down slope of the facility.

1.18.1.2 Groundwater

The infiltration of contaminated water to groundwater is expected to be limited by the compaction of discards as well as the dump footprint and the installation of subsoil drains to convey water volumes. The potential for the discard dump to impact on the local ground water environment is considered to be limited as the appropriate measures have been designed to separate clean and dirty water for both surface and subsurface water.

1.18.1.3 Land Use

The development of the discard dump will result in a change in the land use of the immediate area upon which it is established. It is possible, given the nature of the site, that post closure the facility could be rehabilitated in such a way as to derive economic benefit from the land without risk of damage to the chemical, social or ecological sustainability.

1.18.1.4 Aesthetic Impacts

The facility will have an impact on the aesthetics of the area for as long as it is in existence. The facility could be rehabilitated in such a way as to blend into the surrounding post closure landscape. This should limit the impact of the facility on the aesthetics of the surrounding area.

1.18.1.5 Atmospheric Pollution

The facility will, as with all discard disposal sites, have the potential to generate windblown dust. The compaction and ongoing rehabilitation of the facility is, however, likely to mitigate the effects of wind on the facility. The locality of the discard has taken into account the predominant wind direction.

1.18.2 REHABILITATION OF DISTURBED AREAS

Areas surrounding the discard disposal facility disturbed during the construction process will be rehabilitated as part of the site dis-establishment by the earthworks and civils contractor. The faces of the toe walls and cross walls, surface water diversion trench and berm, and silt trap walls will be covered with a layer of topsoil and seeded with a mixture of indigenous grass seeds.

1.18.3 CONSTRUCTION AND REHABILITATION MATERIALS BALANCE

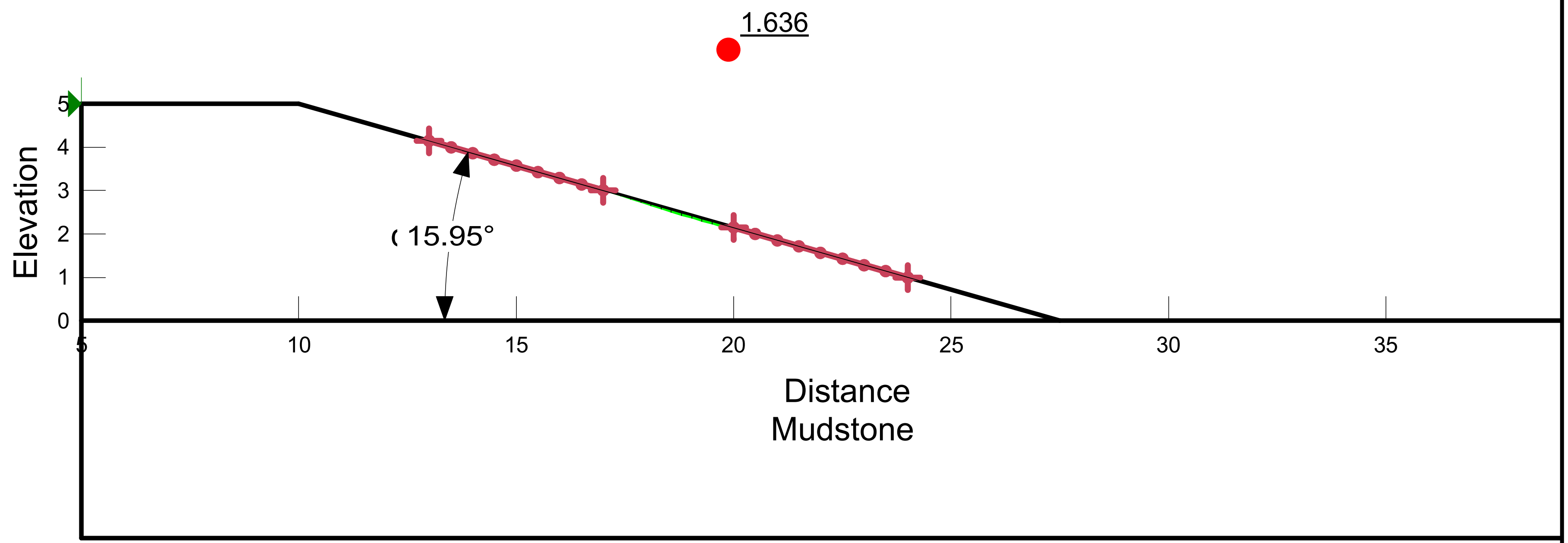
The construction material of the discard dump will comprise material from the mine pit. The topsoil to be utilized for rehabilitation will be the total quantity stripped from the site and stockpiled. It is not anticipated that any additional topsoil will be required.

1.19 CONCLUSION

The zone of influence considered when a possible slippage occurs has very limited threat to infrastructure and human life, the discard is located with ample space between the facility and surrounding infrastructure. The plant is located 150 m south-west of the three-year discard facility toe and the mine infrastructure area is located 300 m south-west of the discard stockpile toe.

The discard dump has therefore been designed to ensure conformance to statutory requirements while also ensuring that the slopes are stable and that water management is done according to the requirements of regulation 704.

APPENDIX A: SLOPE STABILITY DIAGRAMS



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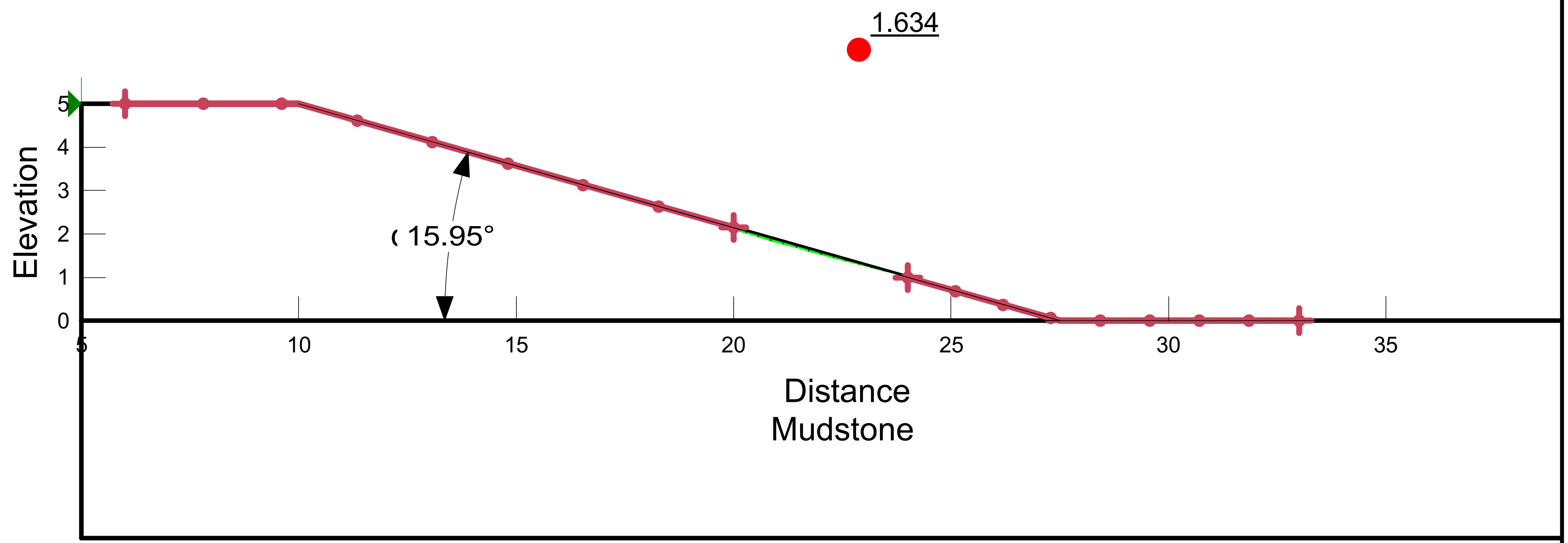

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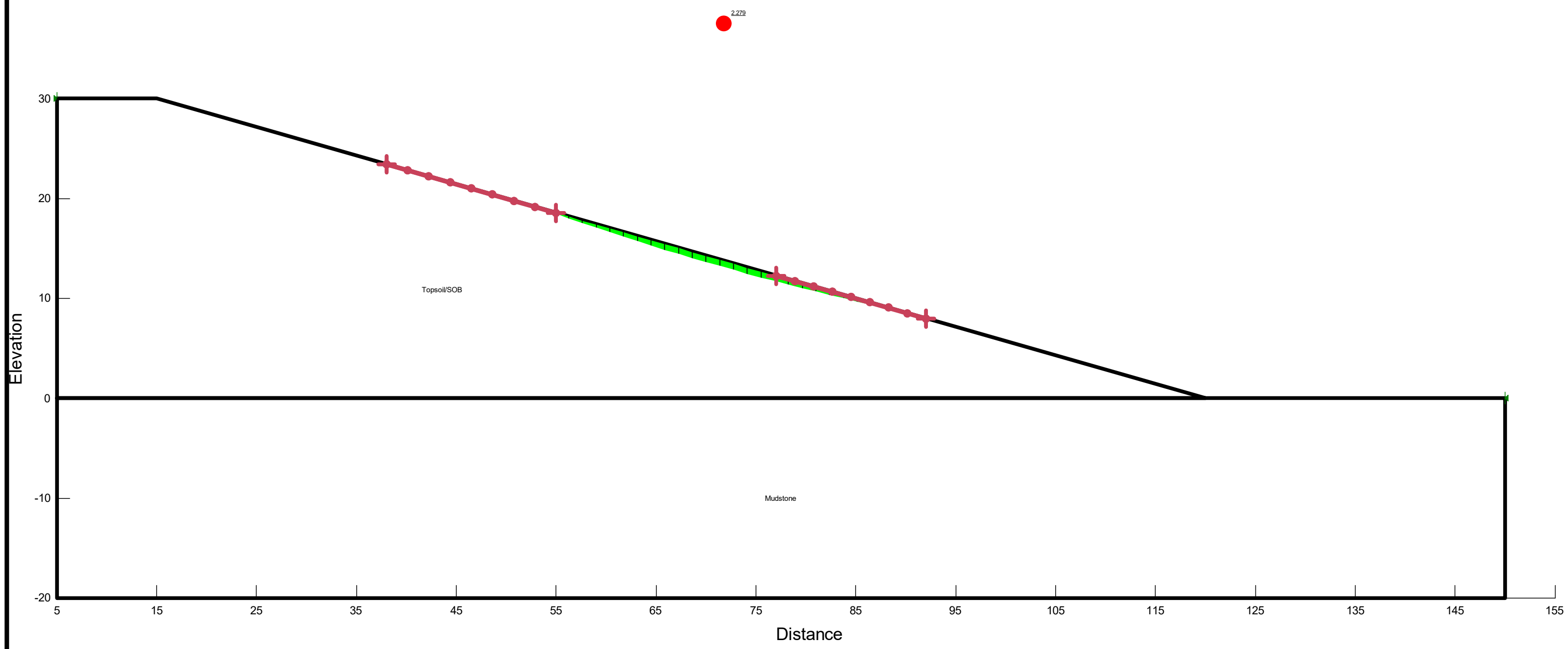

Topsoil/SOB Dump Slope Stability
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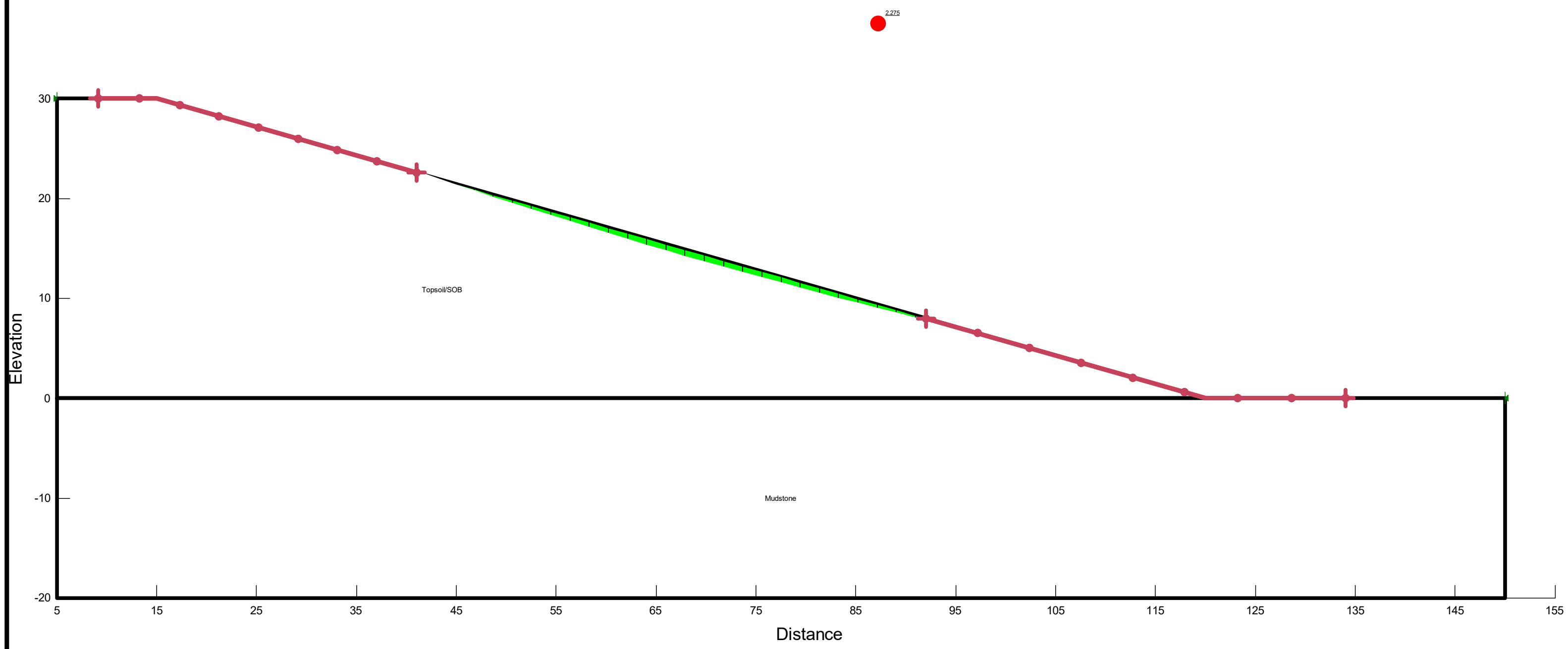
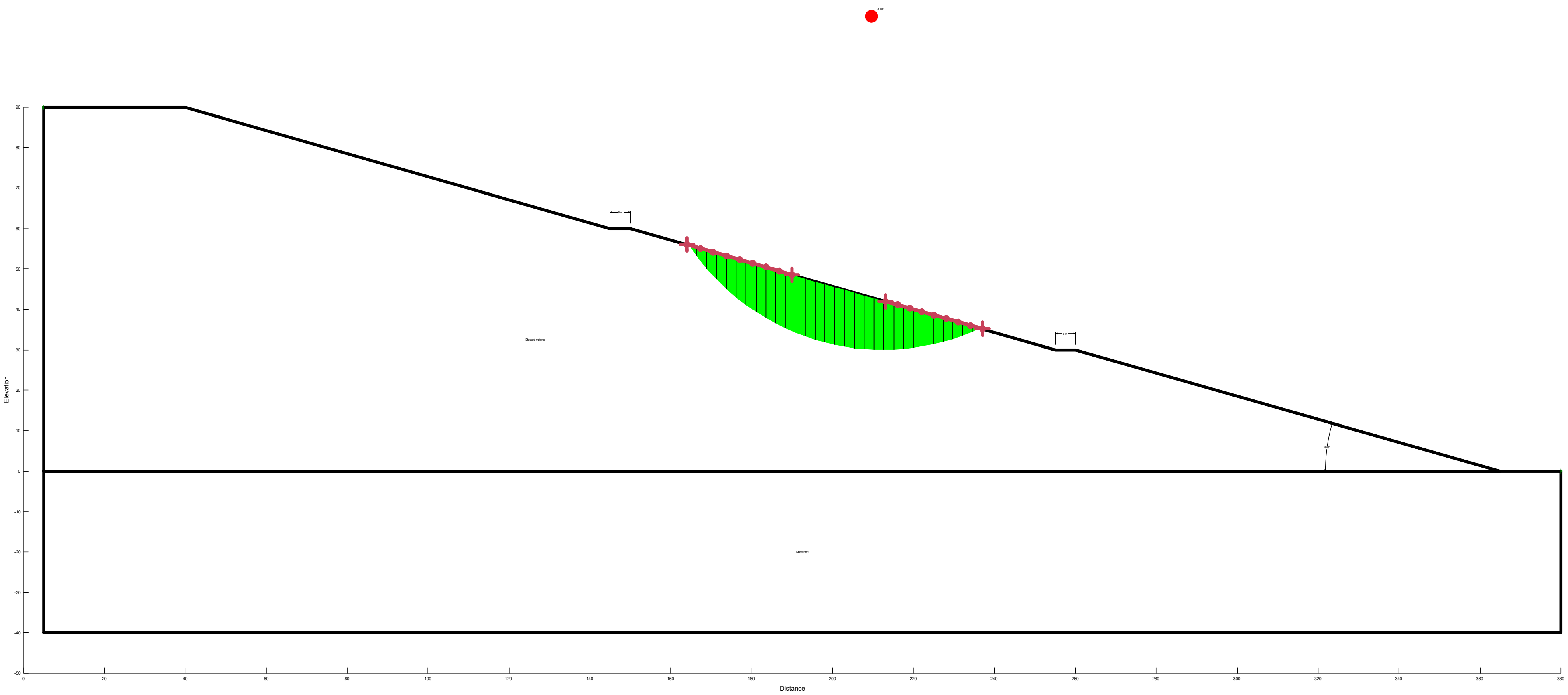


Topsoil/SOB Dump Slope Stability
P18054 Stability Analysis.gsz
2019/09/03 1:750



Main Discard Dump Slope Stability

P18054 Stability Analysis.gsz

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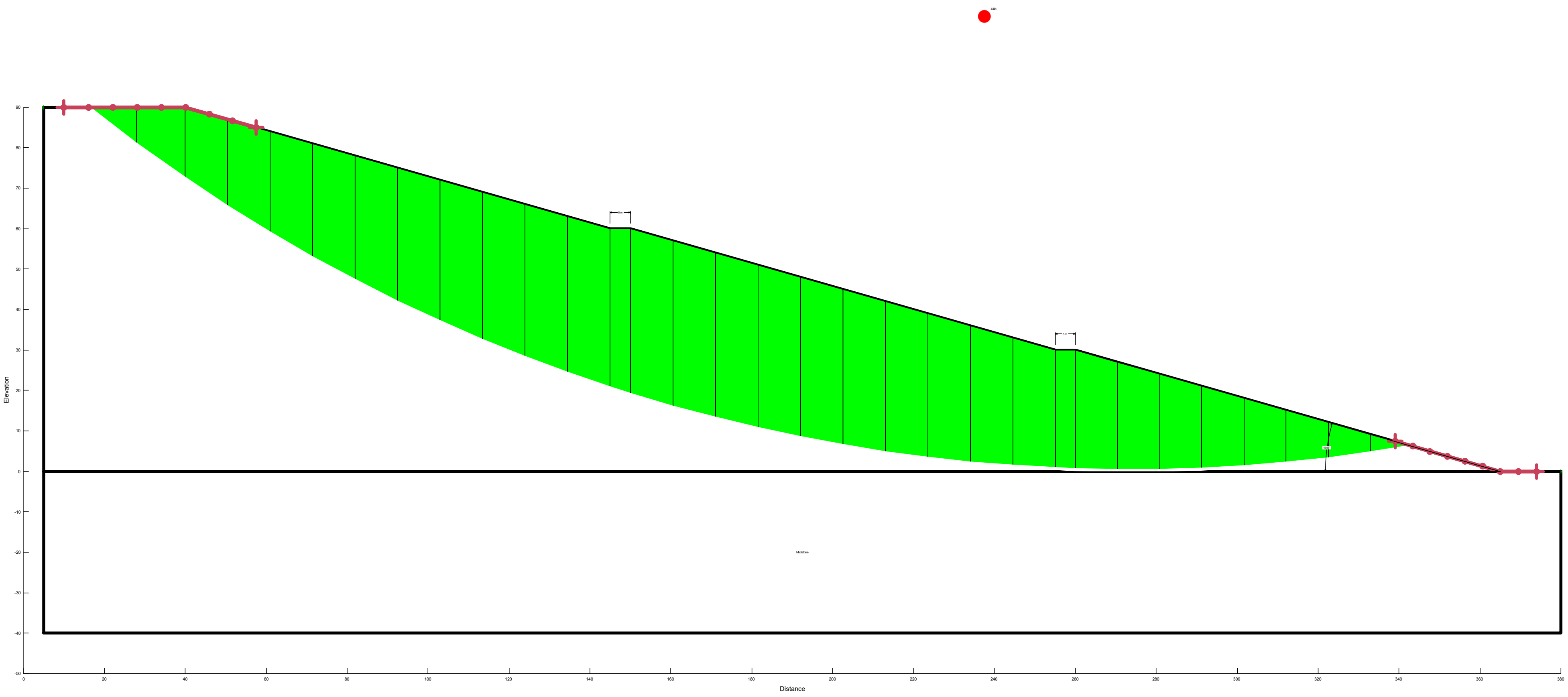

Main Discard Dump Slope Stability	
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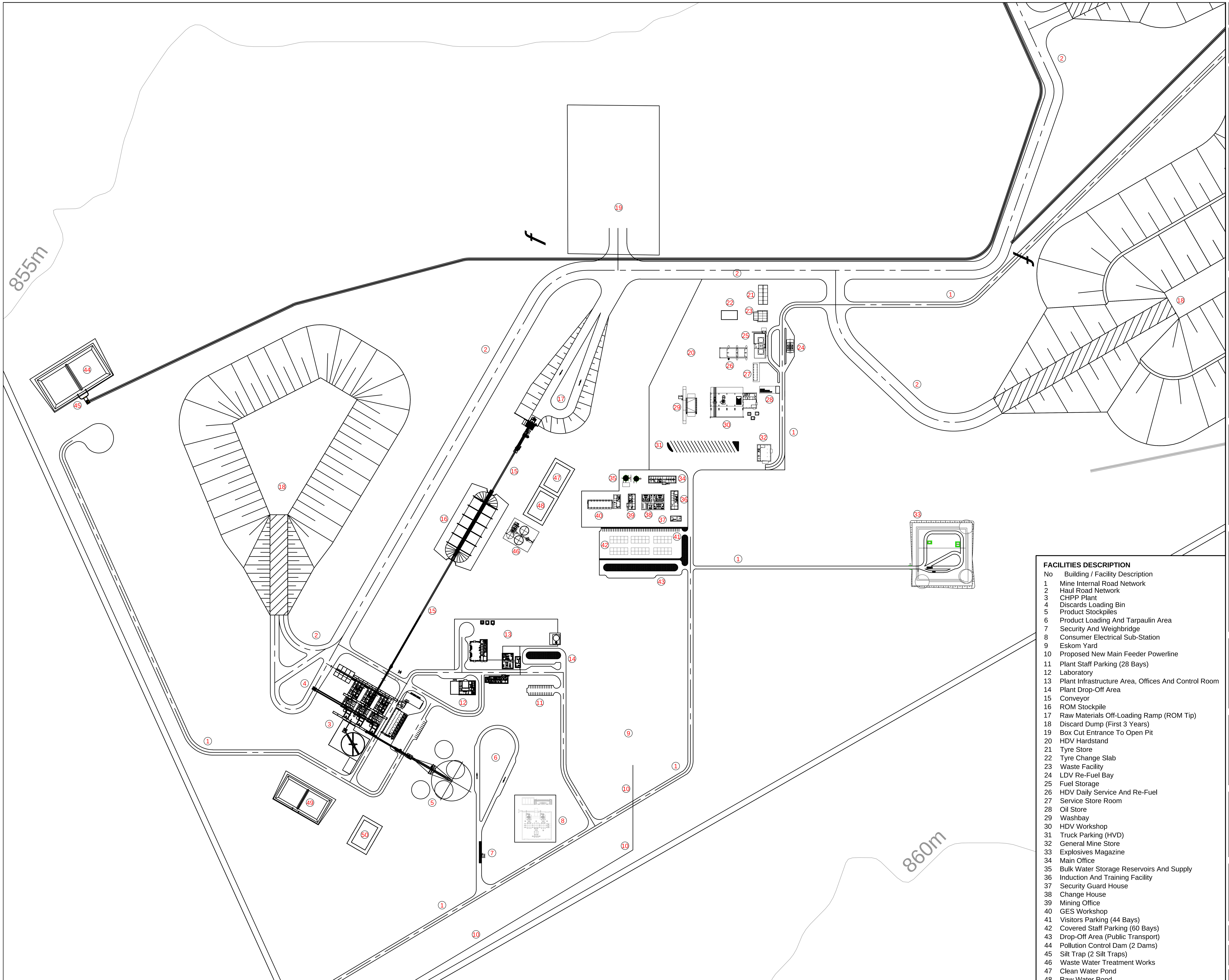
2019/09/03	1:1 500

APPENDIX B: DRAWINGS



GENERAL LAYOUT
SCALE 1:3000

FACILITIES DESCRIPTION

No	Building / Facility Description
1	Mine Internal Road Network
2	Haul Road Network
3	CHPP Plant
4	Discards Loading Bin
5	Product Stockpiles
6	Product Loading And Tarpaulin Area
7	Security And Weighbridge
8	Consumer Electrical Sub-Station
9	Eskom Yard
10	Proposed New Main Feeder Powerline
11	Plant Staff Parking (28 Bays)
12	Laboratory
13	Plant Infrastructure Area, Offices And Control Room
14	Plant Drop-Off Area
15	Conveyor
16	ROM Stockpile
17	Raw Materials Off-Loading Ramp (ROM Tip)
18	Discard Dump (First 3 Years)
19	Box Cut Entrance To Open Pit
20	HDV Hardstand
21	Tyre Store
22	Tyre Change Slab
23	Waste Facility
24	LDV Re-Fuel Bay
25	Fuel Storage
26	HDV Daily Service And Re-Fuel
27	Service Store Room
28	Oil Store
29	Washbay
30	HDV Workshop
31	Truck Parking (HVD)
32	General Mine Store
33	Explosives Magazine
34	Main Office
35	Bulk Water Storage Reservoirs And Supply
36	Induction And Training Facility
37	Security Guard House
38	Change House
39	Mining Office
40	GES Workshop
41	Visitors Parking (44 Bays)
42	Covered Staff Parking (60 Bays)
43	Drop-Off Area (Public Transport)
44	Pollution Control Dam (2 Dams)
45	Silt Trap (2 Silt Traps)
46	Waste Water Treatment Works
47	Clean Water Pond
48	Raw Water Pond
49	Balancing Dam
50	Process Water Pond

Cad File Name: DBEC-MRPRO-09-06
P18054-CC-01-GN-002 REV a - MINE INFRASTRUCTURE LAYOUT

GREEN BUILDING COUNCIL MEMBER ORGANISATION
CESA

LEGEND:

CONCEPT

Rev.	Date	Description of changes	By
a	##-##-2018	ISSUED FOR APPROVAL	PDW

REVISIONS

Client

NOZALA COAL
P O BOX 68413
BRYANSTON
2021
TEL: +27-11-463-5588
FAX: +27-11-463-7590

Consultant

DELTA built environment consultants
P O BOX 35703
MENLO PARK
0102
TEL: +27-12-368-1850
FAX: +27-12-348-4738

APPROVED
THE MASTER HELD AT DELTA BUILT ENVIRONMENT CONSULTANTS BEARS THE ORIGINAL SIGNATURE OF APPROVAL.

SIGNATURE: NAME: DATE:

Project
GRUISFONTEIN COAL MINE PROJECT

Project Description
GRUISFONTEIN PFS DESIGN

Drawing Title
MINE INFRASTRUCTURE LAYOUT

Drawing Units	METERS	Drawing Size	A1

Date	Scale	Designed By
AUGUST 2018	AS SHOWN	G GREYLING
Checked By	**Drawn By**	**Approved By**
B NDHLOVU	I SMIT	P DE WET

Drawing No. P18054-CC-01-GN-002 Rev a

Cad File Name: P18054-CC-01-EW-002 REV a - 3 YEAR DISCARD DUMP LAYOUT

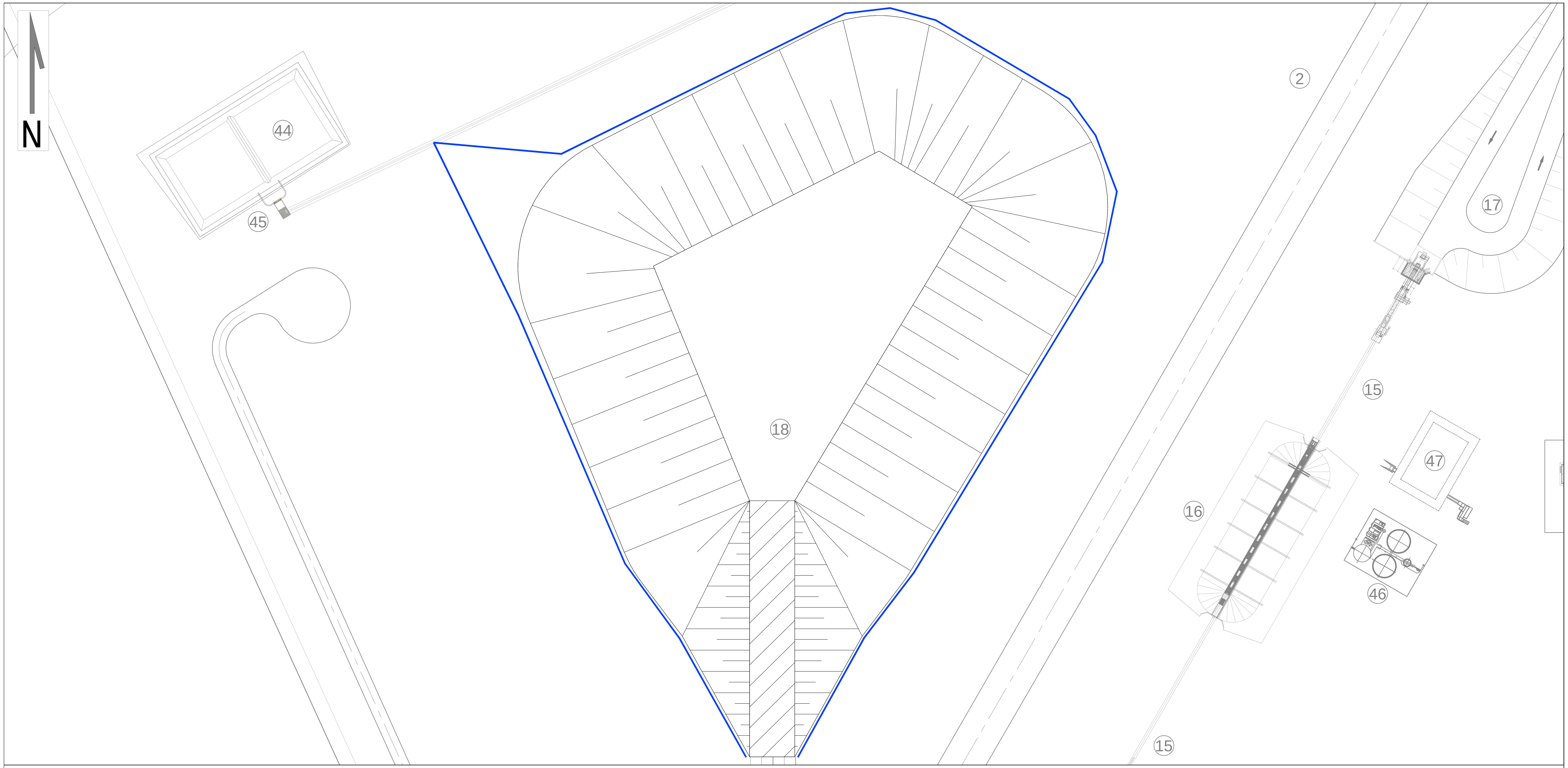
DBEC-MRPRO-09-06

GREEN BUILDING COUNCIL MEMBER ORGANISATION

CESA

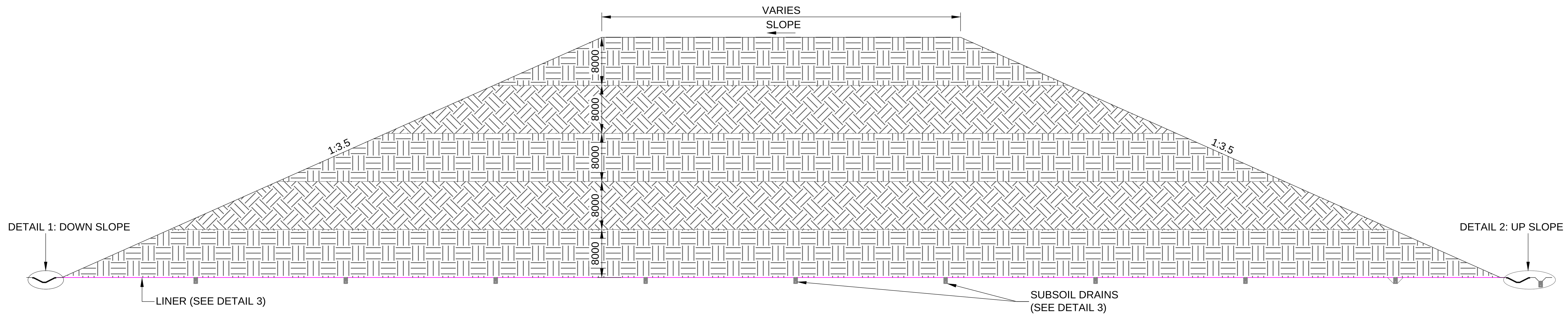
LEGEND:

STORMWATER CUT-OFF CHANNELS



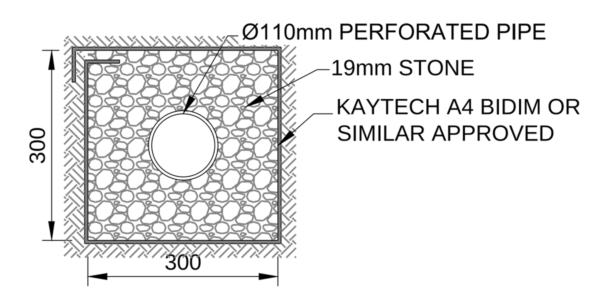
3 YEAR DISCARD DUMP LAYOUT

SCALE 1:1500



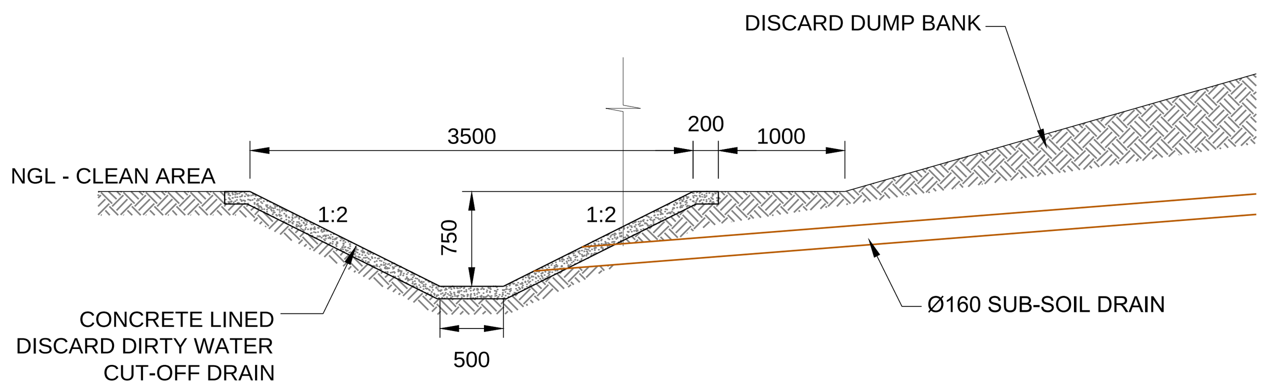
TYPICAL SECTION A-A

SCALE: N.T.S.



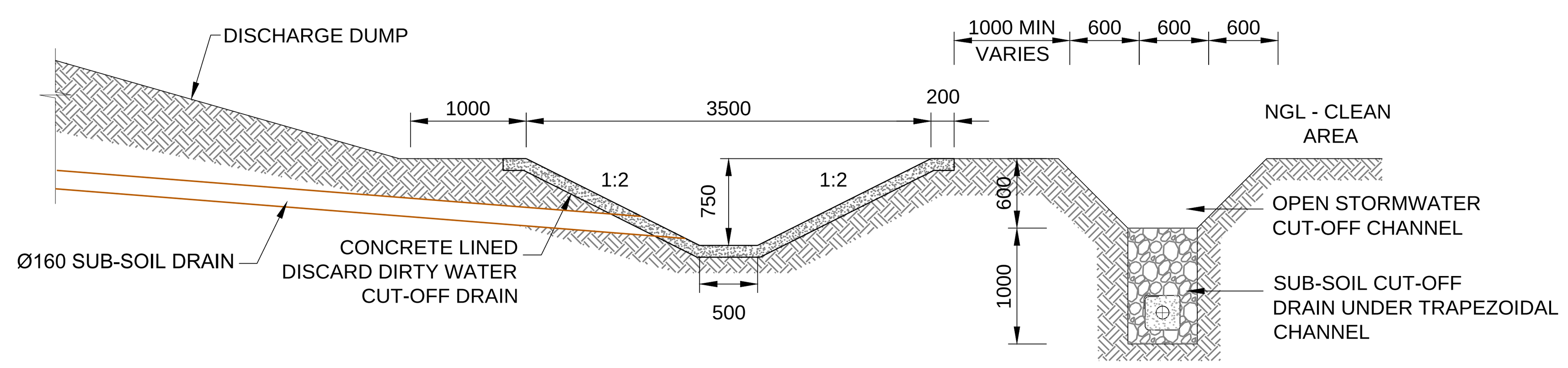
TYPICAL SUB-SOIL DETAIL

N.T.S



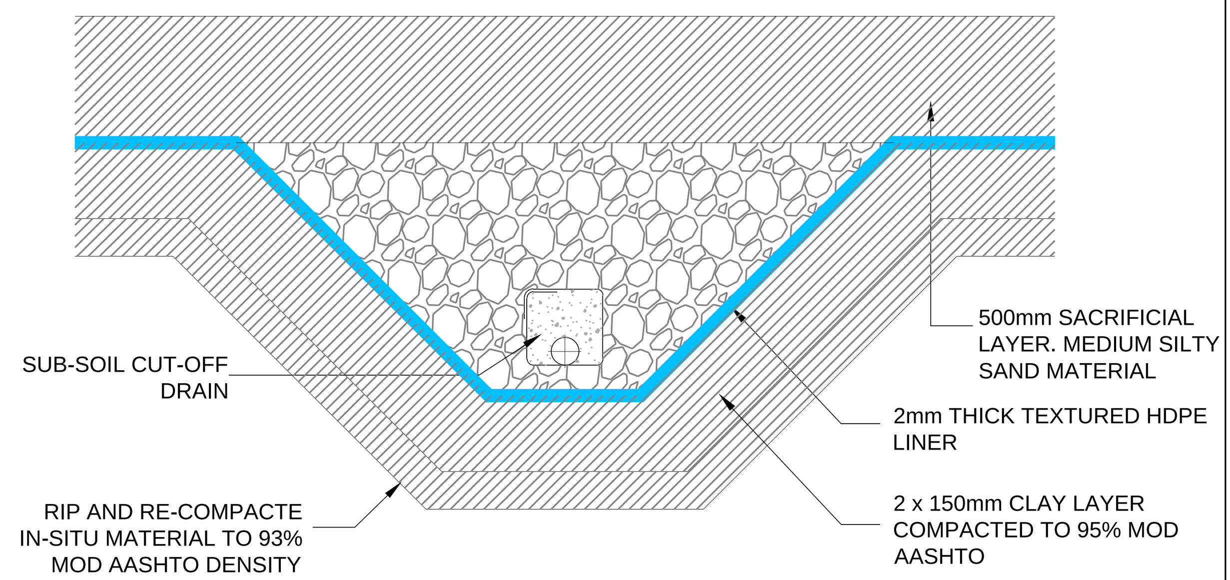
DETAIL 1: DOWN SLOPE

SCALE 1:50



DETAIL 2: UP SLOPE

SCALE 1:50



DETAIL 3

N.T.S

CONCEPT

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a	##-##-2018	ISSUED FOR APPROVAL	PDW

REVISIONS

Client

NOZALA COAL
P O BOX 68413
BRYANSTON
2021
TEL: +27-11-463-5588
FAX: +27-11-463-7590

Consultant

DELTA built environment consultants

P O BOX 35703
MENLO PARK
0102
TEL: +27-12-368-1850
FAX: +27-12-348-4738

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SIGNATURE: NAME: DATE:

Project

GRUISFONTEIN COAL MINE PROJECT

Project Description

GRUISFONTEIN PFS DESIGN

Drawing Title

3 YEAR DISCARD DUMP LAYOUT

Drawing Units	Drawing Size	
METERS	A1	
Date	**Scale**	**Designed By**
AUGUST 2018	AS SHOWN	G GREYLING
Checked By	**Drawn By**	**Approved By**
B NDHLOVU	I SMIT	P DE WET

Drawing No. P18054-CC-01-EW-002 Rev a

NOTES

1. THE DISCARD DUMP COMPLIES WITH TYPE 3 CLASS C LINER TYPE AS CLASSIFIED IN THE REGULATIONS, PUBLISHED IN GOVERNMENT NOTICE R.634 IN GOVERNMENT GAZETTE NO. 36784 DATED 23 AUGUST 2013 (GNR 634)
2. THE LINER COMPROMISES OF FOUR LAYERS, 150mm IN-SITU RIP AND RE-COMPACT TO 93% MOD AASHTO, 4 LAYERS OF BITUMEN EMULSION (E-PRIME) SPRAYED CONTINUOUSLY AND UNIFORMLY OVER THE AREA
3. SACRIFICIAL LAYER OF G7 MATERIAL COMPACTED TO 93% MOD AASHTO

THE CAPACITY OF THE DISCARD DUMP IS: #m³ - FOR THE LIFE OF MINE

CONSTRUCTION NOTES

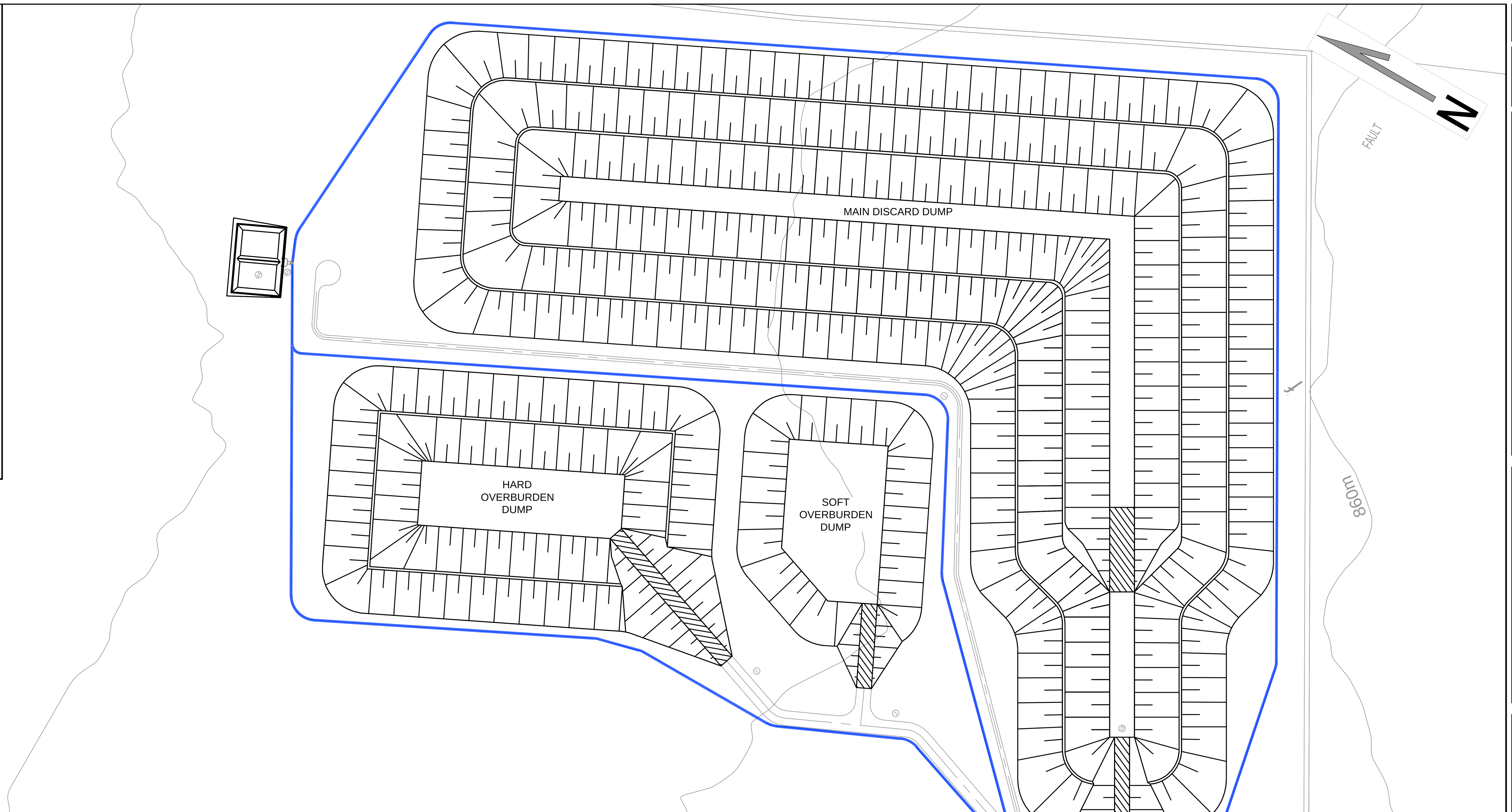
1. CLEAR AND GRUB ARE BY REMOVING 300mm TOPSOIL AND STOCKPILE
2. EXCAVATE SUB-SOIL TRENCHES AND CLEAN WATER DAMS
3. EXCAVATE AND TRIM CUT-OFF CHANNELS
4. RIP AND RE-COMPACT 150mm LAYER
5. 150mm G7 LAYER COMPACTED TO 93% MOD AASHTO AS PER SANS 1200D
6. SPRAY E-PRIME AT A RATE OF 0.55ℓ/m²
7. INSTALL SUB-SOILS AND BACKFILL
8. CONCRETE LINE THE CUT-OFF DRAINS
9. CONSTRUCT CLEAN WATER EARTH DAMS
10. COMPACT 150mm G7 SACRIFICIAL LAYER
11. FINISH OFF SITE WORKS

NOTE

SUB-SOIL DRAINS SPACED AT 15mc/c INTERVALS

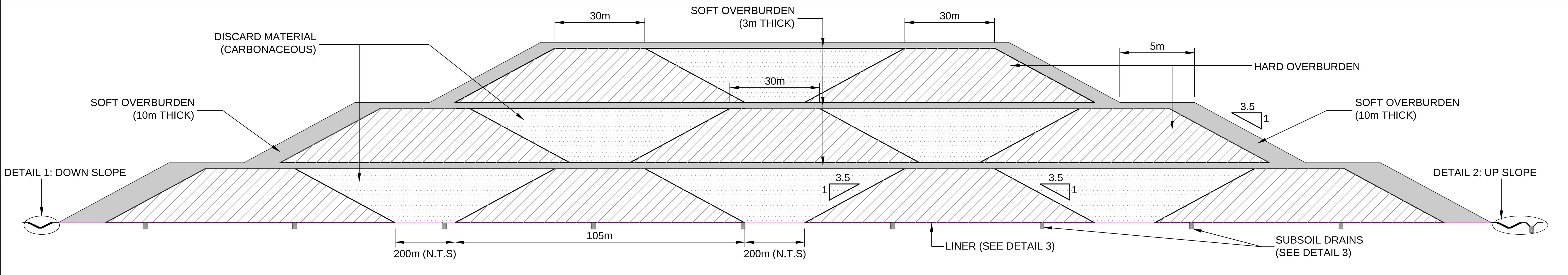
STANDARDS FOR CONSTRUCTION

- TOPSOIL REMOVAL AND STOCKPILING - CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN
- CLEAR AND GRUB - SANS 1200C - SITE CLEARANCE
- BULK EARTHWORKS - SANS 1200D - EARTHWORKS
- HDPE LINER CONFORMANCE - SANS 1526:2015
- HDPE LINER INSTALLATION - SANS 10409:2003



MAIN DISCARD DUMP LAYOUT

SCALE 1:6000



TYPICAL SECTION - MAIN DISCARD DUMP

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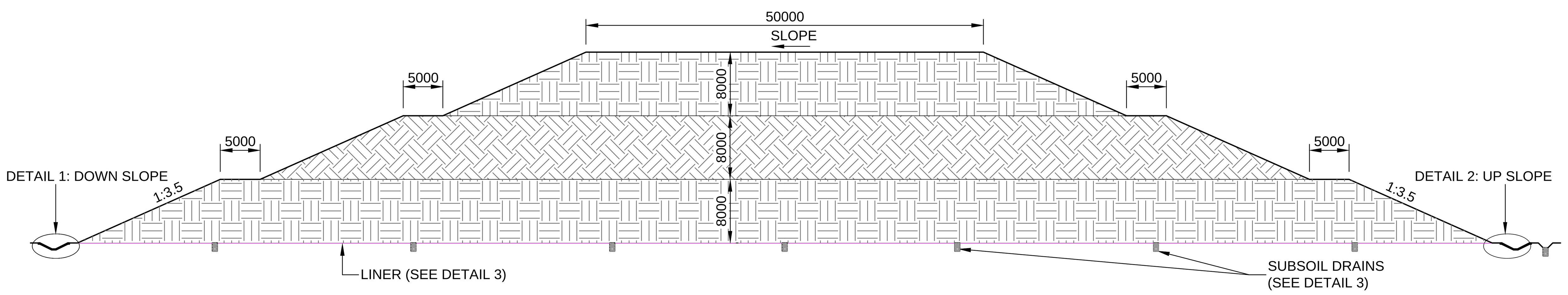

TYPICAL SECTION - SOFT AND HARD OVERBURDEN DUMP

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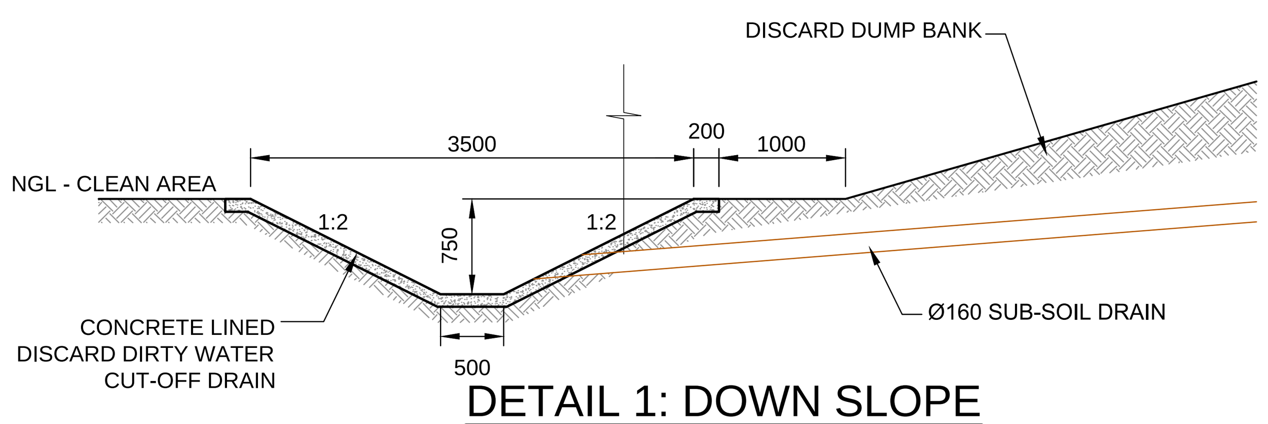
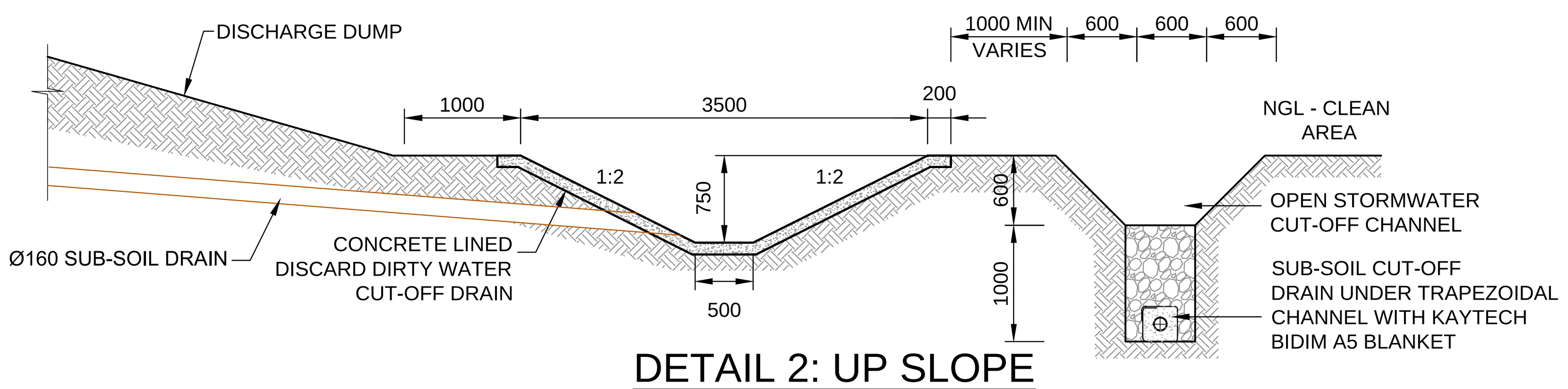


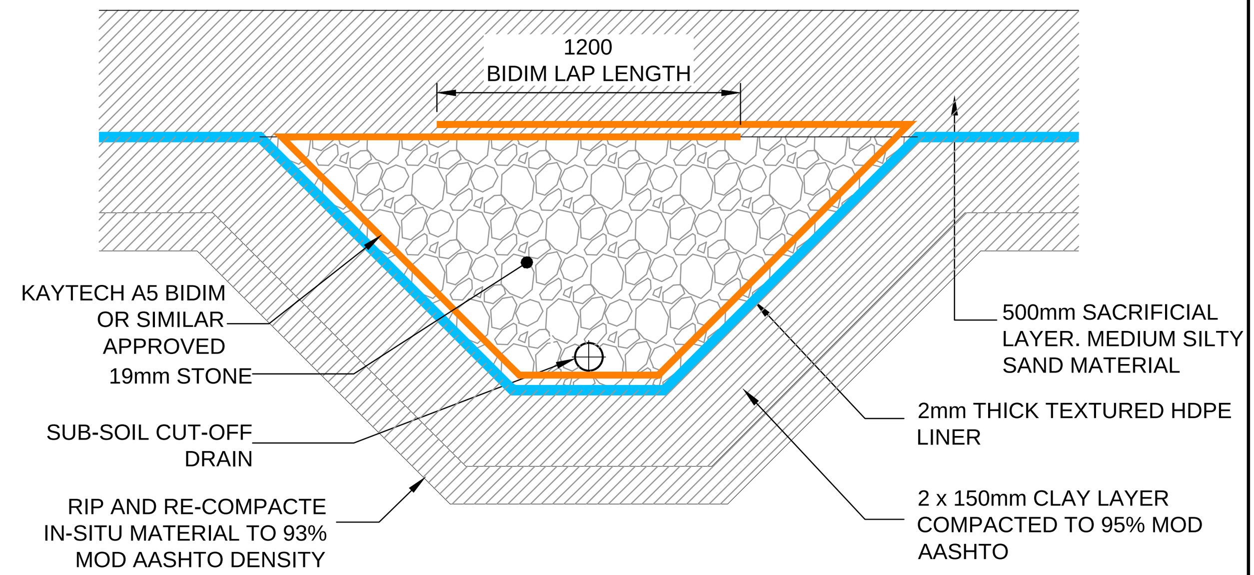
DETAIL 1: DOWN SLOPE

SCALE 1:50



DETAIL 2: UP SLOPE

SCALE 1:50



DETAIL 3

N.T.S

Cad File Name: P18054-CC-01-EW-002 REV a - MAIN DISCARD DUMP LAYOUT

DBEC-MRPRO-09-06

GREEN BUILDING COUNCIL MEMBER ORGANISATION — CESA

LEGEND:

STORMWATER CUT-OFF CHANNELS

CONCEPT

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REVISIONS

Client

NOZALA COAL

P O BOX 68413
BRYANSTON
2021

TEL: +27-11-463-5588
FAX: +27-11-463-7590

Consultant

DELTA built environment consultants

P O BOX 35703
MENLO PARK
0102

TEL: +27-12-368-1850
FAX: +27-12-348-4738

APPROVED

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SIGNATURE: NAME: DATE:

Project

GRUISFONTEIN COAL MINE PROJECT

Project Description

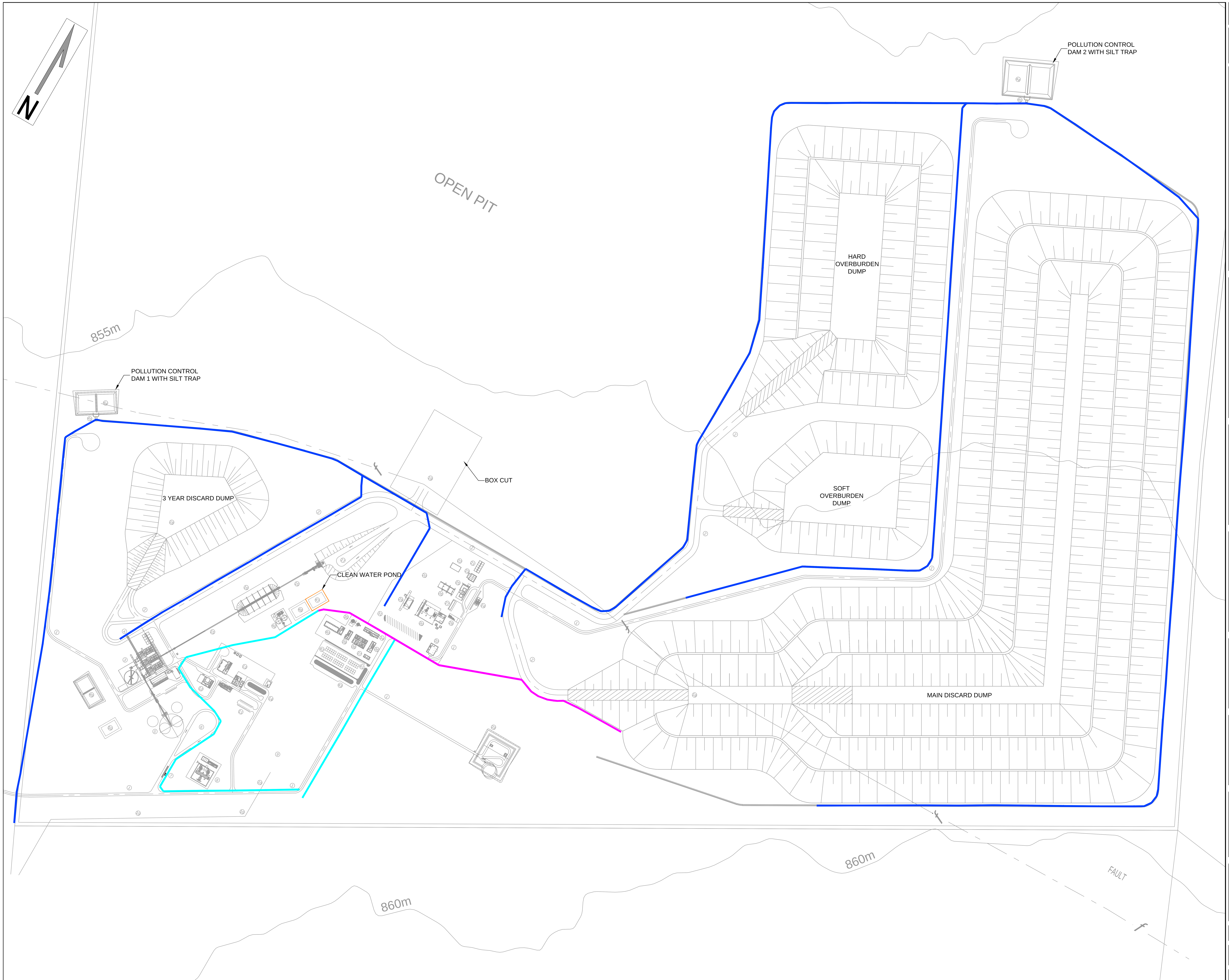
GRUISFONTEIN PFS DESIGN

Drawing Title

MAIN DISCARD DUMP LAYOUT

Drawing Units	Drawing Size	
METERS	A1	
Date: AUGUST 2018	Scale: AS SHOWN	Designed By: G GREYLING
Checked By: B NDHLOVU	Drawn By: I SMIT	Approved By: P DE WET

Drawing No. P18054-CC-01-EW-003 — Rev a



STORMWATER LAYOUT
SCALE 1:5000

Cad File Name: DBEC-MRPRO-09-06
P18054-CC-01-SW-001 REV a - STORMWATER LAYOUT

LEGEND:

STORMWATER CHANNEL PROFILE A
STORMWATER CHANNEL PROFILE B
STORMWATER CHANNEL PROFILE C

NOTE
FOR STORMWATER CHANNEL PROFILE DETAILS REFER TO DRW P18054-CC-01-SWD-004

CONCEPT

Rev.	Date	Description of changes	By
a	##-##-2018	ISSUED FOR APPROVAL	PDW

REVISIONS

Client
NOZALA COAL
P O BOX 68413
BRYANSTON
2021
TEL: +27-11-463-5588
FAX: +27-11-463-7590

Consultant
P O BOX 35703
MENLO PARK
0102
TEL: +27-12-368-1850
FAX: +27-12-348-4738

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GRUISFONTEIN COAL MINE PROJECT

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GRUISFONTEIN PFS DESIGN

Drawing Title
STORMWATER LAYOUT

Drawing Units	Drawing Size	
METERS	A1	
Date: AUGUST 2018	Scale: AS SHOWN	Designed By: G GREYLING
Checked By: B NDHLOVU	Drawn By: I SMIT	Approved By: P DE WET

Drawing No. P18054-CC-01-SW-001
Rev a