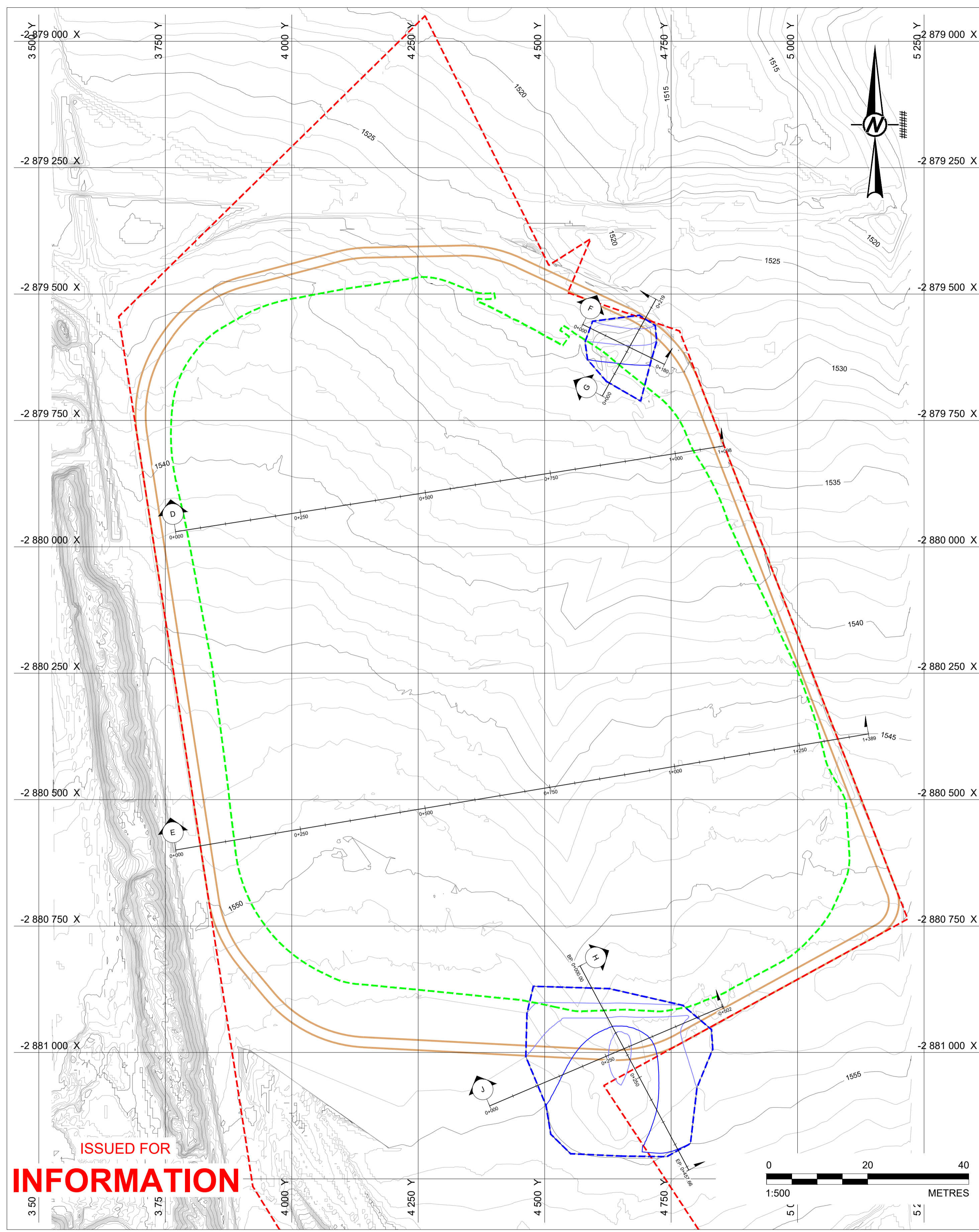


Path: \\p1-164\gdata\Projects\97703 - Reclamation and Closure\Proposed\Drawings\1 - File Name: 04.Landform modifications.dwg | Last Edited By: jakie | Date: 2021-03-24 | Times: 11:23:18 AM

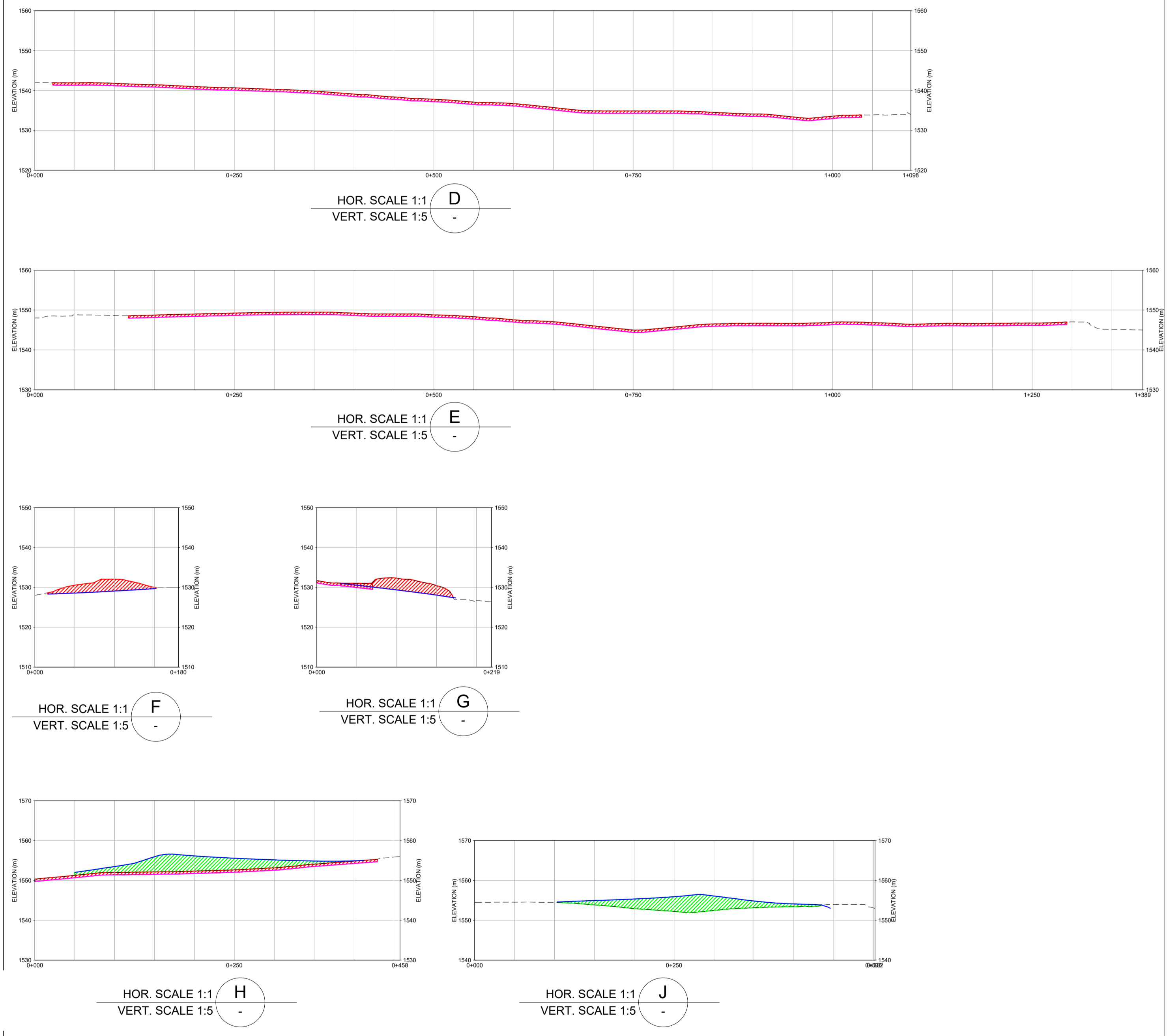


LAYOUT LEGEND

- EXISTING GROUND WITH PROVIDED LANDFORM
- 600mm TOPSOIL STRIPPING EXTENTS
- LANDFORM CORRECTIONS
- MINING RIGHTS
- 20m WIDE VEHICLE MOVEMENT AREA
- AREAS IDENTIFIED FOR TOPSOIL STRIPPING/MATERIAL REMOVAL
- AREAS IDENTIFIED FOR MATERIAL INFILL TO OBTAIN FREE DRAINAGE

SECTION LEGEND

- EXISTING GROUND MARCH 2020 WITH PROVIDED LANDFORM
- 600mm TOPSOIL STRIPPING OFF RECEIVED LANDFORM
- LANDFORM CORRECTION
- FILL
- CUT



ISSUED FOR INFORMATION






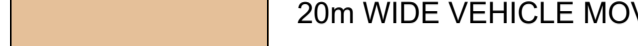

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	SIGNED
0	2021-01-22	ISSUED FOR INFORMATION	JA	JA	FM	FM - 830215	

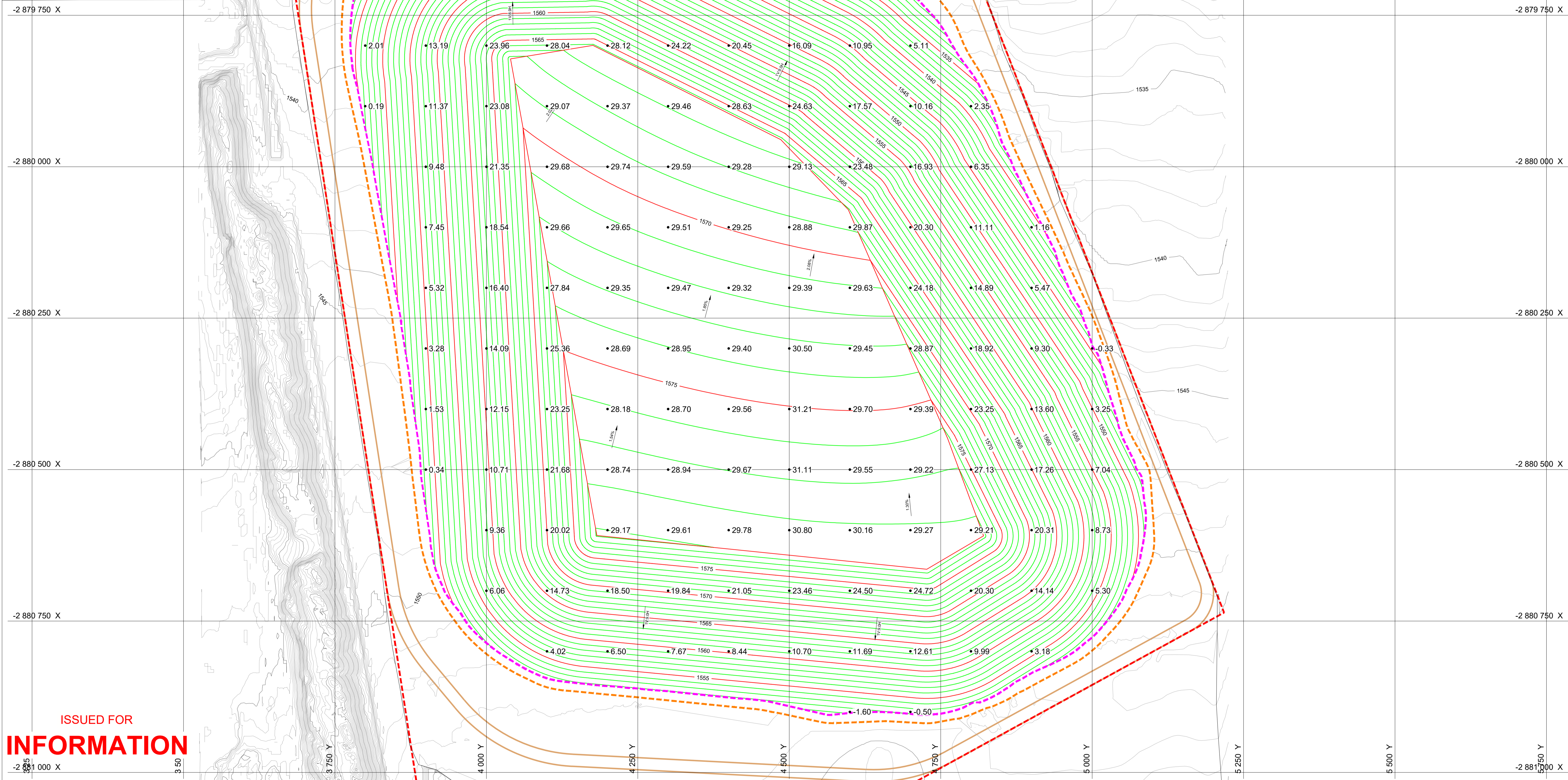
<p>CLIENT</p> <p>ANGLO AMERICAN</p> <p>CONSULTANT</p> <p>GOLDER</p>	<p>PROJECT</p> <p>Zibulo Colliery Discard Facility</p> <p>TITLE</p> <p>PROPOSED FACILITY LANDFORM PREPARATION PRIOR TO DISCARD DUMP DEVELOPMENT</p> <p>PROJECT NO. 19117180</p> <p>PLAN LM</p> <p>REV. 0</p> <p>04 of 10</p>	<p>Building 1, Golder House, Maxwell Office Park, Magwa Crescent West, Waterfall City P.O. Box 6001, Halfway House, 168 Midrand, South Africa, 1685 Tel: [+27] (11) 254 4800 www.golder.com</p>	<p>No 04</p>
---	---	---	--------------

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1

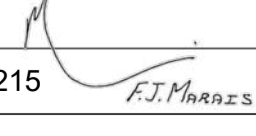
Path: \\p1-1-616\gdata\Projects\97703 - Reclamation and Closure\Project\Drawings\1 - File Name: 05 Discard facility and perimeter channel.dwg | Last Edited By: Jabrie | Date: 2021-03-17 | Time: 9:45:32 AM | Printed By: Jabrie | Date: 2021-03-17 | Time: 10:44:48 AM

LAYOUT LEGEND

-  EXISTING GROUND MARCH 2020
-  DISCARD DUMP
-  DISCARD DUMP AND PERIMETER CHANNEL EXTENTS
-  DISCARD PLACEMENT EXTENTS
-  MINING RIGHTS
-  20m WIDE VEHICLE MOVEMENT AREA
-  ● 20.05
HEIGHT ABOVE RECEIVED LANDFORM



ISSUED FOR INFORMATION

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	SIGNED
0	2021-01-22	ISSUED FOR INFORMATION	JA	JA	FM	FM - 830215	

CLIENT

 ANGLO AMERICAN

CONSULTANT

 GOLDER

Building 1, Golder House, Maxwell Office Park,
 Magwa Crescent West, Waterfall City
 P.O. Box 6001, Halfway House, 168
 Midrand, South Africa, 1685
 Tel: [+27] (11) 254 4800
 www.golder.com

PROJECT
 Zibulo Colliery Discard Facility


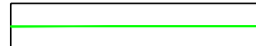






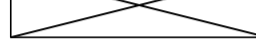

TITLE
DISCARD FACILITY ELEVATION PLAN

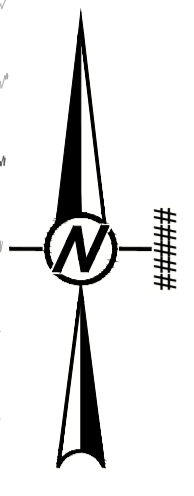
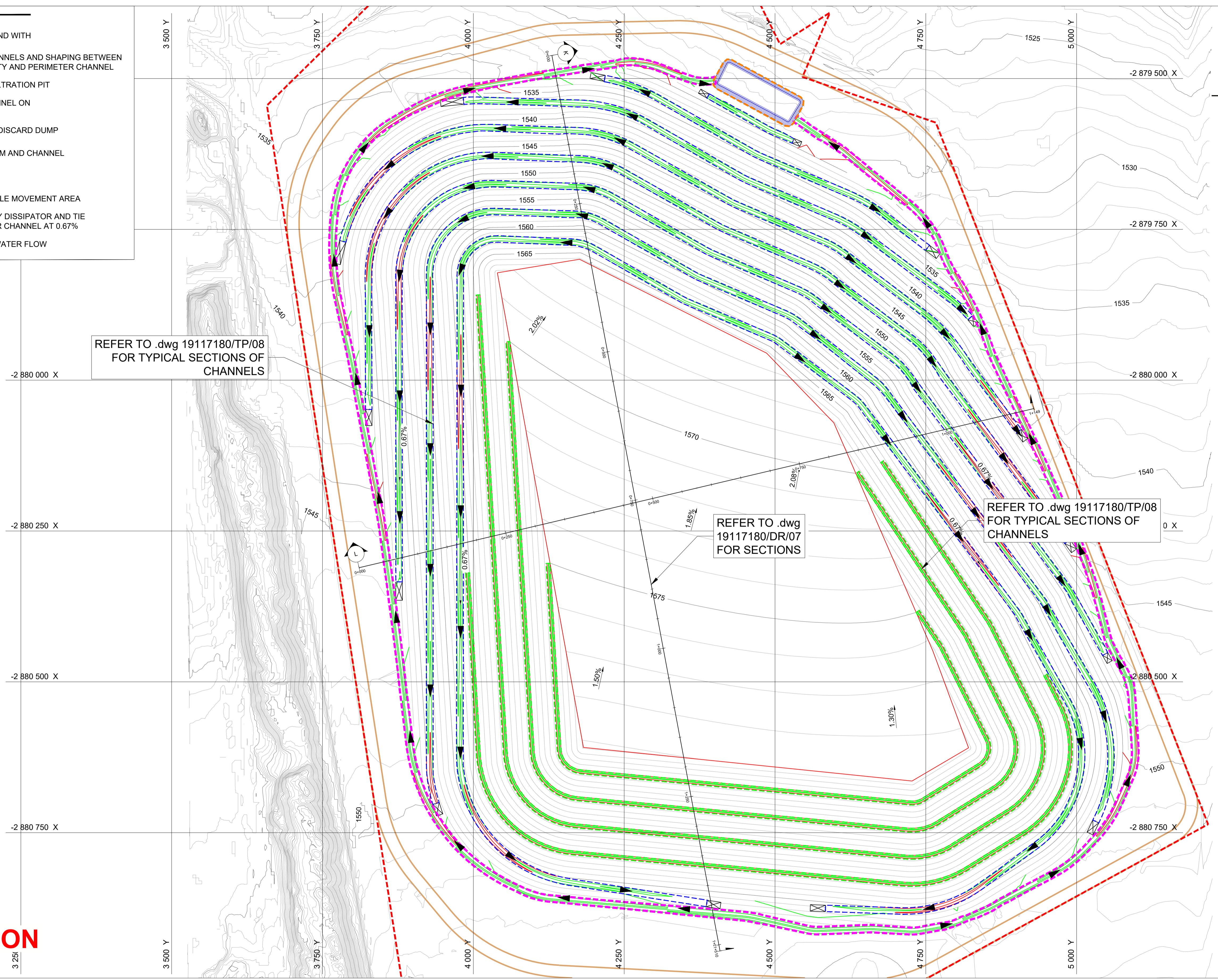
PROJECT NO. 19117180 PLAN EL REV. 0 05 of 10 No 05

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1

Path: \\pse-1-64\gsd\proj\19117180 - Reclamation and Closure\Project\19117180\Drawings\1 - Final\19117180-DR-07.dwg | File Name: 06 Discard facility drainage.dwg | Last Edited By: jahnle | Date: 2021-03-19 | Time: 9:03:03 AM | Printed By: jahnle | Date: 2021-03-19 | Time: 9:03:32 AM

LAYOUT LEGEND

-  EXISTING GROUND WITH DISCARD DUMP
-  PROPOSED CHANNELS AND SHAPING BETWEEN DISCARD FACILITY AND PERIMETER CHANNEL
-  PROPOSED INFILTRATION PIT
-  BERM AND CHANNEL ON DISCARD DUMP
-  BERM ONLY ON DISCARD DUMP
-  PERIMETER BERM AND CHANNEL
-  MINING RIGHTS
-  20m WIDE VEHICLE MOVEMENT AREA
-  INSTALL ENERGY DISSIPATOR AND TIE INTO PERIMETER CHANNEL AT 0.67%
-  DIRECTION OF WATER FLOW



ISSUED FOR INFORMATION

0	2021-01-22	ISSUED FOR INFORMATION	JA	JA	FM	FM - 830215	<i>F.J. Munniz</i>
REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	SIGNED

CLIENT

 CONSULTANT


Building 1, Golder House, Maxwell Office Park,
 Magwa Crescent West, Waterfall City
 P.O. Box 6001, Halfway House, 168
 Midrand, South Africa, 1685
 Tel: [+27] (11) 254 4800
 www.golder.com



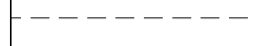
PROJECT
 Zibulo Colliery Discard Facility

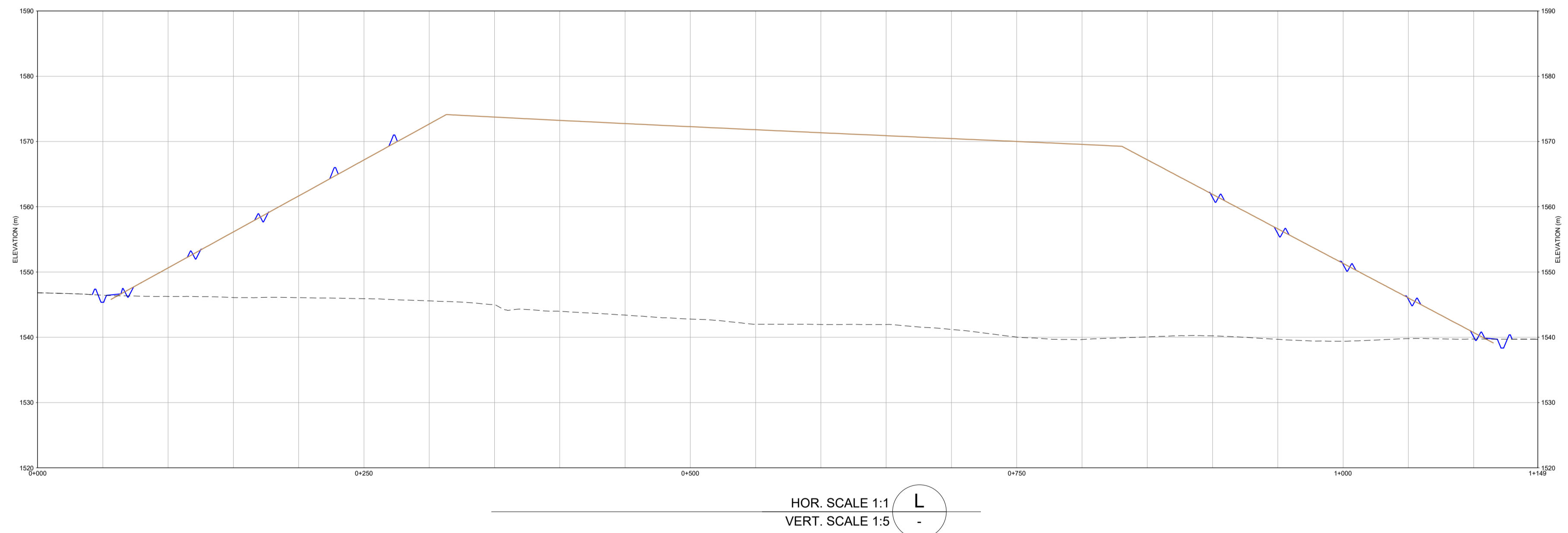
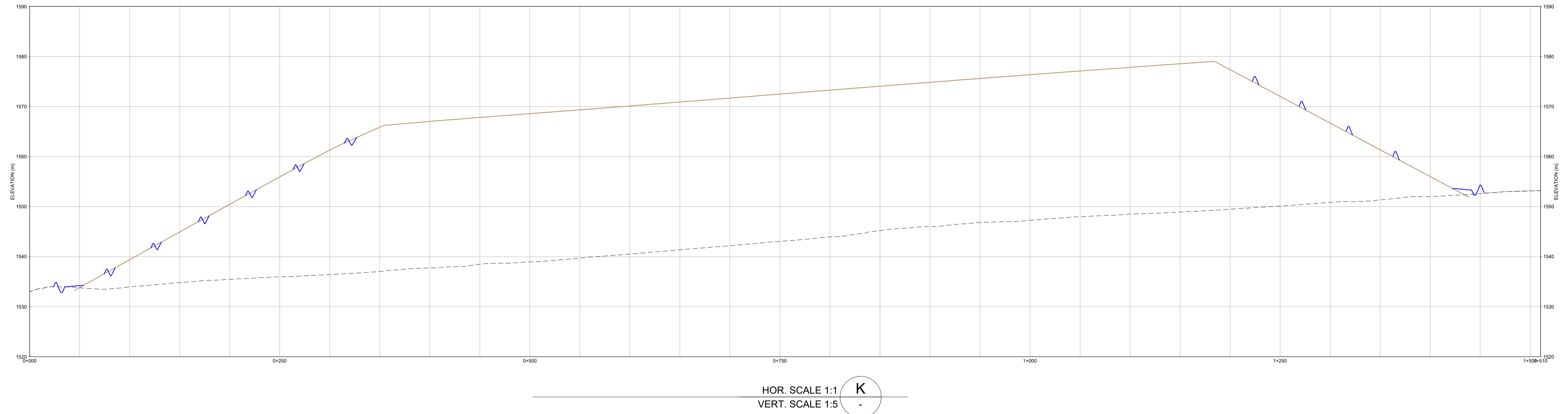
TITLE
DISCARD FACILITY DRAINAGE LAYOUT

PROJECT NO. 19117180	PLAN DR	REV. 0	06 of 10	No 06
-------------------------	------------	-----------	----------	----------

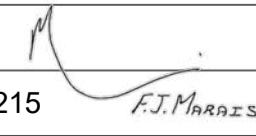
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1

Path: \\p:\s\1\6\1\g\ad\ad\Projects\07\03 - Reclamation and Closure\Project\01 Drawings\1. File Name: 07 Drainage sections.dwg | Last Edited By: jahnle | Date: 2021-03-17 Time: 04:56 AM | Printed By: jahnle | Date: 2021-03-17 Time: 10:47:16 AM

SECTION LEGEND	
	DRAINAGE FACILITIES ON DISCARD DUMP
	DISCARD DUMP
	RECEIVED LANDFORM



ISSUED FOR
INFORMATION

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	SIGNED
0	2021-01-22	ISSUED FOR INFORMATION	JA	JA	FM	FM - 830215	

CLIENT

 CONSULTANT

 **GOLDER**

Building 1, Golder House, Maxwell Office Park,
 Magwa Crescent West, Waterfall City
 P.O. Box 6001, Halfway House, 168
 Midrand, South Africa, 1685
 Tel: [+27] (11) 254 4800
 www.golder.com

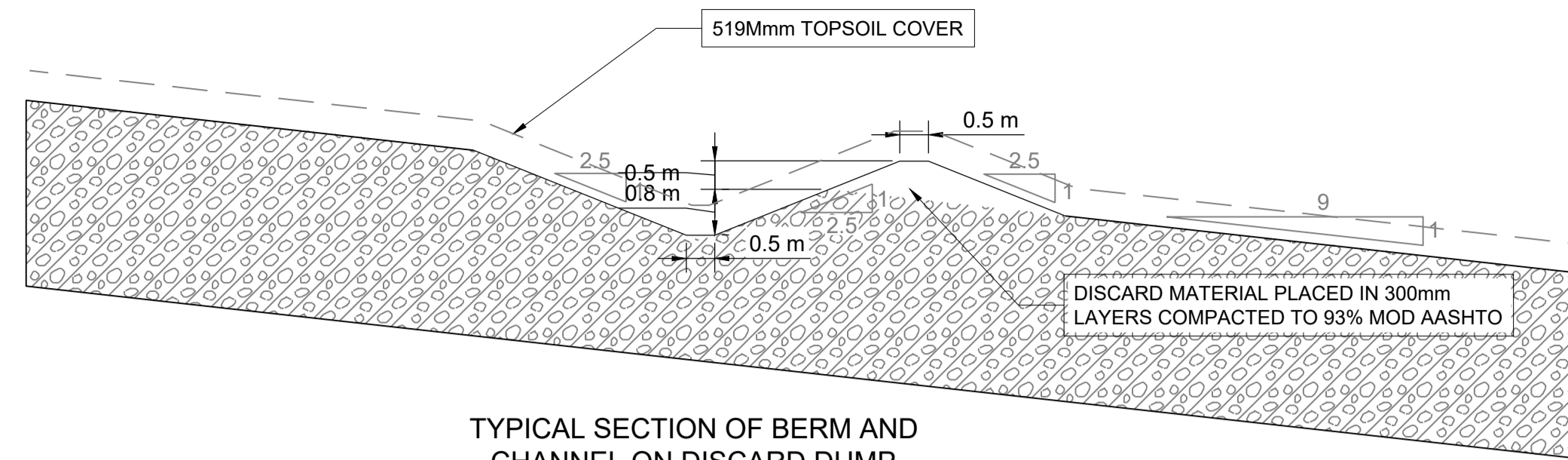
PROJECT
 Zibulo Colliery Discard Facility

TITLE
DISCARD FACILITY SECTIONS

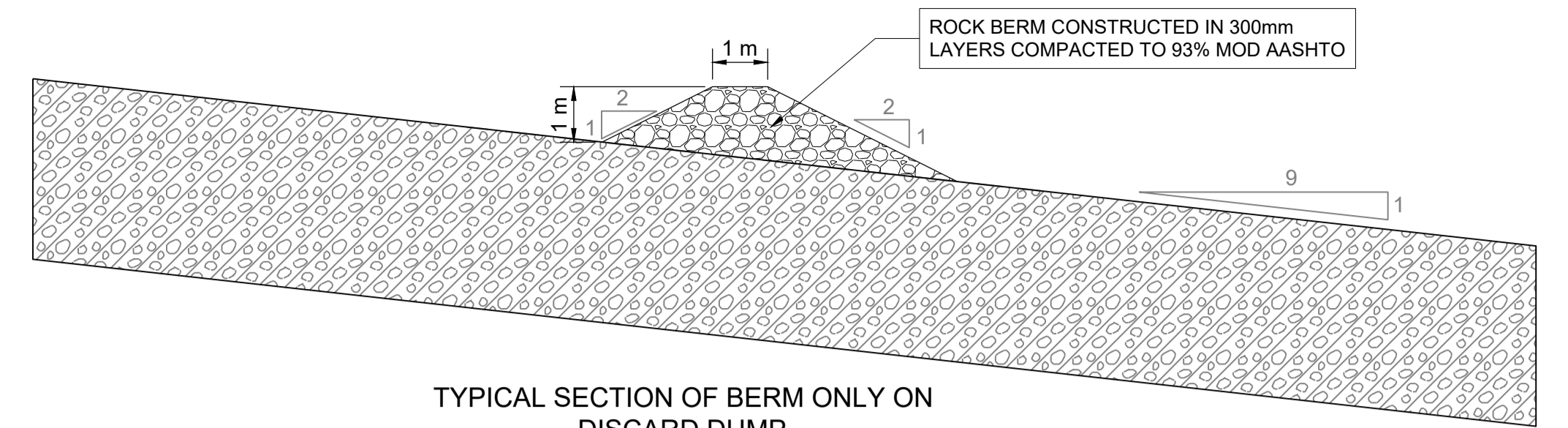
PROJECT NO. 19117180	PLAN DR	REV. 0	07 of 10	No 07
--------------------------------	-------------------	------------------	----------	-----------------

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1 25 mm

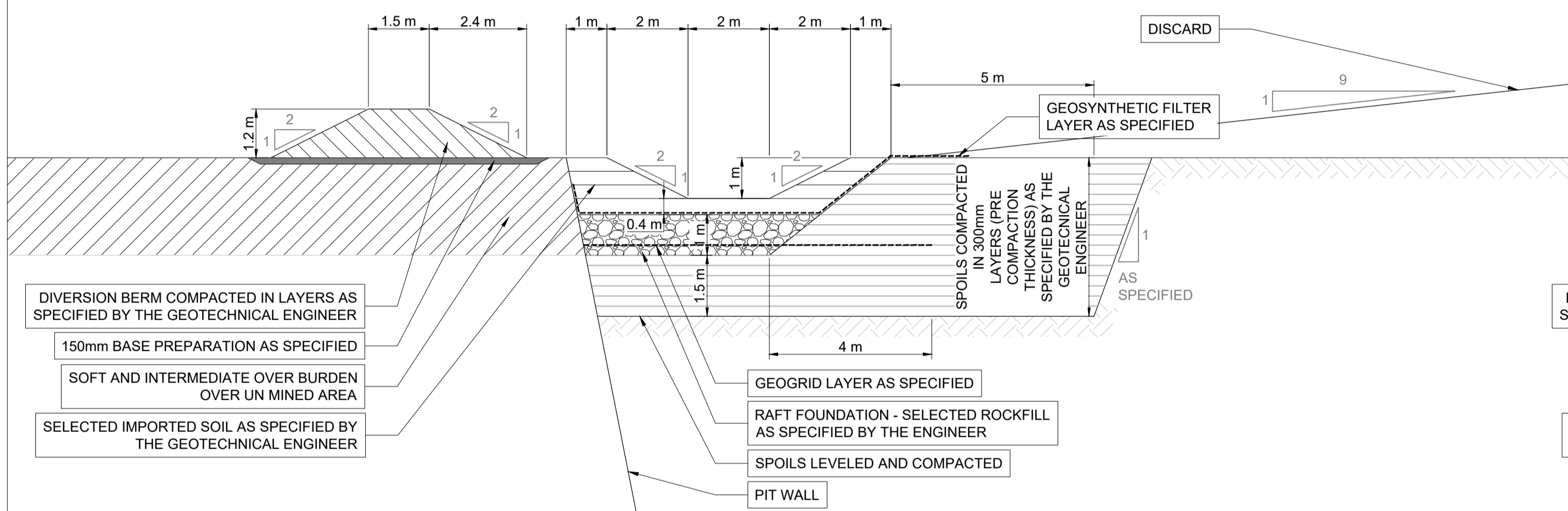
Path: \\p1-14-16\gms\proj\03 - Reclamation and Closure\Project\01 Drawings\1. File Name: 08 Discard facility drainage typical sections.dwg | Last Edited By: jabra | Date: 2021-03-17 Time: 10:49:25 AM



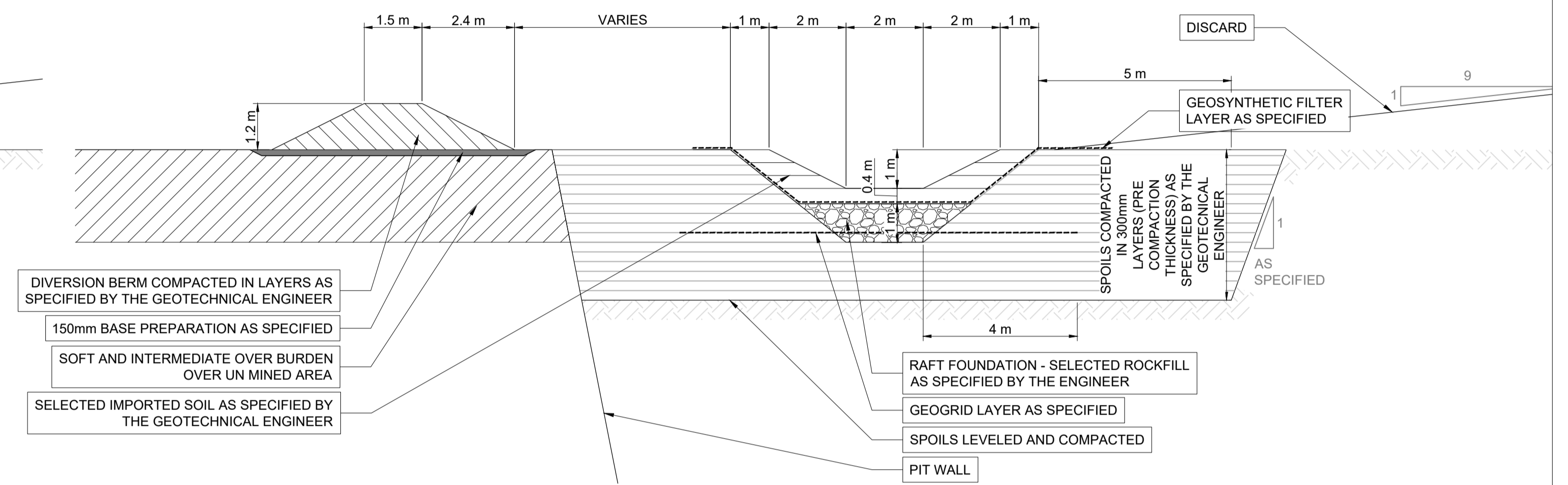
TYPICAL SECTION OF BERM AND CHANNEL ON DISCARD DUMP
SCALE 1 : 100



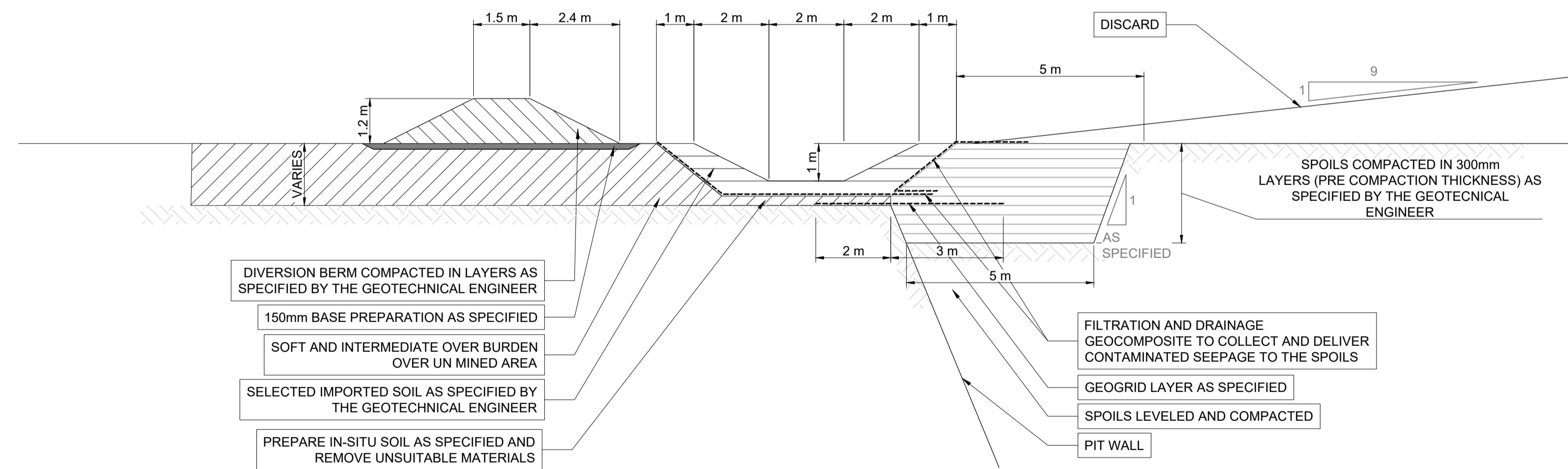
TYPICAL SECTION OF BERM ONLY ON DISCARD DUMP
SCALE 1 : 100



TYPICAL SECTION OF CHANNEL AGAINST PIT WALL
SCALE 1 : 100



TYPICAL SECTION OF CHANNEL AWAY FROM PIT WALL
SCALE 1 : 100



TYPICAL SECTION OF CHANNEL OVER UNMINED SECTIONS
SCALE 1 : 100

ISSUED FOR
INFORMATION

REV.	YYYY-MM-DD	DESCRIPTION
0	2021-01-22	ISSUED FOR INFORMATION

DESIGNED	PREPARED	REVIEWED	APPROVED	SIGNED
JA	JA	FM	FM - 830215	<i>F.J. Phares</i>

CLIENT
ANGLO AMERICAN

CONSULTANT
GOLDER

Building 1, Golder House, Maxwell Office Park,
Magwa Crescent West, Waterfall City
P.O. Box 6001, Halfway House, 168
Midrand, South Africa, 1685
Tel: [+27] (11) 254 4800
www.golder.com

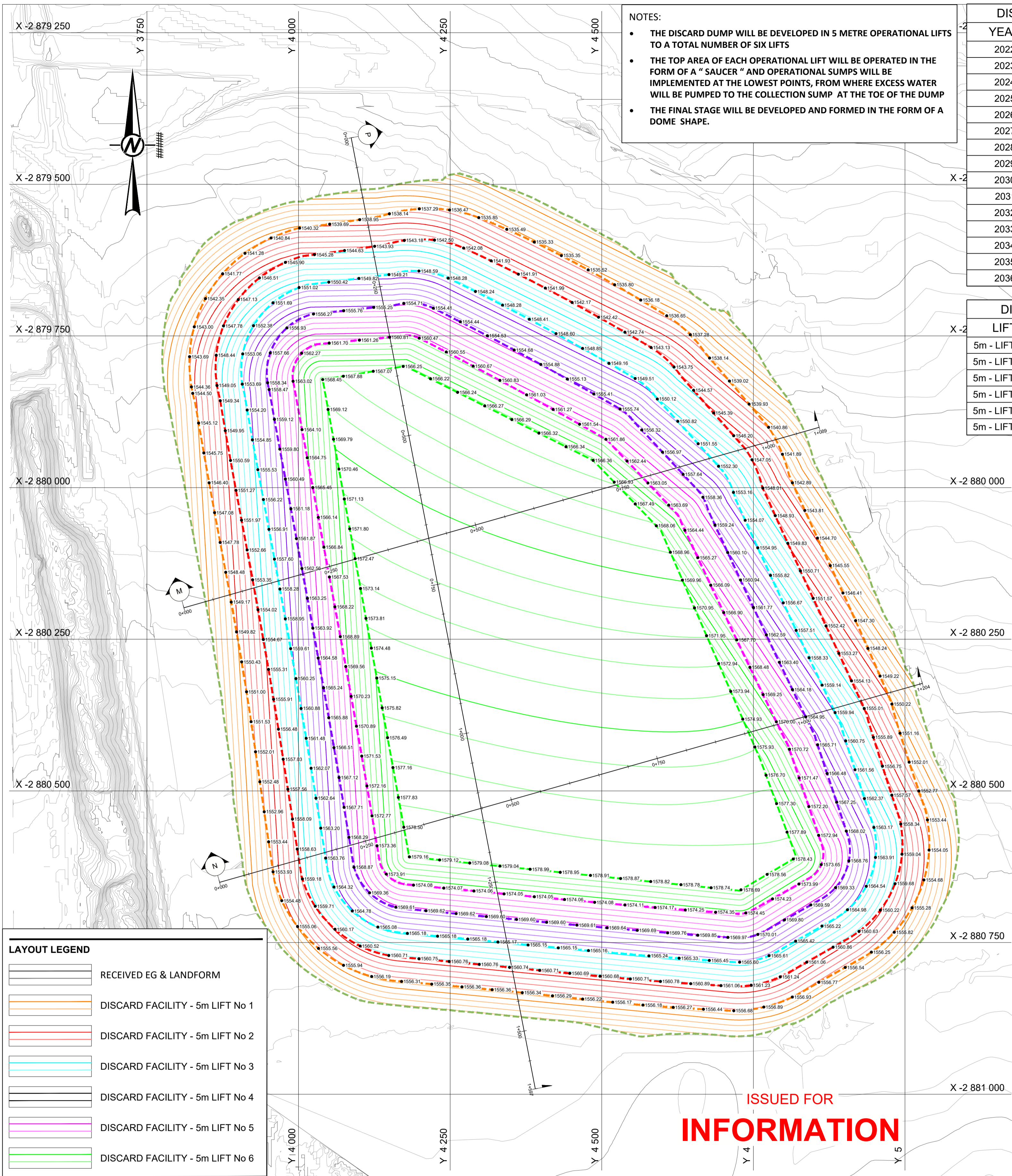
PROJECT
Zibulo Colliery Discard Facility

TITLE
DISCARD FACILITY TYPICAL DRAINAGE SECTIONS

PROJECT NO.	PLAN	REV.	08 of 10	No
19117180	TP	0		08

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1 25 mm

Path: \\p1-4-6\gms\proj\19117180 - Reclamation and Closure\Project\19117180 - Zibulo Colliery Discard Facility - Staged Approach\Drawings\1 - Layout\19117180 - Zibulo Colliery Discard Facility - Staged Approach.dwg | Last Edited By: jahir Date: 2021-03-19 Time: 8:33:03 AM

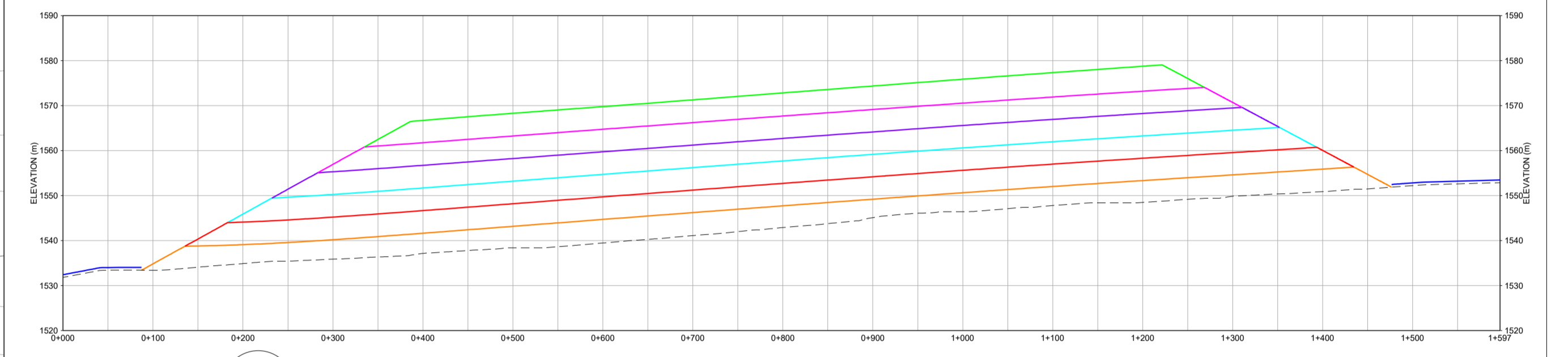
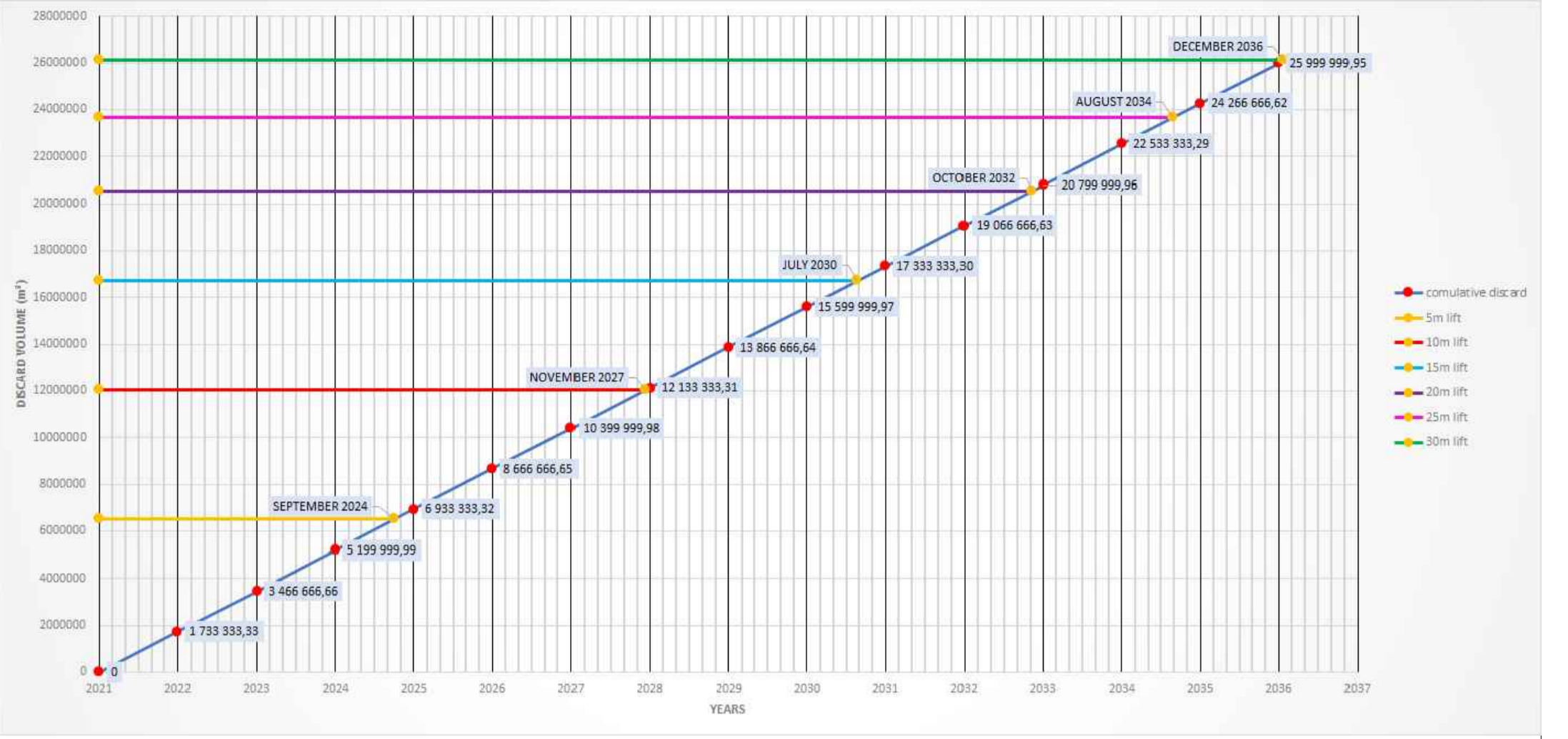


NOTES:

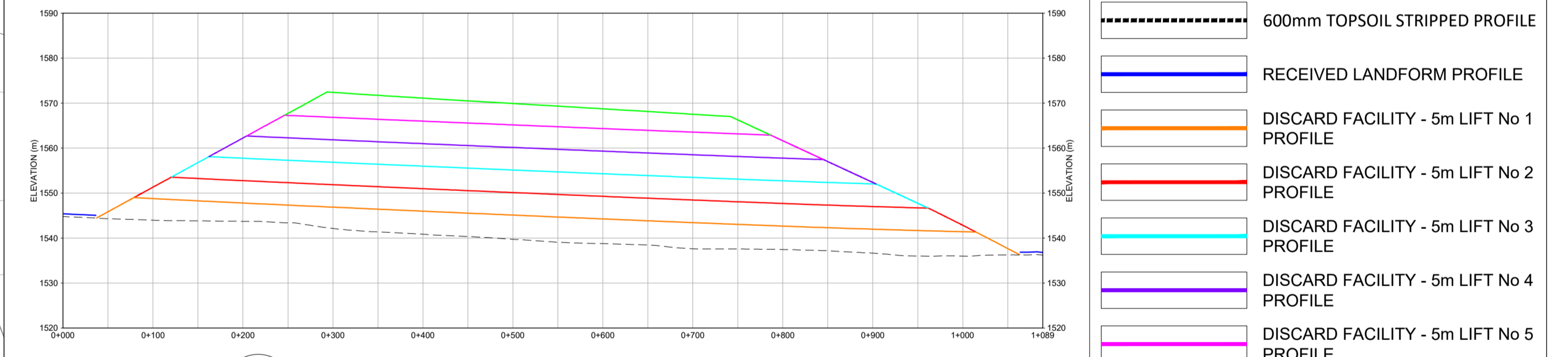
- THE DISCARD DUMP WILL BE DEVELOPED IN 5 METRE OPERATIONAL LIFTS TO A TOTAL NUMBER OF SIX LIFTS
- THE TOP AREA OF EACH OPERATIONAL LIFT WILL BE OPERATED IN THE FORM OF A "SAUCER" AND OPERATIONAL SUMPS WILL BE IMPLEMENTED AT THE LOWEST POINTS, FROM WHERE EXCESS WATER WILL BE PUMPED TO THE COLLECTION SUMP AT THE TOE OF THE DUMP
- THE FINAL STAGE WILL BE DEVELOPED AND FORMED IN THE FORM OF A DOME SHAPE.

DISCARD FACILITY VOLUMES	
YEAR	CUMULATIVE VOLUME
2022	1 733 333,33m ³
2023	3 466 666,66m ³
2024	5 199 999,99m ³
2025	6 933 333,32m ³
2026	8 666 666,65m ³
2027	10 399 999,98m ³
2028	12 133 333,31m ³
2029	13 866 666,64m ³
2030	15 599 999,97m ³
2031	17 333 333,30m ³
2032	19 066 666,63m ³
2033	20 799 999,96m ³
2034	22 533 333,29m ³
2035	24 266 666,62m ³
2036	25 999 999,95m ³

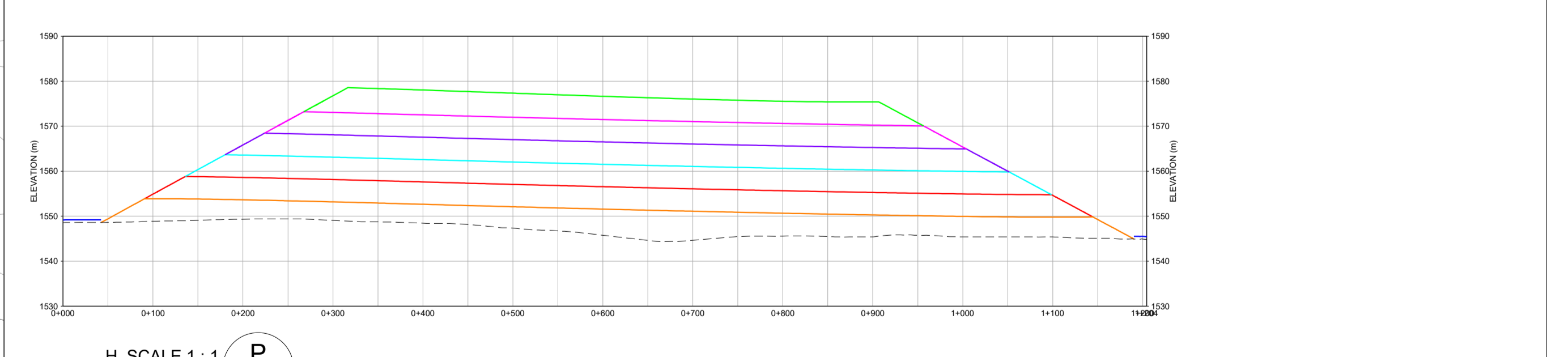
DISCARD 5m LIFT VOLUMES	
LIFT	CUMULATIVE VOLUME
5m - LIFT No 1	6 503 972,36m ³
5m - LIFT No 2	12 033 065,25m ³
5m - LIFT No 3	16 696 531,32m ³
5m - LIFT No 4	20 556 708,95m ³
5m - LIFT No 5	23 674 543,07m ³
5m - LIFT No 6	26 000 000,00m ³



H SCALE 1:1
VERT. SCALE 1:5
M



H SCALE 1:1
VERT. SCALE 1:5
N



H SCALE 1:1
VERT. SCALE 1:5
P

SECTION LEGEND

- 600mm TOPSOIL STRIPPED PROFILE
- RECEIVED LANDFORM PROFILE
- DISCARD FACILITY - 5m LIFT No 1 PROFILE
- DISCARD FACILITY - 5m LIFT No 2 PROFILE
- DISCARD FACILITY - 5m LIFT No 3 PROFILE
- DISCARD FACILITY - 5m LIFT No 4 PROFILE
- DISCARD FACILITY - 5m LIFT No 5 PROFILE
- DISCARD FACILITY - 5m LIFT No 6 PROFILE

LAYOUT LEGEND

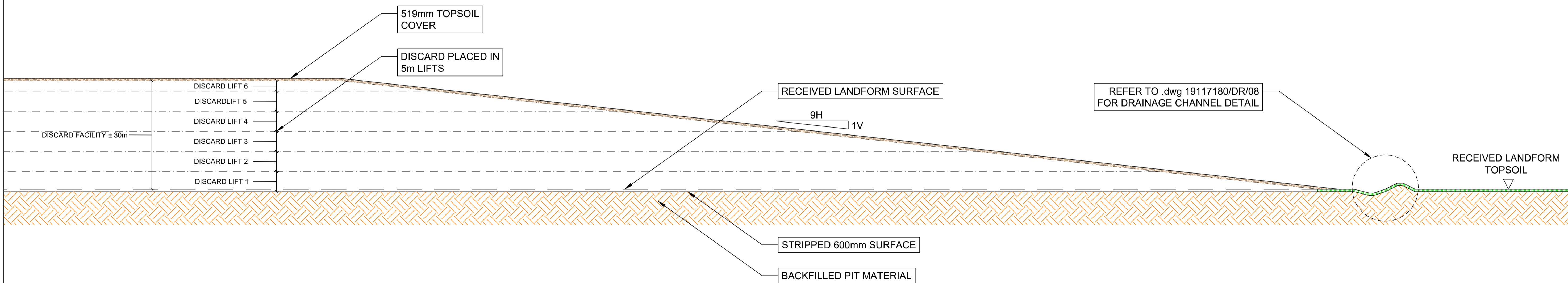
- RECEIVED EG & LANDFORM
- DISCARD FACILITY - 5m LIFT No 1
- DISCARD FACILITY - 5m LIFT No 2
- DISCARD FACILITY - 5m LIFT No 3
- DISCARD FACILITY - 5m LIFT No 4
- DISCARD FACILITY - 5m LIFT No 5
- DISCARD FACILITY - 5m LIFT No 6

ISSUED FOR INFORMATION

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1

NOTE:

THE INSITU SPOILS ARE TO BE RIPPED AND RE-COMPACTED TO 93% MOD AASHTO ONCE SHAPED AND GRADED, AS WELL AS THE INITIAL 500 MM DISCARD CUSHION LAYER IN TWO LAYERS OF 250 MM TO 93% MOD AASHTO. THIS IS TO CREATE A SOLID BASE FOR THE DUMP AND TO MINIMISE SPONTANEOUS COMBUSTION WHICH COULD BE TRANSFERRED FROM BURNING SPOILS INTO THE COAL DISCARD. THE COMPACTION EFFORT OF THE DISCARD SHOULD CONTINUE IN LAYERS NOT EXCEEDING 300MM TO A DENSITY NOT EXCEEDING 15% VOIDS. A TEST STRIP ON SITE WILL BE REQUIRED TO DEVELOPED THE NUMBER OF ROLLER PASSES AND SAND REPLACEMENT TESTS WORK IS REQUIRED, AS WELL DCP TESTS FOR ON-GOING QUALITY CONTROL.



TYPICAL REHABILITATED SIDE SLOPE OF DISCARD FACILITY

SCALE 1 : 500

ISSUED FOR
INFORMATION

Path: \\p1-1-61\gms\proj\19117180 - Rehabilitation and Closure\Project\19117180\Drawings\1 - Site\19117180\Drawings\19117180-01.dwg | File Name: 10_SideSlope section.dwg | Last Edited By: jahnle | Printed By: jahnle | Date: 2021-03-17 Time: 9:46:01 AM |

CLIENT



CONSULTANT



Building 1, Golder House, Maxwell Office Park,
Magwa Crescent West, Waterfall City
P.O. Box 6001, Halfway House, 168
Midrand, South Africa, 1685
Tel: [+27] (11) 254 4800
www.golder.com

PROJECT

Zibulo Colliery Discard Facility

TITLE

**DISCARD FACILITY TYPICAL SECTION OF
REHABILITATED SIDE SLOPE**

PROJECT NO.
19117180

PLAN
TP

REV. 0 10 of 10

No
10

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	SIGNED
0	2021-01-22	ISSUED FOR INFORMATION	JA	JA	FM	FM - 830215	<i>F.J. Marozz</i>

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A1 25 mm

REPORT

Wetland and Aquatic Ecology Specialist Report for the Proposed Discard Facility at Zibulo Colliery Opencast Operations

Anglo American Inyosi Coal (Pty) Ltd

Submitted to:

Ms Melissa Hallquist-Waites

Anglo American Inyosi Coal
Supply Chain
Ground floor security
55 Marshall Street
Johannesburg

Submitted by:

Golder Associates Africa (Pty) Ltd.

Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand, 1685, South Africa
P.O. Box 6001, Halfway House, 1685

+27 11 254 4800

19117180-338303-15

January 2021



Distribution List

1 x electronic copy to Anglo American Coal

1 x electronic copy to projectreports@golder.co.za

1 x electronic copy to SharePoint Site

Executive Summary

Anglo American Inyosi Coal (Pty) Ltd (AAIC) proposes to develop a discard facility at its opencast operations at Zibulo Colliery, situated near Ogies in the Mpumalanga Province. Discard will be transported to the site via a new discard conveyor. This report documents the assessment of the potential impacts of the proposed discard facility and new conveyor on aquatic and wetland ecosystems and biodiversity, and as required, provides recommended measures for the mitigation of any negative impacts to inform the waste management license (WML), environmental authorisation (EA) and water use license (WUL) application for the Project.

The approach followed for this study included a review and synthesis of existing ecological reports pertaining to the broader Zibulo opencast Mining Rights Area (MRA). Since the discard facility will be located within the existing opencast pit, the proposed conveyor will be aligned with the existing conveyor which is situated in transformed lands and does not intercept any wetland or aquatic ecosystems, and there are high-quality recent aquatic and wetland studies available for the study area, no additional fieldwork was considered necessary to inform this impact assessment.

The eastern tributary of the Saalklapspruit most closely associated with the study area is non-perennial, associated with a valley bottom wetland system, and occurs at the top of the catchment, which reduces the usefulness of the conventional macroinvertebrate indices typically used to characterise riparian ecosystem quality, including the South African Scoring System, version 5 (SASS5) macro-invertebrate index (or Macro-invertebrate Response Assessment Index (MIRAI) invertebrate stressor-response index). In addition, fish sampling of the monitoring sites in the study area has been discontinued, due to the presence of limited available fish habitat in the wetland systems, resulting in a diversity of species that is simply too low for biomonitoring to be meaningful.

The results of diatom analyses of samples taken from monitoring sites on the eastern tributary of the Saalklapspruit indicate that organic pollution is the driving variable for biological water quality, with identified sources including sewage discharge from the town of Phola. Water sampled from sites upstream and downstream of the Zibulo open-cast mine were found to pose a Slight (Class II) toxicity hazard, and as such, there was a slight risk that the water was toxic to aquatic biota. The MIRAI scores derived for the sites on the eastern tributary downstream of the Zibulo opencast categorised the invertebrate ecological category for the system as Largely to Seriously Modified (Category D to E).

The present ecological status (PES) of the wetlands within the study area range from Moderately Modified (PES Category C: middle seepage area) to Largely Modified (PES Category D: northern and southern seepage areas), to Critically Modified (PES Category F, relict wetland area); and are considered to be of moderate (C) to low/marginal (D) ecological importance and sensitivity.

Since the proposed new conveyor will be constructed in alignment with an existing conveyor, and the proposed discard facility will be located within the existing opencast mine pit, and as such does not require any footprint preparations as part of a formal construction phase, the assessment of construction phase impacts on wetlands or aquatic ecosystems was deemed not applicable.

A single operation phase impact on aquatic ecosystems was identified - the potential contamination of the Saalklapspruit due to the disposal of discard classified as potential acid generating in the existing opencast pit; however, since seepage from the discard will be managed by the existing pit water management system in place for the mine, whereby excess mine water make intercepted at the pit is sent to the eMalahleni water reclamation plant (EWRP) (via the 40 ML Pollution Control Dam (PCD)) for treatment, no significant residual impacts are anticipated. Since the proposed new conveyor will be operate in alignment with the existing

conveyor and will not intercept any wetland or aquatic ecosystems, no operation phase impacts on wetlands or aquatic ecosystems are predicted in this regard.

During closure, the earthworks involved in rehabilitation of the discard facility have the potential to contribute to increased sediment loading to downstream aquatic habitats, resulting in a localised potential impact of moderate significance prior to mitigation. Provided that the recommended mitigation measures are adhered to, the magnitude and probability of the impact can be decreased, reducing the residual impact to one of low significance. Although decant of contaminated groundwater from the pit to surface water systems is predicted for both the capped and uncapped scenarios at closure, resulting in an impact of potentially high environmental significance (Golder, 2020) on aquatic ecosystems, scavenging boreholes will be installed and the contaminated water will be abstracted and treated at the EWRP, resulting in a residual impact of low significance.

Rehabilitation of the northern and southern seepage systems (as part of the wetland rehabilitation and management strategy for Zibulo), presents an opportunity for a positive impact on the extent and condition of wetlands within the Zibulo MRA. However, since the presence of the discard facility over the mined out footprint will prevent the creation of a new watercourse over the rehabilitated pit, the wetland rehabilitation and management strategy will need to be revisited.

Provided that the recommended mitigation measures and monitoring requirements are strictly adhered to, in particular, the implementation of the approved wetland rehabilitation and management strategy for Zibulo Colliery, the Project may be authorised from an aquatic and wetland ecosystems perspective.

DETAILS OF THE SPECIALIST

Specialist Information	
Name:	Aisling Dower
Designation	Ecologist
Cell phone number:	+27 794650504
Telephone number:	+27 11 254 4800
Email:	adower@golder.co.za
Qualifications:	<p>Master of Science (Hons) Applied Environmental Science, University College Dublin, Dublin, Ireland, 2007.</p> <p>Professional Natural Scientist (South African Council for Natural Scientific Professions), (114477/15).</p> <p>Refer to Appendix B for CV of the specialist.</p>
Summary of experience:	Aisling is an ecologist and biodiversity specialist with over 12 years consulting experience in designing, costing and conducting baseline flora and fauna surveys, wetland assessments, ecosystem services assessments, ecological impact assessment and development of mitigation, compensation and offsetting measures for projects in the mining, O&G, waste, transport, land development and power generation sectors.

Declaration of Independence by Specialist

I, Aisling Dower, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Rietspruit Closure Project;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have nor will have a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

APPENDIX 6 OF THE EIA REGULATIONS

Where applicable, this baseline report has been written in compliance with Appendix 6 of the EIA Regulations.

Section	Requirements	Section addressed in report
1.(1)	A specialist report prepared in terms of these Regulations must contain	
(a)	Details of	
(i)	the specialist who prepared the report; and	See above
(ii)	the expertise of that specialist to compile a specialist report including a curriculum vitae	See above, and Appendix B
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority	See above
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA)	<u>an indication of the quality and age of base data used for the specialist report;</u>	Section 4.2
(cB)	<u>a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;</u>	Section 5.0, 9.0
(d)	the <u>duration</u> , date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4.2
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process <u>inclusive of equipment and modelling used;</u>	Section 5.0
(f)	<u>details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;</u>	Section 6.0
(g)	an identification of any areas to be avoided, including buffers;	-
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 3
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.4
(j)	a description of the findings and potential implications of such findings on the impact of the proposed	Section 6.0

Section	Requirements	Section addressed in report
	activity (including identified alternatives on the environment) or <u>activities</u> ;	
(k)	any mitigation measures for inclusion in the EMPr;	Section 7.0
(l)	any conditions for inclusion in the environmental authorisation;	Section 7.0
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8.0
(n)	a reasoned opinion—	
(i)	(as to) whether the proposed activity, <u>activities</u> or portions thereof should be authorised;	Section 10.0
(iA)	<u>regarding the acceptability of the proposed activity or activities; and</u>	
(ii)	if the opinion is that the proposed activity, <u>activities</u> or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 7.0, 8.0
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	-
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
(q)	any other information requested by the competent authority.	-
2.	<u>Where a government notice <i>gazetted</i> by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.</u>	-

ACRONYMS AND ABBREVIATIONS

Abbreviation	Explanation
AAIC	Anglo American Inyosi Coal (Pty) Ltd
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EWRP	eMalahleni water reclamation plant
LoM	Life of Mine
MBSP	Mpumalanga Biodiversity Sector Plan
MRA	Mining Rights Area
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NWA	National Water Act, 1998 (Act 36 of 1998) (as amended)
NWM5	National Wetland Map version 5
PES	Present Ecological State
PCD	Pollution Control Dam
PCPP	Phola Coal Processing Plant
ROM	Run-of-Mine
TSS	Total Suspended Solids
WCS	Wetland Consulting Services
WUL	Water Use Licence

Table of Contents

1.0 INTRODUCTION	1
1.1 Purpose of the Report	1
2.0 PROJECT DESCRIPTION	1
3.0 APPLICABLE LEGISLATION, GUIDELINES AND STANDARDS	3
4.0 METHODS	3
4.1 Study Area.....	4
4.2 Baseline Description	4
4.3 Impact Assessment.....	7
4.3.1 Method of assessing duration	8
4.4 Assumptions and Limitations	8
5.0 BASELINE DESCRIPTION	8
5.1 Wetlands	8
5.1.1 Regional Context.....	8
5.1.2 Site Context.....	12
5.2 Aquatic Ecosystems	13
5.2.1 Water quality	13
5.2.2 Aquatic Biomonitoring	14
5.2.2.1 Overview	14
5.2.2.2 Diatoms	15
5.2.2.3 Toxicity Testing	15
5.2.2.4 Aquatic Macroinvertebrates	15
6.0 IMPACT ASSESSMENT	15
6.1 Construction Phase	16
6.2 Operation Phase	16
6.3 Closure Phase.....	16
7.0 MITIGATION MEASURES	18
8.0 MONITORING REQUIREMENTS	18
9.0 CUMULATIVE IMPACTS	18
10.0 CONCLUSION	18

11.0 REFERENCES19

TABLES

Table 1: Impact assessment summary17

FIGURES

Figure 1: Proposed design of the Zibulo discard facility2

Figure 2: Locality and layout of discard facility and proposed conveyor3

Figure 3: Study Area5

Figure 4: Aquatic biomonitoring locations6

Figure 5: Channelled valley bottom wetlands within the study area9

Figure 6: PES of wetlands within the study area (van Deventer et al., 2019)10

Figure 7: MBSP Freshwater Assessment of wetlands in the study area11

Figure 8: Remaining wetlands within the opencast operation limits (WCS, 2017)13

Figure 9: Surface water quality monitoring locations14

APPENDICES

APPENDIX A

Document Limitations

APPENDIX B

CV of the Specialist

1.0 INTRODUCTION

Anglo American Inyosi Coal (Pty) Ltd (AAIC) proposes to develop a discard facility at its opencast operations at Zibulo Colliery, situated near Ogies in the Mpumalanga Province. Zibulo Colliery produces an annual eight million run of mine (ROM) tonnes of export thermal coal, with seven million tonnes per annum coming from its underground sections and the remaining one million tonnes from its opencast pit. Underground operations incorporate bord and pillar continuous miner methods while the contractor-run opencast pit utilises the truck and shovel mining method.

Currently, coal from the opencast operation (and underground operation further south) is transported to the Phola Coal Processing Plant (PCPP). The PCPP is a 50:50 joint venture between AAIC and South32 SA Coal Holdings (Pty) Ltd (South32). The coarse and fine discard produced by PCPP is currently stored in a surface discard facility at South32's Klipspruit Colliery. The facility is reaching capacity (110 ha) by 2021 and an alternative discard facility is required to service the discard requirement of Zibulo Colliery.

It is proposed that a new discard facility be developed over the mined-out opencast pit at Zibulo Colliery. The discard (generated at PCPP) will be transported to the site via a new discard conveyor.

The proposed discard facility will require a waste management licence (WML) in terms of the National Environmental Management Waste Act, 2008 (Act 59 of 2008) (as amended) (NEMWA), an environmental authorisation (EA) in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (as amended) (NEMA), and a water use licence (WUL) in terms of the National Water Act, 1998 (Act 36 of 1998) (NWA).

1.1 Purpose of the Report

This report documents the assessment of the potential impacts of the proposed Project on aquatic and wetland ecosystems and biodiversity, and as required, provides recommended measures for the mitigation of any negative impacts to inform the WML, EA and WUL applications for the Project.

2.0 PROJECT DESCRIPTION

It is proposed that a new discard facility be developed over the mined-out opencast pit at Zibulo Colliery. The discard facility will have a life of approximately fifteen (15) years, a total discard disposal capacity of 26 000 m³ and extend over an area of roughly 150 ha.

The discard facility will be designed such that it will be placed over the backfilled pit as illustrated in Figure 1. The facility is anticipated to have a maximum height of 27.5 m above the pit's rehabilitated landform.

The material deposited on the Zibulo discard dump will be deposited as a single stream consisting of coarse discards and filtered fines with the moisture content of the filter cake being around 20 – 23%. The facility will therefore be a dry placed discard waste facility and not a hydraulically placed tailings storage facility.

Seepage from the discard will be managed by the existing pit water management system in place for the mine. Excess mine water make intercepted at the pit is currently sent to the eMalahleni water reclamation plant (EWRP) (via the 40 ML Pollution Control Dam) for treatment.

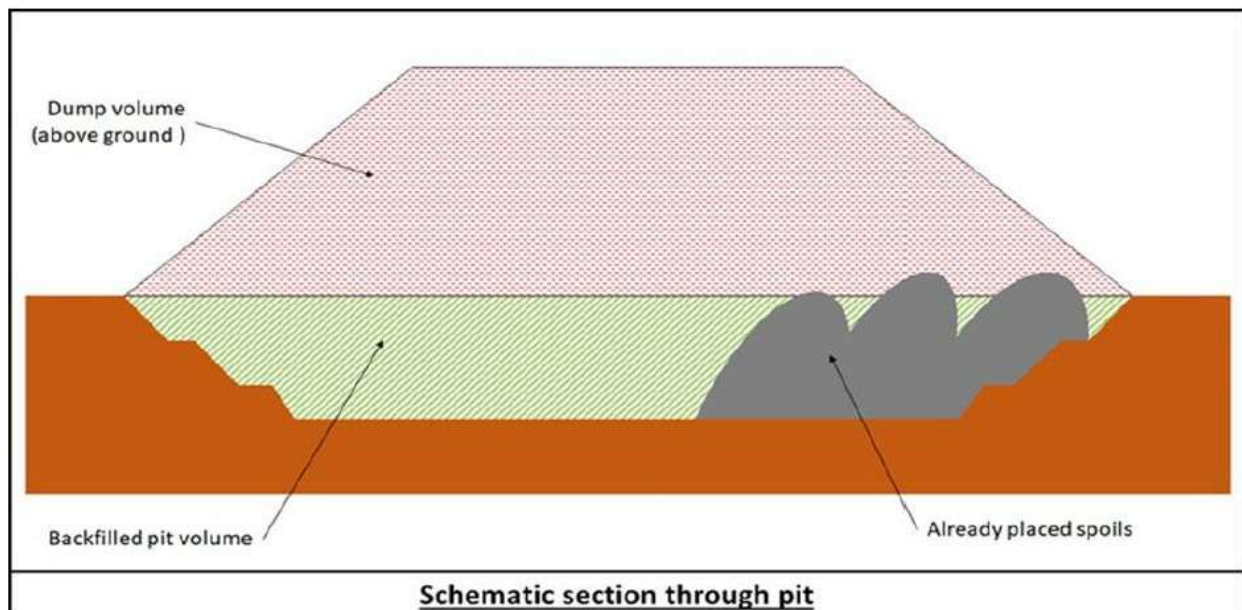


Figure 1: Proposed design of the Zibulo discard facility

Rehabilitation of the discard facility will require the construction of a cover that will be installed during ongoing rehabilitation. The cover will allow for the following:

- A growth medium suitable for the establishment of vegetation to limit erosion; and
- Limit seepage into the discard facility.

Soil for the cover will be sourced from on site.

The discard (generated at PCPP) will be transported to the site via a new conveyor. It is proposed that the new conveyor follow the alignment of the existing conveyor linking the South32 Klipspruit extension project to the PCPP. The proposed new conveyor will lie to the immediate north of the existing conveyor and cross the R545 on a dedicated bridge crossing. Soon after the crossing of the R545 the conveyor will turn north to the opencast pit for final discard disposal. The entire extent of the conveyor route is confined to mine property belonging to either South32 or AAIC.

The locations and layout of the proposed infrastructure is shown on Figure 2.

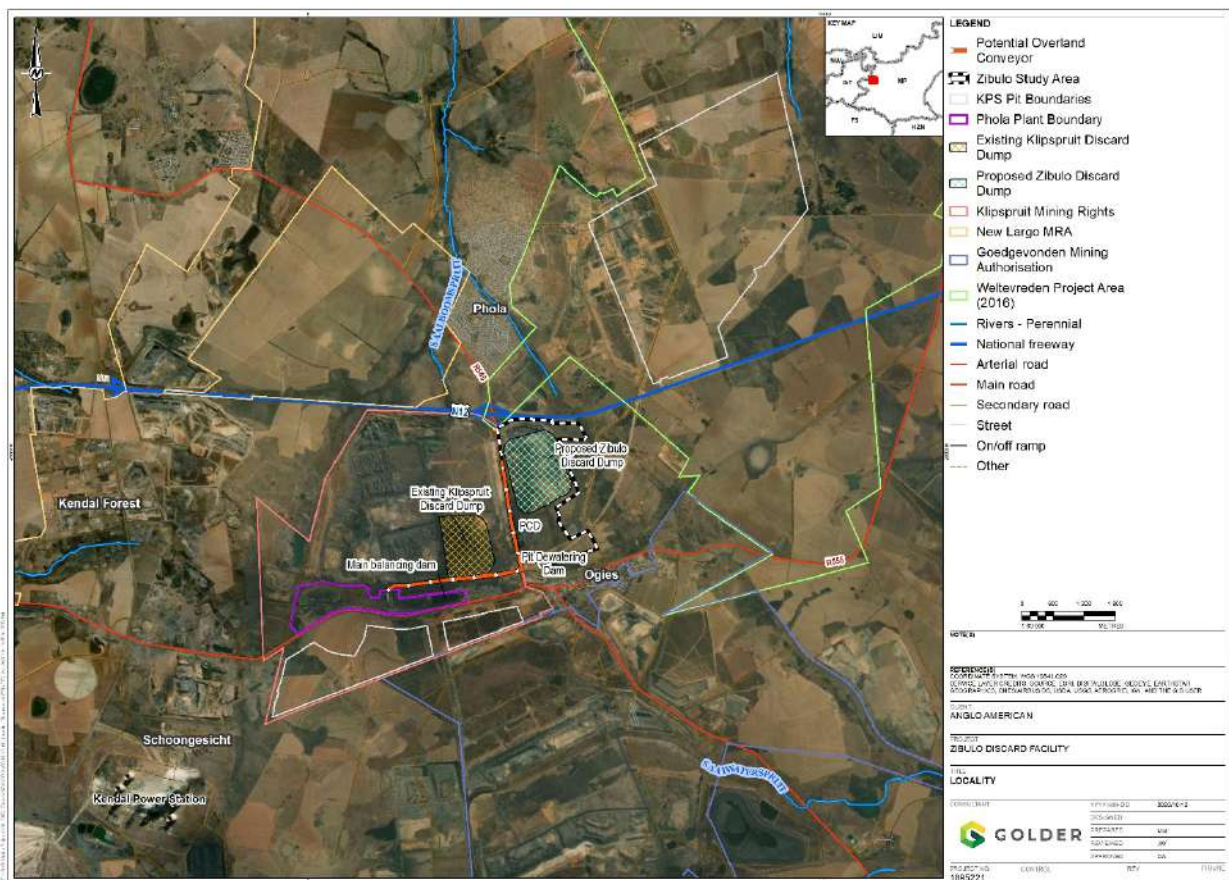


Figure 2: Locality and layout of discard facility and proposed conveyor

3.0 APPLICABLE LEGISLATION, GUIDELINES AND STANDARDS

The following national and provincial legislation was consulted:

- National Environmental Management Act (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA);
- National Water Act (Act No. 36 of 1998);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998); and
- Mpumalanga Biodiversity Sector Plan (2019).

4.0 METHODS

The approach followed for this study included a review and synthesis of existing ecological reports pertaining to the broader Zibulo opencast Mining Rights Area (MRA). Since the discard facility will be located within the existing opencast pit, the proposed conveyor will be aligned with the existing conveyor which is situated in transformed lands and does not intercept any wetland or aquatic ecosystems, and there are high-quality recent aquatic and wetland studies available for the study area, no additional fieldwork was considered necessary to inform this impact assessment.

4.1 Study Area

The study area for the wetland ecosystem impact assessment consisted of the proposed infrastructure, plus a 500 m buffer zone around these infrastructure (Figure 3), representing the 'regulated zone' for the assessment and authorisation of water uses, in accordance with the NWA.

The sampling locations used for the biannual biomonitoring surveys conducted by Clean Stream between 2012 and 2018 are shown in Figure 4.

4.2 Baseline Description

A literature review was conducted to gain an overview of the proposed project background, baseline condition of wetland and aquatic ecosystems in the study area and associated impacts. Previous studies and nationally-available datasets reviewed to inform the baseline description included:

- Wetland Consulting Services (2017). Zibulo Opencast Mine – Onsite Wetland Mitigation Strategy.
- Clean Stream Biological Services (2018). Anglo Coal Zibulo Colliery: Biomonitoring and Ecotoxicity Assessment Programme. December 2018 Survey.
- Aquatico (2019). Anglo Coal: Zibulo Colliery Annual Water Quality Assessment Report January - December 2019.
- van Deventer et al., (2019). National Wetland Map 5: An improved spatial extent and representation of inland aquatic and estuarine ecosystems in South Africa.
- Lotter (2013). Mpumalanga Biodiversity Sector Plan - Freshwater Assessment spatial dataset.

The baseline wetland description of the wetlands to the east of the project footprint consists of a desktop delineation of wetland hydrogeomorphic (HGM) units within 500 m of the proposed infrastructure, and description of their present ecological status (PES) and ecological importance and sensitivity (EIS).

From an instream biota perspective, the desktop assessment of available information was used to infer the health of the rivers in the study area.

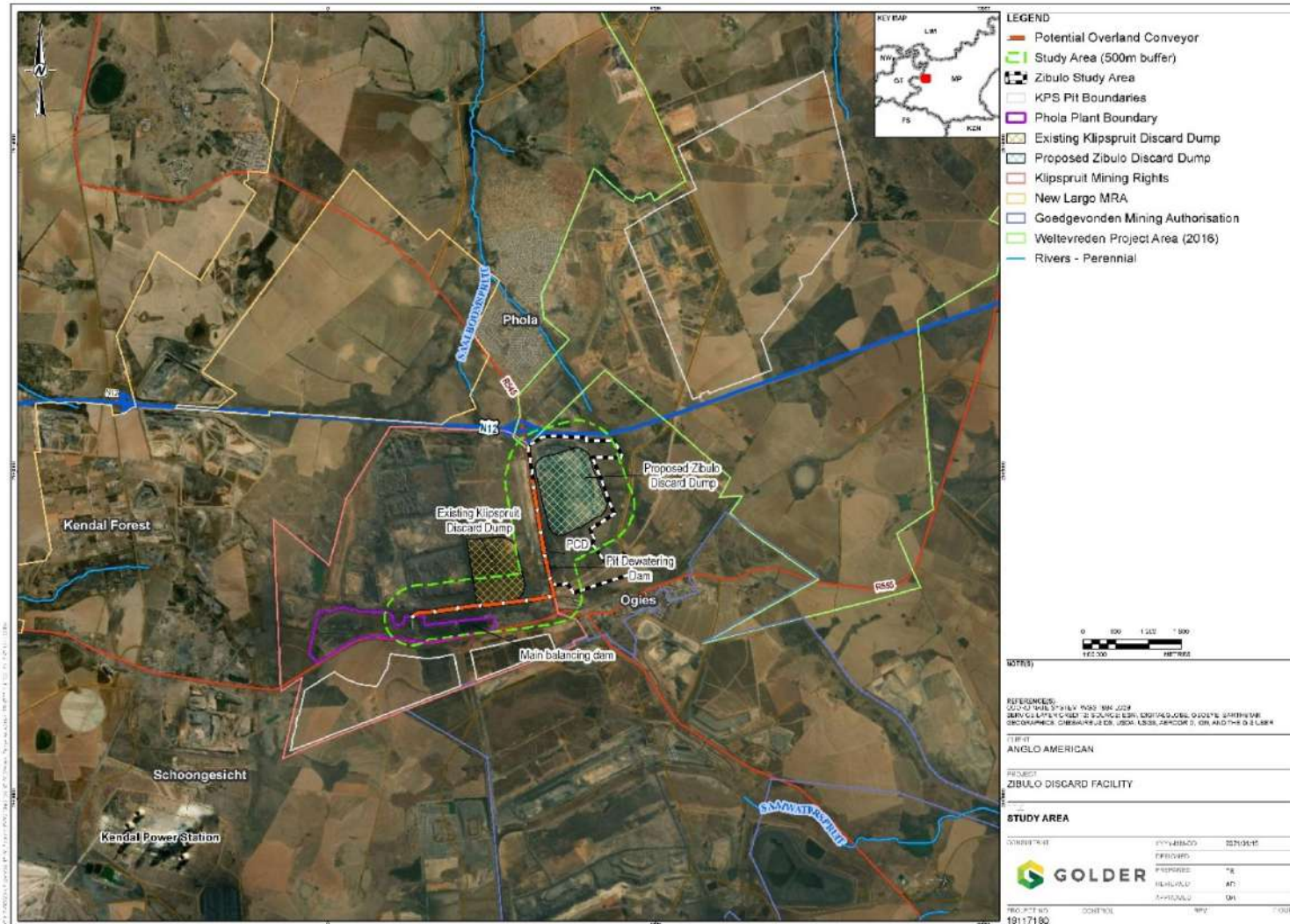


Figure 3: Study Area

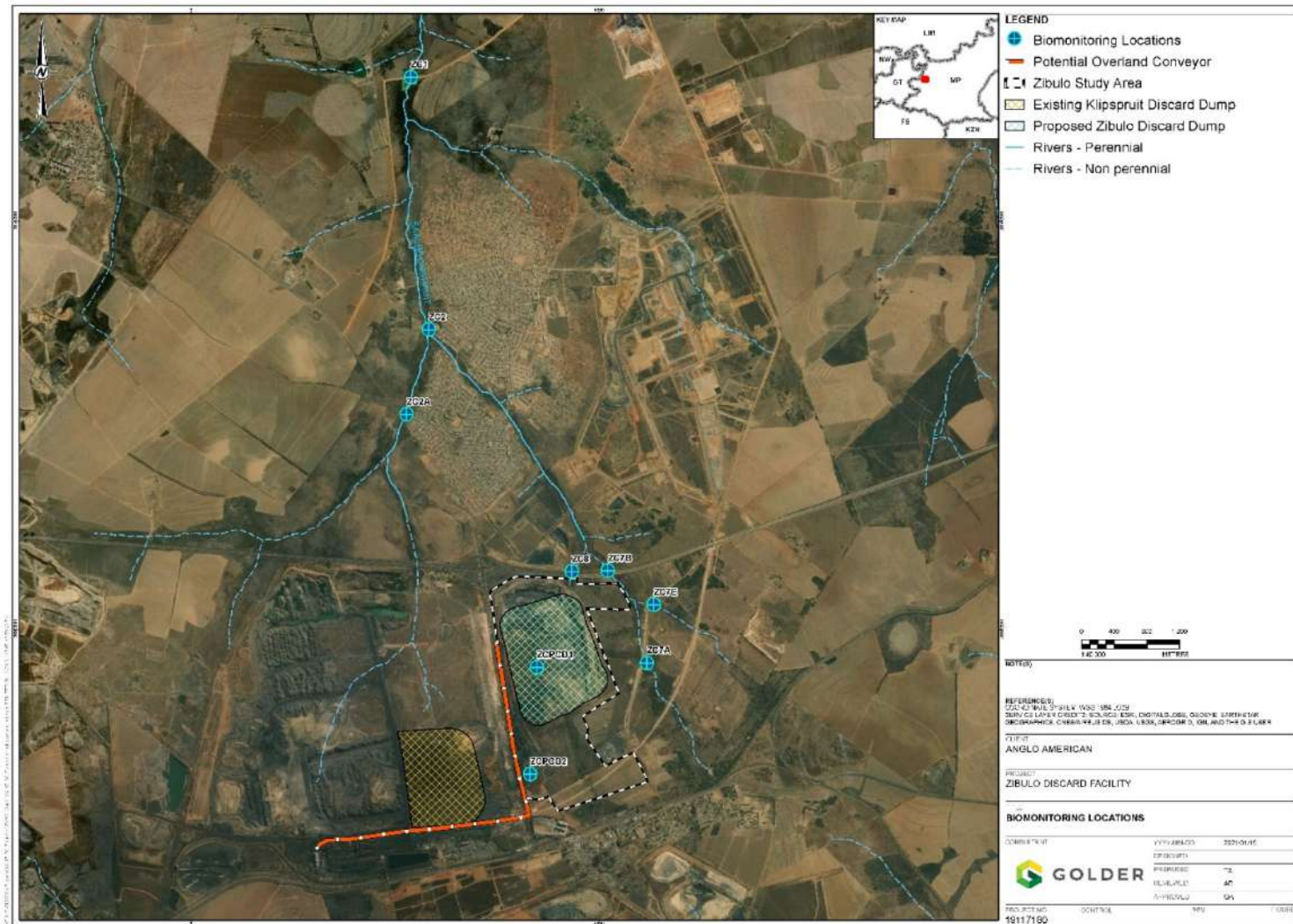


Figure 4: Aquatic biomonitoring locations

4.3 Impact Assessment

The significance of identified impacts will be determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further subdivided as follows:

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale/extent of impact	Magnitude of impact

The following five ranking scales are used to assess the magnitude and duration of impacts:

Magnitude	Duration
10- Very high/unknown	5- Permanent (>10 years)
8- High	4- Long-term (7 - 10 years, impact ceases after site closure has been obtained)
6- Moderate	3- Medium-term (3 months- 7 years, impact ceases after the operational life of the activity)
4- Low	2- Short-term (0 - 3 months, impact ceases after the construction phase)
2- Minor	1- Immediate
Scale	Probability
5- International	5- Definite/Unknown
4- National	4- Highly Probable
3- Regional	3- Medium Probability
2- Local	2- Low Probability
1- Site Only	1- Improbable
0- None	0- None

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:

$$\text{Significance Points} = (\text{Magnitude} + \text{Duration} + \text{Scale}) \times \text{Probability}.$$

The maximum value is 100 significance points (SP). The impact significance will then be rated as follows:

Points	Significance	Description
SP>60	High environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 - 60	Moderate environmental significance	An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP<30	Low environmental significance	Impacts with little real effect and which will not have an influence on or require modification of the project design.
+	Positive impact	An impact that is likely to result in positive consequences/effects.

For the methodology outlined above, the following definitions were used:

- Magnitude is a measure of the degree of change in a measurement or analysis (e.g., the area of pasture or the concentration of a metal in water compared to the water quality guideline value for the metal), and is classified as none/negligible, low, moderate or high. The categorisation of the impact magnitude may be based on a set of criteria (e.g. health risk levels, ecological concepts and professional judgement) pertinent to each of the discipline areas and key questions analysed. The specialist study must attempt to quantify the magnitude and outline the rationale used. Appropriate, widely recognised standards are to be used as a measure of the level of impact;
- Scale/Geographic extent refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international;
- Duration refers to the length of time over which an environmental impact may occur i.e. immediate/transient, short-term (0 to 7 years), medium-term (8 to 15 years), long-term (greater than 15 years with impact ceasing after closure of the project), or permanent; and
- Probability of occurrence is a description of the probability of the impact actually occurring as improbable (less than 5% chance), low probability (5% to 40% chance), medium probability (40% to 60% chance), highly probable (most likely, 60% to 90% chance) or definite (impact will definitely occur).

4.3.1 Method of assessing duration

Duration refers to the length of time over which an environmental impact may occur, i.e. immediate/transient, short-term (0 to 7 years), medium-term (8 to 15 years), long-term (greater than 15 years with impact ceasing after the closure of the project), or permanent.

4.4 Assumptions and Limitations

The baseline ecological assessment of the study area was based on previously conducted aquatic and wetland assessments, and no new field surveys were conducted by Golder to inform this report. Both the wet and dry seasons are well represented in the data used for the assessment.

The available site-level information, together with up-to-date desktop data including the MBSP (2019) assessment and the National Wetland Map 5 (van Deventer, 2019) was considered sufficient to inform the current study, particularly given that the proposed discard facility will be located within an existing, mined out opencast pit.

5.0 BASELINE DESCRIPTION

5.1 Wetlands

5.1.1 Regional Context

The National Wetland Map version 5 (NWM5) for South Africa and other data layers associated with the South African Inventory of Inland Aquatic Ecosystems (van Deventer et al., 2019) indicates the presence of a channelled valley bottom wetland within the study area (Figure 5). The same dataset indicates that the PES of that wetland is Largely to Severely/Critically Modified (Figure 6).

The Mpumalanga Biodiversity Sector Plan (MBSP) comprises two spatial components; maps of terrestrial and freshwater critical biodiversity areas (CBAs); and a set of land-use guidelines that are important for maintaining and supporting the inherent biodiversity values of these critical biodiversity areas. The Freshwater Assessment of the plan has categorized the wetlands within the study area as 'other natural areas' (Figure 7), that is, non-priority wetlands in terms of conservation management.

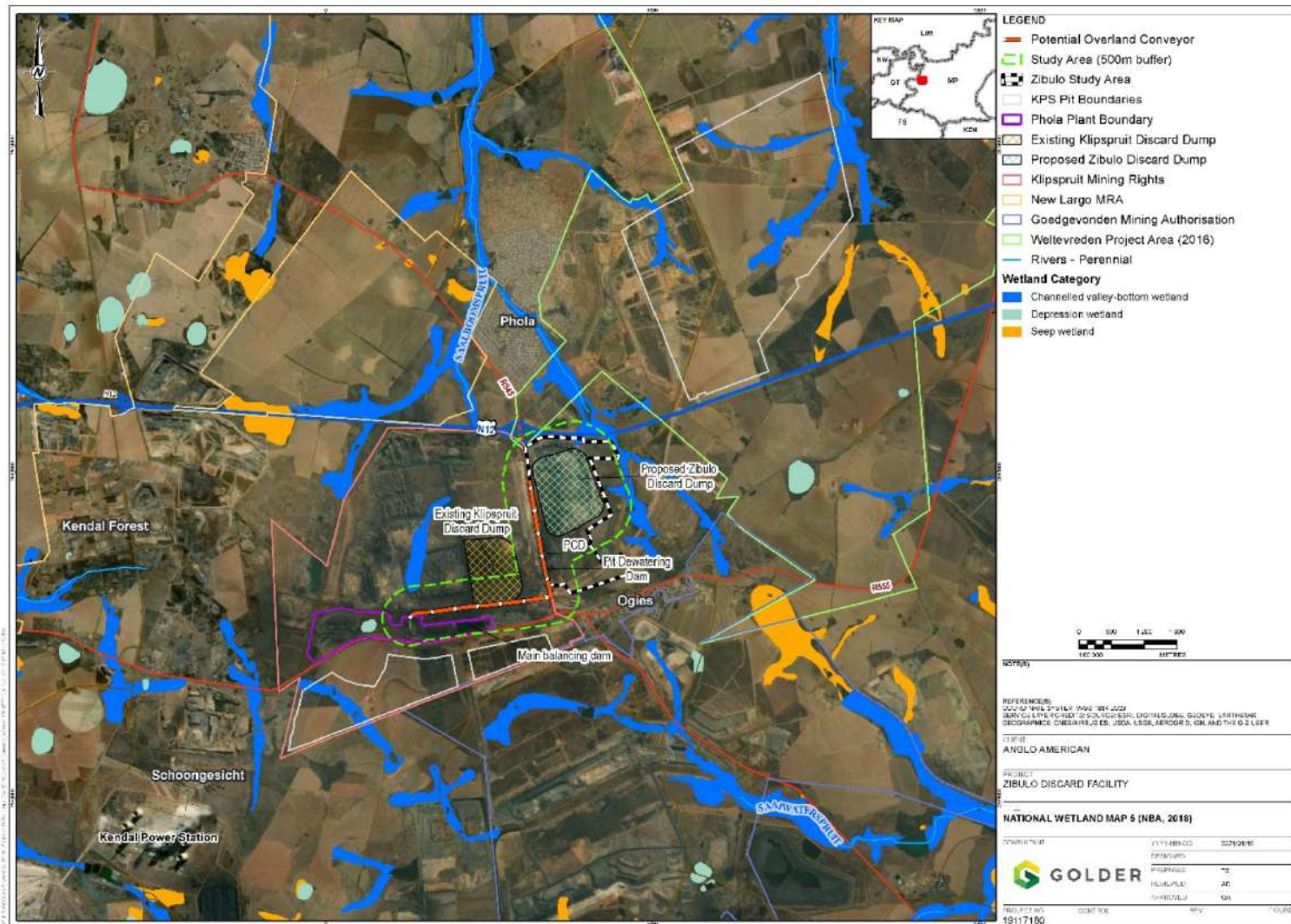


Figure 5: Channelled valley bottom wetlands within the study area

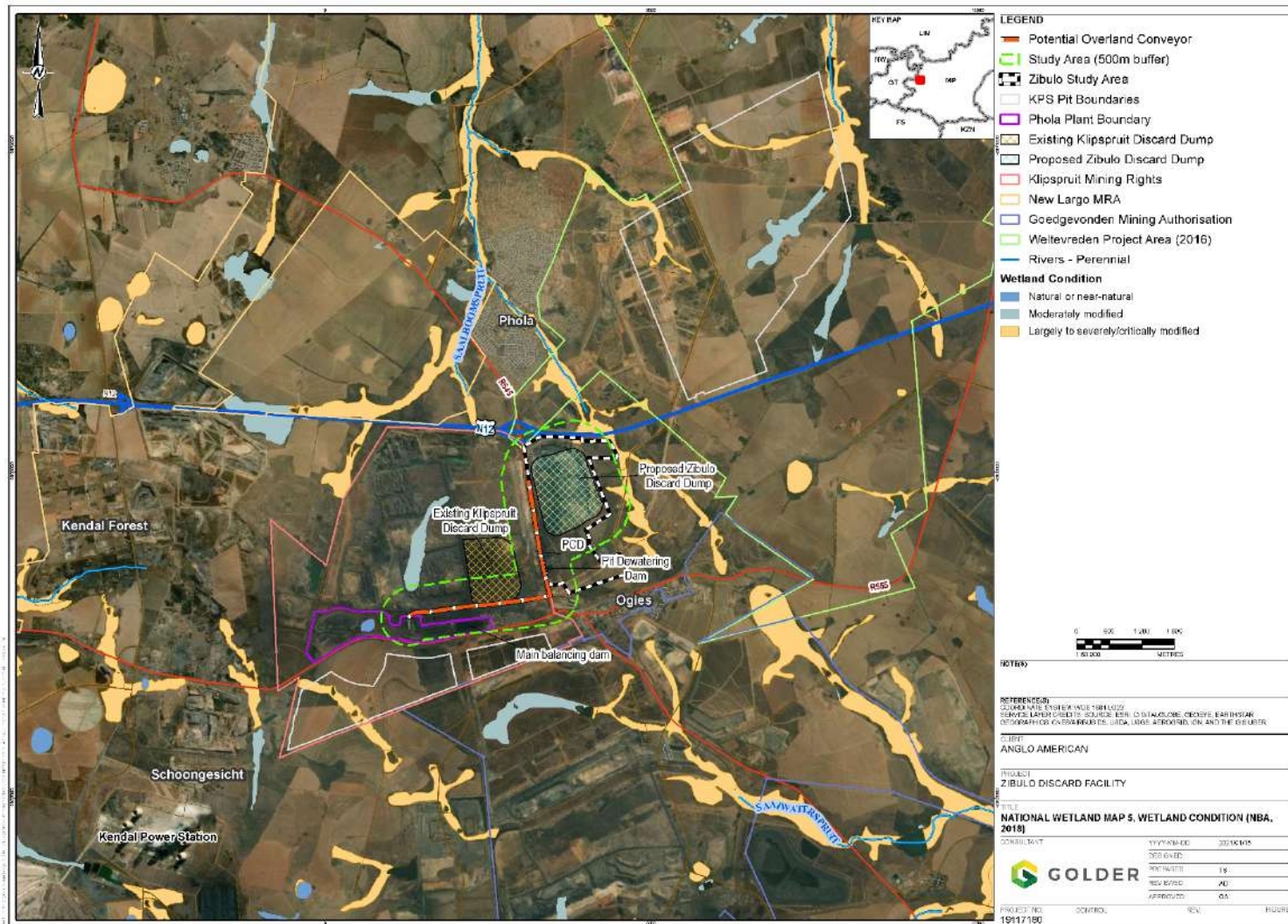


Figure 6: PES of wetlands within the study area (van Deventer et al., 2019)

5.1.2 Site Context

The following information has been extracted from a study conducted by Wetland Consulting Services (Wetland Consulting Services, 2017).

The pre-mining extent of wetlands across the Zibulo Colliery opencast section's catchment area was approximately 62.67 ha and consisted of hillslope seepage wetland habitat (Wetland Consulting Services, 2017). Due to recent opencast mining activities, a portion of this seepage wetland has been lost; the lost section of hillslope seepage wetland is identified as the relict wetland. Where the relict wetland area is shown in Figure 8, the extent shown is that delineated prior to loss of the wetland. Even prior to mining, the relict wetland system had been extensively transformed by the prior land use dominated by agricultural activities, did not offer a high level of ecological services to the landscape, and was of low ecological importance.

Presently, due to the progressive extent of mining activities on site, a section of the natural seepage wetland has been lost (relict wetland) and an artificial wetland has formed along the spoil stockpiles due to the fragmentation of the wetland system by mining activities on site and interruption of the natural flow patterns from the catchment. This artificial wetland forms a diversion of water along the stockpiles, which then discharges to the adjacent wetland within the Zibulo opencast mine. The current extent of wetland habitat on site (both natural and artificial) is shown in Figure 8.

The findings of the 2017 study (Wetland Consulting Services, 2017) indicated that:

- The present ecological state (PES) of the wetlands on site range from Moderately Modified (PES Category C: middle seepage area) to Largely Modified (PES Category D: northern and southern seepage areas), to Critically Modified (PES Category F, relict wetland area); and
- The wetlands within the study area are considered to be of moderate (C) to low/marginal (D) ecological importance and sensitivity.

It is important to note that Zibulo Colliery has an approved wetland rehabilitation strategy, which entails the following:

- Rehabilitating northern and southern seepage areas; and
- Recreation and/or establishment of a watercourse through the mined-out areas.

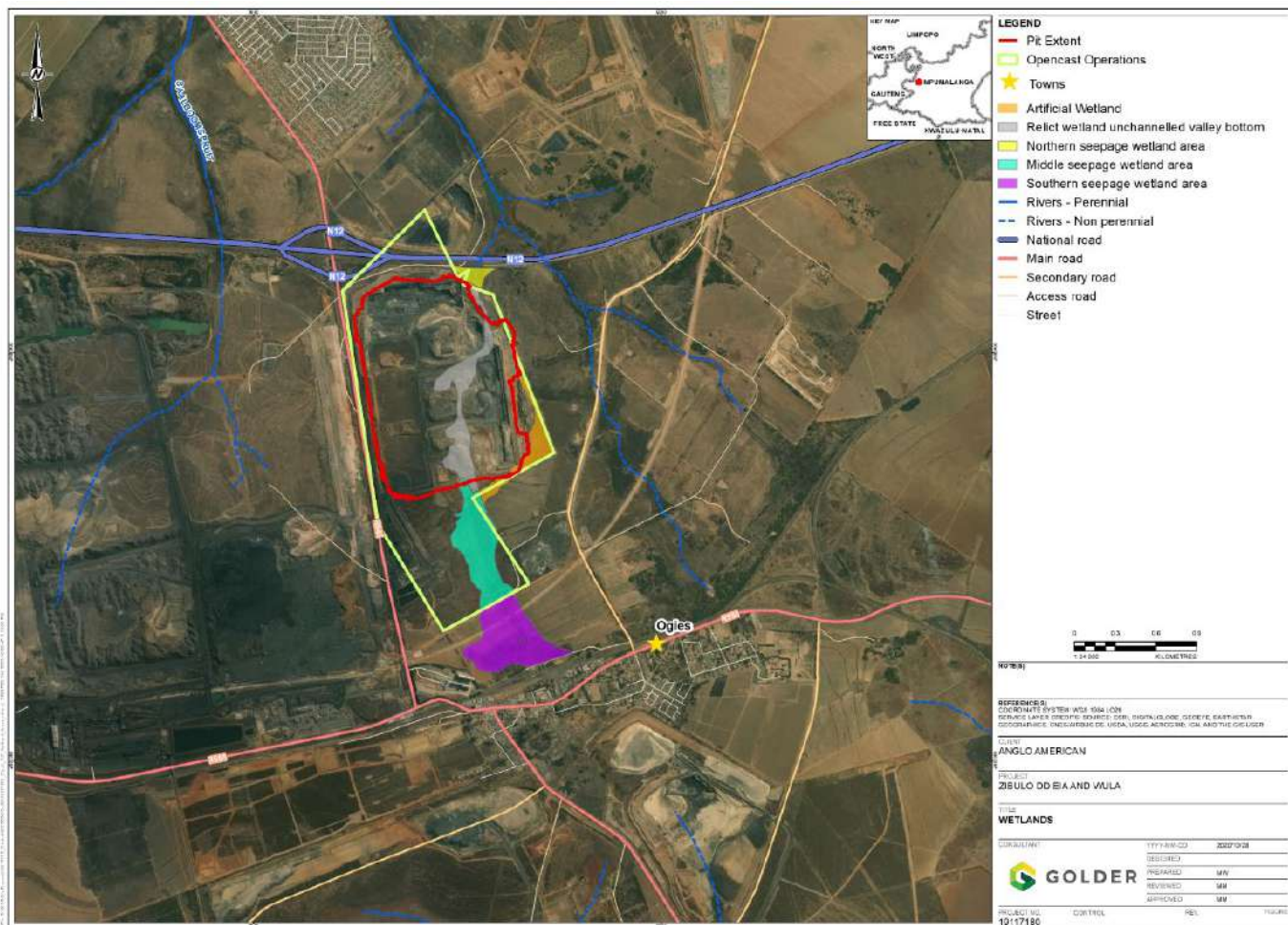


Figure 8: Remaining wetlands within the opencast operation limits (WCS, 2017)

5.2 Aquatic Ecosystems

Zibulo Colliery falls under the Upper Olifants Catchment, Management Unit (MU) 20. The quaternary catchment in which the Colliery lies is B20G. Streams from the mining area drain to the Saalklapspruit which drains into the Wilge River which is a part of the Loskop Dam catchment.

5.2.1 Water quality

Surface water is monitored on a monthly basis at Zibulo Colliery. Surface water quality monitoring of the downstream Saalklapspruit monitoring locations (Figure 9), for the period January to December 2019, indicated the following key points (Aquatigo, 2019):

- On average, none of the monitoring localities exceeded the WQPL for pH (6.5 – 8.4) for the Saalklapspruit.
- The TDS levels at the localities immediately downstream of the Zibulo site, on the Saalklapspruit eastern tributary (ZC7 and ZC8), were below the WQPL (260 mg/L) for the Saalklapspruit, for the majority of the 2019 sampling period. The locality ZC01, further downstream of the Saalklapspruit, after the confluence of the eastern and western tributaries of the Saalklapspruit, did however, on average, exceed the WQPL. The contamination is likely as a result of runoff from human activities and other mining operations in the area, as there is no direct water link between these localities and the Zibulo opencast operation. This will be further investigated as part of the surface water and groundwater studies that will be undertaken as part of the project.

- On average, all the downstream monitoring localities recorded sulphate concentrations below the WQPL (400 mg/L) for the Saalklapspruit.
- The majority of localities were above the WQPL for manganese (0.02 mg/L) for the Saalklapspruit during 2019, but below the integrated water use licence (IWUL) limits set for the site (0.59 mg/l).
- Additionally, none of the downstream localities exceeded the calcium and magnesium WQPL (80 mg/L and 50 mg/L respectively) for the Saalklapspruit.

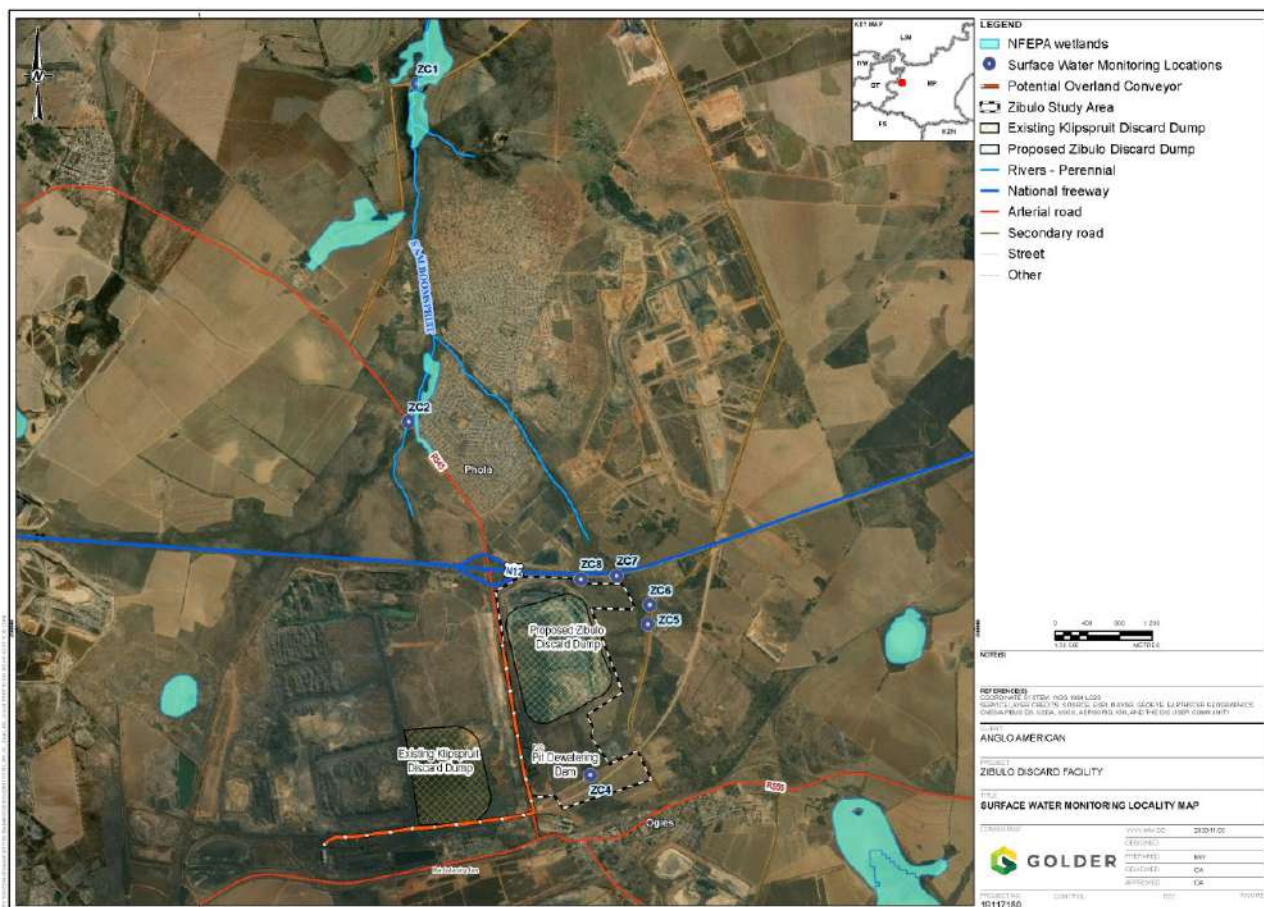


Figure 9: Surface water quality monitoring locations

5.2.2 Aquatic Biomonitoring

Biomonitoring and toxicity testing surveys of selected sites on the Saalklapspruit (Figure 4) have been conducted biannually (during the dry and wet seasons) from 2012 – 2018 by Clean Stream Biological Services for Zibulo Colliery. The results of the most recent survey are summarised in this report, to contextualise the baseline aquatic ecology situation of the Saalklapspruit within the Zibulo Colliery study area.

5.2.2.1 Overview

The eastern tributary of the Saalklapspruit most closely associated with the study area is non-perennial, associated with a valley bottom wetland system, and occurs at the top of the catchment, which reduces the usefulness of the conventional macroinvertebrate indices typically used to characterise riparian ecosystem quality, including the South African Scoring System, version 5 (SASS5) macro-invertebrate index (or Macro-invertebrate Response Assessment Index (MIRAI) invertebrate stressor-response index). In addition, fish

sampling of the monitoring sites in the study area has been discontinued, due to the presence of limited available fish habitat in the wetland systems, resulting in a diversity of species that is simply too low for biomonitoring to be meaningful.

5.2.2.2 Diatoms

The results of diatom analyses of samples taken from monitoring sites on the eastern tributary of the Saalklapspruit indicate that organic pollution is the driving variable for biological water quality, with identified sources including sewage discharge from the town of Phola, which were linked to rapid water quality changes. Nevertheless, the diatom assemblage in 2018 was indicative of a low level of organic pollution, with the abundance of key indicator species associated with industry and sewage similar to the previous year, suggesting that the trends in related impacts remain stable.

5.2.2.3 Toxicity Testing

Toxicity testing is based on the exposure of biota (i.e. algae, fish and invertebrates) to water sampled from the selected biomonitoring locations in a laboratory environment, to assess the potential risk of the sampled waters to the biota/biological integrity of the receiving water bodies.

Water sampled from sites ZC-7A and ZC-7B during December 2019, upstream and downstream of the Zibulo open-cast mine respectively, were found to pose a Slight (Class II) toxicity hazard, and as such, there was a slight risk that the water was toxic to aquatic biota. However, since both upstream and downstream sites were equally affected, this was not conclusively linked to Zibulo activities, and may be linked to external influences such as agricultural activity.

5.2.2.4 Aquatic Macroinvertebrates

SASS5 scores for sites sampled on the eastern tributary of the Saalklapspruit during 2018 ranged between 44 and 55 upstream of the opencast operation, and fell to 26 downstream of the opencast at ZC1, near Phola. Reduced scores compared to previous sampling events were linked to the construction of wetland crossings in the upstream section, and roadworks near Phola, however it was noted that since the system is non-perennial, SASS5 scores are not necessarily indicative of aquatic health; and expansion of the toxicity testing programme is likely to provide a more accurate reflection of aquatic health in relation to the potential effect of Zibulo opencast activities.

The MIRAI scores derived for the sites on the eastern tributary downstream of the Zibulo opencast categorised the invertebrate ecological category for the system as Largely to Seriously Modified (Category D to E).

6.0 IMPACT ASSESSMENT

The objective of this assessment is to identify the potential impacts posed by the proposed Zibulo operations on aquatic or wetland ecosystems that occur within 500 m of the proposed discard facility.

All impacts of the proposed project were evaluated using a risk matrix, which is a semi-quantitative risk assessment methodology. This system derives an environmental impact level on the basis of the magnitude, duration, scale, probability and significance of the impacts, based on a clear understanding of the potential mitigatory measures that can be implemented and changes in risks as a result of implementation of these mitigatory measures. A description of the risk rating methodology is presented in Section 4.3. Outcomes of the aquatic and wetland impact assessment are summarised in Table 1, and a detailed description of the impacts is provided in the sections that follow.

6.1 Construction Phase

The proposed discard facility will be located within the existing opencast mine pit, and as such does not require any footprint preparations as part of a formal construction phase as the discard will simply be deposited within the proposed discard facility footprint.

The proposed new conveyor will be constructed in alignment with the existing conveyor, in an area already heavily impacted by mining. The new conveyor will lie immediately north of the existing conveyor and cross the R545 road on a dedicated bridge crossing. Soon after the crossing of the R545, the conveyor will turn north to the opencast pit for final discard disposal. The entire extent of the conveyor route is confined to mine property belonging to either South32 or AAIC, and the conveyor will not cross any wetland or aquatic systems.

Assessment of construction phase impacts on wetlands or aquatic ecosystems is thus not applicable.

6.2 Operation Phase

The disposal of the discard – which is classified as potential acid generating (Golder, 2020) - in the opencast pit has the potential to add to the contaminant load of the already highly-contaminated Saalklapspruit through surface water runoff and seepage from the pit, and subsequently affect the extent/condition and survival/reproduction of downstream aquatic and wetland ecosystems and species, respectively. Seepage from the discard will be managed by the existing pit water management system in place for the mine. Excess mine water intercepted at the pit is currently sent to the eMalahleni water reclamation plant (EWRP) (via the 40 ML PCD) for treatment. Should the stormwater management system not be well maintained, contamination of the Saalklapspruit could result in negative impacts on the aquatic ecosystem downstream of the facility. The potential impact is expected to be of high significance prior to mitigation. The application of the recommended mitigation measures reduces both the potential magnitude of the impact and the probability of the impact occurring, resulting in the same low level of significance, with a lower overall significance score.

6.3 Closure Phase

Rehabilitation of the discard facility will require the construction of a cover that will be installed during ongoing rehabilitation. The cover will utilise a growth medium suitable for the establishment of vegetation to limit erosion and rainwater ingress/seepage into the discard facility. The earthworks involved in rehabilitation of the discard facility have the potential to contribute to increased sediment loading to downstream aquatic habitats. The impact is expected to be short-term in duration with a moderate probability of occurrence, resulting in a localised impact of moderate significance prior to mitigation. Provided that the recommended mitigation measures are adhered to, the magnitude and probability of the impact can be decreased, reducing the potential impact to one of low significance.

The approved wetland rehabilitation strategy for Zibulo includes the rehabilitation of the northern and southern seepage areas; and recreation and/or establishment of a watercourse through the mined-out areas. Rehabilitation of the northern and southern seepage systems presents an opportunity for a positive impact on the extent and condition of wetlands within the Zibulo mining right area. However, since the presence of the discard facility over the mined out footprint will prevent the creation of a new watercourse over the rehabilitated pit, the wetland rehabilitation and management strategy will need to be revisited.

Although decant of contaminated groundwater from the pit to surface water systems is predicted for both the capped and uncapped scenarios (Golder, 2020), resulting in an impact of potentially high environmental significance on aquatic ecosystems, scavenging boreholes will be installed and the contaminated water will be abstracted and treated at the EWRP, resulting in a residual impact of low significance.

Table 1: Impact assessment summary

Phase	Activity	Impact	Aspect	Without Mitigation						With Mitigation					
				Magnitude	Duration	Scale	Probability	Significance	Significance	Magnitude	Duration	Scale	Probability	Significance	Significance
Operational phase	Seepage arising from pit, poorly maintained stormwater management systems	Entry of contaminated pit water and/or stormwater to downstream rivers and wetlands	Survival and reproduction of aquatic and wetland fauna	10	3	2	5	75	High	4	3	2	1	9	Low
Closure phase	Earthworks involved in the rehabilitation of discard facility	Sediment mobilisation to aquatic ecosystems	Water quality	6	3	2	3	33	Moderate	4	3	2	2	18	Low
Closure phase	Wetland rehabilitation	Improved wetland functioning	Wetland condition						Positive						+
Closure phase	Decant of contaminated groundwater	Entry of contaminated groundwater to downstream rivers and wetlands	Survival and reproduction of aquatic and wetland fauna	10	5	2	5	85	High	4	5	2	2	22	Low

7.0 MITIGATION MEASURES

- An adequately designed stormwater management system to meet the GN 704 requirements of separating clean and dirty water, will assist in ensuring that only clean water from the eastern sub-catchment drains to the Saalklapspruit and ultimately will help to achieve the ecological water quality requirements of receiving watercourses.
 - Clean water intercepted and diverted around the discard facility should be reintroduced into the downstream watercourses in a manner which does not create erosion and aids in diffuse dispersion of flow across most of the width of the downstream wetlands.
- Concurrent rehabilitation of the discard facility is proposed, commencing during operation. Rehabilitated parts of the cap on the discard facility should be seeded and early vegetation establishment encouraged.
 - Vegetation establishment should prioritise the use of indigenous and/or fast-growing stoloniferous grasses to protect the soils from erosion and reduced the likelihood of sedimentation of downstream aquatic systems.
- The approved wetland rehabilitation plan should be revised to develop an alternative solution to the originally proposed creation of a watercourse through the pit footprint, which is no longer feasible.
- To prevent decant of seepage water from the discard facility, boreholes will be pumped and the contaminated water treated at the EWRP.

8.0 MONITORING REQUIREMENTS

- The current aquatic biomonitoring programme should remain ongoing throughout the operation of the discard facility.
- During the operation and closure phase, once rehabilitation activities have commenced, fixed point photography monitoring to provide a record of vegetation establishment and monitor erosion is recommended.

9.0 CUMULATIVE IMPACTS

Since the discard facility will be located within an existing opencast pit, and the proposed conveyor will be aligned adjacent to an existing conveyor in an already transformed landscape, no significant cumulative impacts on aquatic ecosystems or wetlands are anticipated.

10.0 CONCLUSION

The discard facility will be located within an existing opencast pit, and the proposed conveyor will be aligned adjacent to an existing conveyor in an already transformed landscape. The conveyor will not intercept any wetland or aquatic ecosystems, and as such, its construction and operation are not anticipated to have any negative impact on these ecosystems or associated species.

The presence of the discard in the pit during operation and closure will contribute to the contamination of groundwater systems, which could potentially exacerbate the contamination of downstream aquatic ecosystems and/or associated wetlands, as a result of poorly maintained stormwater management systems, or uncontrolled decant. However, provided that stormwater and decant are managed appropriately, as recommended in the hydrology/hydrogeology report for the discard facility (Golder 2020), residual impacts of low significance on aquatic and wetland ecosystems and species are predicted.

Provided that the recommended mitigation measures and monitoring requirements are strictly adhered to, in particular, the review and update of the approved wetland rehabilitation and management strategy for Zibulo Colliery, the Project may be authorised from an aquatic and wetland ecosystems perspective.

11.0 REFERENCES

Aquatico. (2019). Anglo Coal: Zibulo Colliery Annual Water Quality Assessment Report January - December 2019.

Clean Stream Biological Services (2018). Anglocoal Zibulo Colliery: Biomonitoring and Ecotoxicity Assessment Programme. December 2018 Survey.

Golder (2020). Hydrology/ Hydrogeology Report for the Discard Facility at Zibulo Opencast Operation. Report Number 19117180-337629-10.

Wetland Consulting Services (2017). Zibulo Opencast Mine – Onsite Wetland Mitigation Strategy.

Signature Page

Golder Associates Africa (Pty) Ltd.



Aisling Dower
Senior Ecologist

Olivia Allen
Environmental Assessment Practitioner

AD/OA/mc

Reg. No. 2002/007104/07

Directors: RGM Heath, MQ Mokolubete, MC Mazibuko (Mondli Colbert), GYW Ngoma

Golder and the G logo are trademarks of Golder Associates Corporation

[https://golderassociates.sharepoint.com/sites/104294/project files/6 deliverables/19117180-338303-15_wetland & aquatic/19117180-338303-15_zibulo_aquatic_wetland_ia_final_15apr21.docx](https://golderassociates.sharepoint.com/sites/104294/project%20files/6%20deliverables/19117180-338303-15_wetland%20&%20aquatic/19117180-338303-15_zibulo_aquatic_wetland_ia_final_15apr21.docx)

APPENDIX A

Document Limitations

DOCUMENT LIMITATIONS

This document has been provided by Golder Associates Africa Pty Ltd (“Golder”) subject to the following limitations:

- i) This Document has been prepared for the particular purpose outlined in Golder’s proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.
- ii) The scope and the period of Golder’s Services are as described in Golder’s proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regard to it.
- iii) Conditions may exist which were undetectable given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.
- iv) In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Golder’s opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- v) Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.
- vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.
- vii) The Client acknowledges that Golder may have retained sub-consultants affiliated with Golder to provide Services for the benefit of Golder. Golder will be fully responsible to the Client for the Services and work done by all its sub-consultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from Golder and not Golder’s affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against Golder’s affiliated companies, and their employees, officers and directors.
- viii) This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on this Document.

GOLDER ASSOCIATES AFRICA (PTY) LTD

APPENDIX B

CV of the Specialist



Education

*Master of Science (Hons)
Applied Environmental
Science , University
College Dublin, Dublin,
Ireland, 2007*

*Bachelor of Science (Hons)
Zoology, University College
Cork, Cork, Ireland, 2005*

Certifications

*Professional Natural
Scientist (South African
Council for Natural
Scientific Professions) ,
(114477/15)*

Languages

English – Fluent

French – Basic

Golder Associates Africa (Pty.) Ltd. – Johannesburg

Biodiversity and Ecosystem Services Specialist

Aisling is an ecologist and biodiversity specialist with over 12 years consulting experience in Europe and sub-Saharan Africa. Experienced in designing, costing and conducting baseline flora and fauna surveys, ecosystem services assessments, ecological impact assessment and development of mitigation, compensation and offsetting measures for projects in the mining, O&G, waste, transport, land development and power generation sectors.

She has completed baseline biodiversity studies and ecosystem service reviews for numerous projects in Southern Africa, East Africa, and Central and West Africa, and is experienced in conducting such assessments to satisfy both national environmental regulations and international financing requirements particularly those demanded by the International Finance Corporation's 2012 Performance Standards. To date she has worked on biodiversity-related projects in Ireland, UK, Kosovo, Gabon, Guinea, Guinea-Bissau, Kenya, DRC, Mozambique and Uganda, in addition to numerous projects in South Africa, covering northern temperate, Mediterranean, tropical rainforest, desert, savanna and coastal environments.

She has specific expertise in bat survey and population assessment, having completed her MSc research on bat population correlates, carried out bat assessments for mining and wind power developments in Ireland and the UK, and conducted baseline studies of bat populations and subsequent impact assessments for both mining and power generation projects in West Africa, Central Africa, South Africa and Europe.

Employment History

Golder Associates Africa (Pty) Ltd. – Johannesburg Terrestrial Ecologist (February 2013 to Present)

Biodiversity specialist with responsibility for Project Management and implementation of baseline biodiversity studies and impact assessments for development projects in the mining, transport, land development, power and waste sectors, in both South Africa and sub-Saharan Africa. Role responsibilities include: Project management, including budget preparation and management, task allocation, and technical review of proposals and reports; Technical review of consultant's draft reports; biodiversity study design to satisfy national legislation and international financing requirements; Biodiversity baseline and impact assessment reporting; Biodiversity offset strategies; Biodiversity action/management plans; Ecosystem services review and impact assessment; Wetland delineation surveys and assessments; Large and small mammal surveys.

Golder Associates Ireland – Naas, Ireland Ecologist (April 2008 to Present)

Responsible for ecological input on a range of resource development, mining, power and transportation projects, both in Ireland and Internationally. Typical project activities were undertaking baseline ecological surveys including surveys of bat activity, reptile population size and composition, newt presence/absence and population size, badger and otter presence/absence and territory size assessment, small mammal surveys, aquatic invertebrate species composition, vegetation surveys and habitat mapping. Authored numerous Ecological

Baseline, Ecological Impact Assessment and Appropriate Assessment reports, in fulfilment of regulatory requirements.

Golder Associates UK – Oxford, UK

Ecologist (April 2010 to Present)

Responsible for the ecological input on a range of resource development, mining and transportation projects, both internationally and in the U.K. to inform planning applications and Ecological Impact Assessments (EclA), and uphold monitoring regimes. Project activities included: Route options constraints study and baseline ecological survey & mapping, statutory authority consultation and stakeholder engagement for production of baseline ecology report and ecological impact assessment chapter of ESIA for Kosovo Motorway alignment; EU-protected species survey and monitoring, including great crested newts (GCN) and bat species, for several large-scale landfill and quarry sites; Reptile, amphibian, mammal and Phase 1 habitat surveys for a suite of composting/biogas developments, subsequent baseline ecology reports and Ecological Impact Assessment; Provision of Ecological clerk of works services at development sites

NATURA Environmental Consultants – Wicklow, Ireland

Ecologist (September 2007 to March 2008)

Responsible for report writing, data interpretation and analysis, and project management. Contributed extensively to the production of the publication "The Status of EU Protected Habitats and Species in Ireland" (NPWS, 2008).

University College Dublin – Dublin, Ireland

Field Assistant (July 2007 to September 2007)

Field assistant for salmonid fish population assessment and crayfish surveys, including electrofishing, fish handling and scale sampling, sorting and ID of freshwater invertebrates and plants.

Thomson Scientific & Healthcare – Limerick, Ireland

Scientific Information Specialist (May 2005 to August 2006)

Researcher responsible for writing article abstracts, proof-reading and editing newly published scientific research papers.

PROJECT EXPERIENCE – IFC PERFORMANCE STANDARD 6 PROJECTS

- Kamoa Copper BMP (2021)**
Katanga, DRC
Lead biodiversity specialist responsible for development of a biodiversity management plan for species, ecosystems and ecosystem services of concern within the Kamoa MRA. Field studies included responsibility for the identification of peat-forming systems and refinement of vegetation mapping through ground-truthing.
- Camalco Biodiversity Capacity building (2020)**
Adamawa, Cameroon
Lead biodiversity specialist providing guidance and technical review to in country consultants, for survey design, implementation and reporting biodiversity baseline data gathering activities to achieve the requirements of IFC PS6.
- Kamoa Copper powerline ESIA (2020)**
Katanga, DRC
Review and update of biodiversity impact assessment for powerline ESHIA
- Kamoa Copper Cumulative Impact Assessment (2020)**
Katanga, DRC
Lead author for the cumulative impact assessment study for the Kamoa Copper project.
- SMFG Nimba Fauna Baseline (2020)**
Nimba Mountains, Guinea
Compiled baseline fauna report for the ESIA, including update of baseline information with results of various taxonomic studies done since the original 2013 baseline, and critical habitat-triggering species descriptions.
- Large Infrastructure Barging Route - Marine Ecology Impact Assessment (2020)**
Vilanculos, Mozambique
Lead biodiversity specialist for marine baseline surveys including sea grass and coral reef extent and condition assessments, to inform microrouting of a proposed barging route in close proximity to Bazaruto Archipelago National Park.
- Konza Techno City - Biodiversity Baseline and BMP Review (2019)**
Machakos, Kenya
Acting as biodiversity expert on behalf of the lending institution, was responsible for review of the initial biodiversity baseline study and BMP, and development of recommendations for additional work required to ensure that the baseline and BMP are of the standard necessary to satisfy the requirements of Performance Standard 6.
- Proposed Oil Field Development (Confidential) (2014 - 2019)**
Turkana, Kenya
Screening for Critical Habitats as defined by IFC PS6 and IFC GN6, 2012. Desktop biodiversity description and remote land cover sensing to inform scoping report and fieldwork planning for biodiversity and ecosystem services baseline data gathering phase. Authored Biodiversity baseline report and impact assessment to Kenyan and IFC standards.
- Ahafo North Mine Biodiversity Baseline and IA (2018)**
Brong-Ahafo, Ghana
Consolidated biodiversity data from previous studies with up-to-date baseline data on aquatic ecosystems and vegetation into an updated biodiversity baseline report and impact assessment for the proposed mining of Ahafo North
- Beach Landing Sites (Confidential) - Marine and Coastal baseline and Critical Habitat Assessment (2018)**
Vilanculos, Mozambique
Authored marine and coastal baseline study report based on available reports and data. Determined species and ecosystem triggers of Critical Habitat in the study area and assessed impacts and developed bespoke mitigation measures to ensure NNL of natural habitat and NG of critical habitats.

Kinsevere Copper Mine (2018) Haut-Katanga, DRC	Consolidated biodiversity data from previous studies with up-to-date baseline data on flora and birds into an updated biodiversity baseline report and impact assessment for the proposed expansion of TSF to adjoining tenement
Oil Exploration Block - Biodiversity Baseline and Impact Assessment (2018) Hoima, Uganda	Baseline biodiversity description to inform the overall Environmental Baseline Report for that exploration block. Updated biodiversity impact assessment chapter and authored cumulative impact assessment report for the project.
Proposed Copper Mine (Confidential) (2017) Katanga, DRC	Ecosystem services review and impact assessment to satisfy the requirements of IFC PS6 for a proposed copper mine development.
Bokpoort Solar PV & CSP Tower (2016) Northern Cape, South Africa	Conducted specialist bat baseline study and impact assessment for solar PV and CSP tower project. Authored ecosystem services review and impact assessment for the full project.
Kingfisher Development Area (2015) Hoima, Uganda	Ecosystems goods and services assessment to IFC PS6 standards, for a proposed oil development project on the shore of Lake Albert.
Proposed Mine (Confidential) (2013) KwaZulu-Natal, South Africa	Ecosystems goods and services assessment to IFC PS6 standards, for a proposed magnetite mine in an area of tribal lands in KZN, also known for its rich biodiversity.
Proposed Iron Ore Mine (2012) Nimba, Guinea	Led specialist bat survey of proposed mine site in Guinea. Conducted extensive wet and dry season bat presence and activity surveys and established population status of a Critically Endangered bat species within proposed site. Produced Critical Habitat mapping and reporting in accordance with requirements of IFC Performance Standard 6.
Proposed Rare Earth Mine (Confidential) (2012) Gabon	Led specialist bat survey of proposed mine site in a remote rainforest area in Gabon. Conducted wet and dry season bat presence and activity surveys to get a baseline bat species list for the proposed site, which included new bat records for Gabon.

PROJECT EXPERIENCE – ECOSYSTEM SERVICES ASSESSMENT

Oil Development Block (2018) Turkana, Kenya	Ecosystem services review and impact assessment to IFC PS6 for a proposed oil field development including proposed overland haulage route.
Kingfisher Development Area (2018) Hoima, Uganda	Ecosystem services review and impact assessment to IFC PS6 standards, for a proposed oil development project on the shore of Lake Albert.
Kipoi/Luputo Mine (2016) Katanga, DRC	Ecosystem services review and impact assessment to IFC PS6 for a copper/cobalt mine in DRC.
Metalkol (2016) Kolwezi, DRC	Ecosystem services review and impact assessment to IFC PS6 for a copper/cobalt mine in DRC.

- Proposed Mine, Melmoth (2015)**
KwaZulu-Natal, South Africa
Ecosystems goods and services assessment to IFC PS6 standards, for a proposed magnetite mine in an area of tribal lands in KZN, also known for its rich biodiversity.
- Gas to Liquid Plant (2013)**
Tashkent, Uzbekistan
Produced ecosystem goods and services assessment based on information garnered from ecology, surface water and social baseline assessments, in order to fulfil International Finance Corporation Performance Standard 6 requirements for the project funding and ESIA.

PROJECT EXPERIENCE – BATS

- Proposed Iron Ore Mine - ESIA to IFC Standards**
Nimba Mountains, Guinea
Led specialist bat survey of proposed mine site in Guinea. Conducted extensive wet and dry season bat presence and activity surveys and established population status of a Critically Endangered bat species within proposed site. Produced Critical Habitat mapping and reporting in accordance with requirements of IFC Performance Standard 6.
- Proposed rare earth mine - ESIA to IFC Standards**
(Confidential), Gabon
Led a six-week specialist bat field survey of proposed mine site in a remote rainforest area in Gabon. Conducted wet and dry season bat presence and activity surveys to compile a baseline bat species list for the study area, which included new bat records for Gabon. Authored baseline and impact assessment reports to inform the overall ESIA.
- Phalaborwa Mine - Artificial Roost Creation Guidance**
Phalaborwa, Limpopo, South Africa
Provided design guidance to our client who proposed to construct an artificial bat roost on their property using old mining vehicle tyres and overburden materials.
- Kosovo Wind Farm ESIA to World Bank Standards**
Kosovo
Analysed passive acoustic monitoring data for bats to compile a baseline report on bat species assemblage, diversity and spatial distribution of bat activity within the wind farm area of influence.
- Varkensvlei Mine ESIA**
Waterberg, Limpopo, South Africa
Baseline study of bat species assemblage, diversity and spatial distribution of bat activity within the surface mining rights area, including identification of sensitive habitats and terrain features on site that could constitute important roosting or foraging habitat for various species. Authored baseline and impact assessment reports to inform the overall ESIA.
- Rio Tinto Tete**
Tete, Mozambique
Bat monitoring surveys (passive acoustic monitoring supplemented by trapping surveys) in compliance with environmental authorisation conditions and in line with the recommended mitigation measures of the ESIA.
- Farim Phosphate Project ESIA**
Farim, Guinea-Bissau
Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to establish baseline bat diversity, including passive acoustic monitoring and identification of sensitive habitats and terrain features on site that could constitute important roosting or foraging habitat for various species. Authored baseline study report to inform the ESIA.
- Bokpoort Solar PV & CSP Tower (2016)**
Northern Cape, South Africa
Conducted specialist bat baseline surveys including passive acoustic monitoring and identification of sensitive habitats and terrain features on site that could constitute important roosting or foraging habitat for various species. Authored the baseline report and the impact assessment for a solar PV and CSP tower project, to IFC PS6 standard.

PROJECT EXPERIENCE – WETLAND ECOLOGY

- Kamoa Copper BMP (2021)**
Katanga, DRC
Wetland ecologist responsible for the identification of peat-forming systems and refinement of vegetation mapping through ground-truthing.
- AGA Pipeline wetland assessment (2019)**
Gauteng, South Africa
Wetland delineation, baseline PES, EIS and EcoServices scores and impact assessment for proposed water return pipeline.
- Twinsaver Water Use License (2018)**
Gauteng, South Africa
Wetland delineation, baseline PES, EIS and EcoServices scores and impact assessment for ESIA for water use license application
- Belfast Implementation Project (2015 - 2018)**
Mpumalanga, South Africa
Wetland baseline monitoring to inform environmental impact assessment, including multi-seasonal surveys and updates of PES, EIS and WET-Ecoservices scores for each HGM unit concerned.
- Kangra Kuisipongo Overland Conveyor ESIA (2017)**
Kwazulu Natal, South Africa
Conducted wetland delineation and baseline assessment (PES, EIS, WetEcoservices) and impact assessment of overland coal conveyor.
- Mafube LifeX Project (2015 - 2017)**
Mpumalanga, South Africa
Wetland mitigation strategy fieldwork and assessments. Ongoing project support during construction through monitoring and management of construction activities, and overseeing implementation of WUL conditions on the ground.
- BECSA Middelburg (2015)**
Mpumalanga, South Africa
Wetland delineation and assessment of proposed sludge pipeline river crossings, and wetlands lying within 500m of proposed slurry dump pits to inform Water Use Licence application and EIA.
- Metmar, Steelpoort (2014)**
Limpopo, South Africa
Delineation and assessment of floodplains of the Steelpoort River, upstream, within and downstream of the proposed site of an open cast pit.
- Mooifontein, Arnot (2014)**
Mpumalanga, South Africa
Bird and amphibian surveys of pans and wetlands within mining rights area to update PES and EIS, for use in determining wetland reserve.
- Interwaste Amadwala (2014)**
Gauteng, South Africa
Delineated wetlands and assessed Present Ecological Status, Ecological Importance and Sensitivity, and Ecosystem services provided by each wetland within project area of influence. Conducted impact assessment and devised mitigation measures and monitoring regimes.

PROJECT EXPERIENCE – MINING

- Bankable Feasibility Study (confidential) (2019)**
Mpumalanga, South Africa
Responsible for authoring environment chapter of BFS.

<p>Belfast Implementation Project (2015-2018) Mpumalanga, South Africa</p>	<p>Led three years of pre-construction wetland monitoring including assessment of PES, EIS and EcoServices for mining right area</p>
<p>Phalaborwa Mine - Biomonitoring (2015) Limpopo, South Africa</p>	<p>Biological monitoring of the Oliphants and Selati Rivers, including assessment of fish populations, aquatic macroinvertebrates and riparian vegetation to monitor the condition of habitat in the vicinity of the mine, observing any significant changes and providing advice to PMC on biodiversity management. This ongoing project continues to be conducted in compliance with the most rigorous health and safety standards, due to the frequent presence of dangerous large mammal fauna including elephant, buffalo and lion in and around the mine site.</p>
<p>Tshikondeni Mine (2014) Limpopo, South Africa</p>	<p>Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to determine baseline large and small mammal, bat and bird diversity and vegetation community mapping for development of a rehabilitation plan for mined areas.</p>
<p>Bat Baseline Study to IFC Standards (2012) Gabon</p>	<p>Led specialist bat survey of proposed mine site in a remote rainforest area in Gabon. Conducted wet and dry season bat presence and activity surveys to get a baseline bat species list for the proposed site, which included new bat records for Gabon.</p>
<p>Bat Baseline Study to IFC Standards (2012) Nimba, Guinea</p>	<p>Led specialist bat survey of proposed mine site in an upland region of Guinea. Conducted extensive wet and dry season bat presence and activity surveys and established population status of a Critically Endangered bat species within proposed site. Produced Critical Habitat mapping and reporting in accordance with requirements of IFC Performance Standard 6.</p>
<p>Farim Phosphate Project ESIA (2011) Farim, Guinea Bissau</p>	<p>Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to establish baseline bat, mammal and bird diversity, and vegetation mapping for subsequent ecological impact assessment.</p>
<p>Rio Tinto Tete Project (2013 - 2015) Tete, Mozambique</p>	<p>Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to determine baseline small mammal and bird diversity and vegetation community mapping for subsequent ecological impact assessment.</p>

PROJECT EXPERIENCE – POWER

<p>Bokpoort CSV and PV developments (2017) Northern Cape, South Africa</p>	<p>Biodiversity and ecosystem services baseline and impact assessment as part of overall ESIA for two PV and one CSV development on adjoining properties.</p>
<p>Solar Park - Gordonia Park substation powerline (2016) Northern Cape, South Africa</p>	<p>Conducted survey of powerline route to identify cluster of protected trees, other plants of conservation importance, and areas potentially important to bird species of concern to inform the final routing and placement of pylons and bird deterrents</p>
<p>Kendal Power Plant (2013) Mpumalanga, South Africa</p>	<p>Terrestrial vegetation, bird and mammal monitoring to assess impacts of existing ash dump, and compile baseline data for proposed new ash dump.</p>

**Ndumo-Gezisa
Powerline Route
Corridor - Impact
Assessment (2013)**

KwaZulu-Natal, South
Africa

Terrestrial flora and fauna assessment of route corridor options for proposed powerline approx. 30 km long. Studies included small and large mammals, birds, reptiles and vegetation mapping.

**Vaalbank 88 Kv
Powerline - Basic
Assessment (2014)**

Gauteng, South Africa

Terrestrial and wetland baseline study and impact assessment reports to assess the impacts of a proposed powerline corridor and switching station footprint.

**Begg Farm Wind
Cluster EIA (2012)**

Fife, Scotland

Responsible for production of Environmental Impact Statement for a 3MW wind farm at Begg Farm, Kirkcaldy, Fife. Authored chapters including Project Description, Scoping, Existing Environment, Summary of Effects and Non-Technical Summary. Also responsible for authoring baseline chapter on Local Land Use and Recreational Access.

**Barrel Law Wind Farm
EIA (2012)**

Scottish Borders,
Scotland

Responsible for co-ordinating front-end production of Environmental Impact Statement for a 21MW wind farm at Barrel Law, Hawick. Authored chapters including Project Description, Scoping, Policy Framework and Existing Environment.

PROJECT EXPERIENCE – TRANSPORTATION

**Kosovo Motorway
ESHIA (2010)**

Prizren-Pristine, Kosovo

Golder was commissioned by Bechtel/Enka to prepare Route Corridor Selection Study and Environmental and Social Impact Assessment for approx. 70 km of proposed motorway. As Project Ecologist, role included undertaking ecological constraints mapping for three route options, and multi-disciplinary walkover survey of selected route - coordinating a team of local zoological and botanical experts. Produced Ecological Impact Assessment chapter and devised design mitigation recommendations. Developed tool-box talk regarding dealing with protected species on site during construction.

PROJECT EXPERIENCE – EU HABITATS DIRECTIVE - APPROPRIATE ASSESSMENT

**Report on Cumulative
Impacts of Proposed
Gold Mine (2010)**

Krumovgrad, Bulgaria

Golder were commissioned to technically review a report outlining an Assessment of the compatibility of Natura 2000 site conservation objectives with an investment proposal for the extraction and processing of gold-bearing ore from the Krumovgrad Exploration Area. Role on this project included technical review of the report, identification of information gaps in the cumulative impact assessment, and recommendations for addressing these issues within the report.

**Stage 2 Appropriate
Assessment of WWTP
(2011)**

Kildare, Ireland

Undertook Stage 2 Appropriate Assessments of the discharges from a number of waste water treatment plants (WWTP) on Pollardstown Fen SAC, a groundwater-fed fen habitat which is the largest of its type in Ireland. WWTP that discharged to both surface water systems and groundwater systems were examined for their potential to impact on groundwater quality of the fen and subsequent impacts on the vegetation community composition of the fen, and other water-dependent protected species including the rare, EU-protected whorl snails *Vertigo* spp. Cumulative impact assessment reports regarding Pollardstown Fen SAC and Mouds Bog SAC were also subsequently prepared

Stage 2 Appropriate Assessment - Lidl Supermarket Extension (2011)
Tipperary, Ireland

Project Ecologist for Stage II Appropriate Assessment of proposed upgrade works to retail unit in Clonmel, Co. Tipperary, which is situated adjacent to the River Suir SAC. Role included desktop research and consultations with statutory authorities, Phase I habitat survey of lands between the retail unit and the river, Ecological Impact Assessment and subsequently Stage II Appropriate Assessment report production.

Appropriate Assessment of Quarry discharge to SAC (2011)
Carlow, Ireland

Project Ecologist responsible for undertaking an Appropriate Assessment screening of the potential impacts of a treated quarry wash-water discharge to the River Slaney, which is an SAC protected under the EU Habitats Directive. Surveys included an Extended Phase I habitat survey of the quarry site, and aquatic invertebrate sampling of the River Slaney upstream and downstream of the discharge point to assess any potential impacts of the discharge on the river water biological quality. Consultation with the regional Fisheries Board and the National Parks and Wildlife Service was undertaken and mitigation measures regarding the reduction of silt load in the discharge were recommended.

Proposed Leisure Facility Adjacent to Blessington Lake SPA
Wicklow, Ireland

Undertook Appropriate Assessment Stage 1 (Screening) and subsequent Stage 2 Appropriate Assessment of proposed leisure facility. Acquisition of additional ornithological data in consultation with local NPWS ranger and local birders in progress and final report to be submitted to NPWS for comment.

Appropriate Assessment Screening of Local Area Development Plans (2011)
Kildare, Ireland

Undertook Appropriate Assessment Stage 1 (Screening) for a number of local area plans that could potentially impact significantly on nearby protected sites including SACs and SPAs. Surveys considered features for which these sites are designed including Annex I habitats, wintering bird populations, otter, kingfisher and aquatic species such as brook lamprey.

PROJECT EXPERIENCE – UK & IRELAND: ECOLOGICAL BASELINE STUDIES AND IMPACT ASSESSMENT

Future Biogas - Various sites (2010)
Norfolk, UK

Project Ecologist responsible for undertaking Extended Phase I habitat surveys of three sites in Norfolk for which the construction of biogas plants is proposed. Each site (including a 250m buffer area surrounding the sites) was surveyed and the habitats mapped. Other features considered included hedgerow assessments, bat foraging/commuting/roosting potential assessment, and great crested newt habitat suitability assessments. During this project I was also responsible for training a third-level summer student in botanical identification and habitat mapping techniques; and desk top research and baseline data acquisition

Biffa Landfill Extension (2010)
Cambridgeshire, UK

Project Ecologist responsible for undertaking great crested newt surveys, including presence/absence, evidence of breeding, and population size, age and sex distribution enumeration.

British Sugar Site Extension (2010, 2011)
Norfolk, UK

Project Ecologist responsible for undertaking baseline ecological surveys of three large areas of arable cropland, intersected by numerous drainage ditches, where British Sugar intends to expand their processing plant. Surveys undertaken included Phase I habitat surveys, reptile surveys, and aquatic vegetation assessment and water vole surveys of approximately 3km of drainage ditches.

**Proposed Bioenergy
and Composting
Facility (2011)**
Essex, UK

Project Ecologist responsible for coordinating and undertaking baseline ecological surveys of a former army airbase site, which is to be developed as a quarry and subsequently a bioenergy and composting facility. Surveys included bat roost emergence and re-entry surveys in a number of abandoned farmyard and army base buildings undertaken by 6 surveyors, and great crested newt population presence/absence, evidence of breeding and population assessment surveys undertaken by 5 surveyors within 250m of the site to inform European Protected Species Licence Application; and Extended Phase I Ecology survey of the site including badger surveys to inform the Ecological Impact Assessment of the EIS.

**Otter Survey -
Johnstown Flood
Relief Works (2011)**
Kildare, Ireland

Project ecologist responsible for carrying out an intensive otter survey along the banks of a river channel which is within the range of the local otter population, and which is to be dredged and widened for flood relief works. Otter usage of the site was assessed by sprainting frequency, and spraints were examined for evidence of seasonal dietary habits.

**Ornithological Surveys
for Proposed Wind
Farm (2009)**
Mayo, Ireland

Undertook monthly vantage point and walkover bird surveys on an upland site in the west of Ireland for 6 months, to gather bird site usage data in order to ultimately assess collision risks and other impacts of the construction of a wind farm across the mountainside. Surveys included walkover surveys and vantage point watches; where species, flight height and direction, and behaviour was noted for 3 hour periods at each vantage point on each survey occasion.

**Leixlip Hot Springs/
Spa and Toll House
(2009)**
Kildare, Ireland

Project ecologist responsible for assessing common newt presence/absence in hot spring, and provision of advice to Parks Department on most appropriate season for works, and requirements for Appropriate Assessment in line with the EU Habitats Directive. Also undertook bat roost dusk emergence and dawn re-entry surveys of a derelict toll-house structure adjacent to the Royal Canal to assess the presence/absence of roosting bats.

**Sallins Flood Relief
Works (2010)**
Kildare, Ireland

Undertook Extended Phase 1 Habitat Survey and ecological constraints mapping for proposed flood relief works. Surveys included river habitat assessment, fisheries potential assessment, and survey of trees and structures for potential bat roosts.

**Coastal Habitats
Survey and Mapping
(2009)**
Dublin, Ireland

Golder Associates were retained by Dún Laoghaire-Rathdown County Council to collect, collate and review all available biodiversity data relating to coastal and marine habitats of the 17km coastline of Dún Laoghaire Rathdown. Preliminary habitat maps were derived from aerial photography and in-house Level II habitat classification data holdings, and were ground-truthed by field survey of all accessible areas of the coastline to produce Level III classification habitat mapping. Role included desk top study and collation of available biodiversity data on the locality, and preparation and ground truthing of preliminary habitat maps to refine the habitat mapping of the coastline to Level III habitat classifications.

**Geotextile Assisted
Dewatering of Lakes,
Naas Town Council
(2008)**
Kildare, Ireland

Golder was commissioned by Naas Town Council to prepare a Feasibility Study for the removal of silt from Naas Lakes, Naas, Co. Kildare, and subsequently assisted Naas Town Council in the production of tender documents for the required works. Project Ecologist responsible for undertaking a survey of nesting waterfowl on the lake and provision of recommendations regarding optimum timing of the works, in order to avoid the main bird breeding season and any significant negative impacts on local bird populations; and consulted with the Regional Fisheries Board as to their requirements for the preservation of crayfish and brook/river lamprey populations within the lakes, in order to inform the tendering process.

TRAINING***Tools for Wetland Assessment (WET-Health, WET-Ecosystems)***

Rhodes University, August 2016

Mainstreaming Biodiversity into Business

National Business and Biodiversity Network, South Africa, November, 2014

First Aid Level 1

Action Training Academy, July, 2014

Wetland Management: Introduction and Delineation

University of the Free State, November. 2013

Flora of Witwatersrand

Botany Dept, University of Witwatersrand, October, 2013

Mammal Identification

The Mammal Society, May 2009

Bat Detector Workshop

Bat Conservation Ireland, June 2007, June 2008

Irish Botany

National Botanic Gardens, Glasnevin, Dublin, 2008

Outdoor Safety & First Aid

Mountain Rescue Trainer, November 2007

PROFESSIONAL AFFILIATIONS

Professional Natural Scientist (Pr. Sc. Nat. 114477/15)

Member of South African Bat Assessment Association

Member of South African Wetland Society

PUBLICATIONS**Journal Articles**

Monadjem, A., L. Richards, P. J. Taylor, C. Denys, A. Dower and S. Stoffberg. Diversity of Hipposideridae in the Mount Nimba massif, West Africa, and the taxonomic status of *Hipposideros lamottei*. *Acta Chiropterologica*, 15(2) (2013), 341-352.

Other

The Status of EU Protected Habitats and Species in Ireland. National Parks & Wildlife Service, 2008.



golder.com