PT-CE Ltd

PODE HOLE QUARRY LANDFILL

Stability Risk Assessment

UK0038843.2142-WSP-RP-GW-0004_C03
OCTOBER 2025

CONFIDENTIAL

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. UK0038843.2142

OUR REF. NO. UK0038843.2142-WSP-RP-GW-0004_C03

DATE: OCTOBER 2025

WSP

Attenborough House, Browns Lane Business Park
Stanton-on-the-Wolds
Nottingham
NG12 5BL

Phone: +44 115 9371111

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Final for Issue			
Date	14 October 2025			
Prepared by	Bo Zhang			
Signature	bo.zhang@wsp.com Digitally signed by bo.zhang@wsp.com DN: cn=bo.zhang@wsp.com Date: 2025.10.15 10:17:22 +01'00'			
Checked by	Russell Jones			
Signature	Jones, Russell (UKDRJ850) Digitally signed by Jones, Russell (UKDRJ850) DN: cn=Jones, Russell (UKDRJ850), ou=Active, email=russell.jones@wsp.com Location: Nottingham, UK Date: 2025.10.15 11:03:50 +01'00'			
Authorised by	Russell Jones			
Signature	Jones, Russell (UKDRJ850) Digitally signed by Jones, Russell (UKDRJ850) DN: cn=Jones, Russell (UKDRJ850), ou=Active, email=russell.jones@wsp.com Location: Nottingham, UK Date: 2025.10.15 11:04:05 +01'00'			
Project number	UK0038843_2142			
Report number	Report Ref UK0038843_2142-WSP-RP-GW-0003 C03			
File reference				

CONTENTS

TABLES

APPENDICES

APPENDIX SRA1

SIDE SLOPE SUB-GRADE AND LINER ANALYSES

APPENDIX SRA2

TEMPORARY WASTE SLOPE ANALYSES

1 INTRODUCTION

1.1 REPORT CONTEXT

This Stability Risk Assessment (SRA) Report has been prepared by WSP UK Ltd (WSP), on behalf of PT-CE Ltd (PT-CE), in support of its application for an Environmental Permit (EP) for waste Deposit for Recovery (DfR) (hereafter referred to as the 'permit application') for Pode Hole Quarry, The Causeway, Thorney, Peterborough PE6 0QH (hereafter referred to as the 'Site').

The Stability Risk Assessment has been prepared in accordance with the Environment Agency R&D Technical Report P1-385/TR2 (Reference 1). The assistance of PT-CE in the provision of data for this work is gratefully acknowledged. WSP has not independently verified any of the information supplied.

1.2 PROPOSED DEVELOPMENT AND PROJECT OBJECTIVES

Aggregate Industries has engaged Quarry Restoration Partnerships Ltd to deliver restoration of the Site. The restoration proposal for the Site is described in Planning Permission Ref. 18/02044/MMFUL dated 12 April 2019 for the "Importation of up to 1,807,000 cubic metres of inert waste to restore Pode Hole Quarry".

The Directive on Waste (2008/98/EC), amended in 2018 (2018/851) includes a definition of 'backfilling' as a recovery operation where suitable non-hazardous waste is used for reclamation in excavated areas or for engineering in landscaping (i.e. waste material is used instead of non-waste material to perform a function). To take advantage of this definition, Planning Permission Ref. 19/01373/NONMAT dated 16 October 2019 was subsequently issued to amend the wording of Condition 20 and 22 of Planning Permission Ref. 18/02044/MMFUL to remove reference to the 'waste hierarchy' and refer to the use of 'inert materials' to restore the quarry as opposed to 'waste materials'. This is to enable restoration to be performed as a waste for recovery operation rather than as landfilling of waste.

Restoration of the Site will be undertaken using either site-won topsoil or by selected imported waste soils. The waste soils imported will be placed as subsoils. The topsoil will be stripped from relevant areas of the Site, stored and then placed on top of the imported waste. This will ensure that the imported waste is not used as a growing surface medium.

On completion of filling to final levels, the majority of the Site will be restored back to farmland and has been designed to create a congruous landform that contains similar profiles and features to the surrounding landscape. The restored landform will maintain the existing direction of surface drainage towards the southeast of the Site. The southeast corner of the Site will be restored as grassland and wetland with a wildlife pond.

This document forms the SRA to support the DfR permit application for restoration of the site and aims to assess the potential stability related risks of restoring the quarry with inert materials. This report should be read in conjunction with the updated Environmental Setting and Installation Design (ESID) Report (report ref. UK0038843.2142-WSP-RP-GW-0002).

1.3 GEOLOGY

1.3.1 REGIONAL GEOLOGY

The British Geological Survey Sheet 158 for Peterborough (1:50,000 scale) and BGS Geoindex indicates that the Site is underlain by Quaternary River Terrace deposits which overlie the Jurassic Oxford Clay Formation and Kellaways Sand. The geological succession is summarised in **Table 1-1**.

Table 1-1 – Summary of Regional Geology

Age	Formation	Description	Approximate Thickness (m)
Quaternary	River Terrace Deposits	Sand and gravel, locally with lenses of silt, clay or peat.	Variable
Jurassic	Oxford Clay (Lower Part – Peterborough Member)	Olive grey fossiliferous, bituminous shale and blocky mudstone.	63 – 76 m
	Kellaways Sand	Grey clayey silt and mudstone.	1.9 – 6.4 m
	Kellaways Clay	Grey fissile mudstone.	1.4 – 5.8 m
	Cornbrash	Fine grained shell-detrital limestone.	1.2 – 4.3 m
	Blisworth Clay	Grey/Green mudstone with thin limestone.	3.0 – 6.0 m
	Blisworth Limestone	Shell-detrital to micritic limestone with marl and mudstone.	1.9 – 5.1 m

There is a small area of Tidal Flat deposits mapped in the southern part of the Site and no superficial deposits are mapped along the eastern part of the Site. The River Terrace Deposits are also mapped to the west and south of the Site but are not laterally extensive; other superficial deposits such as Tidal Flat Deposits, which normal comprise a soft silty clay, and Peat dominate the mapped superficial geology east of the Site and further to the south. No faults are mapped at the Site.

1.3.2 LOCAL GEOLOGY

Current ground levels in the surrounding area are fairly flat and at about 3 m above Ordnance Datum (AOD). The Site currently has a shallow undulating landform that is mostly below surrounding ground level.

Within the quarry void are semi-restored areas backfilled with overburden materials, areas where the underlying Oxford Clay has been excavated and replaced in engineered layers, and stockpiles of sub-soil and topsoil.

There are four BGS borehole records located within the Site (BGS, 2023 – BGS borehole references TF20SE4, TF20SE5, TF20SE50 and TF20SE51). These describe the local geology as comprising topsoil over silty sands, and sand and gravel to between about 4 m and 6 m below ground level, underlain by a grey, blue-grey or bluish-green clay. This geology correlates well with additional logs from boreholes and trial pits completed in 1989, 1991 and 2017 on nearby parcels of land also targeted for sand and gravel reserves (Aggregate Industries, 2017 and 2018). These show topsoil underlain by around 3 m to 8 m (but typically to about 6 m) of alternating layers of sand and gravel, and silty clay (River Terrace Deposits), that are underlain by a grey clay (Oxford Clay).

A deeper BGS borehole (TF20SW53) located approximately 850 m to the south-west of the site reports 0.61 m of topsoil with underlying River Terrace Deposits to a depth of 8.23 m BGL (thickness of 7.62 m), and then Oxford Clay to a depth of 18.59 m BGL (thickness of 10.36 m), beneath which lies the "Kellaways Beds" comprising 0.31 m of "stone" to 18.9 mBGL (likely to be the Kellaways Sands) over 5.18 m "blue clay" to 24.08 mBGL (likely to be the Kellaways Clay). Another BGS borehole in the vicinity of the Site (TF20SW55) recorded a thickness of Oxford Clay of 15.24 m and Kellaways Sand of 1.53 m.

Six monitoring wells were installed at the Site during April 2024 (Key GeoSolutions, 2024). The works involved drilling six boreholes to depths ranging between 4.0 and 7.4 metres below ground level (mBGL) and installing monitoring wells (BH01 to BH06) to depths ranging between 3.0 mBGL and 6.1 mBGL. The geology encountered is summarised in **Table 1-2** and broadly correlates with that found in BGS boreholes and during earlier ground investigations.

Table 1-2 – Summary of Geology Encountered in 2024 Ground Investigation

Depth (mBGL)	Thickness (m)	Geology
0.5 – 0.7	0.5 – 0.7	Soft dark brown sandy clay topsoil
0.5 – 1.1	0.2 – 0.4	Soft brown mottled orange-brown slightly sandy gravelly clay – River Terrace Deposits.
07 – 0.8	0.1	BH05 only: Mottled brown slightly clayey gravelly sand – River Terrace Deposits.
0.7 – 6.4	2.2 – 5.5	Orange-brown slightly clayey very sandy gravel (flint and sst) – River Terrace Deposits. A layer of soft grey slightly gravelly silt was encountered in BH02 from 5.0-5.1 mBGL (0.1 m thick), in BH05 from 2.8-4.1 mBGL (1.3 m thick) and in BH06 from 2.9-4.0 mBGL (1.1 m thick).
3.0 – 7.4 (Base not proven)	1-1.1 (Thickness not proven)	Stiff to very stiff bluish grey clay - Oxford Clay

1.4 CONCEPTUAL STABILITY MODEL

1.4.1 BASAL SUB-GRADE AND LINING MODEL

The basal sub-grade comprises *in-situ* Oxford Clay. The Oxford Clay is greater than 10 m thick in the vicinity of the Site. This will also form the basal geological barrier.

1.4.2 SIDE SLOPES SUB-GRADE AND LINING MODEL

The sides of the quarry (landfill) currently comprise sand and gravel which does not form a natural geological barrier. In line with the Landfill Directive requirements, an artificial geological barrier with a hydraulic conductivity of no great than 1 x 10-7 m/s and a minimum thickness of 1.0 m (or equivalent) will be placed against the exposed gravel at the edges of the excavation. The artificially established geological barrier will comprise Oxford Clay sourced directly from the base of the Site. A clay batter was installed in 2016/2017 along an approximately 300 m section of the quarry sides in the southwest corner of the Site. It is understood that the clay batter was constructed in approximate 300 mm layers and compacted with a sheepsfoot roller, but no further details have been made available.

1.4.3 WASTE MASS MODEL

Only suitable inert restoration materials will be imported for the purpose of the quarry restoration in order to comply with the requirements of DfR. The inert restoration materials in this case will include soils, subsoils and minerals. These materials will not be classified as hazardous waste.

Temporary waste slopes are required in between cells. The gradient of temporary waste slope is subject to the outcome of this stability risk assessment. The final waste slopes are relatively flat in accordance with the proposed restoration contours.

1.4.4 CAPPING SYSTEM MODEL

On completion of filling to final levels, the majority of the Site will be restored back to farmland and has been designed to create a congruous landform that contains similar profiles and features to the surrounding landscape. No formal capping system will therefore be required.

1.4.5 LEACHATE EXTRACTION SYSTEM MODEL

Leachate collection, management and monitoring will not be required as the Site will only accept waste that meets the inert waste criteria and will be regulated on entry to the Site.

2 STABILITY RISK ASSESSMENT

2.1 RISK SCREENING

2.1.1 BASAL SUB-GRADE AND LINING SYSTEM SCREENING

The site investigation data indicates there are no cavities beneath the Site. The Oxford Clay at the base is considered to be stable and not subject to any significant total or differential settlement.

Basal heave is not considered to be a concern at the Site due to the significant thickness of the Oxford Clay. Therefore, no basal heave assessments are required.

2.1.2 SIDE SLOPE SUB-GRADE AND LINING SYSTEM SCREENING

For the western side slope (Section A, Drawing ESID5), the sand and gravel slope has been formed to a shallow gradient of approximately 1v:3h, prior to 1 m thick engineered clay liner being placed to the slope. The stability of the western side slope sub-grade and liner requires assessment.

For the southern side slope (Section B, Drawing ESID5), the sand and gravel slope has been formed to a steep slope of approximately 2v:1h. A clay batter was installed in 2016/2017 along an approximately 300 m section of the quarry sides in the southwest corner of the Site. It is envisaged that similar arrangement will be adopted in the future to place a clay batter against any steep sand and gravel slopes to form a shallow clay liner slope gradient of approximately 1v:3h. The stability of the southern side slope sub-grade and liner requires assessment.

2.1.3 WASTE SCEENING

The analysis of the temporary waste slopes will start with an initial proposed gradient of 1v:2h. The effect of rainfall infiltration has been modelled using an r_u value of 0.1.

2.1.4 CAPPING SYSTEM SCREENING

No capping system is present hence no such assessment is required.

2.1.5 LEACHATE EXTRACTION SYSTEM SCREENING

No leachate extraction system is present hence no such assessment is required.

2.2 SELECTION OF APPROPRIATE FACTORS OF SAFETY

2.2.1 FACTOR OF SAFETY FOR SIDE SLOPES SUB-GRADE AND LINER

A minimum factor of safety of 1.3 against failure in the side slope sub-grade and liner will be considered acceptable providing reasonably conservative material strength parameters have been used.

2.2.2 FACTOR OF SAFETY FOR WASTE MASS

A minimum factor of safety of 1.3 against failure in the waste mass will be considered acceptable providing reasonably conservative material strength parameters have been used.

2.3 JUSTIFICATION FOR MODELLING APPROACH AND SOFTWARE

Methods of analysis are those described in the de facto Environment Agency Guidelines 'Stability of Landfill Lining Systems' (Reference 1).

2.3.1 STABILITY OF SITE SLOPE SUB-GRADE AND LINER

The analysis of the side slope sub-grade and line has been carried out for circular failure surfaces (Morgenstern-Price method) using the Slope/W computer code. The clay lining system has been assessed using both total stress and effective stress conditions. Groundwater levels in the sub-grade have been modelled using a peizometric surface. Further effect of the pore water pressure has been modelled using the pore water pressure coefficient, i.e. an r_u value.

2.3.2 STABILITY OF TEMPORARY WASTE SLOPES

The analysis of the anticipated temporary waste slopes with a gradient of 1v:2h have been carried out for a range of failures using the Slope/W computer code. Potential leachate levels of 1 m and 2 m have been modelled using a peizometric line. The effects of rainfall infiltration and potential leachate recirculation have also been modelled using the pore water pressure coefficient, i.e. an r_u value.

2.4 JUSTIFICATION OF GEOTECHNICAL PARAMETERS SELECTED FOR ANALYSES

This section describes the parameters used in the Stability Risk Assessment. Parameter values have been selected based on a combination of the available site data, WSP's in-house experience and the technical literature (References 2). At all stages in the analysis conservative parameters have been selected, and where practicable, ultimate limit state parameters checked to ensure that failure is not likely with extreme conditions. The geotechnical parameters should be verified by site-specific tests during the construction stage.

2.4.1 PARAMETERS SELECTED FOR SIDE SLOPE SUB-GRADE AND LINER ANALYSES

The material parameters used in the Slope/W analyses of the side slopes sub-grade and liner are presented in **Table 2-1**.

Table 2-1: Parameters Selected for Side Slope Sub-Grade Analyses

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (°)
Compacted Clay - Undrained	19	50	-
Compacted Clay - Drained	19	2	24
In Situ Oxford Clay	19	3	24
Sand and Gravel	18	0	35

2.4.2 PARAMETERS SELECTED FOR WASTE ANALYSES

The material parameters used in the Slope/W analyses of the temporary waste slope are presented in **Table 2-2.**

Table 2-2: Parameters Selected for Waste Analyses

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (°)
Waste	16	1	23

2.5 ANALYSES

Two cross sections have been selected for slope stability assessment, the locations of which are shown on Drawing ESID5.

Section A represents the typical cross section for the western slope analyses, as shown in Drawing ESID5.

Section B represents the typical cross section for the southern slope analyses, as shown in Drawing ESID5.

2.5.1 SIDE SLOPE SUB-GRADE AND LINER ANALYSES

A summary of the Slope/W runs for the side slope sub-grade and liner stability are presented in **Table 2-3**, and the output files are given in **Appendix SRA1**.

Table 2-3: Summary of Slope/W Runs for Side Slope Analyses

Ref	Description	Factor of Safety
Section A_1.1	1v:3h side slope subgrade, dry	2.13
Section A_1.2	1v:3h side slope subgrade, piezometric surface without drainage	0.86
Section A_1.3	1v:3h side slope subgrade, piezometric surface with drainage	1.39
Section A_2.1	1v:3h side slope subgrade and liner, undrained condition	1.49
Section A_2.2	1v:3h side slope subgrade and liner, drained condition	1.49
Section A_2.3	1v:3h side slope subgrade and liner, drained condition, r_u = 0.2	1.69
Section B_1.1	1v:3h side slope clay bund, dry, undrained condition	2.31
Section B_1.2	1v:3h side slope clay bund, dry, drained condition	1.70
Section B_1.3	1v:3h side slope clay bund, piezometric surface without drainage	1.08
Section B_1.4	1v:3h side slope clay bund, piezometric surface with drainage	1.67
Section B_1.5	1v:3h side slope clay bund, piezometric surface with drainage	1.38

2.5.2 WASTE SLOPE ANALYSES

A summary of the Slope/W runs for the temporary waste slopes is presented in **Table 2-4** and the output files are given in **Appendix SRA2**.

Table 2-4: Summary of Slope/W Runs for Temporary Waste Analyses

Ref	Description	Factor of Safety
SRA2.1	Typical temporary waste slope, 1v:2h gradient, dry	1.07
SRA2.2	Typical temporary waste slope, 1v:2.5h gradient, dry	1.30
SRA2.3	Typical temporary waste slope, 1v:3h gradient, dry	1.52
SRA2.4	Typical temporary waste slope, 1v:3h gradient, r_u = 0.1	1.38

2.6 ASSESSMENT

2.6.1 SIDE SLOPES SUB-GRADE AND LINER ASSESSMENT

The analyses of the side slope sub-grade for Section A show that the factors of safety against circular failure for dry material is 2.13. When the side slope is analysed with a full piezometric surface is developed (i.e. without a toe drain), the factor of safety reduces to 0.88. With an effective toe drain installed, the factor of safety increases back to 1.88. The 1v:3h side slope sub-grade stability is therefore considered satisfactory, provided that an effective toe is put in place during construction.

2.6.2 SIDE SLOPES LINER ASSESSMENT

Following placement of a layer of compacted clay on top of the 1v:3h side slope subgrade (Section A), the factor of safety calculated with undrained clay strength is 1.49, which is considered satisfactory. When drained parameters are applied for the compacted clay, the factor of safety remains at 1.49. Further analysis with an r_u value of 0.2 adopted for all materials (without a piezometric surface) shows the factor of safety increases to 1.69. This is considered satisfactory.

For Section B where a clay bund is used to buttress the steep sand and gravel face, the factor of safety calculated with undrained clay strength is 2.31. The factor of safety reduces to 1.70 when drained parameters are adopted for the compacted clay under the dry condition. When the clay bund is analysed with a full piezometric surface is developed (i.e. without a toe drain), the factor of safety reduces to 1.08. With an effective toe drain installed, the factor of safety increases back to 1.67. Further analysis with an r_u value of 0.2 adopted for all materials (without a piezometric surface) shows the factor of safety increases to 1.38. This is considered satisfactory.

2.6.3 WASTE ASSESSMENT

For a typical temporary waste slope with a gradient of 1v:2h, the factor of safety against circular failure is calculated as 1.07 for a dry condition. This is considered unsatisfactory, and the slope gradient will need to be reduced.

When the slope gradient is reduced to 1v:2.5h, the factor of safety increases to 1.30 for a dry condition. Whilst this meets the minimum requirement, the factor of safety is expected to reduce below 1.3 with any pore water pressure build-up. The slope gradient should therefore be further reduced.

When the slope gradient is further reduced to 1v:3h, the factor of safety increases further to 1.52 for a dry condition. When an r_u value of 0.1 is applied, the factor of safety reduces to 1.38. This is considered satisfactory.

3 STABILITY MONITORING

3.1 BASAL SUB-GRADE MONITORING

Basal sub-grade monitoring is not deemed necessary.

3.2 SIDE SLOPE SUB-GRADE MONITORING

The side slopes sub-grade system should be visually monitored during construction for any signs of groundwater ingress.

3.3 BASAL LINING SYSTEM MONITORING

Site-specific shear strength testing should be undertaken to verify that the materials on site are in accordance with the parameters used within this assessment.

3.4 SIDE SLOPE LINING SYSTEM MONITORING

Site-specific shear strength testing should be undertaken to verify that the materials on site are in accordance with the parameters used within this assessment.

3.5 WASTE MASS MONITORING

Site-specific shear strength testing should be undertaken to verify that the materials on site are in accordance with the parameters used within this assessment. The temporary waste slopes will have a gradient not greater than 1v:3h, based on the assumed waste shear strength. The temporary waste slopes should be monitored for signs of instability on a weekly basis and immediately after any heavy rainfall period.

3.6 CAPPING SYSTEM MONITORING

As there is no formal capping system, no monitoring is necessary.

4 REFERENCES

1) Environment Agency 2003, *'Stability of Landfill Lining Systems: Report No 1 Literature Review'*, R & D Technical Report, Ref. P1-385/TR1, 2003.

2) D R V Jones, D Taylor & N Dixon (1997), *Shear Strength of Waste and its use in Landfill Stability Analysis. Proc. Geoenvironmental Engineering conf.*, Yong & Thomas (eds.), Thomas Telford, London, pp. 343-350.

3) D R V Jones & N Dixon (1998), *The stability of geosynthetic landfill lining systems*, *Geotechnical Engineering of* Landfills, Thomas Telford, pp. 99-117.

Appendix SRA1

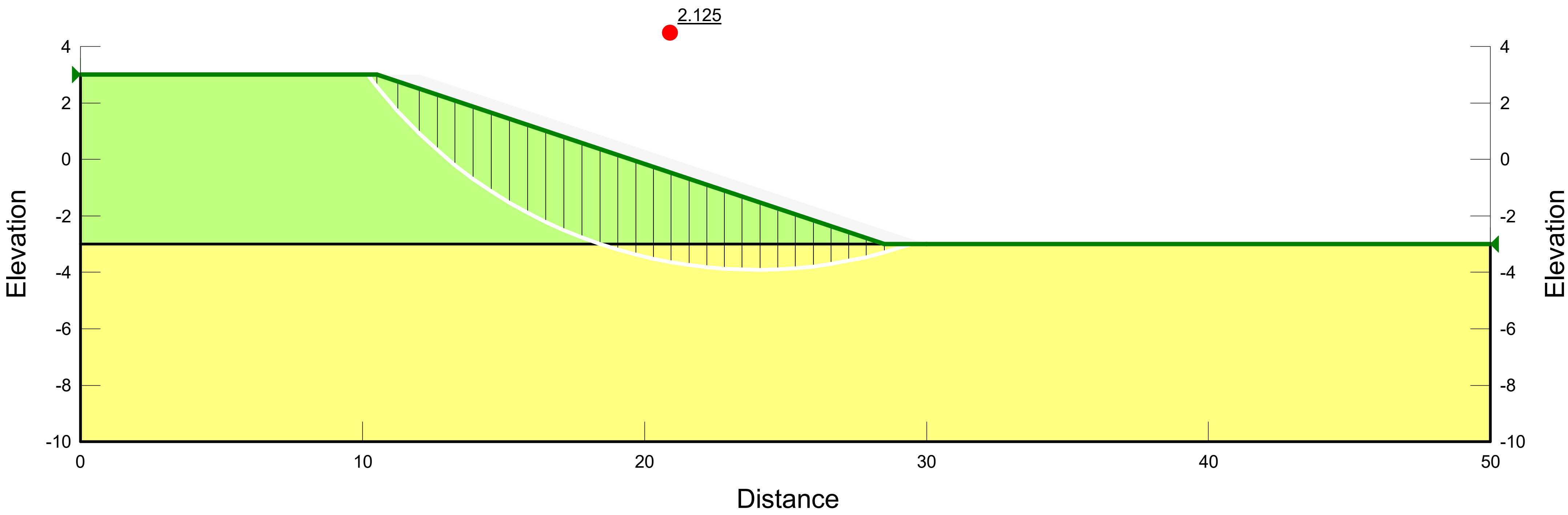
SIDE SLOPE SUB-GRADE AND LINER ANALYSES

CROSS SECTION
Section B

SCENARIO
Section A_1.1_Dry

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
Yellow	Oxford Clay	Mohr-Coulomb	19	3	24
Green	Sand and Gravel	Mohr-Coulomb	18	0	35



CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

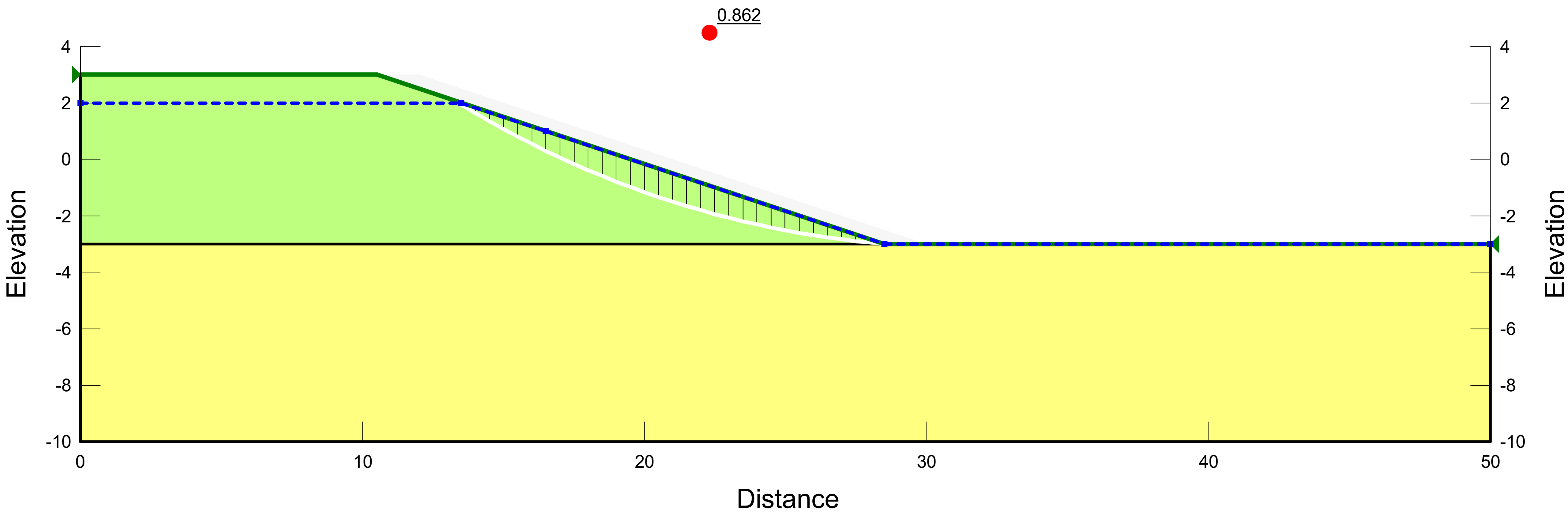
FOR INFORMATION

CROSS SECTION
Section B

SCENARIO
Section A_1.2_GW1

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	Oxford Clay	Mohr-Coulomb	19	3	24	1
	Sand and Gravel	Mohr-Coulomb	18	0	35	1



CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

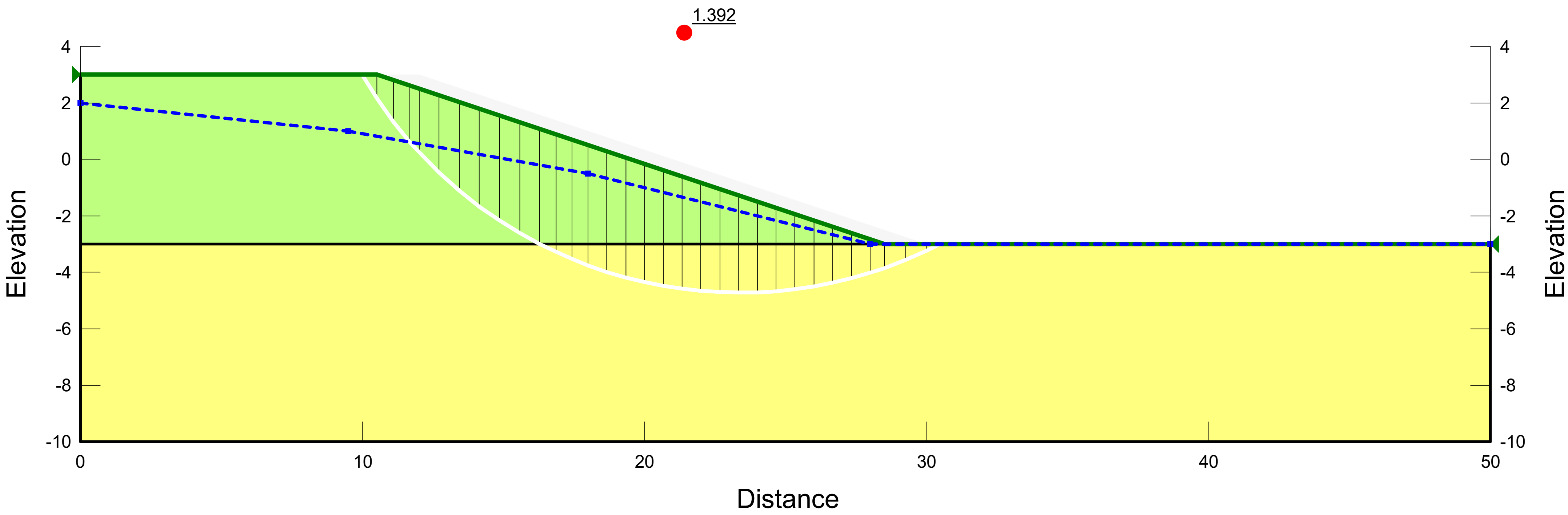
FOR INFORMATION

CROSS SECTION
Section B

SCENARIO
Section A_1.3_GW2

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	Oxford Clay	Mohr-Coulomb	19	3	24	1
	Sand and Gravel	Mohr-Coulomb	18	0	35	1



CLIENT
PT-CE Ltd

CONSULTANT

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

PROJET
Pode Hole Stability Risk Assessment

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

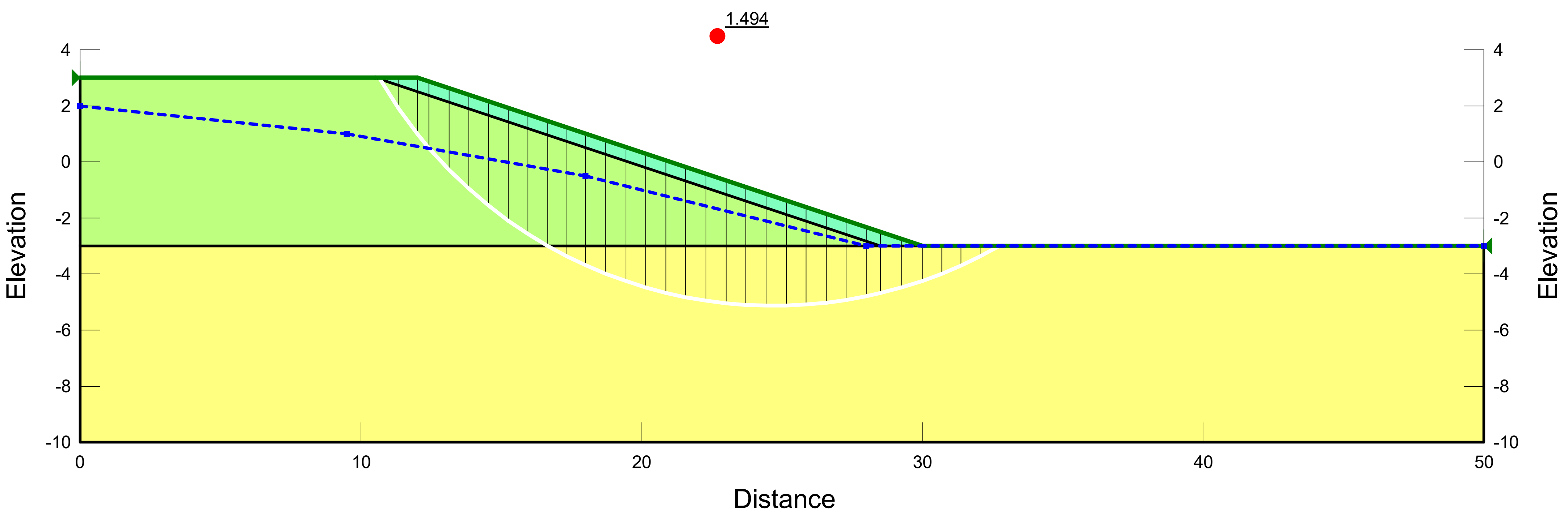
FOR INFORMATION

CROSS SECTION
Section B

SCENARIO
Section A_2.1_GW2

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface	Undrained Shear Strength (kPa)
	Compacted Clay - Undrained	Undrained (Phi=0)	19			1	50
	Oxford Clay	Mohr-Coulomb	19	3	24	1	
	Sand and Gravel	Mohr-Coulomb	18	0	35	1	



CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT
wsp

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

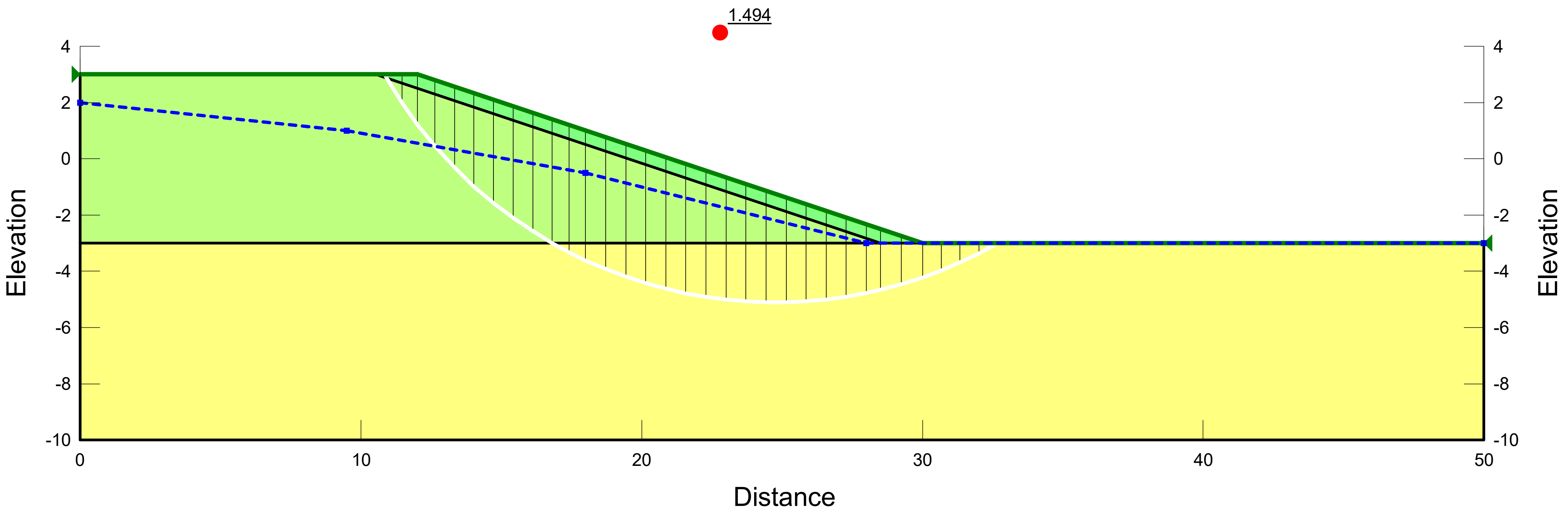
TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

FOR INFORMATION

CROSS SECTION	Section B
SCENARIO	Section A_2.2_GW2
LOADING CONDITION	STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
(green)	Compacted Clay	Mohr-Coulomb	19	2	24	1
(yellow)	Oxford Clay	Mohr-Coulomb	19	3	24	1
(light green)	Sand and Gravel	Mohr-Coulomb	18	0	35	1



CLIENT	PT-CE Ltd
CONSULTANT	wsp
DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

PROJET	Pode Hole Stability Risk Assessment
TITLE	Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

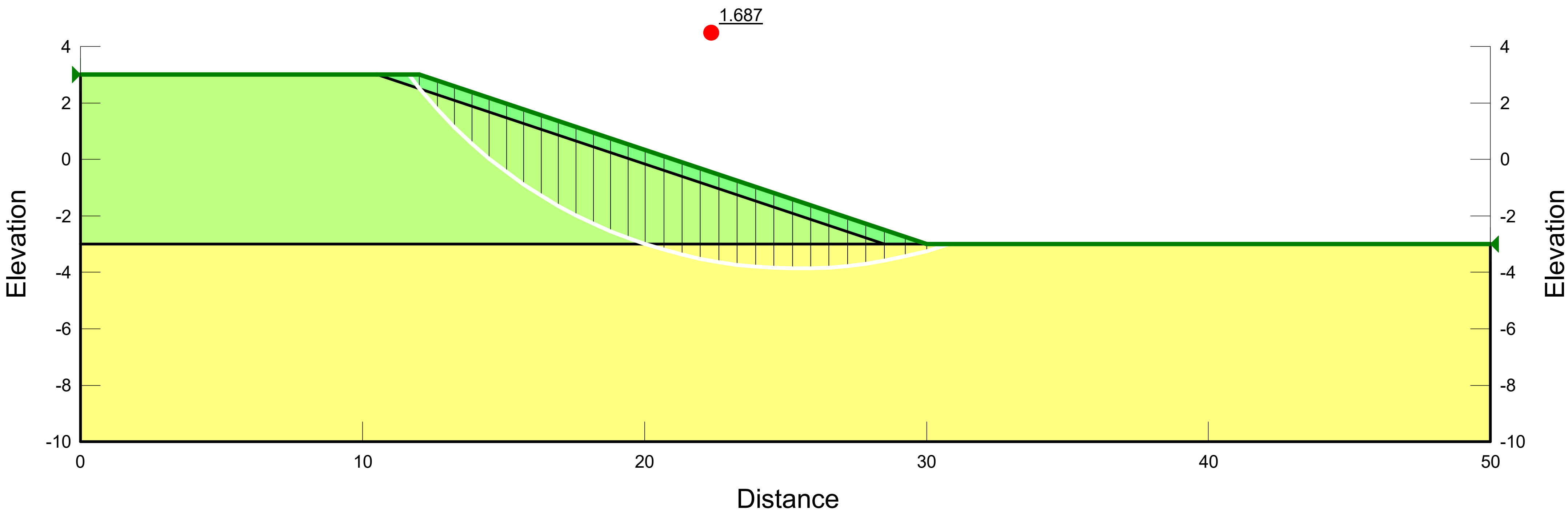
FOR INFORMATION

CROSS SECTION
Section B

SCENARIO
Section A_2.3_ru=0.2

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Ru
	Compacted Clay	Mohr-Coulomb	19	2	24	0.2
	Oxford Clay	Mohr-Coulomb	19	3	24	0.2
	Sand and Gravel	Mohr-Coulomb	18	0	35	0.2



CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

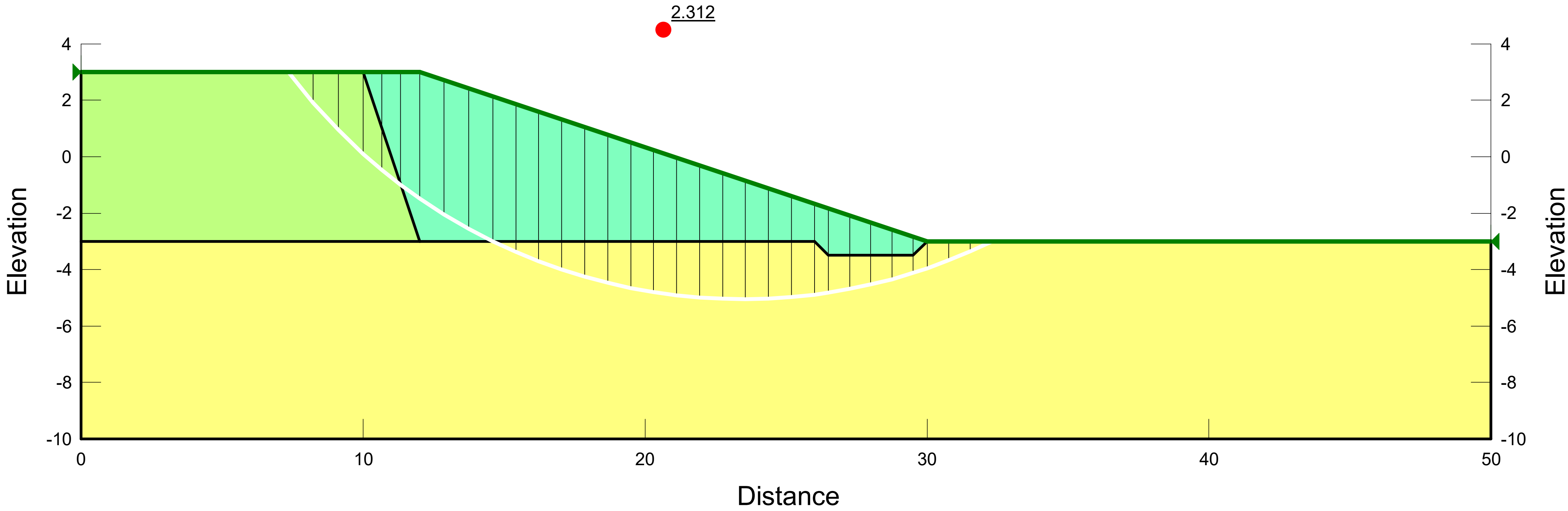
FOR INFORMATION

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Undrained Shear Strength (kPa)
	Compacted Clay - Undrained	Undrained (Phi=0)	19			50
	Oxford Clay	Mohr-Coulomb	19	3	24	
	Sand and Gravel	Mohr-Coulomb	18	0	35	

CROSS SECTION
Section B

SCENARIO
Section B_1.1_Undrained

LOADING CONDITION
STATIC



CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

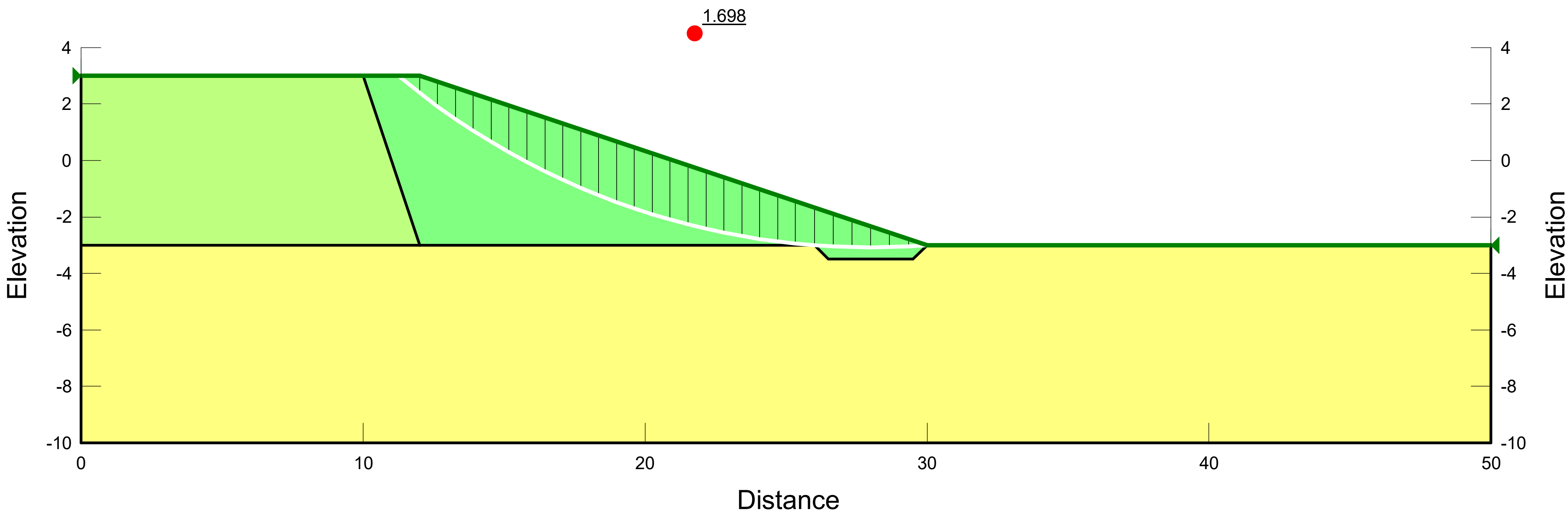
FOR INFORMATION

CROSS SECTION
Section B

SCENARIO
Section B_1.2_Dry

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Compacted Clay	Mohr-Coulomb	19	2	24
	Oxford Clay	Mohr-Coulomb	19	3	24
	Sand and Gravel	Mohr-Coulomb	18	0	35



CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

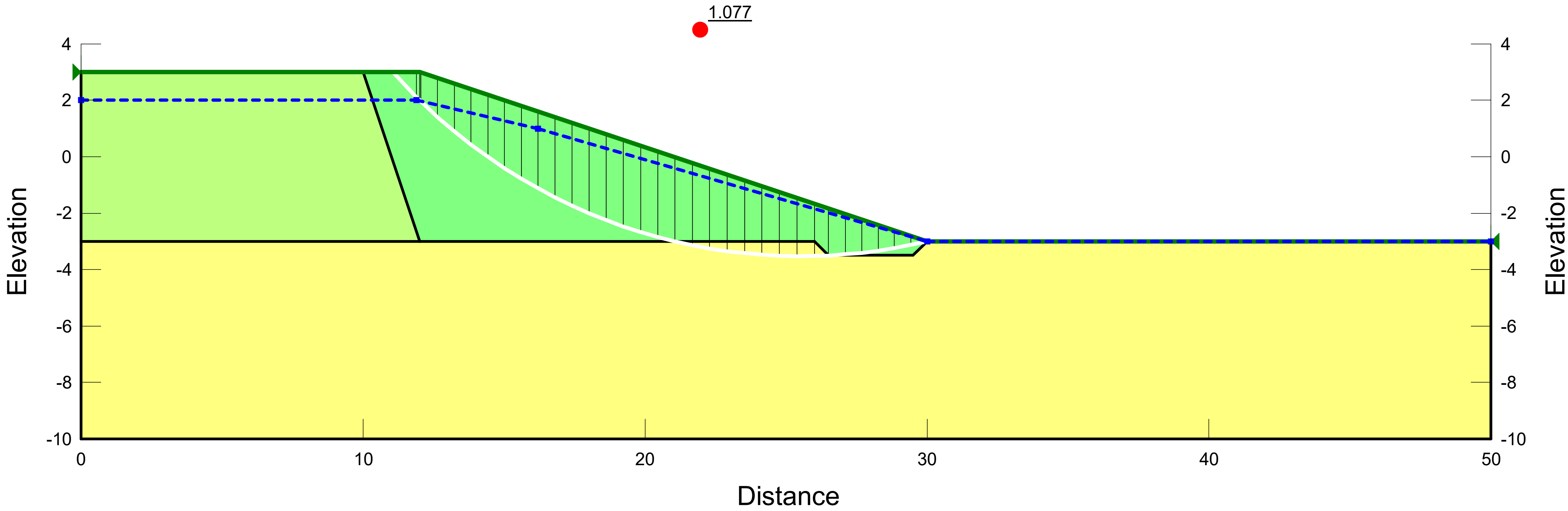
TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

FOR INFORMATION

CROSS SECTION	Section B
SCENARIO	Section B_1.3_GW1
LOADING CONDITION	STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	Compacted Clay	Mohr-Coulomb	19	2	24	1
	Oxford Clay	Mohr-Coulomb	19	3	24	1
	Sand and Gravel	Mohr-Coulomb	18	0	35	1



CLIENT	PT-CE Ltd
PROJET	Pode Hole Stability Risk Assessment
CONSULTANT	wsp
DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ
TITLE	Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

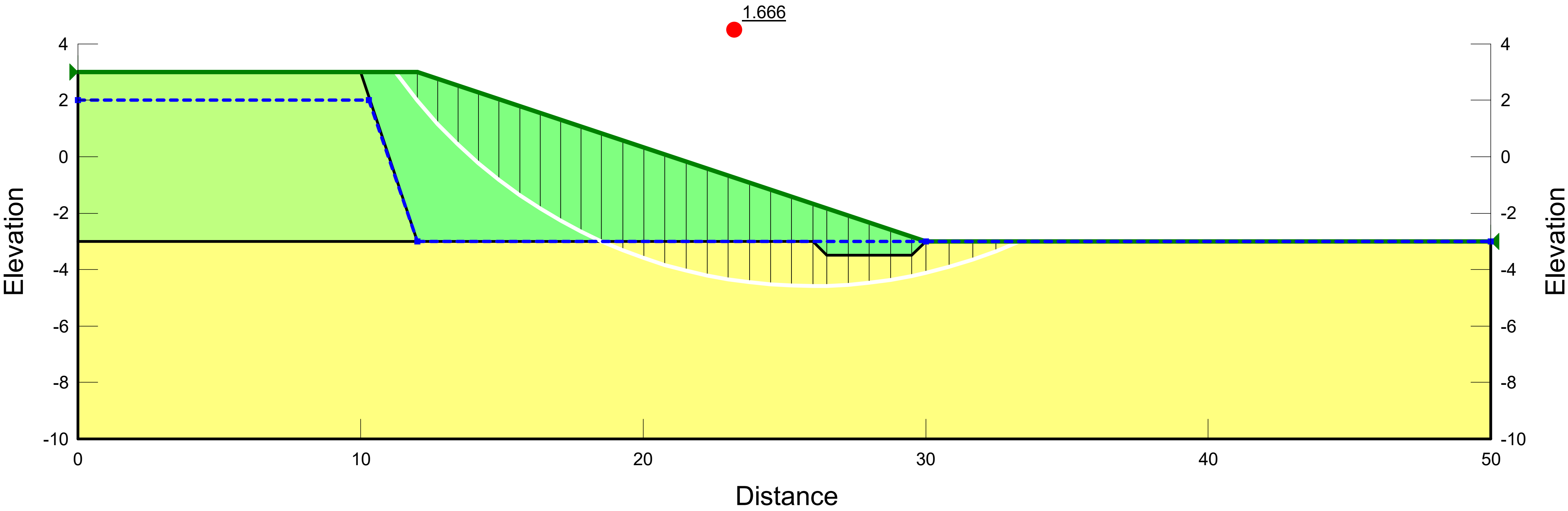
FOR INFORMATION

CROSS SECTION
Section B

SCENARIO
Section B_1.4_GW2

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	Compacted Clay	Mohr-Coulomb	19	2	24	1
	Oxford Clay	Mohr-Coulomb	19	3	24	1
	Sand and Gravel	Mohr-Coulomb	18	0	35	1



CLIENT	
PT-CE Ltd	

CONSULTANT		
wsp	DATE	02/07/2025
	PREPARED	BZ
	REVIEWED	DRVJ
	APPROVED	DRVJ

PROJET
Pode Hole Stability Risk Assessment

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

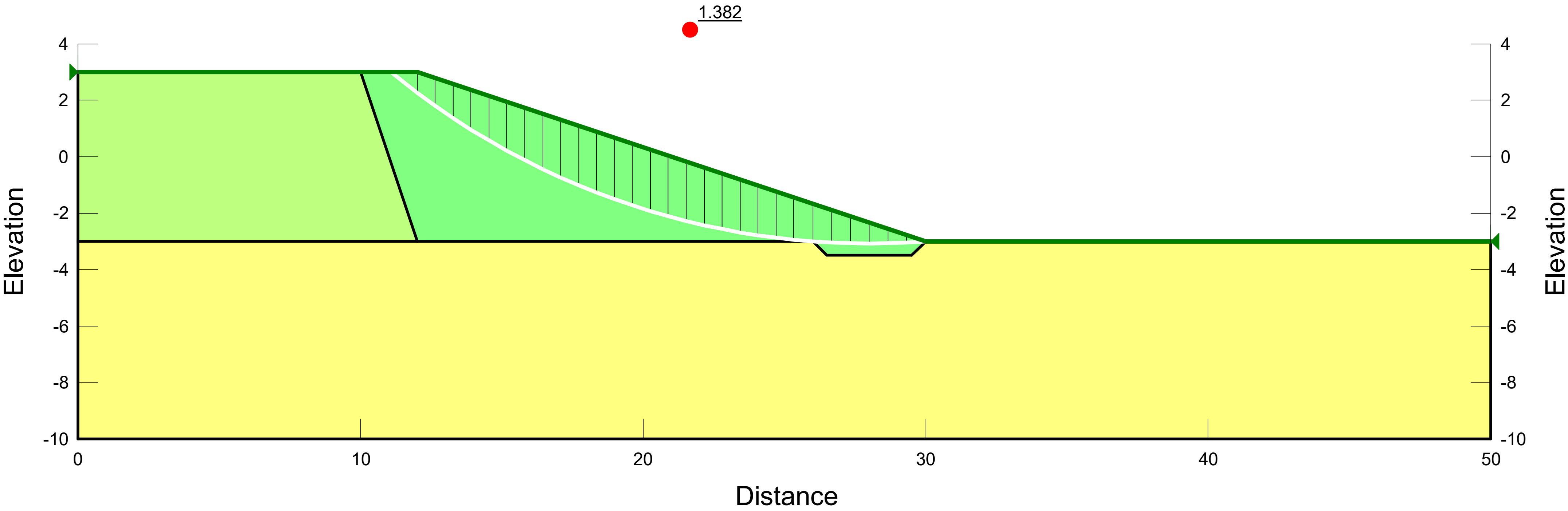
FOR INFORMATION

CROSS SECTION
Section B

SCENARIO
Section B_1.5_ru=0.2

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Ru
	Compacted Clay	Mohr-Coulomb	19	2	24	0.2
	Oxford Clay	Mohr-Coulomb	19	3	24	0.2
	Sand and Gravel	Mohr-Coulomb	18	0	35	0.2



CLIENT
PT-CE Ltd

CONSULTANT
wsp

DATE	02/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

PROJET
Pode Hole Stability Risk Assessment

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

FOR INFORMATION

Appendix SRA2

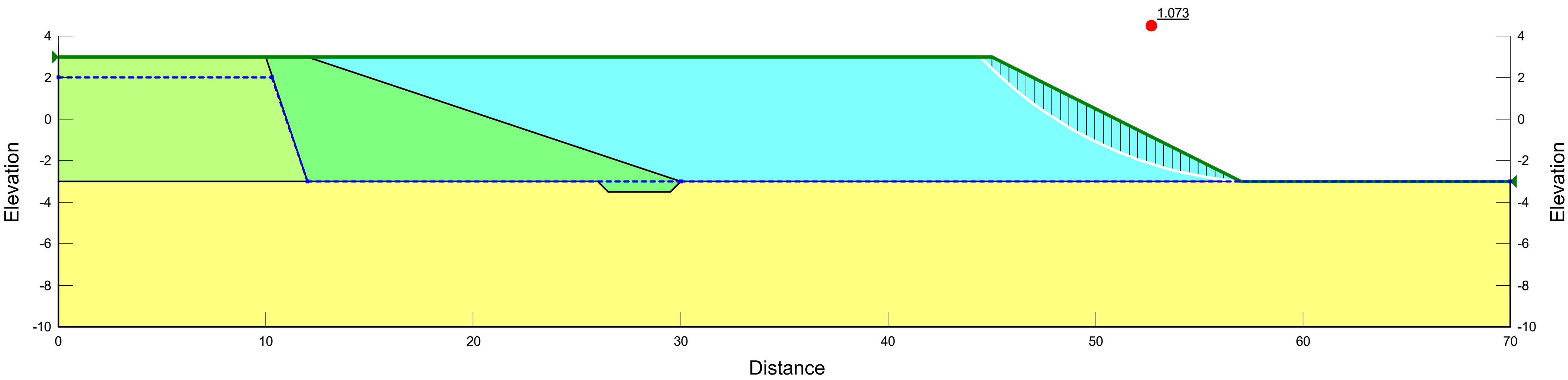
TEMPORARY WASTE SLOPE ANALYSES

CROSS SECTION
Typical 1 in 2

SCENARIO
SRA2.1_Waste_Dry

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	Compacted Clay	Mohr-Coulomb	19	2	24	1
	Inert Waste	Mohr-Coulomb	16	1	23	1
	Oxford Clay	Mohr-Coulomb	19	3	24	1
	Sand and Gravel	Mohr-Coulomb	18	0	35	1



CLIENT
PT-CE Ltd

CONSULTANT
wsp

DATE	03/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

PROJET
Pode Hole Stability Risk Assessment

TITLE
Side Slope Subgrade and Liner Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA1	A	NTS	SRA1

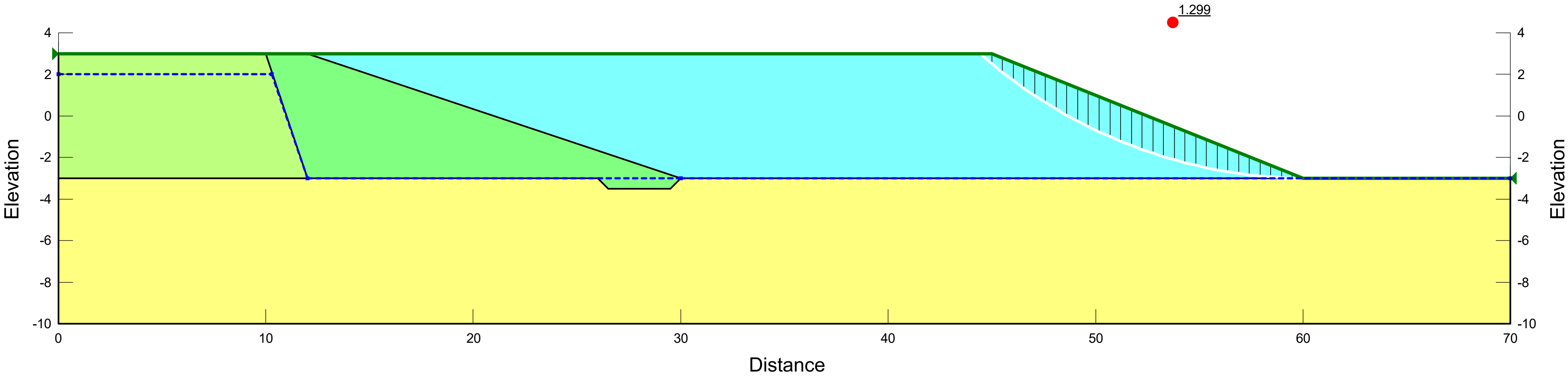
FOR INFORMATION

CROSS SECTION
Typical 1 in 2.5

SCENARIO
SRA2.1_Waste_Dry

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	Compacted Clay	Mohr-Coulomb	19	2	24	1
	Inert Waste	Mohr-Coulomb	16	1	23	1
	Oxford Clay	Mohr-Coulomb	19	3	24	1
	Sand and Gravel	Mohr-Coulomb	18	0	35	1



FOR INFORMATION

CLIENT
PT-CE Ltd

CONSULTANT
wsp

DATE	03/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

PROJET
Pode Hole Stability Risk Assessment

TITLE
Side Slope Subgrade and Liner Analyses

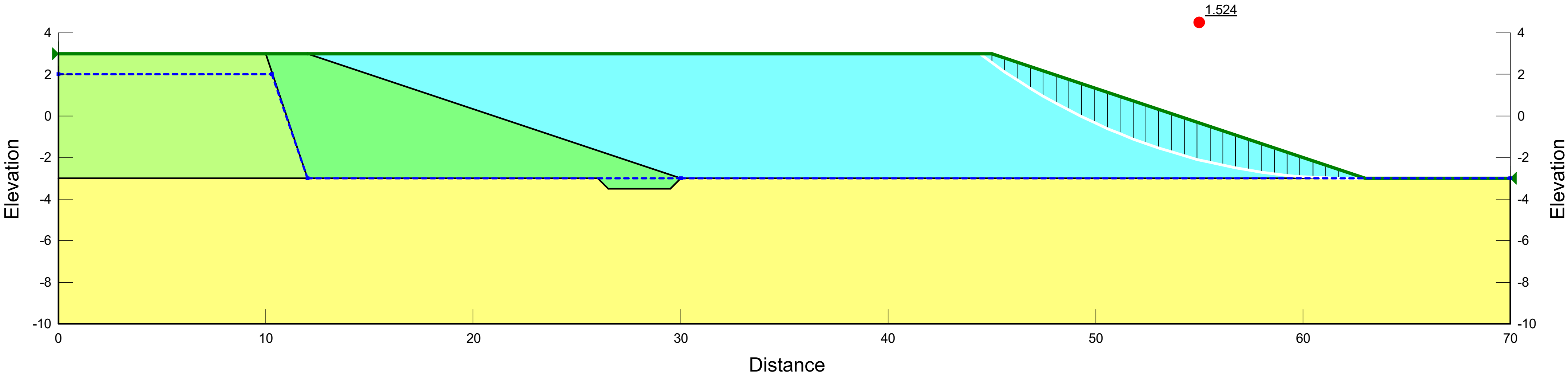
PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA2	A	NTS	SRA2

CROSS SECTION
Typical 1 in 3

SCENARIO
SRA2.3_Waste_Dry

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	Compacted Clay	Mohr-Coulomb	19	2	24	1
	Inert Waste	Mohr-Coulomb	16	1	23	1
	Oxford Clay	Mohr-Coulomb	19	3	24	1
	Sand and Gravel	Mohr-Coulomb	18	0	35	1



CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT

wsp

DATE	03/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

TITLE
Temporary Waste Slope Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA2	A	NTS	SRA2

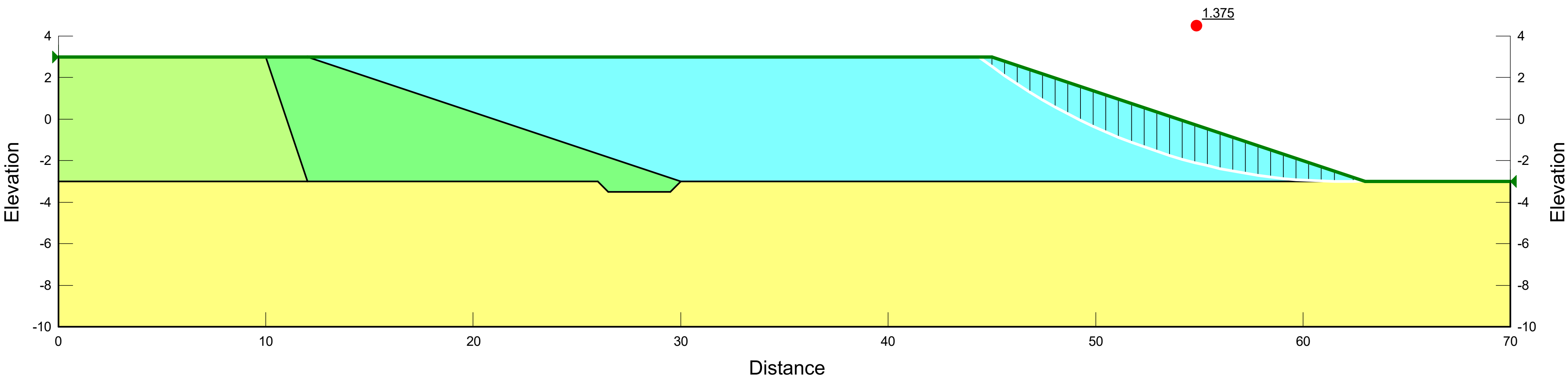
FOR INFORMATION

CROSS SECTION
Typical 1 in 3

SCENARIO
SRA2.4_Waste_ru=0.1

LOADING CONDITION
STATIC

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Ru
	Compacted Clay	Mohr-Coulomb	19	2	24	0
	Inert Waste	Mohr-Coulomb	16	1	23	0.1
	Oxford Clay	Mohr-Coulomb	19	3	24	0
	Sand and Gravel	Mohr-Coulomb	18	0	35	0



FOR INFORMATION

CLIENT
PT-CE Ltd

PROJET
Pode Hole Stability Risk Assessment

CONSULTANT
wsp

DATE	03/07/2025
PREPARED	BZ
REVIEWED	DRVJ
APPROVED	DRVJ

TITLE
Temporary Waste Slope Analyses

PROJECT NO.	APPENDIX	REV	SCALE	FIGURE
UK0038843.2142	SRA2	A	NTS	SRA2

Attenborough House, Browns Lane Business Park
Stanton-on-the-Wolds
Nottingham
NG12 5BL

wsp.com