



**NOVA GEO
CONSULTING**

Meriden Quarry

Clay Liner CQA Report

NRS Waste Care Ltd

Prepared by:

NOVA GEO CONSULTING LIMITED

Job No: 25-273
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Drawings

25-273-D-001	Topographic Survey (March 2025)
25-273-D-002	Cross Sections

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1.0 INTRODUCTION

Nova Geo Consulting (NGC) were commissioned to undertake Construction Quality Assurance (CQA) validation of the clay liner constructed at the 'Banana Field' void, Cornets End Lane, Meriden Quarry, Meriden, Solihull (hereafter referred to as "the site"). The purpose of the CQA works is to verify that the clay liner has been constructed in accordance with the approved design specifications, relevant guidance, and regulatory requirements.

2.0 DESCRIPTION OF WORKS

The first phase of the clay liner has been completed along the southern, south-western, and eastern extents of the 'Banana Field' void and has been highlighted on drawing 25-273-D-001.

The construction of the completed clay liner took place between March 2023 and September 2024 and is summarised below.

2.1 Site Location

The quarry is located off Cornets End Lane and approximately 1.5km to the southwest of the centre of Meriden village, see Diagram 1 below.

The National Grid Reference of Meriden Quarry (South) is 423000mE 281400mN.

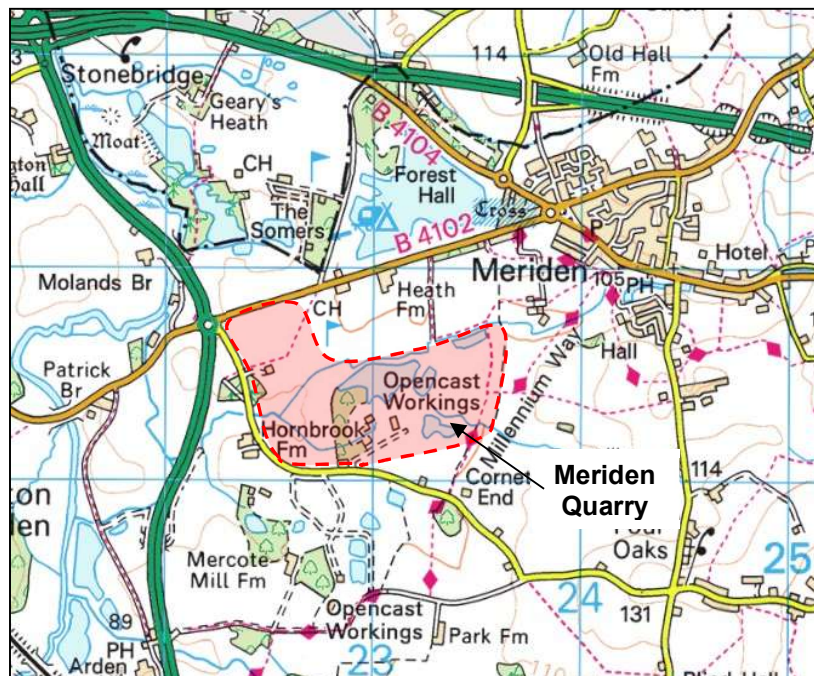


Diagram 1 - Site Location (Reproduced by permission of Ordnance Survey all rights reserved)

2.2 Site Drainage

As part of the approved restoration scheme, Cornets End Brook, which was temporarily diverted to facilitate quarrying, will be reinstated on its approximate original alignment. In addition, several small ponds are proposed along the brook corridor, integrated within a wildlife-enhanced ecological corridor. The brook and associated ponds are designed to be clay-lined and hydraulically connected, with sufficient capacity to retain water throughout the year.

As the restored inert waste will have a lower soakaway capacity than pre-development conditions, a network of land drains is proposed within the restoration profile. These drains will discharge to a storm-balancing pond located in the north-western area of the site, which will in turn discharge to the reinstated Cornets End Brook.

2.3 Site Clearance and Foundation Preparation

The restoration scheme requires the formation of a quarry void suitable for infilling with inert material. Clay / mudstone associated with the Mercia Mudstone sequence present at the quarry floor has been excavated and utilised in the construction of the sidewall clay liner.

2.4 Selection of Construction Materials

2.4.1 Chemical Suitability

The geological barrier forming part of the restoration scheme comprises site-won Mercia Mudstone clay. This material is inherently low permeability and is considered suitable for use as a geological barrier, subject to Construction Quality Assurance testing.

2.4.2 Physical Suitability

The Mercia Mudstone clay used for the sidewall liner is derived from the quarry floor and is considered suitable for placement as a low-permeability barrier. The liner is designed to be a minimum of 3 m thick and to meet the required permeability criteria, as demonstrated through CQA testing.

2.5 Placement of Construction Materials

It is a requirement of the construction to ensure that the artificial geological barrier be as follows:

- The perimeter side slopes of the restored areas shall be formed at a gradient to ensure stability.

- The barrier shall be formed of selected naturally occurring, non-organic (residual clays from the sand and gravel extraction) materials occurring on site.
- The material used shall be placed at a permeability of 1×10^{-7} m/s or less.
- The artificial barrier shall be constructed to a minimum thickness of 1m in any direction.
- The material forming the artificial geological barrier shall be placed in layers with a maximum uncompacted thickness of 350mm.
- All phases of barrier construction shall be adequately “keyed-in” to any previous phases, such that a continuous barrier underlies the proposed area of restoration.
- The barrier shall be placed directly against the base and side slopes of the extraction area.

2.5.1 Construction of the Geological Barrier

NRS personnel report that the clay was excavated from the floor of the excavation and placed and compacted in layers. Compaction was undertaken using a Hamm H13i self-propelled vibratory roller. The completed liner geometry has been verified through comparison of the topographic surveys and permeability testing.

As this is the first phase of barrier construction, there were no previous phases to key into.

The site survey shows a minimum sidewall thickness of 3.8 meters has been placed at the crest of the slope, and an overall slope gradient of 1V in 2H has been achieved.

2.5.2 Agricultural Restoration Profile

The restored agricultural land will comprise a full soil profile consisting of a minimum of 300 mm of topsoil over 300 mm of subsoil, underlain by 600 mm of overburden material previously stripped and stored on site. This 1.2 m soil profile is designed to restore the land to best and most versatile agricultural quality (Grades 2/3a).

The restoration will also include native grass and wildflower margins at least 6 m wide around the boundaries of the restored arable farmland.

2.6 Compliance Testing of the Geological Barrier

The geological barrier was tested and confirmed as having achieved the appropriate level of permeability in accordance with the requirements of the CQA Plan.

- Three field permeability tests were undertaken by NGC following the construction of the clay liner

- The drawing, 25-273-D-001 shows the approximate locations of the permeability tests undertaken
- Results of the permeability testing are provided in Section 3.2 of this report.

2.7 Supervision of Works

Construction supervision and record keeping were undertaken by NRS Meriden Quarry personnel, including retention of logs and photographic records. NGC have reviewed the completed works as part of this CQA validation report.

2.8 Topographic Surveys

A topographic survey was undertaken after the artificial geological barrier was constructed; however, no survey was undertaken before the construction.

In the absence of a pre-construction survey, it has been assumed that quarrying operations removed the sand and gravel deposit to the base of the worked mineral horizon. The pre-construction excavation profile has therefore been inferred based on typical quarry face geometry and visible crest positions.

For the sidewall (along the southern margin) it is reasonable to assume that the temporary excavation slope in the sand and gravel is as present elsewhere on the site, being excavated to approximately 70°, the top of the sand and gravel excavation is visible behind the crest of the constructed clay liner. For the sidewall profiles of the excavation, this face geometry has been projected down to the base of the quarry void.

The topographic survey and cross sections (with pre-construction survey shown on) are presented as drawings 25-273-D-001 and 25-273-D-002.

The surveys demonstrate that a sidewall geological barrier of a minimum width of 3.8m has been placed from the crest of the slope down, based on 1V in 2H in artificial geological barrier and 70° buried face. (See cross section drawing 25-273-D-002).

3.0 COMPLIANCE TESTING

3.1 Contaminant Testing of Materials Used in Construction

The geological barrier comprises site-won Mercia Mudstone clay, which is naturally occurring and considered chemically suitable for use as a geological barrier.

3.2 Permeability Testing

Three permeability tests were undertaken on samples taken at the locations indicated on Drawing 25-273-D-001, using a Permeability in a Triaxial Cell test in accordance with *BS 1377: Part 6: 1990: Clause 6*, to demonstrate that adequate permeability of the geological barrier was achieved. The results of the tests are summarised in Table 1 below and included in full in Appendix 1.

Test Reference	Test Result	Description
44094 - 241700	1.6x10 ⁻⁹ m/s	Undisturbed. Firm orangish brown slightly gravelly sandy CLAY
44094 - 241701	2.1x10 ⁻⁹ m/s	Undisturbed. Firm red brown mottled dark grey slightly gravelly sandy CLAY
44094 - 241702	5.1x10 ⁻⁹ m/s	Undisturbed. Firm reddish brown mottled light grey gravelly sandy CLAY

Table 1 - Summary of Permeability Tests

3.3 Conclusion of Material Compliance Testing

The permeability values obtained are all below the specified maximum permeability of 1×10^{-7} m/s and therefore comply with the design requirements of the geological barrier.

4.0 SUMMARY

This Construction Quality Assurance Report has been prepared by Nova Geo Consulting (the CQA Engineer) on behalf of NRS Waste Care Ltd and relates to the recent construction of a landfill barrier at Meriden Quarry.

The construction of the completed clay liner took place between March 2023 and September 2024 and is the first phase of the 'Banana Field' void clay liner, which has so far been completed along the southern, south-western, and eastern extents.

This report provides a description of the works and details of the compliance testing undertaken on the barrier materials in order to ensure conformity with the requirements stipulated by the Environment Agency.

No tipping of waste should commence at the site until this report has been submitted to, and agreed in writing by, the Environment Agency.

As proposed in the CQA Plan, following this initial CQA Validation report for area of construction, and subsequent acceptance in writing by the Environment Agency, subsequent individual areas of clay liner within this cell/phase will be validated by the CQA Engineer and advised to the EA following each stage of construction.

Based on the available information, including laboratory permeability testing and verification of liner geometry through topographic survey and cross-sections, the artificial geological barrier constructed at the Banana Field void is considered to comply with the permeability and thickness requirements specified for the restoration scheme.

APPENDIX 1
Permeability Results

PERMEABILITY IN A TRIAXIAL CELL

Location 1
 Sample Ref 1
 Sample Depth 0.30 m
 Sample Type CC

Description:

Firm orangish brown slightly gravelly sandy CLAY.

SPECIMEN DETAILS

Depth within original sample 2mm
 Orientation within original Vertical
 Specimen preparation Undisturbed

TEST DETAILS

		INITIAL	FINAL
Diameter	mm	99.12	98.36
Height	mm	101.50	100.72
Water Content	%	14.9	17.7
Bulk Density	Mg/m ³	2.07	2.17
Dry Density	Mg/m ³	1.80	1.84
Average Laboratory Temperature	°C	20	
Source of Permeant Water		De-aired tap water	

SATURATION STAGE

Saturation initially by constant water content, followed by back-pressure assistance.

Pore pressure coefficient ('B' value) 0.80 0.95

CONSOLIDATION STAGE

Effective pressure kPa 100
 Volume change mL 18.0

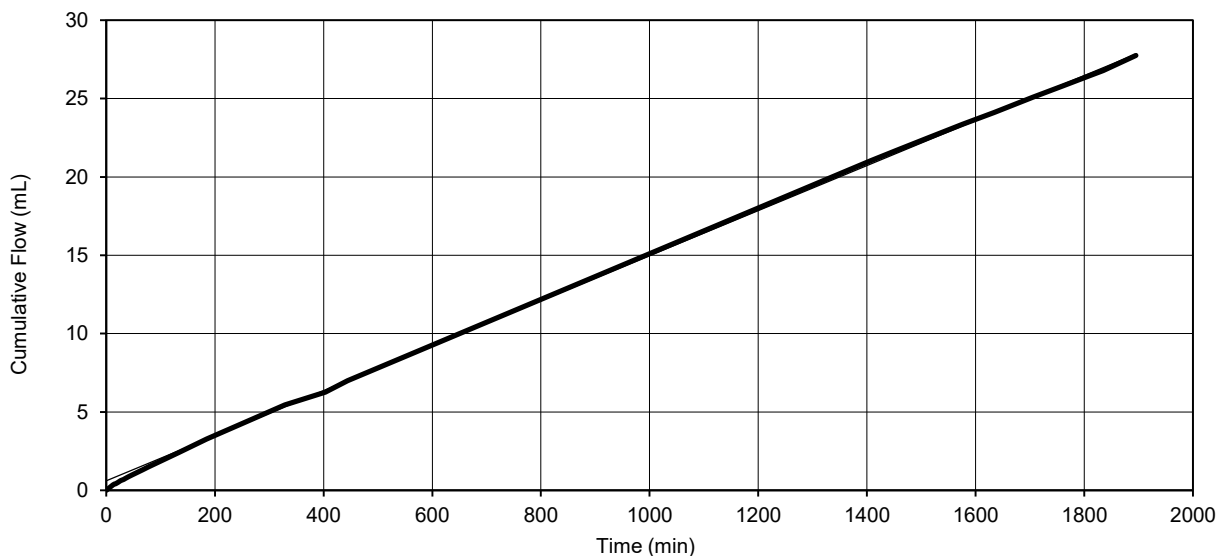
PERMEABILITY STAGE

Measured under constant head conditions in a triaxial cell

Pressure difference across specimen kPa 20
 Hydraulic gradient 20.2
 Mean effective stress kPa 100
 Correction for head loss kPa 0

TEST DURATIONS

Saturation days 2
 Consolidation days 2
 Flow days 2

Coefficient of Permeability $k_v \text{ at } 20^\circ\text{C} = 1.6 \times 10^{-9} \text{ m/s}$ 

Tested by DN

Checked and Approved by

P. Heritage

P Heritage - Project Manager
 09/02/2026

Project Number:

GEO / 44094

Project Name:

MERIDEN QUARRY
25-273

GEOLABS

PERMEABILITY IN A TRIAXIAL CELL

Location 2
 Sample Ref 2
 Sample Depth 0.30 m
 Sample Type CC

Description:

Firm red brown mottled dark grey slightly gravelly sandy CLAY. Gravel and sand fine to medium.

SPECIMEN DETAILS

Depth within original sample 10mm
 Orientation within original Vertical
 Specimen preparation Undisturbed

TEST DETAILS

		INITIAL	FINAL
Diameter	mm	98.36	97.88
Height	mm	101.28	100.79
Water Content	%	23.1	24.1
Bulk Density	Mg/m ³	1.92	1.97
Dry Density	Mg/m ³	1.56	1.59
Average Laboratory Temperature	°C	20	
Source of Permeant Water		De-aired tap water	

SATURATION STAGE

Saturation initially by constant water content, followed by back-pressure assistance.

Pore pressure coefficient ('B' value) 0.51 0.97

CONSOLIDATION STAGE

Effective pressure kPa 100
 Volume change mL 11.3

PERMEABILITY STAGE

Measured under constant head conditions in a triaxial cell

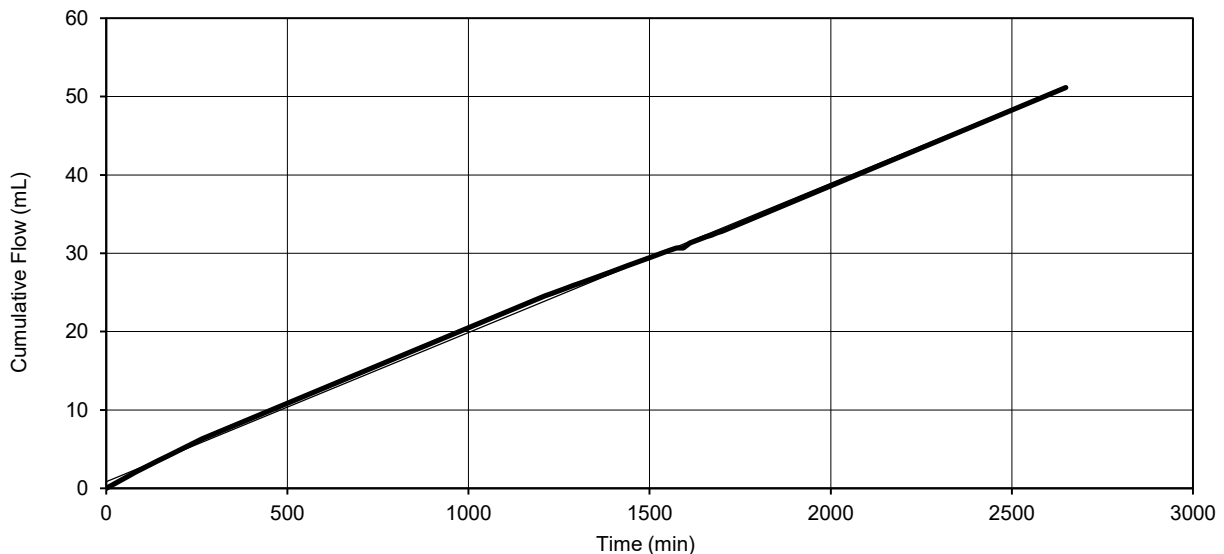
Pressure difference across specimen kPa 20
 Hydraulic gradient 20.2
 Mean effective stress kPa 100
 Correction for head loss kPa 0

TEST DURATIONS

Saturation days 3
 Consolidation days 1
 Flow days 2

Coefficient of Permeability

k_v at 20 °C = 2.1×10^{-9} m/s



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P. Heritage

P Heritage - Project Manager
 13/02/2026

Project Number:

GEO / 44094

Project Name:

**MERIDEN QUARRY
 25-273**

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PERMEABILITY IN A TRIAXIAL CELL

Location 3
 Sample Ref 3
 Sample Depth 0.30 m
 Sample Type CC

Description:

Firm reddish brown mottled light grey gravelly sandy CLAY. Gravel and sand fine to coarse.

SPECIMEN DETAILS

Depth within original sample n/a
 Orientation within original n/a
 Specimen preparation Undisturbed

TEST DETAILS

		INITIAL	FINAL
Diameter	mm	99.63	99.06
Height	mm	101.53	100.94
Water Content	%	22.2	22.6
Bulk Density	Mg/m ³	1.99	2.03
Dry Density	Mg/m ³	1.63	1.65
Average Laboratory Temperature	°C	20	
Source of Permeant Water		De-aired tap water	

SATURATION STAGE

Saturation initially by constant water content, followed by back-pressure assistance.

Pore pressure coefficient ('B' value) 0.60 0.96

CONSOLIDATION STAGE

Effective pressure kPa 100
 Volume change mL 13.6

PERMEABILITY STAGE

Measured under constant head conditions in a triaxial cell

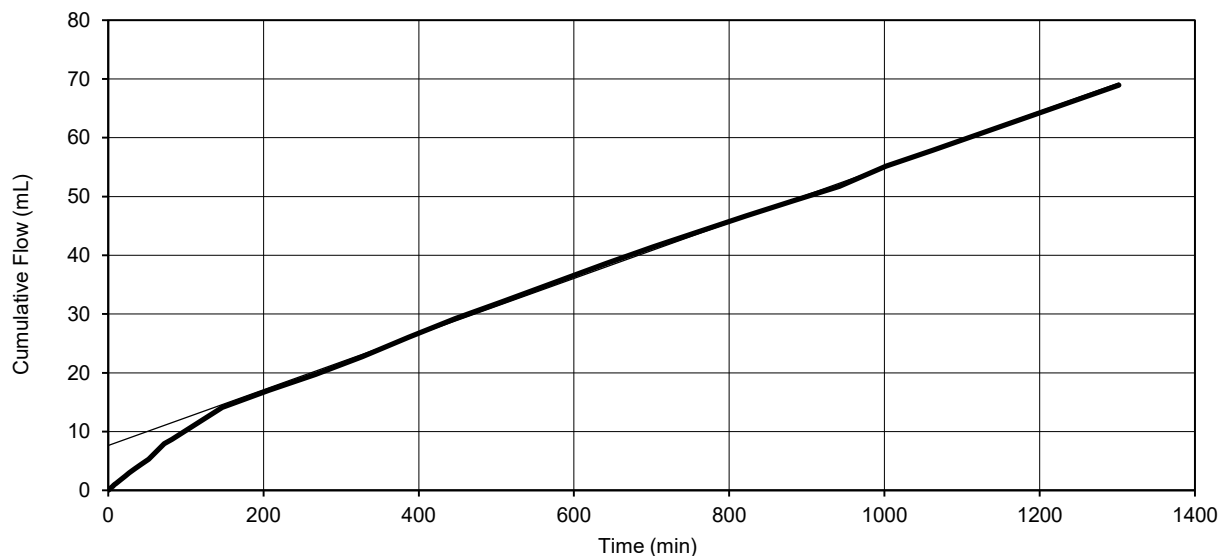
Pressure difference across specimen kPa 20
 Hydraulic gradient 20.2
 Mean effective stress kPa 100
 Correction for head loss kPa 0

TEST DURATIONS

Saturation days 3
 Consolidation days 1
 Flow days 1

Coefficient of Permeability

k_v at 20 °C = 5.1×10^{-9} m/s



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Checked and Approved by

P. Heritage

P Heritage - Project Manager
 06/03/2026

Project Number:

GEO / 44094

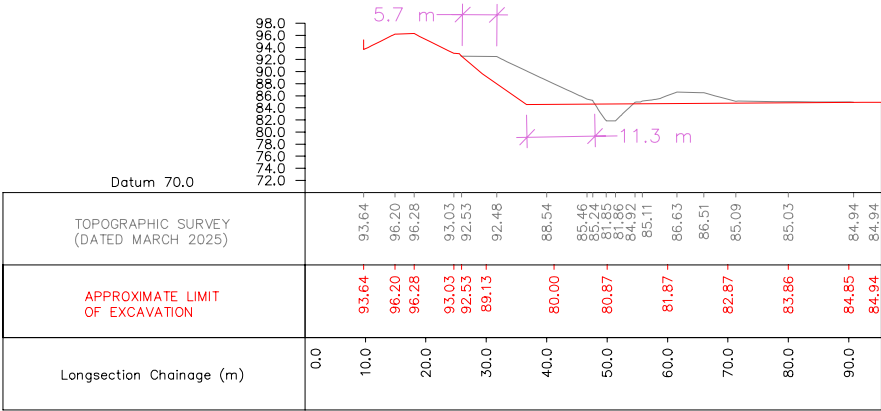
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**MERIDEN QUARRY
 25-273**

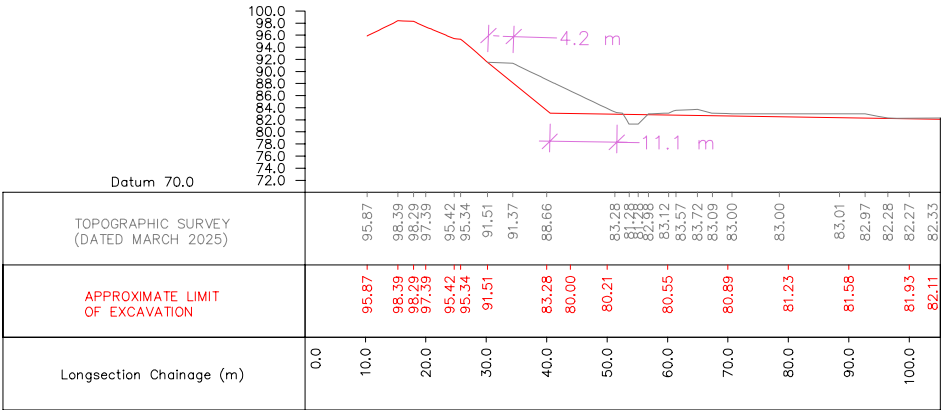
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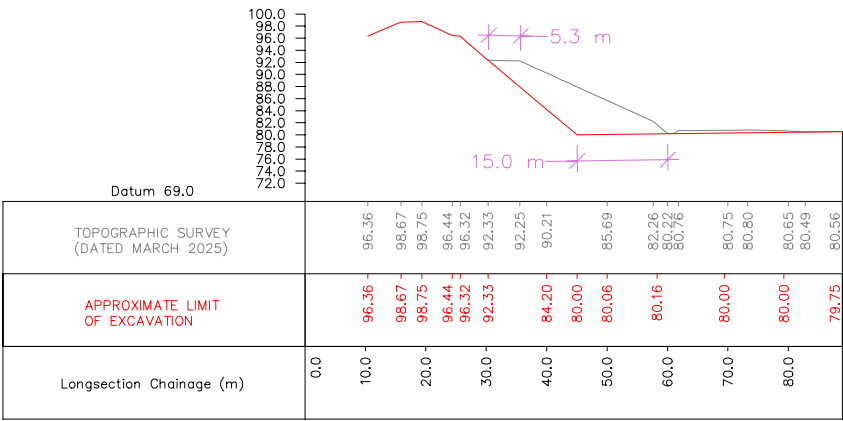
Drawings



XS 1 - 1'



XS 2 - 2'



XS 3 - 3'

NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

01	First Issue	RB	17/12/25
Rev.	Revision Detail	Drawn	Date

CLIENT:



PROJECT:

MERIDEN QUARRY

TITLE:

BANANA FIELD
CROSS SECTIONS

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SCALE:	1:1250	ORIGINAL SHEET SIZE:	A3	STATUS:	DRAFT

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NOVA GEO CONSULTING LTD



Photo 1. Material placement prior to wetting



Photo 2. Material compaction

Photos