



Groundforce Shorco

Excavation Support

SHORING MANUAL

For Sheeted Excavations

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For technical or user information on these systems please refer to the technical area of our website

www.vpgroundforce.com

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SHORING MANUAL FOR SHEETED EXCAVATIONS

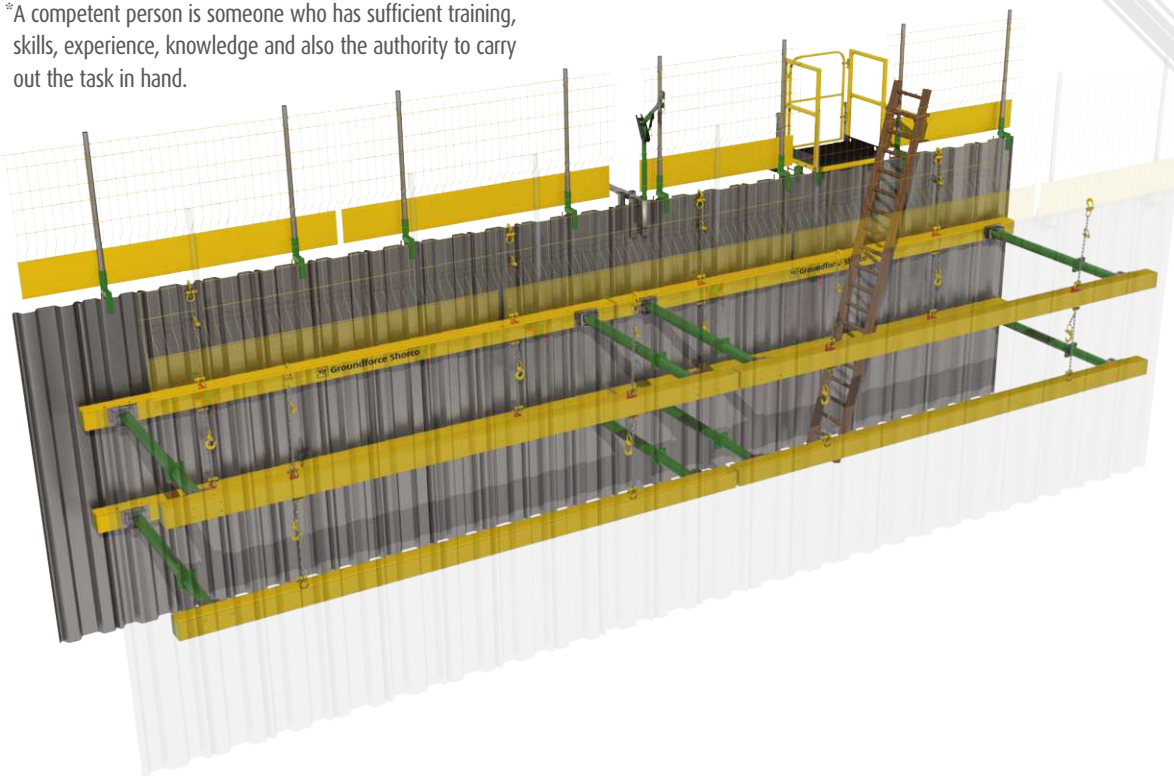
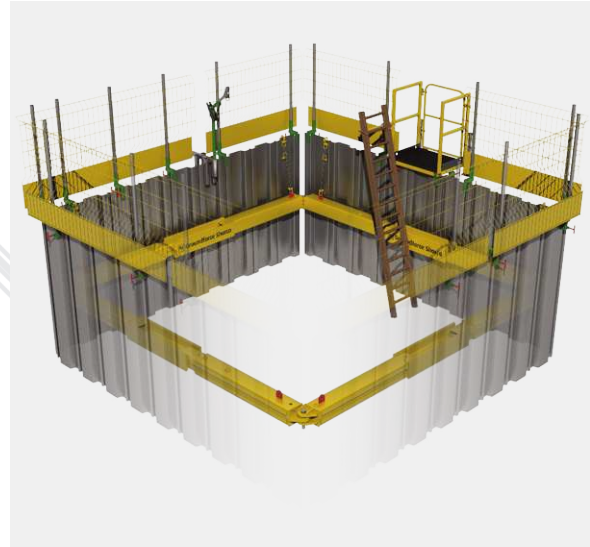
INTRODUCTION

The use of proprietary equipment such as manhole brace and waler frames to support excavations is common place in the UK. For relatively shallow excavations (i.e. less than 3.0m deep) it is often possible to categorise soil types and support systems into a series of standardised design cases so as to avoid having to produce a site specific design.

This manual is intended as a guide to enable a competent person* to specify the shoring requirements for relatively small, shallow trenches or manhole type excavations, up to 3.0m maximum depth in reasonable ground conditions from standard sets of calculations.

The flowcharts presented on the following pages act as a guide to enable a competent person to assess whether the designs enclosed in this document are appropriate, or whether a site specific design will be required.

*A competent person is someone who has sufficient training, skills, experience, knowledge and also the authority to carry out the task in hand.



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STANDARD CALCULATIONS

The designs contained in this document have been carried out using Groundforce Shorco's specialist temporary works design software, GFsafe.

The calculations have been carried out with reference to the following authoritative documents:

- Piling Handbook.
- CIRIA Special Publication 95: The Design & Construction of Sheet-Piled Cofferdams.
- CIRIA C760: Embedded Retaining Walls
- BS 8002:1994 Code of Practice for Earth Retaining Structures
- BS 6031:2009 Code of Practice for Earthworks.

The structural resistance of the supporting equipment has been generally designed in accordance with the following standards:

- BS 5950 Part1:2000: Structural Use of Steelwork in Building where applicable
- Eurocode 3: Design of steel structures. BS EN 1993 (part 1)
- BS EN 14653 (parts 1 & 2) 2005: Manually operated hydraulic shoring systems for groundwork support.

The designs have been based on the basic assumptions listed below, which the competent person must assess as having been satisfied. If any parameter exceeds these assumptions, then the user should obtain a site specific design by contacting Groundforce on 0800 000 345.

- These standard designs are only valid when used in conjunction with Groundforce Shorco equipment.
- The maximum excavation depth illustrated within this manual is 3.0m.
- These standard designs are only valid in reasonable ground conditions. i.e. If the ground is mainly cohesive it should be reasonably firm or if the ground is mainly granular it should be reasonably compacted (see the Soil Description Chart for guidance on page 8).
- Groundwater is not likely to be present within the depth of the dig. However, the designs included in this manual are based on saturated soil densities to allow for pipe bursts etc.
- The excavation area is reasonably flat and is not located adjacent to any significantly sloping ground e.g. an embankment.
- No abnormal surcharges such as railways, building foundations or cranes are likely to exist within close proximity of the excavation.
- Excavations are not to be open for greater than twelve weeks duration.

SERVICES CROSSING THE EXCAVATION

Where services cross the excavation, it is possible to omit trench sheeting in this area providing that the ground conditions are stable. The suitability of the ground must be assessed on site by a competent person. When omitting a sheet, the sheets either side must be doubled up. Secure boarding above and below the services is recommended to reduce the possibility of material entering into the excavation.

LIFTING OPERATIONS

The contractor must ensure the following for all lifting operations:

- Restraining chains are NOT to be used for lifting purposes.
- All lifting equipment must have a valid test certificate.
- Lifting operations to be carried out by a suitably qualified operator.
- Lifting operations must be carried out in accordance with the contractors own company's procedures.

ACCESS, EGRESS AND EDGE PROTECTION

The Contractor must provide a safe means of access and egress to / from the excavation and provide adequate edge protection at ground level. Groundforce Shorco have a range of integrated equipment for this purpose.

GENERAL GUIDANCE

- The use of this manual does not remove the responsibility from the contractor in providing a safe excavation and place of work under the CDM regulations.
- A site specific risk assessment and method statement (RAMS) must be carried out prior to commencing any excavation work.
- Safe access and egress must be provided such as the Groundforce Edgesafe and Laddersafe systems
- Training in the correct usage of this document is strongly recommended.
- The use of this document is entirely at the contractor's own risk.
- For technical or user information on these systems please refer to the technical area of our website www.vpgroundforce.com. Video user guides are also available on YouTube: www.youtube.com/user/vpgroundforce
- If in doubt, contact Groundforce Shorco on 0800 000 345.

WHAT HAPPENS IF THE EXCAVATION BECOMES UNSTABLE?

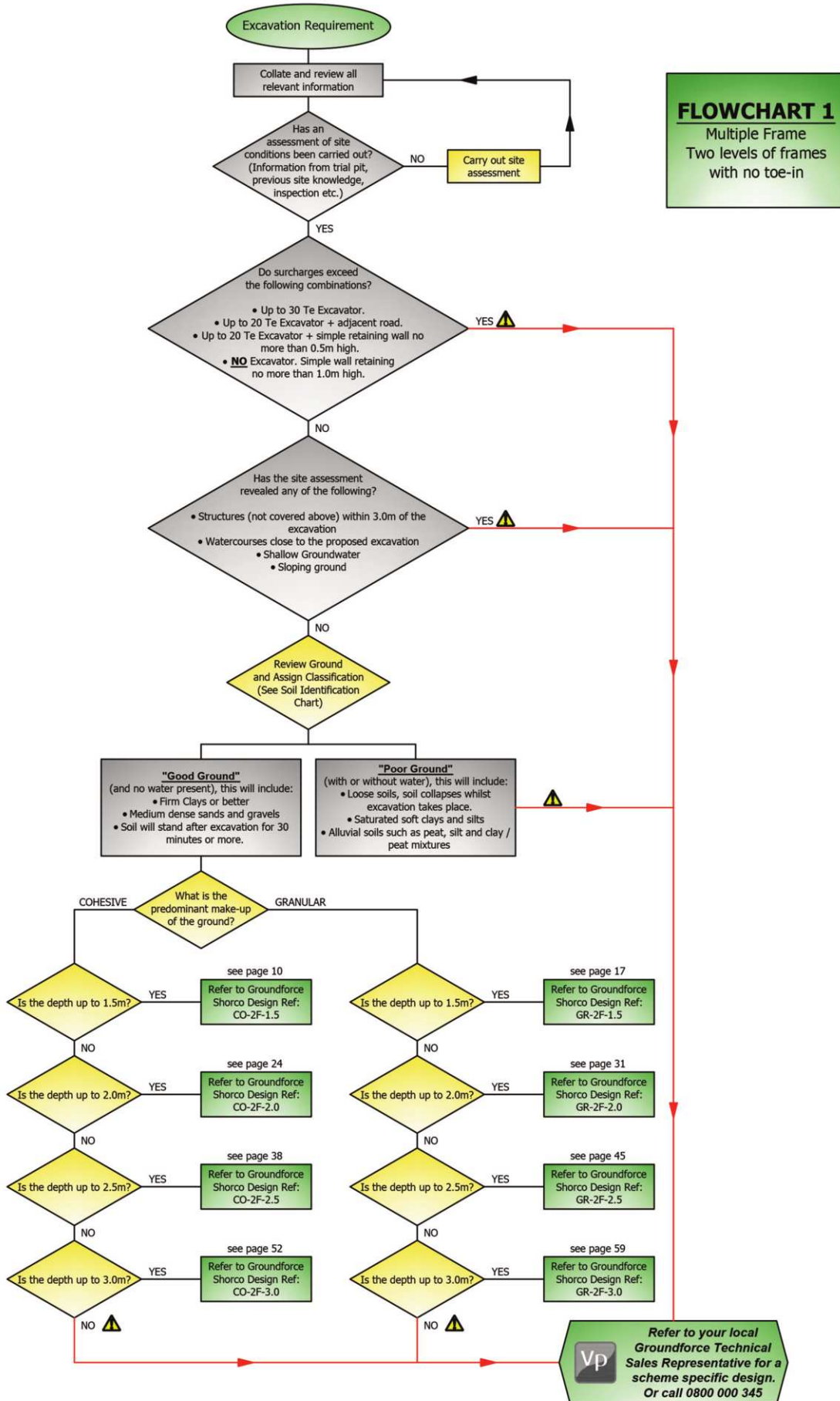
If at any stage during the excavation process the ground becomes unstable or the shoring slips or shows signs of distress, evacuate the excavation immediately and seek further advice. In extreme circumstances where there is a risk of collapse for example, the excavation must be back filled immediately and further advice sought from an appropriately qualified engineer. In these circumstances, it is advisable to gather as much information as possible without entering the excavation.

Information which may prove useful includes:

- Accurate ground conditions to the depth you have dug before backfilling.
- Note ground water level, if appropriate.
- Services located during excavating.
- Photos of the part dug excavation (ideally before backfilling)
- Photos of the excavation in relation to the surrounding area.
- Note down all surcharges such as bridges, roads, embankments, etc.
- Provide a detailed sketch (plan view and cross section) of the excavation detailing all of the above.

FLOWCHART 1 - TWO FRAMES, NO TOE-IN FOR THE SELECTION OF GROUNDFORCE SHORCO GENERIC TEMPORARY WORKS DESIGNS

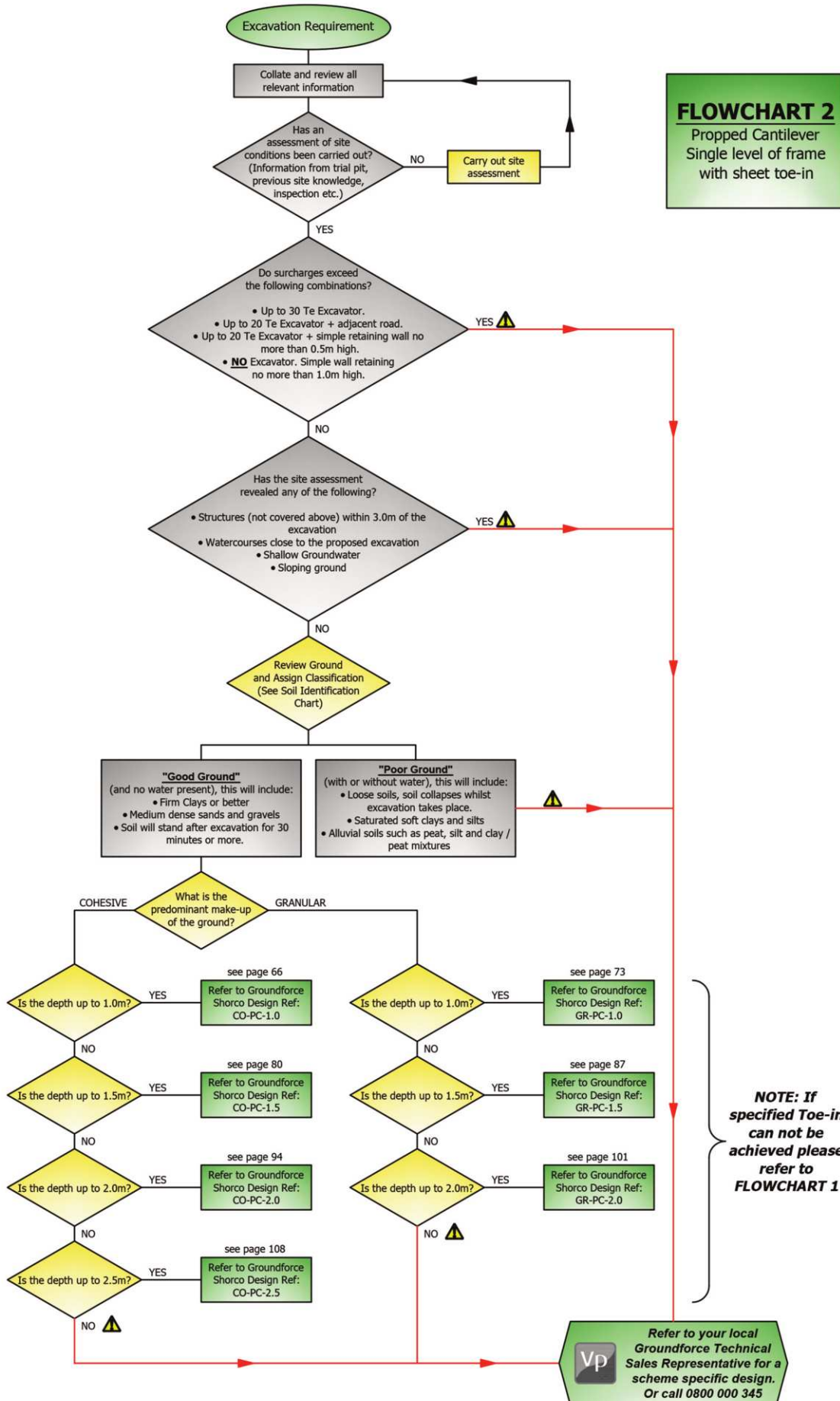
(All aspects to be assessed by a "competent" person)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

FLOWCHART 2 - ONE FRAME, PROPPED CANTILEVER FOR THE SELECTION OF GROUNDFORCE SHORCO GENERIC TEMPORARY WORKS DESIGNS

(All aspects to be assessed by a "competent" person)



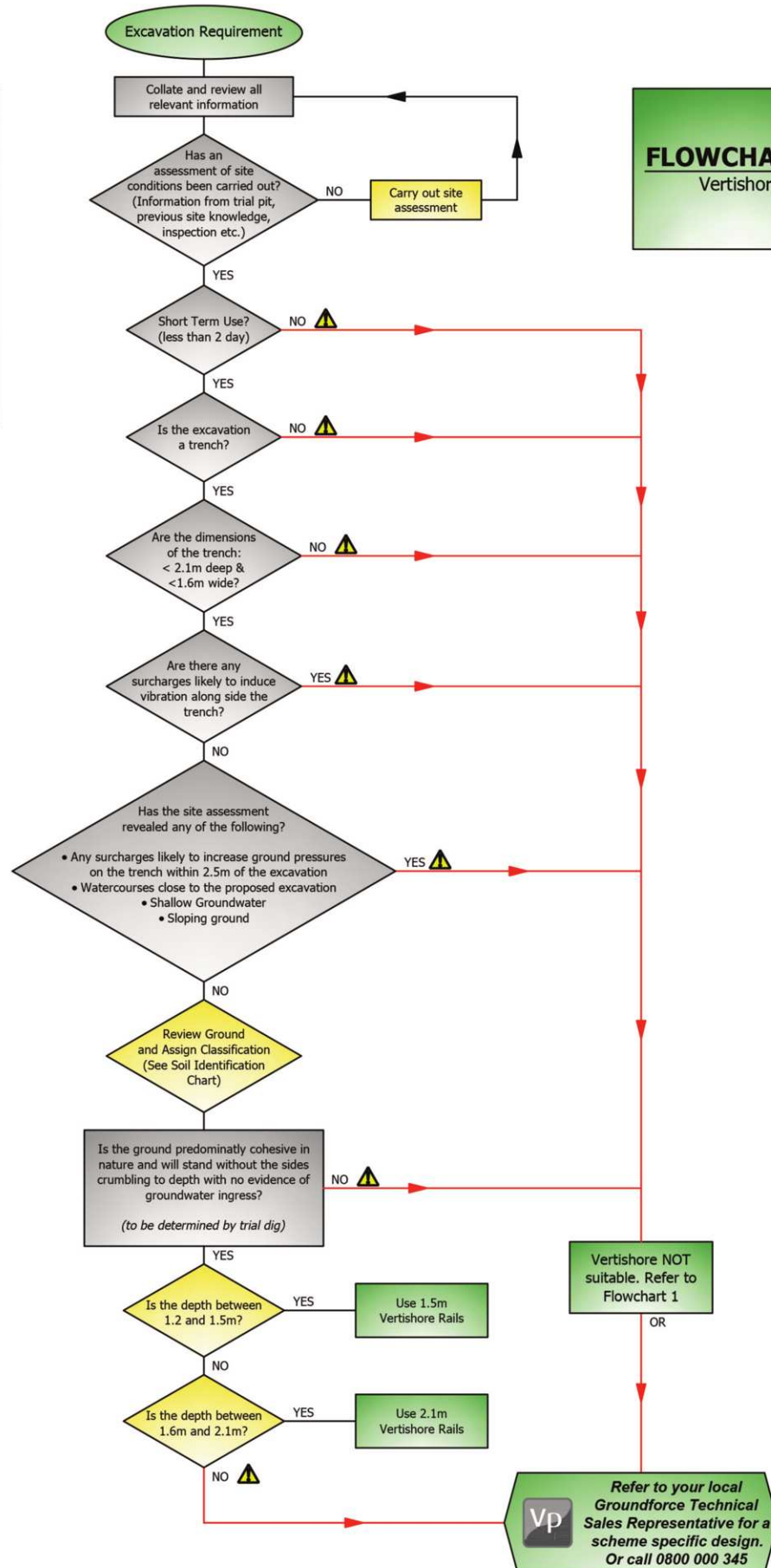
Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

FLOWCHART 3 FOR THE SELECTION OF GROUNDFORCE SHORCO GENERIC TEMPORARY WORKS DESIGNS

(All aspects to be assessed by a "competent" person)

PLEASE NOTE:
Vertishore is a lightweight compact shoring unit designed for **short-term** trench support in **stable ground conditions** which do not require close sheeting.

FLOWCHART 3
Vertishore



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SOILS DESCRIPTION CHART

SOIL TYPE		SIZE (mm)	COMPACTNESS / STRENGTH			SUITABILITY		
VERY COARSE	BOULDERS	2000	Term	Field Identification of Compactness for Very Coarse Soils.		#		
		600	Loose	By inspection of voids and particle packing.				
	COBBLES	200	Dense	Descriptions generally in accordance with BS 5930:1981. For more information see British Standard				
60		Term	Field Identification of Compactness for Coarse Soils.					
COARSE GRAVELS	COARSE	20	Density/SPT 'N' Value Correlation					
	MEDIUM	6	Loose	Excavated by spade; 50mm peg driven easily.		Density	'N' Value	Ø
	FINE	2	Dense	Requires pick for excavation; 50mm peg hard to drive. (See Note)		Very Loose	< 4	< 28°
	COARSE SANDS	0.6	Slightly cemented	Visual examination; pick removes soil in lumps which can be abraded.		Loose	4 - 10	28° - 30°
FINE SILTS	COARSE	0.06	Term	Field Identification of Compactness/Strength for Silts.		Secondary constituent of coarse soils		
	MEDIUM	0.02	Soft or loose	Easily moulded or crushed in the fingers.		Prefix	Suffix	Proportion (%)
	FINE	0.006	Firm or dense	Can be moulded or crushed by strong pressure in the fingers.		Slightly (Sandy)	With a little Occasional	< 5
	CLAYS	0.002	Term	Field Identification of Strength for Clays.		Secondary constituent of fine soils		
Very Soft		Exudes between fingers when squeezed.	< 20 kN/m ²	Prefix		Suffix	Proportion (%)	
ORGANIC	PEAT	See Van Post Grade	Firm	Fibres already compressed together.	Fibrous:-			
			Spongy	Very compressible and open structure.	Plant remains recognisable and retains some strength.			
			Plastic	Can be moulded in hand, and smears on fingers.	Amorphous:-			
					Recognisable plant remains absent.			
VISUAL IDENTIFICATION OF SOIL TYPES								
BOULDERS:		Only seen complete in pits or exposures.						
COBBLES:		Often difficult to recover from boreholes.						
GRAVELS:		Easily visible to the naked eye; particle shape can be described; grading can be described.						
SANDS:		Visible to the naked eye; very little or no cohesion when dry; grading can be described.						
SILTS:		Only coarse silt barely visible to the naked eye; exhibits little plasticity; slightly granular or silky to the touch. Disintegrates in water; lumps dry quickly; possesses cohesion but can be powdered easily between fingers.						
CLAYS:		Dry lumps can be broken but not powdered between fingers; they also disintegrate under water but more slowly than silt; smooth to the touch; exhibits plasticity; sticks to the fingers and dries slowly; shrinks appreciably on drying usually showing cracks.						
ORGANIC SOILS:		Contains substantial amounts of organic vegetable matter.						
PEATS:		Predominantly plant remains usually dark brown or black in colour, often with distinctive smell; low bulk density.						
	NOT SUITABLE (REQUIRES SPECIALIST DESIGN)			SEEK FURTHER ADVICE			SUITABLE TO USE THIS MANUAL	

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DESIGN INTERNAL CHECK CERTIFICATE

Internal Checking Certificate


Internal Check: Category 1 (see design procedure for explanation)

This design has been prepared by the Groundforce Shorco (GFS) technical department in accordance with their documented design procedure (a copy of which is available on request). Great professional skill and care has been taken to provide a safe and workable solution in accordance with the principles set out in BS 5975:2008+A1:2011 section 2, sub-section 9 and the Construction (Design and Management) Regulations 2015 as far as is reasonably possible.


The shoring temporary works schemes is described by the documents referenced below

- Shoring Manual for Sheeted Excavations covering the following designs:
- Two Frame, No Toe-in:
CO-2F-1.5, GR-2F-1.5, CO-2F-2.0, GR-2F-2.0, CO-2F-2.5, GR-2F-2.5, CO-2F-3.0, GR-2F-3.0
- One Frame, Propped Cantilever:
CO-PC-1.0, GR-PC-1.0, CO-PC-1.5, GR-PC-1.5, CO-PC-2.0, GR-PC-2.0, CO-PC-2.5

I certify that reasonable professional skill and care has been used in the design of the Temporary Works scheme identified and described by the above referenced drawings and other documents:

Signed:		Name: Andrew Lowe MEng (Hons) CEng MStructE MICE
Title / Position:	Head of Engineering Design	

I certify that reasonable professional skill and care has been used in the checking to **Category 1** of the Temporary Works scheme identified and described by the above referenced drawings and other documents and that the design is fit for purpose:

Signed:		Name: Duncan Pearson BEng (Hons)
Title / Position:	Design Manager	

I certify that the staff who have completed the above design and check are competent to carry out their duties and that they have exercised reasonable professional skill, care and diligence under CDM 2015.

Signed:		Name: Tony Gould BSc (Hons) CEng FICE
Title / Position:	Technical Director	

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STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 1.5m DEEP - COHESIVE (CO-2F-1.5)

TWO FRAMES, NO TOE-IN COHESIVE GROUND – 1.5m DEEP

INPUT

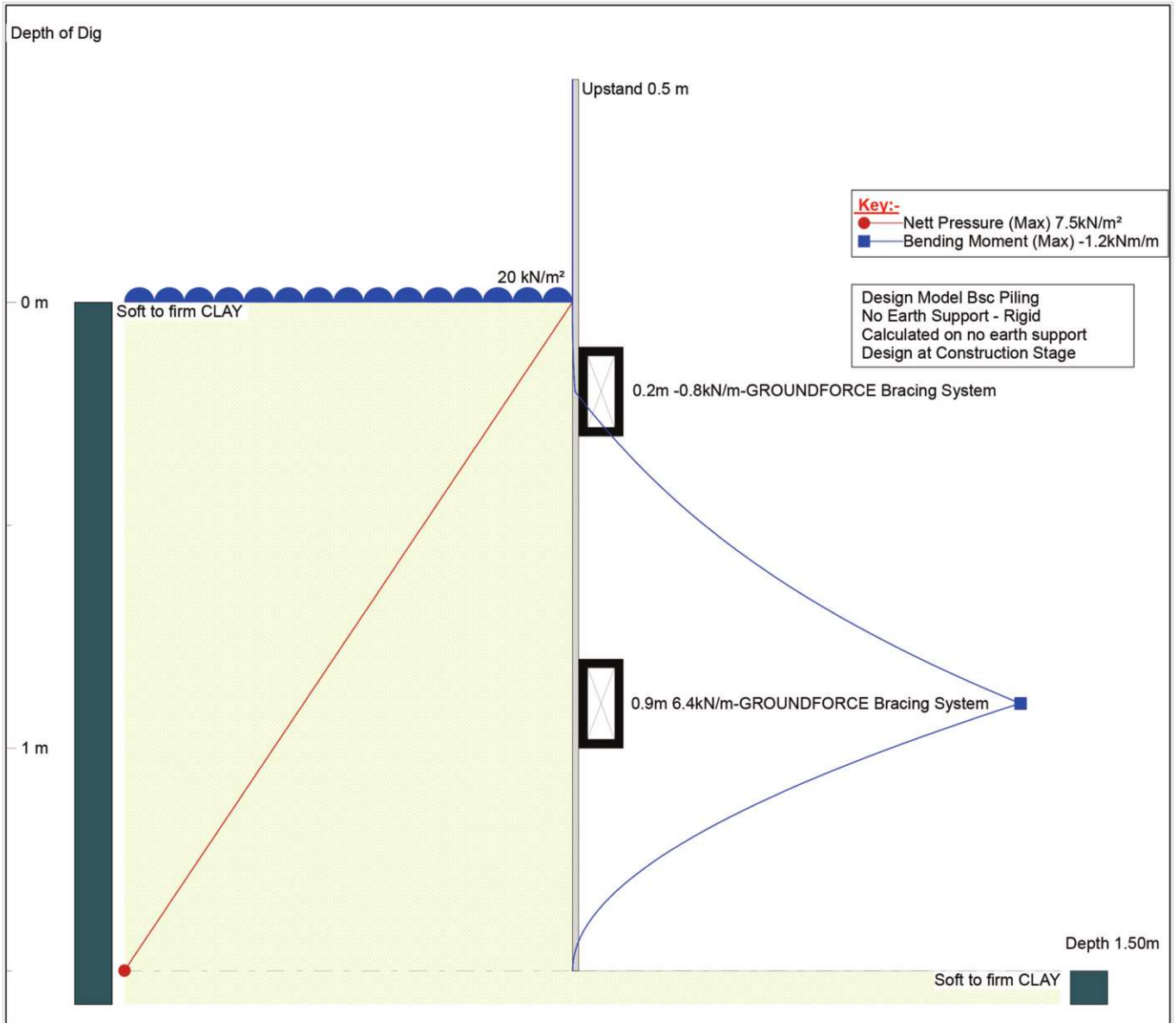
EXCAVATION DEPTH	1.5 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 1.5	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

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1.5m DEEP - COHESIVE (CO-2F-1.5)



Issued for Construction.

Support Information
Frame 1
 Level: 0.20 m
 Load: -0.8 kN/m
Frame 2
 Level: 0.90 m
 Load: 6.4 kN/m

Sheet Pile Definition

8.5kNm/m > 1.2kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

Groundforce

Designer : Groundforce
 Reference: CO-2F-1.5
 Rev: A
 Issued for Construction

vp Groundforce Shorco
 Excavation Support

GFsafe Version 2.0.16 Copyright VP plc 2010

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SUMMARY – TWO FRAMES, NO TOE-IN COHESIVE GROUND – 1.5m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	1.2kNm/m
MAXIMUM FRAME LOAD	6.4kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 1.5m + Required upstand* (* to be assessed by contractor)
(N.B. Minimum available sheet length = 2.0m)

SUITABLE BRACES (see drawing no. CO-2F-1.5-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-2F-1.5-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers

(not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2
C2	2.50 – 3.40	10.6

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1.5m DEEP - COHESIVE (CO-2F-1.5)

Rev	A	Issued for Construction	Des	ARL	ARL	DRP	DRW	CHK
Comments								

Plan View of Frames
Typical Layout - WLL - See Table

Typical Section

Groundforce Manhole Brace Length - See Table

Groundforce Manhole Brace Width - See Table

Clear Opening: See Table

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 16 No.

Must NOT to be used for lifting purposes

Schedule of Weights: Manhole Brace Frames

Compatibility	Description:	Sheet Range (m)	Clear Opening (m)	WLL (kN/m)*	Weight per Item (kg)
→	S/A Manhole Brace - 540	1.5 - 2.4	1.1 - 2.0	28.8	35
→	S/A Manhole Brace - Leg A	1.7 - 2.4	1.3 - 2.0	47.7	70
→	S/A Manhole Brace - Leg B	2.2 - 3.0	1.8 - 2.6	29.8	95
→	D/A Manhole Brace - Leg A	2.0 - 3.0	1.5 - 2.5	84.0	260
→	D/A Manhole Brace - Leg B	3.0 - 4.0	2.5 - 3.5	45.7	305
→	D/A Manhole Brace - 290	1.5 - 2.25	1.0 - 1.75	115.0	145
→	D/A Manhole Brace - 490	2.24 - 3.24	1.74 - 2.74	80.2	250
→	D/A Manhole Brace - 690	2.9 - 4.6	2.3 - 4.0	56.5	440

* - Minimum value based on maximum leg range

Values per Leg

Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment

Description:	Weight per Item (kg)
Driving Cap	7
Quick Release Shackle	19
Standard Extractor	11
Lifting Chain	-

Notes:

- Please refer to the section headers of the manual to ensure that the design is suitable for use.
- A detailed site specific risk assessment must be carried out prior to commencing work.
- Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
- Assumed Installer Method: Dig and Lower (See General Method Statement)
- Two levels of frame are installed in the excavation at 0.2m and 0.9m B.G.L. respectively
- A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If additional surcharges are likely to be present, seek further advice from Groundforce.
- If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring system must be undertaken by a competent person.
- Remove is the reverse of the installation process and must be undertaken in a safe and controlled manner as detailed in the manual.

Typical Section

Face of existing Building / Edge (not including construction plant)

0.00m B.G.L.

1.50m B.G.L.

Cohesive Ground (Minimum Soft - Firm)

Safe access/egress must be provided

Range - See Table

Depth of Excavation = 1.5m

EdgeSafe as required

David Arm - Has an emergency rescue system been considered? (Sheets will require doubling up at clamp location if SD33 utilised)

Allowable surcharges (1 option per side):

- Up to 30 Te Excavator.
- Up to 20 Te Excavator + adjacent road.
- Up to 20 Te Excavator + simple retaining wall no more than 0.5m high.
- NO** Excavator. Simple wall retaining no more than 1.0m high.

Note: Basic boundary wall (up to 2.0m) not retaining anything is covered in first two options

Groundwater not anticipated
Note: If soil properties and water level varies significantly from those illustrated please seek advice immediately

Groundforce Technical,
Alma House, Tunberry Park,
Lends, LS27 7LE

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VP
Excavation Support

Groundforce Shorco

Title: Cohesive Ground - 1.5m Deep
Two Frames - Manhole Braces

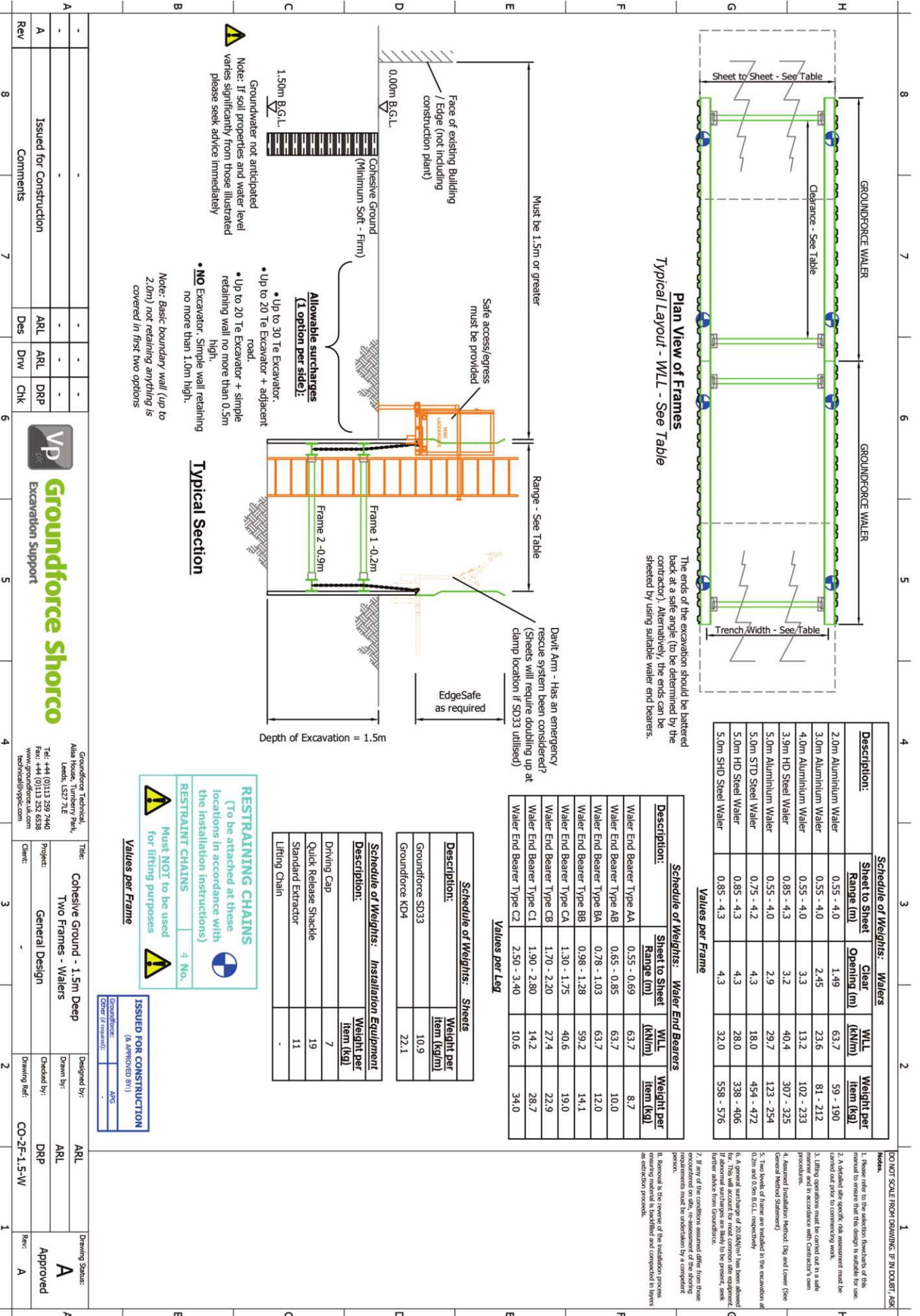
Project: General Design

Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: CO-2F-1.5-B

Drawing Status: **A**
Approved

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Rev	Comments	Des	DW	CHK
A	Issued for Construction	ARL	ARL	DRP

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technical@vgc.com

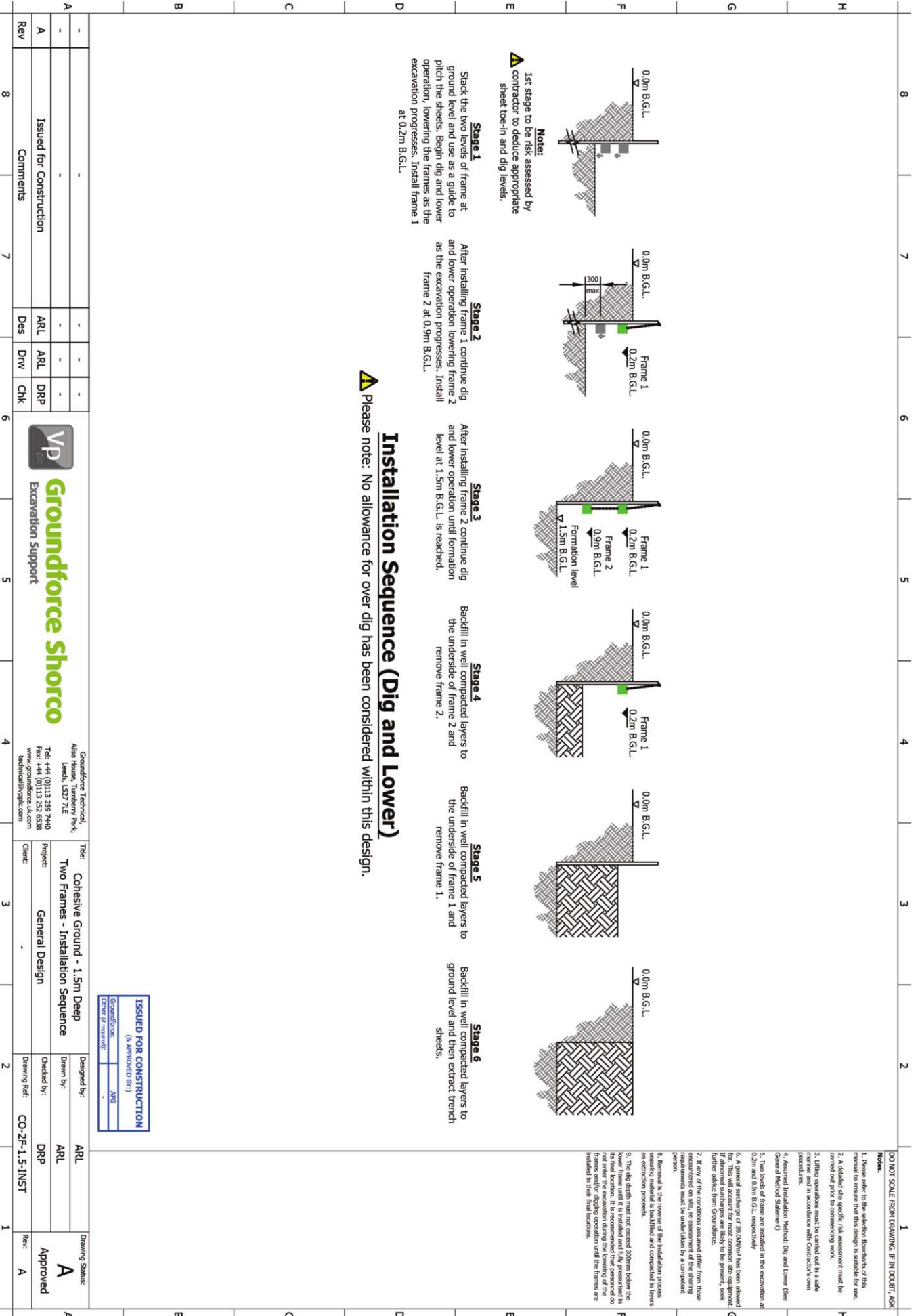
Client: Cohesive Ground - 1.5m Deep
Two Frames - Walers
General Design

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: CO-2F-1.5-W

Drawing Status: Approved

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1.5m DEEP - COHESIVE (CO-2F-1.5)



Installation Sequence (Dig and Lower)
 Please note: No allowance for over dig has been considered within this design.

ISSUED FOR CONSTRUCTION
 (8 APPROVED BY:)
 Groundforce:
 (Date of revision):

Rev	A	Des	ARL	DRP	CHK	8	7	6	5	4	3	2	1
Comments	Issued for Construction												

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 www.groundforce.co.uk
 technical@vpic.com

Title:	Cohesive Ground - 1.5m Deep	Designed by:	ARL
Project:	Two Frames - Installation Sequence	Drawn by:	ARL
Client:	General Design	Checked by:	DRP
		Drawing Ref:	CO-2F-1.5-INST
		Rev:	A
		Drawing Status:	Approved

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STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 1.5m DEEP - GRANULAR (GR-2F-1.5)

1.5m DEEP - GRANULAR (GR-2F-1.5)

TWO FRAMES, NO TOE-IN GRANULAR GROUND – 1.5m DEEP

INPUT

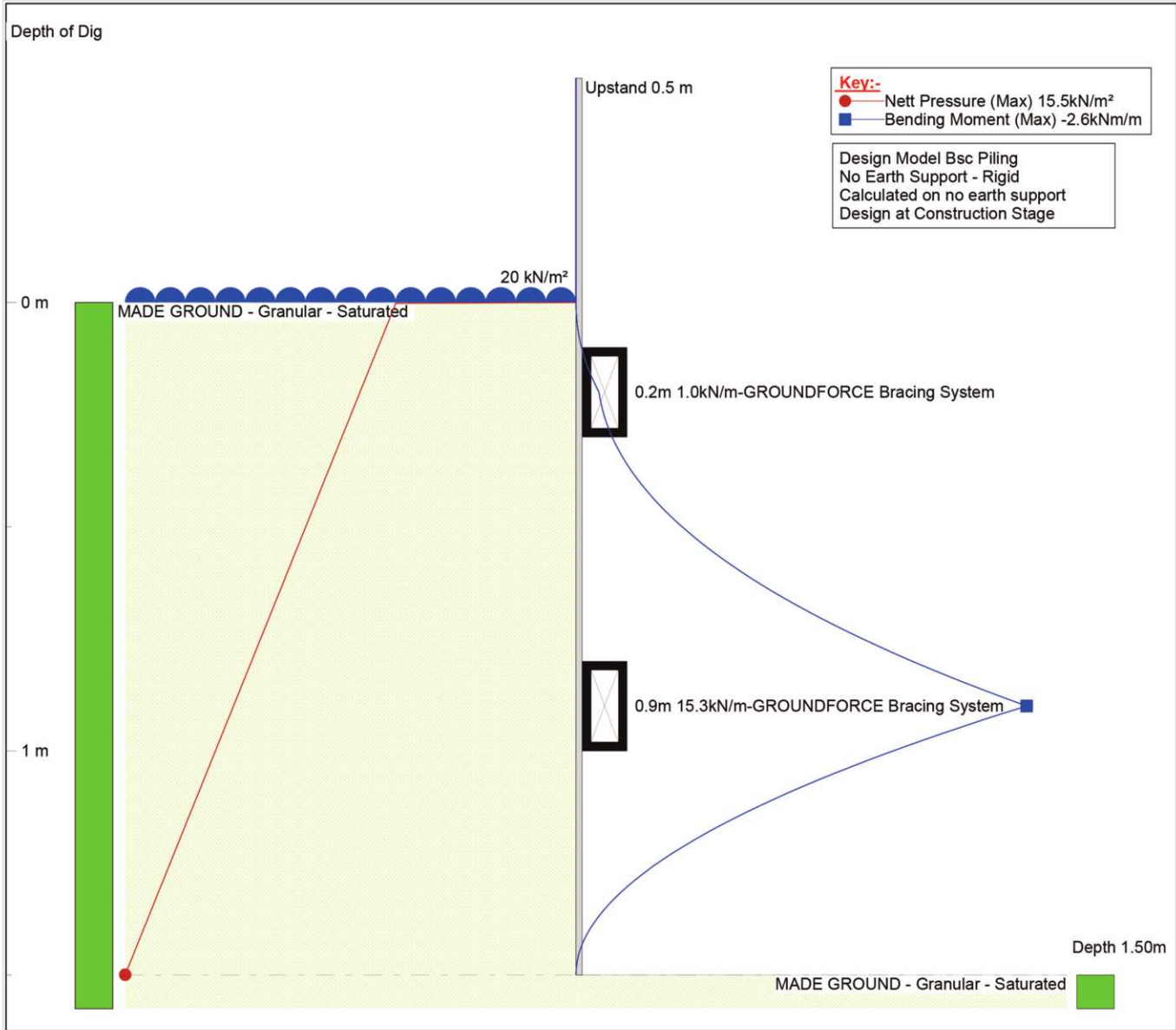
EXCAVATION DEPTH	1.5 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ_{sat} (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 1.5	MADE GROUND Granular (well compacted)	20.10	10.30	0.00	32.00	0.31	3.25	0.00	0.00	0.00

N.B. This design is based on saturated soil densities to allow for pipe bursts etc.

1.5m DEEP - GRANULAR (GR-2F-1.5)



Issued for Construction.

Support Information
 Frame 1
 Level: 0.20 m
 Load: 1.0 kN/m
 Frame 2
 Level: 0.90 m
 Load: 15.3 kN/m

Sheet Pile Definition

8.5kNm/m > 2.6kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

<p>Groundforce</p>	<p>Designer :Groundforce Reference:GR-2F-1.5 Rev A Issued for Construction</p>	<p>vp Groundforce Shorco Excavation Support</p> <p>GFsafe Version 2.0.16 Copyright VP plc 2010</p>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - GRANULAR (GR-2F-1.5)

SUMMARY – TWO FRAMES, NO TOE-IN GRANULAR GROUND – 1.5m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	2.6kNm/m
MAXIMUM FRAME LOAD	15.3kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 1.5m + Required upstand* (* to be assessed by contractor)
(N.B. Minimum available sheet length = 2.0m)

SUITABLE BRACES (see drawing no. GR-2F-1.5-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

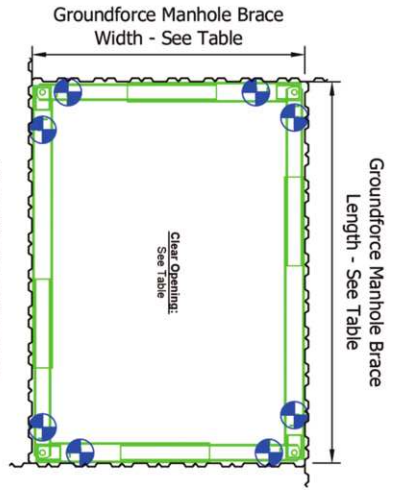
SUITABLE WALERS & END BEARERS (see drawing no. GR-2F-1.5-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 16 No.

Must NOT be used for lifting purposes

Compatibility	Description:	Schedule of Weights: Manhole Brace Frames		
		Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m) [*] Weight per Item (kg)
→	S/A Manhole Brace - 540	1.5 - 2.4	1.1 - 2.0	28.8 35
→	S/A Manhole Brace - Leg A	1.7 - 2.4	1.3 - 2.0	47.7 70
→	S/A Manhole Brace - Leg B	2.2 - 3.0	1.8 - 2.6	29.8 95
→	D/A Manhole Brace - Leg A	2.0 - 3.0	1.5 - 2.5	84.0 260
→	D/A Manhole Brace - Leg B	3.0 - 4.0	2.5 - 3.5	45.7 305
→	D/A Manhole Brace - 290	1.5 - 2.25	1.0 - 1.75	115.0 145
→	D/A Manhole Brace - 490	2.24 - 3.24	1.74 - 2.74	80.2 250
→	D/A Manhole Brace - 690	2.9 - 4.6	2.3 - 4.0	56.5 440

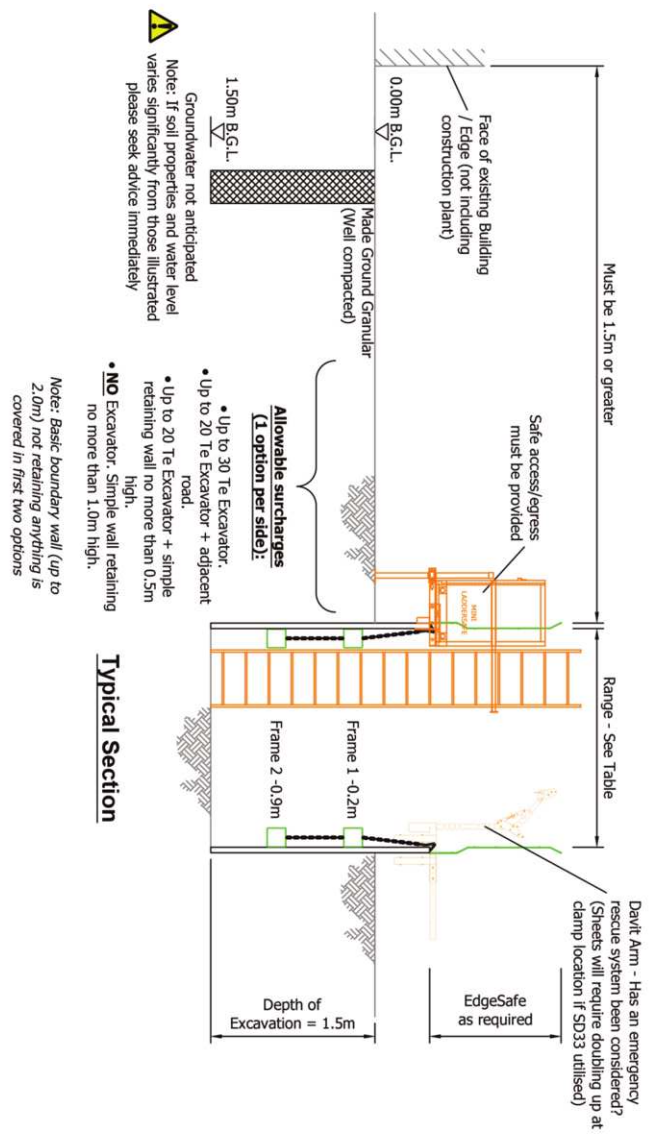
* - Minimum value based on maximum leg range

Values per Leg

Schedule of Weights: Sheets	
Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment	
Description:	Weight per Item (kg)
Driving Cap	7
Quick Release Shackle	19
Standard Extractor	11
Lifting Chain	-

Typical Section



ISSUED FOR CONSTRUCTION
(APPROVED BY:)

Groundforce: ABC
Client (or reviewer): -

- Notes:**
- Please refer to the selection handbooks of the material to ensure that the design is suitable for use.
 - A detailed site specific risk assessment must be carried out prior to commencing work.
 - Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 - Assumed Installer Method: Dig and Lower (See General Method Statement)
 - Two levels of frame are installed in the excavation at 0.2m and 0.9m B.G.L. respectively
 - A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. Further surcharges are likely to be present, seek further advice from Groundforce.
 - If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring system must be undertaken by a competent person.
 - Removal is the reverse of the installation process as detailed and completed in steps as erection proceeds.

Rev	Comments	Des	DRP	CHK	6	5	4	3	2	1
A	Issued for Construction	ARL	ARL	DRP	-	-	-	-	-	-
8		-	-	-	-	-	-	-	-	-

VP
Excavation Support

Groundforce Shorco

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Alisa House, Tumberry Park,
Letchford, LE27 7LE
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Fax: +44 (0)113 232 6538
technical@vgc.com

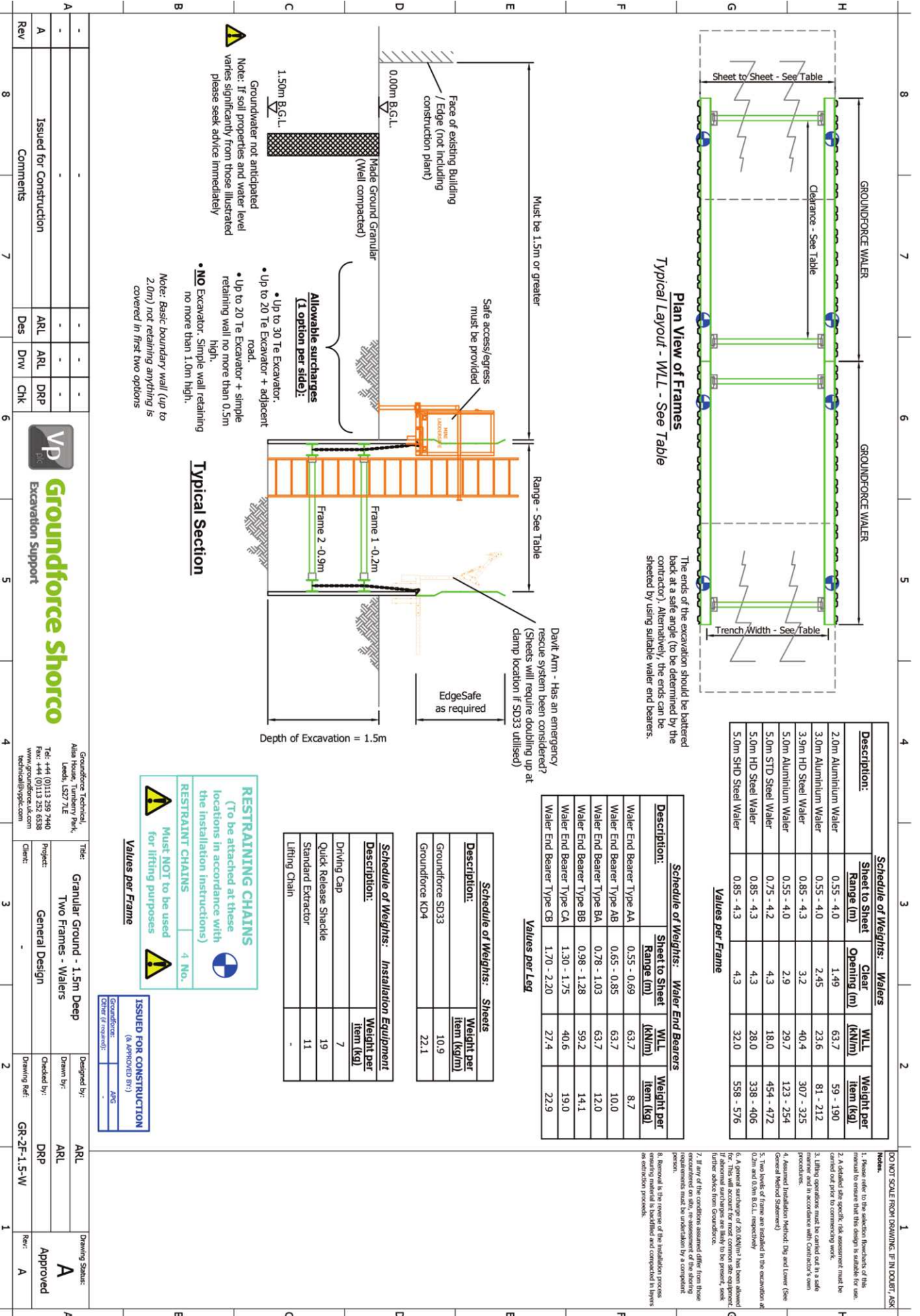
Title: Granular Ground - 1.5m Deep
Two Frames - Manhole Braces
Project: General Design
Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-2F-1.5-B

Drawing Status: Approved
Rev: A

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - GRANULAR (GR-2F-1.5)



Schedule of Weights: Walers				
Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)	Weight per Item (kg)
2.0m Aluminium Waler	0.55 - 4.0	1.49	63.7	59 - 190
3.0m Aluminium Waler	0.55 - 4.0	2.45	23.6	81 - 212
3.9m HD Steel Waler	0.85 - 4.3	3.2	40.4	307 - 325
5.0m Aluminium Waler	0.55 - 4.0	2.9	29.7	123 - 254
5.0m STD Steel Waler	0.75 - 4.2	4.3	18.0	454 - 472
5.0m HD Steel Waler	0.85 - 4.3	4.3	28.0	338 - 406
5.0m SHD Steel Waler	0.85 - 4.3	4.3	32.0	558 - 576

Values per Frame

Schedule of Weights: Water End Bearers				
Description:	Sheet to Sheet Range (m)	WLL (kN/m)	Weight per Item (kg)	
Waler End Bearer Type AA	0.55 - 0.69	63.7	8.7	
Waler End Bearer Type AB	0.65 - 0.85	63.7	10.0	
Waler End Bearer Type BA	0.78 - 1.03	63.7	12.0	
Waler End Bearer Type BB	0.98 - 1.28	59.2	14.1	
Waler End Bearer Type CA	1.30 - 1.75	40.6	19.0	
Waler End Bearer Type CB	1.70 - 2.20	27.4	22.9	

Values per Leg

Schedule of Weights: Sheets		
Description:	Weight per Item (kg/m)	
Groundforce SD33	10.9	
Groundforce KD4	22.1	

Schedule of Weights: Installation Equipment		
Description:	Weight per Item (kg)	
Drying Cap	7	
Quick Release Shackles	19	
Standard Extractor	11	
Lifting Chain	-	

RESTRAINING CHAINS

(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.

Must NOT be used for lifting purposes

ISSUED FOR CONSTRUCTION
(8 APPROVED BY:)

Groundforce: [Signature]

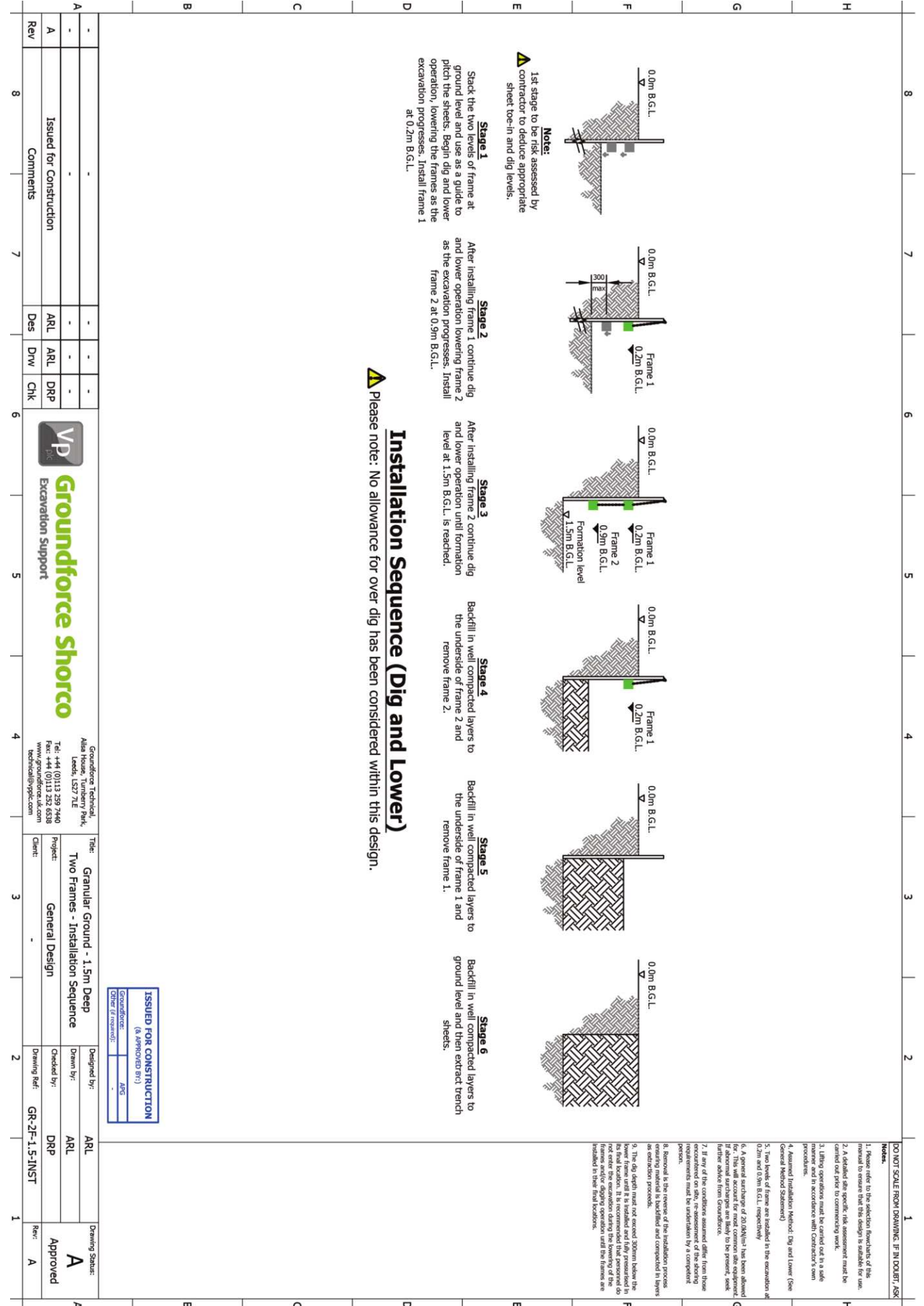
Client (Approved): [Signature]

Rev	A	Issued for Construction	Des	ARL	ARL	DRP	CHK	VP	Groundforce Shorco	Excavation Support	Groundforce Technical, Alias House, Tunberry Park, Leeds, LS27 7LE	Title: Granular Ground - 1.5m Deep Two Frames - Walers	Designed by: ARL	Drawing Status: A Approved
Rev	8	Comments	Des	ARL	ARL	DRP	CHK	VP	Groundforce Shorco	Excavation Support	Tel: +44 (0)113 339 3440 Fax: +44 (0)113 339 4750 www.groundforce.co.uk technical@vpcc.com	Project: General Design	Checked by: DRP	Rev: A

- DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK
1. Please refer to the section headers of this manual to ensure that the design is suitable for use.
 2. A detailed site specific risk assessment must be carried out prior to commencing work.
 3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 4. Assumed Installation Method: Dig and Lower (See General Method Statement)
 5. Two levels of frame are installed in the excavation at 0.2m and 0.9m B.G.L. respectively
 6. A general surcharge of 20 (kN/m²) has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 7. If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring personnel.
 8. Removal is the reverse of the installation process and should be undertaken by a competent person.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - GRANULAR (GR-2F-1.5)



Installation Sequence (Dig and Lower)

Please note: No allowance for over dig has been considered within this design.

ISSUED FOR CONSTRUCTION
(APPROVED BY:)

Groundforce:	ARL
Client (or reviewer):	ARL

Rev	-	-	-	-	-	-	-	-	-
Rev	A	Issued for Construction	Des	ARL	ARL	DRP	DRP	DRP	DRP
Rev	8	Comments	Des	ARL	ARL	DRP	DRP	DRP	DRP



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www.vpgroundforce.com
technical@vpfc.com

Client: Granular Ground - 1.5m Deep
Project: Two Frames - Installation Sequence
General Design

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-2F-1.5-INST
Rev: A
Approved

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 2.0m DEEP - COHESIVE (CO-2F-2.0)

TWO FRAMES, NO TOE-IN COHESIVE GROUND – 2.0m DEEP

INPUT

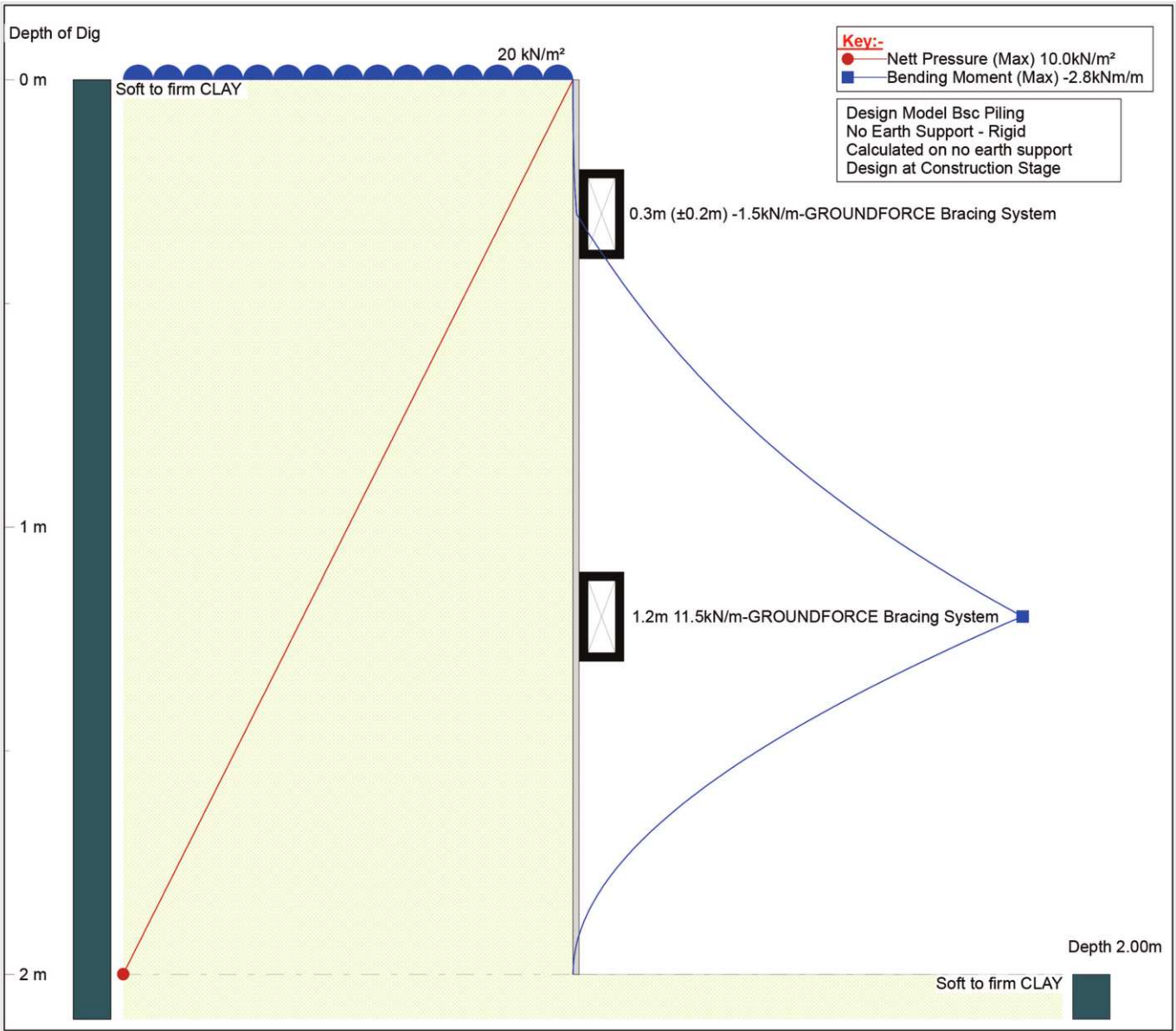
EXCAVATION DEPTH	2.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 2.0	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - COHESIVE (CO-2F-2.0)



Issued for Construction.


Support Information
 Frame 1
 Level: 0.30 m
 Load: -1.5 kN/m
 Frame 2
 Level: 1.20 m
 Load: 11.5 kN/m

Sheet Pile Definition

8.5kNm/m > 2.8kNm/m(Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

<p>Groundforce</p>	<p>Designer :Groundforce Reference:CO-2F-2.0 Rev: A Issued for Construction</p>	<p> Excavation Support</p> <p>GFsafe Version 2.0.16 Copyright VP plc 2010</p>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

SUMMARY – TWO FRAMES, NO TOE-IN COHESIVE GROUND – 2.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	2.8kNm/m
MAXIMUM FRAME LOAD	11.5kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 2.0m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. CO-2F-2.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-2F-2.0-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

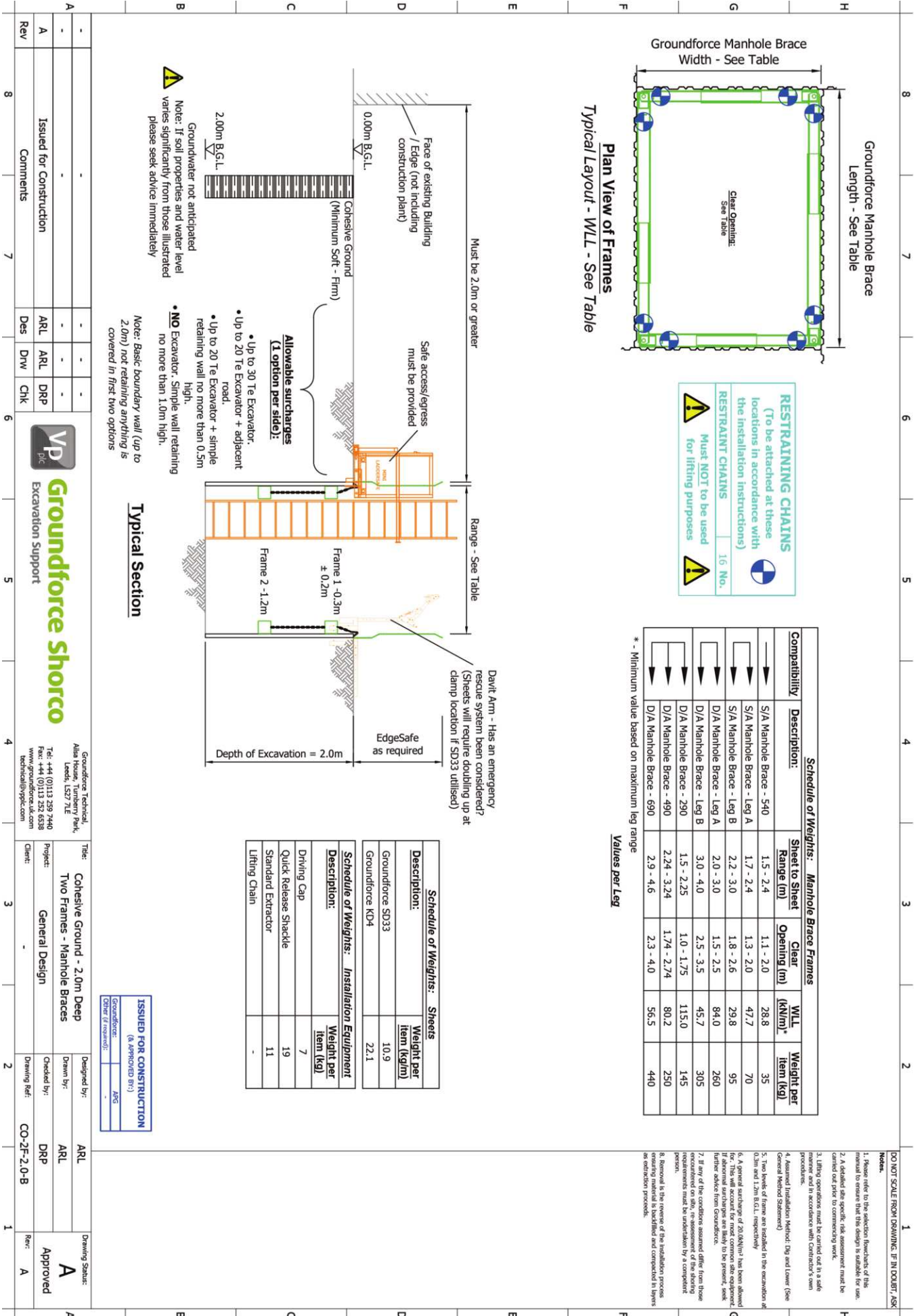
End Bearers for use in conjunction with Aluminium Walers

(not suitable for use with Steel Walers)

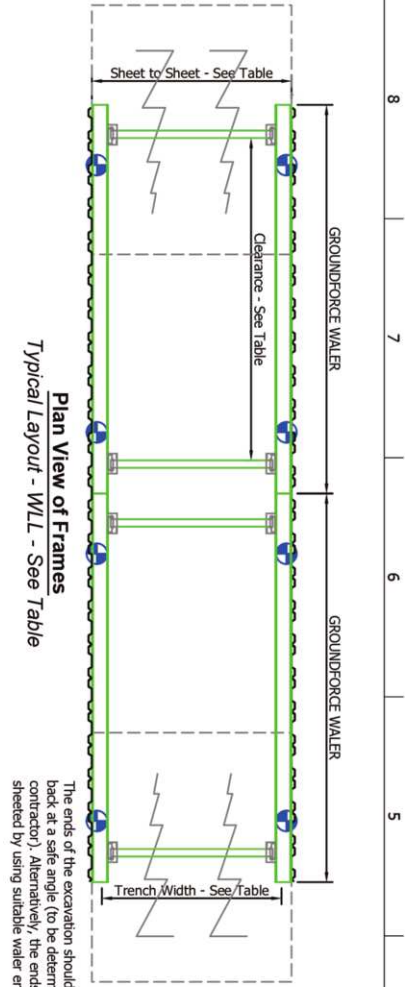
END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - COHESIVE (CO-2F-2.0)

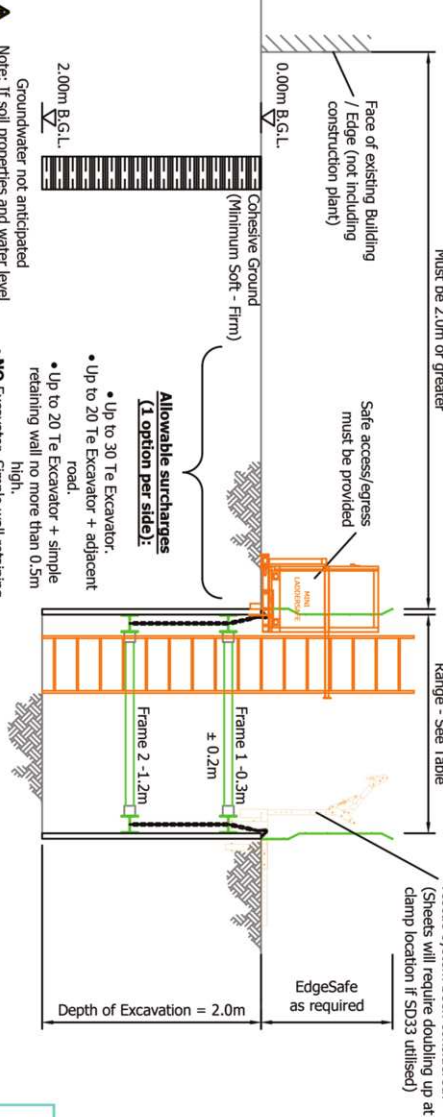


Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Schedule of Weights: Wallers				
Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)	Weight per Item (kg)
2.0m Aluminium Waller	0.55 - 4.0	1.49	63.7	59 - 190
3.0m Aluminium Waller	0.55 - 4.0	2.45	23.6	81 - 212
4.0m Aluminium Waller	0.55 - 4.0	3.3	13.2	102 - 233
3.9m HD Steel Waller	0.85 - 4.3	3.2	40.4	307 - 325
5.0m Aluminium Waller	0.55 - 4.0	2.9	29.7	133 - 254
5.0m STD Steel Waller	0.75 - 4.2	4.3	18.0	454 - 472
5.0m HD Steel Waller	0.85 - 4.3	4.3	28.0	338 - 406
5.0m SHD Steel Waller	0.85 - 4.3	4.3	32.0	558 - 576

Schedule of Weights: Water End Bearers			
Description:	Sheet to Sheet Range (m)	WLL (kN/m)	Weight per Item (kg)
Waler End Bearer Type AA	0.55 - 0.69	63.7	8.7
Waler End Bearer Type AB	0.65 - 0.85	63.7	10.0
Waler End Bearer Type BA	0.78 - 1.03	63.7	12.0
Waler End Bearer Type BB	0.98 - 1.28	59.2	14.1
Waler End Bearer Type CA	1.30 - 1.75	40.6	19.0
Waler End Bearer Type CB	1.70 - 2.20	27.4	22.9
Waler End Bearer Type CI	1.90 - 2.80	14.2	28.7



RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.
Must NOT be used for lifting purposes

VALUES PER FRAME

ISSUED FOR CONSTRUCTION
(APPROVED BY: ARS)

Rev	Comments	Des	DW	CHK
A	Issued for Construction	ARL	ARL	DRP

VP Groundforce Shorco
Excavation Support

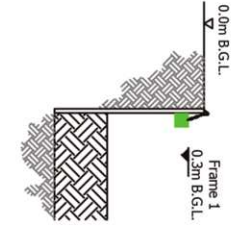
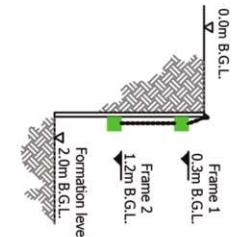
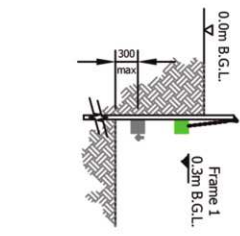
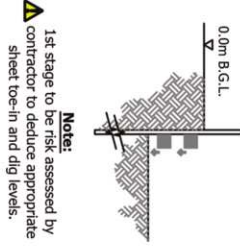
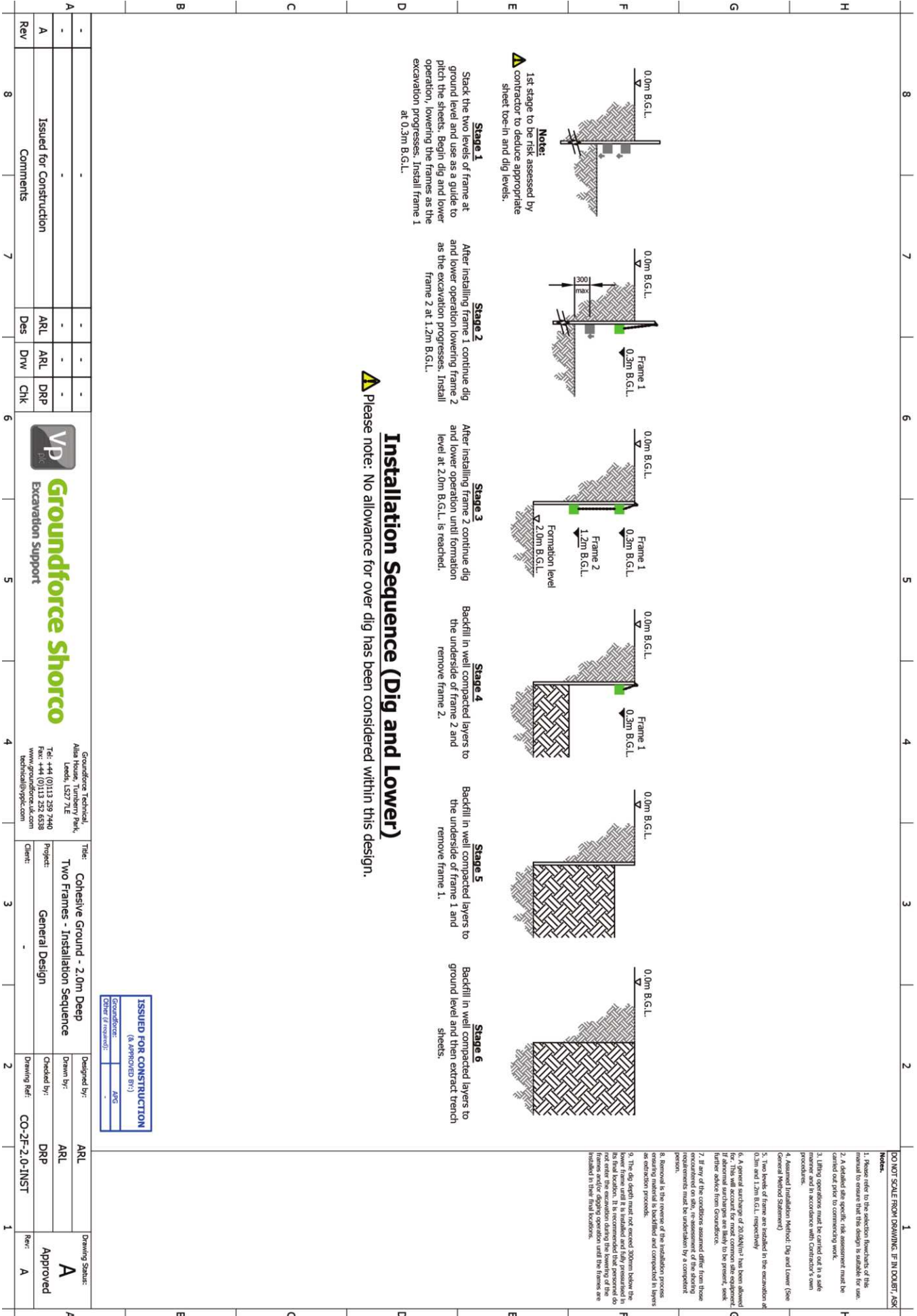
Groundforce Technical
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www.vpgroundforce.com
technical@vpgroundforce.com

Title:	Designed by:	Drawing Status:
Cohesive Ground - 2.0m Deep	ARL	A
Two Frames - Wallers	ARL	Approved
General Design	DRP	

- Please refer to the section headers of this manual to ensure that this design is suitable for use.
- A detailed site specific risk assessment must be carried out prior to commencing work.
- Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
- Assumed Installer Method: Dig and Lower (See General Method Statement)
- Two levels of frame are installed in the excavation at 0.3m and 1.2m B.G.L. respectively.
- A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
- If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring system must be undertaken by a competent person.
- Removal is the reverse of the installation process as detailed and completed in steps as extraction proceeds.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - COHESIVE (CO-2F-2.0)



Installation Sequence (Dig and Lower)

⚠ Please note: No allowance for over dig has been considered within this design.

ISSUED FOR CONSTRUCTION
(8 APPROVED BY:)
Groundforce:
(Date of revision):

Rev	8	7	6	5	4	3	2	1
Des	ARL	ARL	DRP					
DRW								
CHK								
Comments	Issued for Construction							
<p>Groundforce Technical: Alpha House, Turnberry Park, Leeds, LS27 7JE Tel: +44 (0)113 393 3440 Fax: +44 (0)113 393 4750 www.groundforce.uk.com technical@vpgc.com</p> <p>Client: -</p> <p>Project: General Design</p> <p>Title: Cohesive Ground - 2.0m Deep Two Frames - Installation Sequence</p> <p>Designed by: ARL</p> <p>Drawn by: ARL</p> <p>Checked by: DRP</p> <p>Drawing Ref: CO-2F-2.0-INST</p> <p>Rev: A</p> <p>Drawing Status: A Approved</p>								
<p>VP Groundforce Shorco Excavation Support</p>								

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 2.0m DEEP - GRANULAR (GR-2F-2.0)

2.0m DEEP - GRANULAR (GR-2F-2.0)

TWO FRAMES, NO TOE-IN GRANULAR GROUND – 2.0m DEEP

INPUT

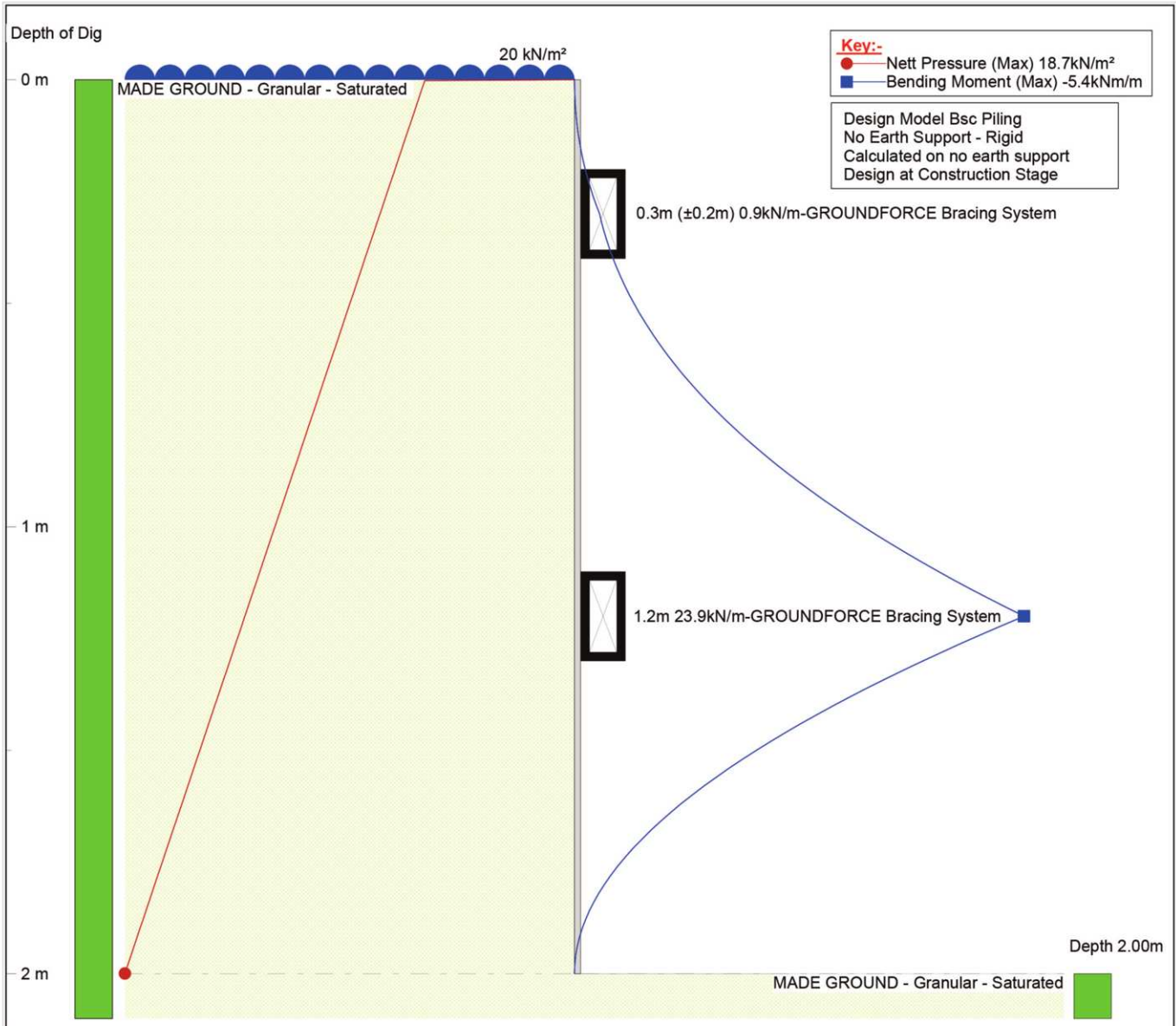
EXCAVATION DEPTH	2.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ_{sat} (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 2.0	MADE GROUND Granular (well compacted)	20.10	10.30	0.00	32.00	0.31	3.25	0.00	0.00	0.00

N.B. This design is based on saturated soil densities to allow for pipe bursts etc.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Issued for Construction.

Support Information
Frame 1
 Level: 0.30 m
 Load: 0.9 kN/m
Frame 2
 Level: 1.20 m
 Load: 23.9 kN/m

Sheet Pile Definition

8.5kNm/m > 5.4kNm/m(Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

Groundforce

Designer :Groundforce
 Reference:GR-2F-2.0
 Rev A
 Issued for Construction



GFsafe Version 2.0.16 Copyright VP plc 2010

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - GRANULAR (GR-2F-2.0)

SUMMARY – TWO FRAMES, NO TOE-IN GRANULAR GROUND – 2.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	5.4kNm/m
MAXIMUM FRAME LOAD	23.9kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 2.0m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. GR-2F-2.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. GR-2F-2.0-W)

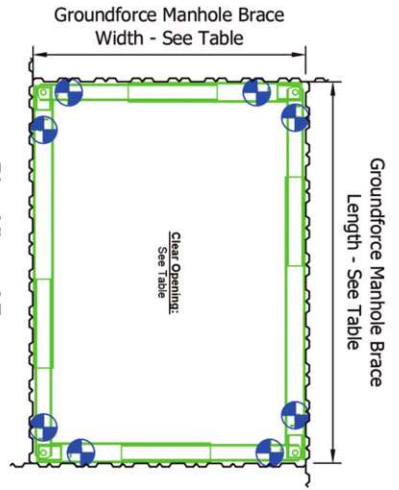
WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers

(not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Plan View of Frames
Typical Layout - WLL - See Table

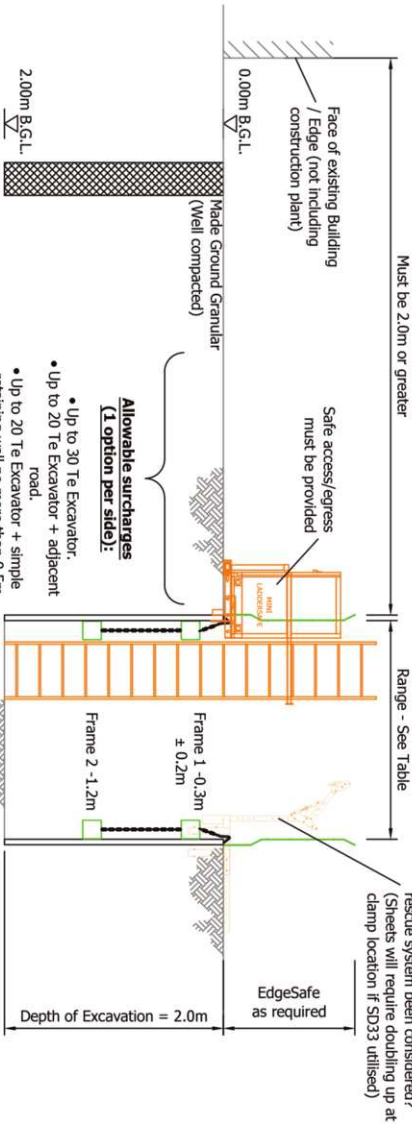
RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS - 16 NO.
Must NOT be used for lifting purposes

Schedule of Weights: Manhole Brace Frames					
Compatibility	Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kNm) [*]	Weight per item (kg)
→	S/A Manhole Brace - 540	1.5 - 2.4	1.1 - 2.0	28.8	35
→	S/A Manhole Brace - Leg A	1.7 - 2.4	1.8 - 2.0	47.7	70
→	S/A Manhole Brace - Leg B	2.2 - 3.0	1.8 - 2.6	29.8	95
→	D/A Manhole Brace - Leg A	2.0 - 3.0	1.5 - 2.5	84.0	260
→	D/A Manhole Brace - Leg B	3.0 - 4.0	2.5 - 3.5	45.7	305
→	D/A Manhole Brace - 290	1.5 - 2.25	1.0 - 1.75	115.0	145
→	D/A Manhole Brace - 490	2.24 - 3.24	1.74 - 2.74	80.2	250
→	D/A Manhole Brace - 690	2.9 - 4.6	2.3 - 4.0	56.5	440

* - Minimum value based on maximum leg range

Values per Leg



Groundwater not anticipated
Note: If soil properties and water level varies significantly from those illustrated please seek advice immediately

Note: Basic boundary wall (up to 2.0m) not retaining anything is covered in first two options

Typical Section

Schedule of Weights: Sheets	
Description:	Weight per item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment	
Description:	Weight per item (kg)
Driving Cap	7
Quick Release Shackle	19
Standard Extractor	11
Lifting Chain	-

ISSUED FOR CONSTRUCTION
(APPROVED BY: ARG)

Rev	Comments	Des	DRP	CHK
A	Issued for Construction	ARL	ARL	DRP
8				

VP Groundforce Shorco
Excavation Support

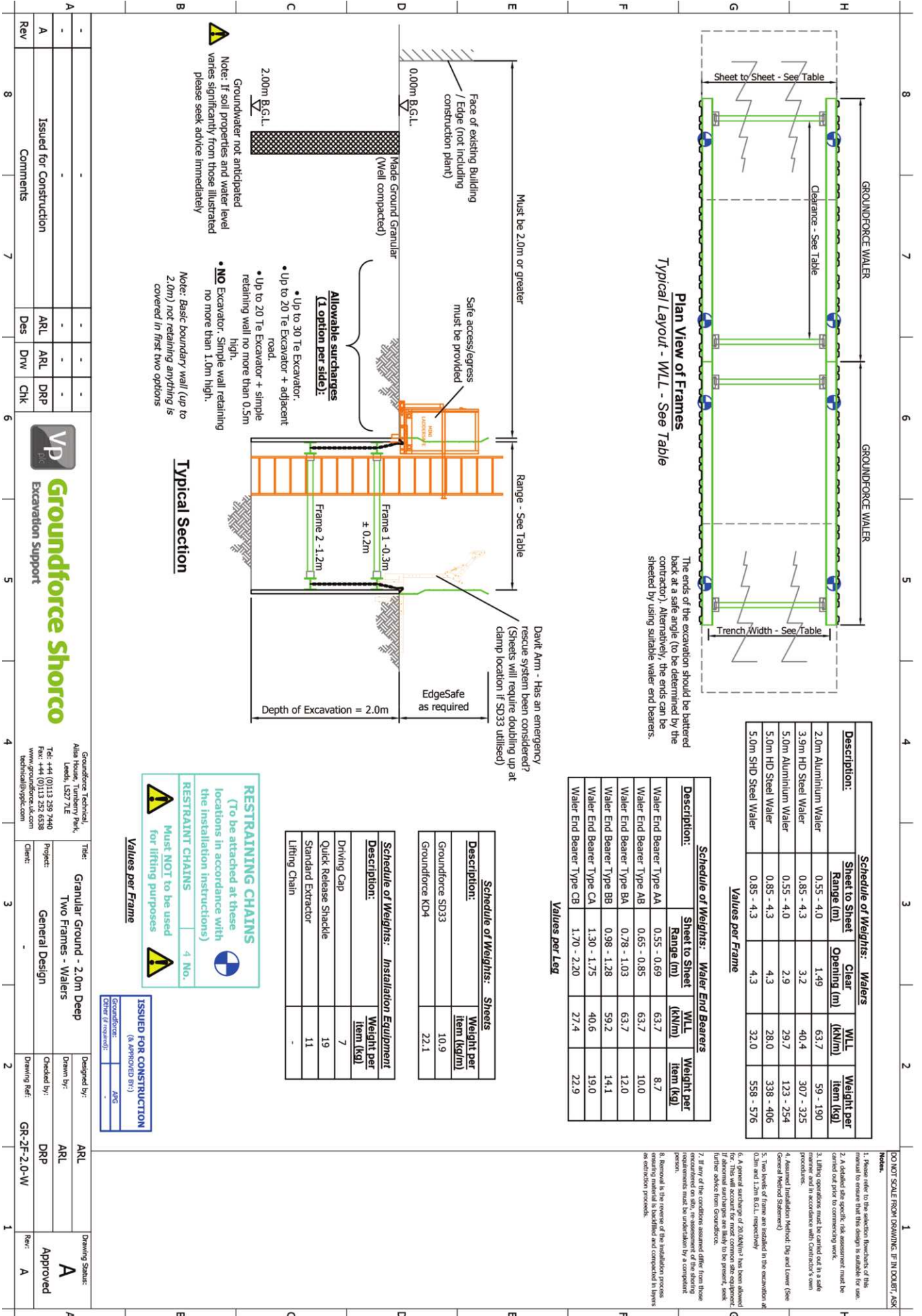
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Fax: +44 (0)113 252 6538
technical@vpgc.com

Client:		Designed by:		Drawing Status:	
Two Frames - Manhole Braces	General Design	ARL	ARL	Approved	Approved
Client:		Checked by:		Rev:	
		DRP		A	
		Drawing Ref:		GR-2F-2.0-B	

- Notes:**
- Please refer to the section headworks of this manual to ensure that this design is suitable for use.
 - A detailed site specific risk assessment must be carried out prior to commencing work.
 - Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 - Assumed Installer Method: Dig and Lower (See General Method Statement)
 - Two levels of frame are installed in the excavation at 0.3m and 1.2m B.G.L. respectively
 - A general surcharge of 20 (kN/m²) has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 - If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring system must be undertaken by a competent person.
 - Removal is the reverse of the installation process as detailed and completed in steps as extraction proceeds.

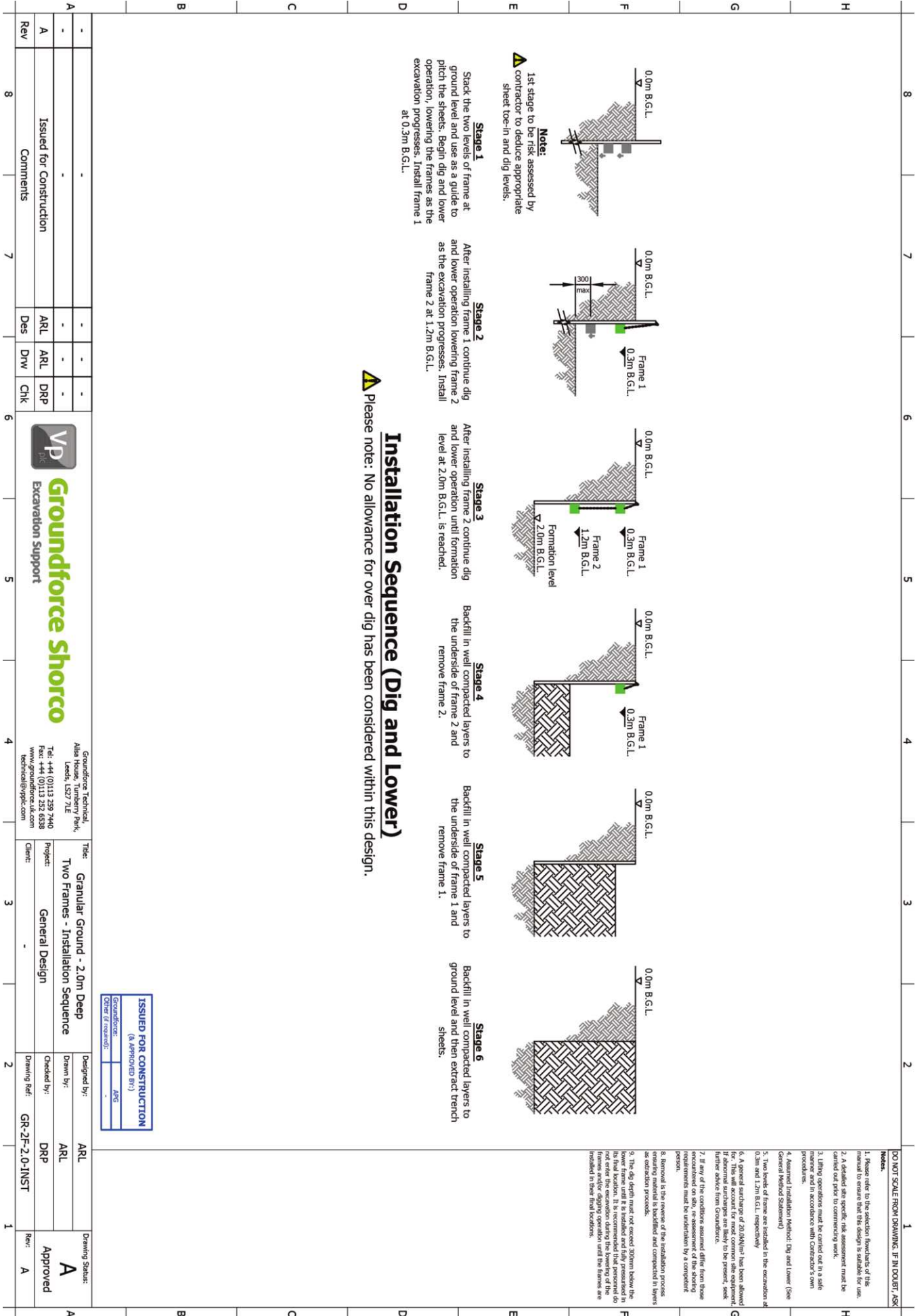
Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - GRANULAR (GR-2F-2.0)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - GRANULAR (GR-2F-2.0)



Stage 1
Stack the two levels of frame at ground level and use as a guide to pitch the sheets. Begin dig and lower operation, lowering the frames as the excavation progresses. Install frame 1 at 0.3m B.G.L.

Stage 2
After installing frame 1 continue dig and lower operation lowering frame 2 as the excavation progresses. Install frame 2 at 1.2m B.G.L.

Stage 3
After installing frame 2 continue dig and lower operation until formation level at 2.0m B.G.L. is reached.

Stage 4
Backfill in well compacted layers to the underside of frame 2 and remove frame 2.

Stage 5
Backfill in well compacted layers to the underside of frame 1 and remove frame 1.

Stage 6
Backfill in well compacted layers to ground level and then extract trench sheets.

Installation Sequence (Dig and Lower)
Please note: No allowance for over dig has been considered within this design.

ISSUED FOR CONSTRUCTION
(APPROVED BY:)
Groundforce: [Signature]
Client (if required): [Signature]

Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
DRW								
CHK								
Designed by:	ARL							
Drawn by:	ARL							
Checked by:	DRP							
Drawing Ref:	GR-2F-2.0-INST							
Rev:	A							



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Title: Granular Ground - 2.0m Deep
Two Frames - Installation Sequence
Project: General Design
Client: -

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 2.5m DEEP - COHESIVE (CO-2F-2.5)

TWO FRAMES, NO TOE-IN COHESIVE GROUND – 2.5m DEEP

INPUT

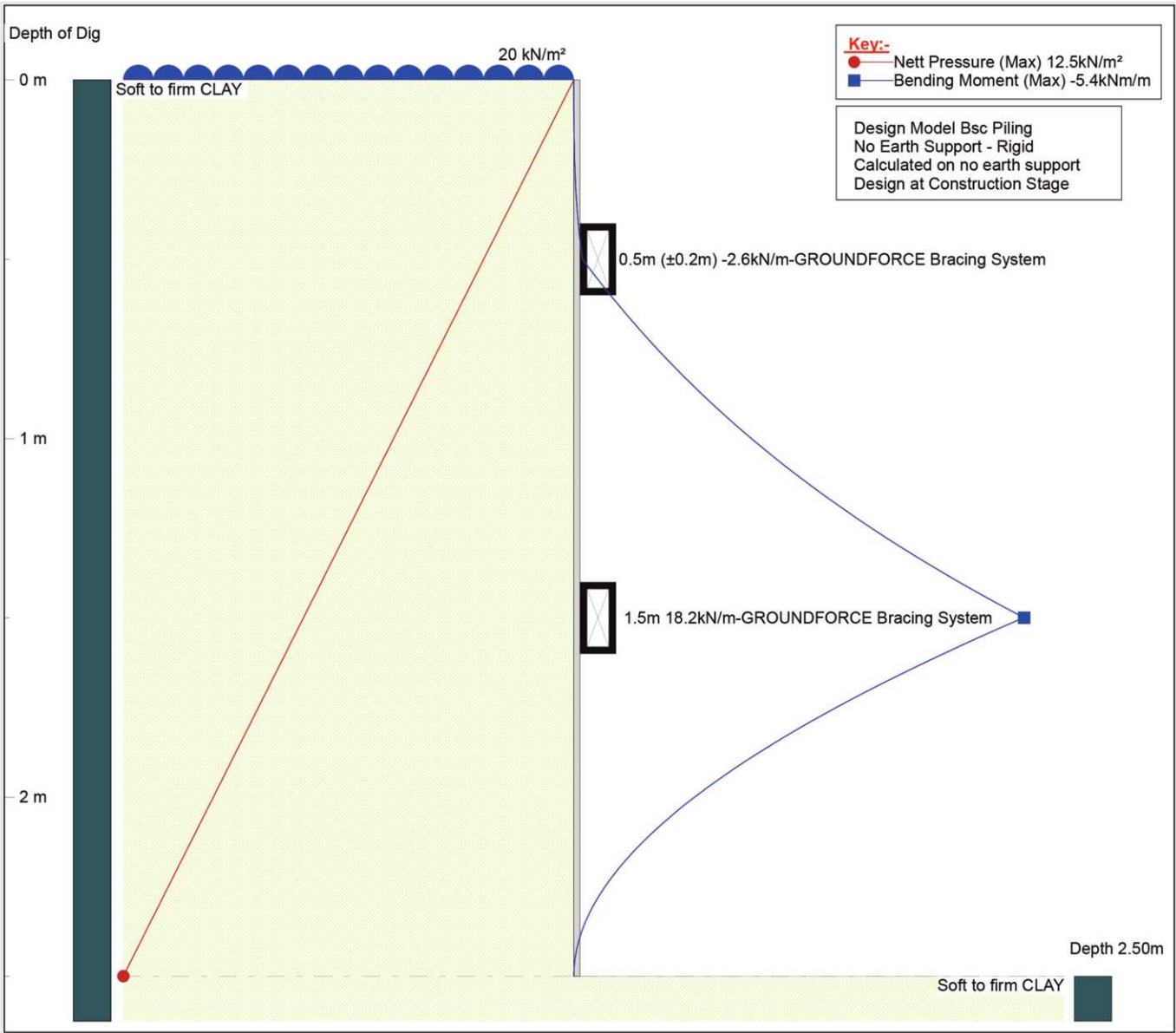
EXCAVATION DEPTH	2.5 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 2.5	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - COHESIVE (CO-2F-2.5)



Issued for Construction.


Support Information
 Frame 1
 Level: 0.50 m
 Load: -2.6 kN/m
 Frame 2
 Level: 1.50 m
 Load: 18.2 kN/m

Sheet Pile Definition

8.5kNm/m > 5.4kNm/m(Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

<p>Groundforce</p>	<p>Designer :Groundforce Reference:CO-2F-2.5 Rev A Issued for Construction</p>	<p> Excavation Support</p> <p>GFsafe Version 2.0.16 Copyright VP plc 2010</p>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

SUMMARY – TWO FRAMES, NO TOE-IN COHESIVE GROUND – 2.5m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	5.4kNm/m
MAXIMUM FRAME LOAD	18.2kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 2.5m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. CO-2F-2.5-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-2F-2.5-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - COHESIVE (CO-2F-2.5)

Rev: A
Issued for Construction
Comments

Plan View of Frames
Typical Layout - Will - See Table

Typical Section
Depth of Excavation = 2.5m

8
7
6
5
4
3
2
1

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 16 No.
Must NOT to be used for lifting purposes

Schedule of Weights: Manhole Brace Frames

Compatibility	Description:	Sheet Range (m)	Clear Opening (m)	WLL (kN/m) [*]	Weight per Item (kg)
→	S/A Manhole Brace - 540	1.5 - 2.4	1.1 - 2.0	28.8	35
→	S/A Manhole Brace - Leg A	1.7 - 2.4	1.3 - 2.0	47.7	70
→	S/A Manhole Brace - Leg B	2.2 - 3.0	1.8 - 2.6	29.8	95
→	D/A Manhole Brace - Leg A	2.0 - 3.0	1.5 - 2.5	84.0	260
→	D/A Manhole Brace - Leg B	3.0 - 4.0	2.5 - 3.5	45.7	305
→	D/A Manhole Brace - 290	1.5 - 2.25	1.0 - 1.75	115.0	145
→	D/A Manhole Brace - 490	2.24 - 3.24	1.74 - 2.74	80.2	250
→	D/A Manhole Brace - 690	2.9 - 4.6	2.3 - 4.0	56.5	440

* - Minimum value based on maximum leg range

Schedule of Weights: Sheets

Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment

Description:	Weight per Item (kg)
Driving Cap	7
Quick Release Shackles	19
Standard Extractor	11
Lifting Chain	-

Typical Section

Face of existing Building / Edge (not including construction plant)

0.00m B.G.L.

2.50m B.G.L.

Must be 2.5m or greater

Safe access/egress must be provided

Allowable surcharges (1 option per side):

- Up to 30 Te Excavator.
- Up to 20 Te Excavator + adjacent road.
- Up to 20 Te Excavator + simple retaining wall no more than 0.5m high.
- **NO** Excavator. Simple wall retaining no more than 1.0m high.

Note: Basic boundary wall (up to 2.0m) not retaining anything is covered in first two options

Depth of Excavation = 2.5m

EdgeSafe as required

Devit Arm - Has an emergency/ rescue system been considered? (Sheets will require doubling up at clamp location if SD33 utilised)

ISSUED FOR CONSTRUCTION
(8 APPROVED BY: ARS)

Notes:

- Please refer to the section headers of this manual to ensure that the design is suitable for use.
- A detailed site specific risk assessment must be carried out prior to commencing work.
- Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
- Assumed Installer Method: Dig and Lower (See General Method Statement)
- Two levels of frame are installed in the excavation at 0.5m and 1.5m B.G.L. respectively.
- A general surcharge of 20 (kN/m²) has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
- If any of the conditions assumed differ from those encountered on site, re-assessment by a competent person.
- Removal is the reverse of the installation process and must be carried out in a safe manner and in accordance with Contractor's own procedures.

Groundforce Shorco
Excavation Support

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www.groundforce.co.uk
technical@vpgc.com

Title: Cohesive Ground - 2.5m Deep
Two Frames - Manhole Braces

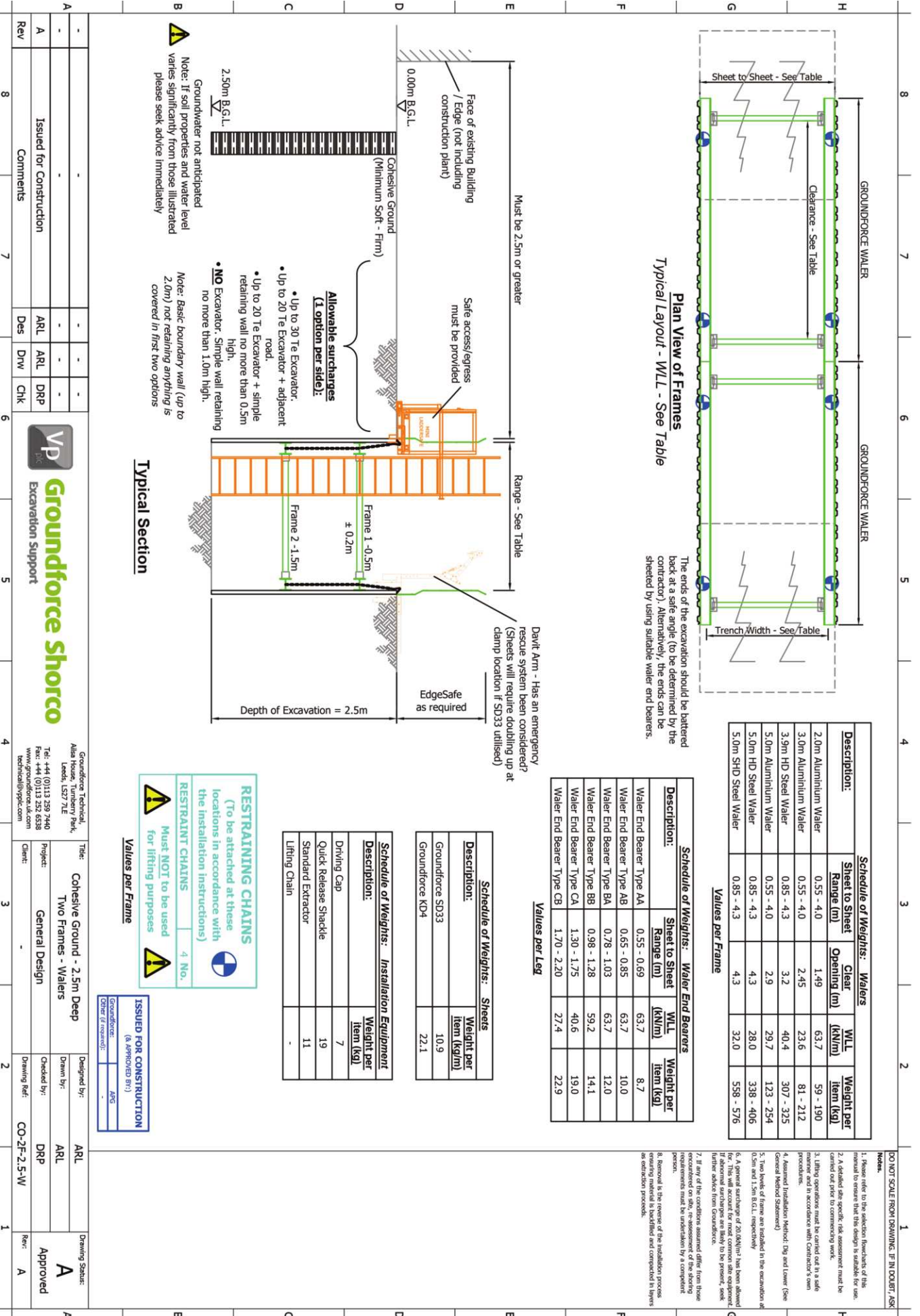
Project: General Design

Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: CO-2F-2.5-B

Approved

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



- DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK
1. Please refer to the section headers of this manual to ensure that this design is suitable for use.
 2. A detailed site specific risk assessment must be carried out prior to commencing work.
 3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 4. Assumed Installer Method: Dig and Lower (See General Method Statement)
 5. Two levels of frame are installed in the excavation at 0.5m and 1.5m B.G.L. respectively
 6. A general surcharge of 20 (kN/m²) has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 7. If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring system must be undertaken by a competent person.
 8. Removal is the reverse of the installation process as detailed in this manual and completed in steps as extraction proceeds.

Description:	Sheet to Sheet Range (m)	WLL (kNm)	Weight per Item (kg)
Waler End Bearer Type AA	0.55 - 0.69	63.7	8.7
Waler End Bearer Type AB	0.65 - 0.85	63.7	10.0
Waler End Bearer Type BA	0.78 - 1.03	63.7	12.0
Waler End Bearer Type BB	0.98 - 1.28	59.2	14.1
Waler End Bearer Type CA	1.30 - 1.75	40.6	19.0
Waler End Bearer Type CB	1.70 - 2.20	27.4	22.9

Values per Leg

Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Description:	Weight per Item (kg)
Drying Cap	7
Quick Release Shackle	19
Standard Extractor	11
Lifting Chain	-

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.
Must NOT be used for lifting purposes

ISSUED FOR CONSTRUCTION
(APPROVED BY:)

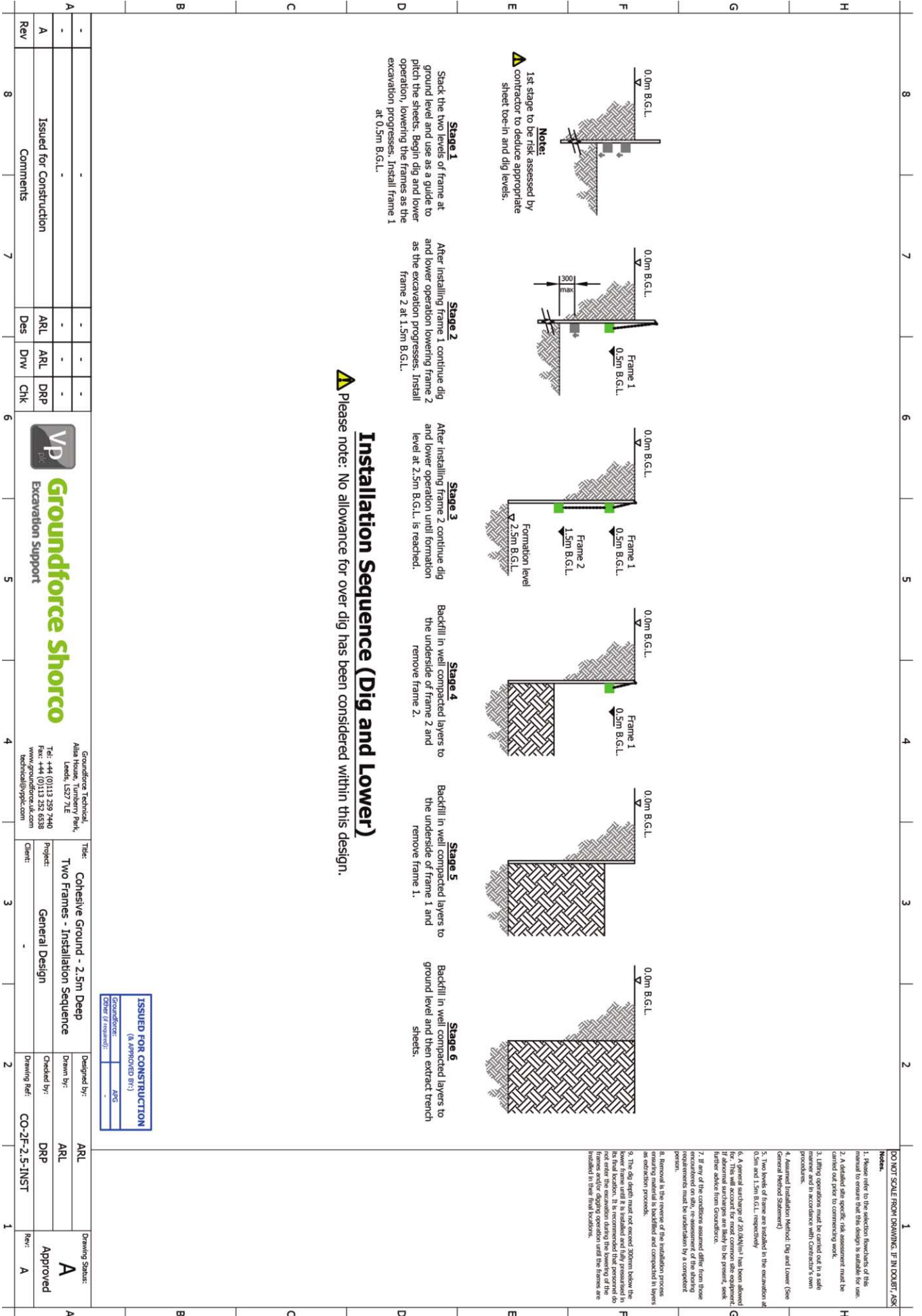
Groundforce: ARG
Client (if required): -

Groundforce Technical, Albia House, Tumbery Park, Leeds, LS27 7LE	Title: Cohesive Ground - 2.5m Deep	Designed by: ARL	Drawing Status: A
Tel: +44 (0)113 259 7440	Project: Two Frames - Walers	Drawn by: ARL	Approved
Fax: +44 (0)113 252 6538	Client: General Design	Checked by: DRP	
www.groundforce.com		Drawing Ref: CO-2F-2.5-W	
technical@vgp.com			

Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
CHK								

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - COHESIVE (CO-2F-2.5)



ISSUED FOR CONSTRUCTION
(& APPROVED BY:)
Groundforce:
Date (Approved):

Rev	A	8	7	6	5	4	3	2	1
Comments	Issued for Construction								
Des	ARL	ARL	DRP						
DW									
CHK									
<p>Groundforce Technical: Alisa House, Turnberry Park, Lends, LS27 7JE Tel: +44 (0)113 359 3440 Fax: +44 (0)113 359 4750 www.groundforce.uk.com technical@vpgc.com</p> <p>VP Groundforce Shorco Excavation Support</p> <p>Title: Cohesive Ground - 2.5m Deep Project: Two Frames - Installation Sequence Client: General Design</p> <p>Designed by: ARL Drawn by: ARL Checked by: DRP Drawing Ref: CO-2F-2.5-INST</p> <p>Drawing Status: A Approved</p>									

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 2.5m DEEP - GRANULAR (GR-2F-2.5)

2.5m DEEP - GRANULAR (GR-2F-2.5)

TWO FRAMES, NO TOE-IN GRANULAR GROUND – 2.5m DEEP

INPUT

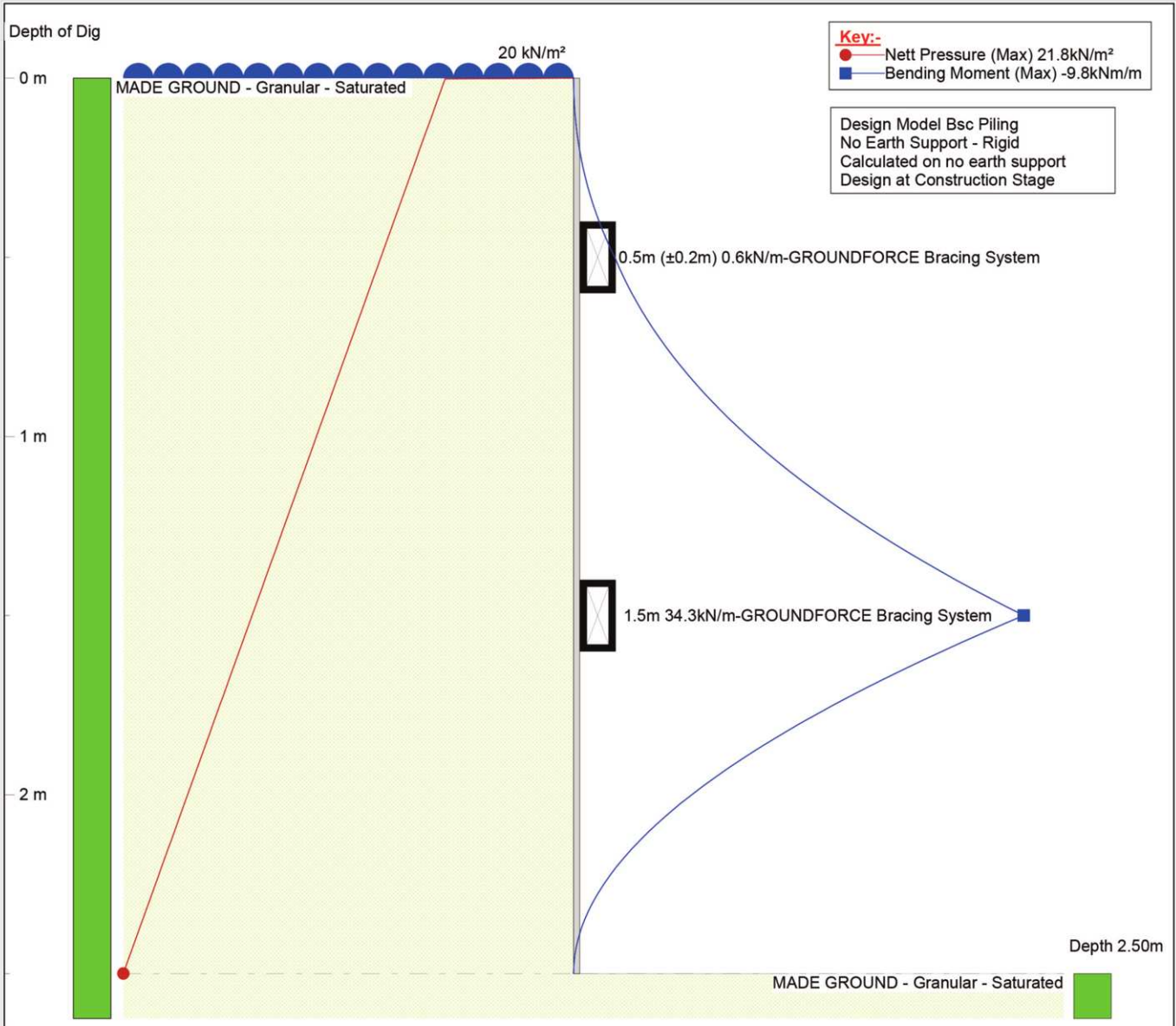
EXCAVATION DEPTH	2.5 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ_{sat} (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 2.5	MADE GROUND Granular (well compacted)	20.10	10.30	0.00	32.00	0.31	3.25	0.00	0.00	0.00

N.B. This design is based on saturated soil densities to allow for pipe bursts etc.

2.5m DEEP - GRANULAR (GR-2F-2.5)



Issued for Construction.

Support Information
Frame 1
 Level: 0.50 m
 Load: 0.6 kN/m
Frame 2
 Level: 1.50 m
 Load: 34.3 kN/m

Sheet Pile Definition

19kNm/m > 9.8kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce KD4**
 Allowable Moment = 19.0 kNm/m
 Moment of Inertia = 254.0 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 102.2 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

Groundforce

Designer :Groundforce
 Reference:GR-2F-2.5
 Rev A
 Issued for Construction



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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - GRANULAR (GR-2F-2.5)

SUMMARY – TWO FRAMES, NO TOE-IN GRANULAR GROUND – 2.5m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	9.8kNm/m
MAXIMUM FRAME LOAD	34.3kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 2.5m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. GR-2F-2.5-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

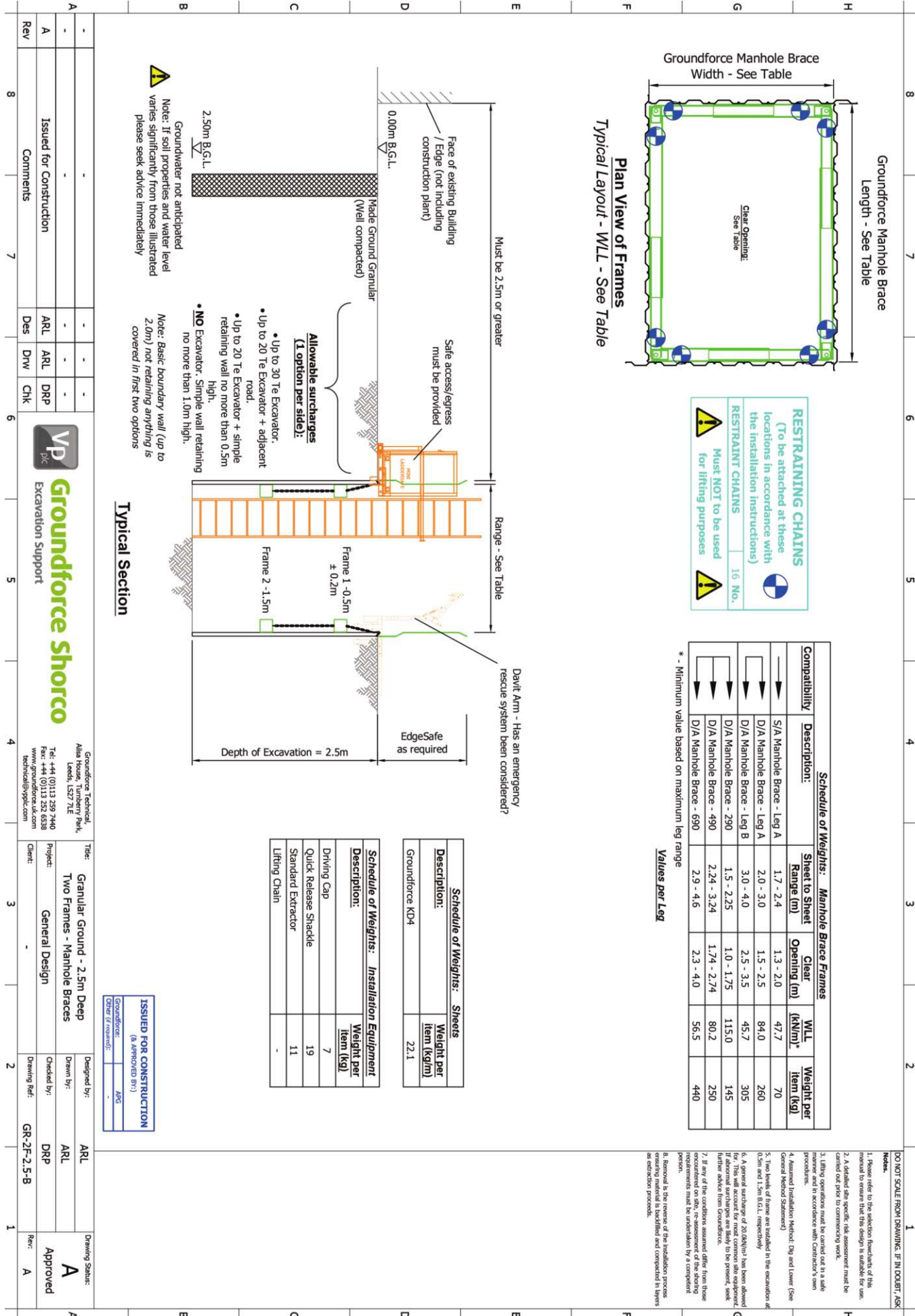
SUITABLE WALERS & END BEARERS (see drawing no. GR-2F-2.5-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

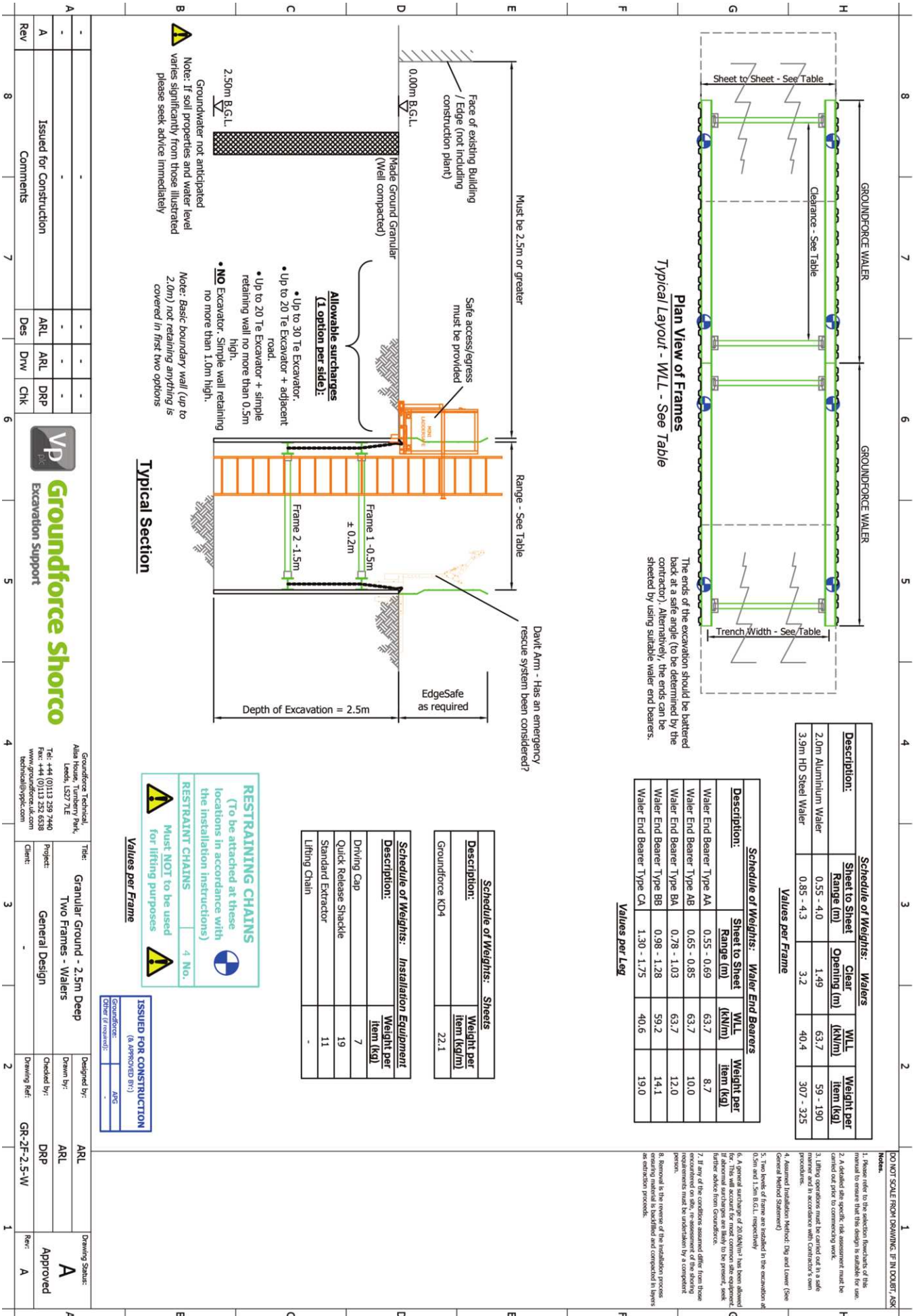
END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - GRANULAR (GR-2F-2.5)



Schedule of Weights: Waterers

Description:	Sheet to Sheet		WLL (kNm)	Weight per item (kg)
	Range (m)	Clear Opening (m)		
2.0m Aluminium Waterer	0.55 - 4.0	1.49	63.7	59 - 190
3.9m HD Steel Waterer	0.85 - 4.3	3.2	40.4	307 - 325

Values per Frame

Schedule of Weights: Water End Bearers

Description:	Sheet to Sheet Range (m)	WLL (kNm)	Weight per item (kg)
Water End Bearer Type AA	0.55 - 0.69	63.7	8.7
Water End Bearer Type AB	0.65 - 0.85	63.7	10.0
Water End Bearer Type BA	0.78 - 1.03	63.7	12.0
Water End Bearer Type BB	0.98 - 1.28	59.2	14.1
Water End Bearer Type CA	1.30 - 1.75	40.6	19.0

Values per Leg

Schedule of Weights: Sheets

Description:	Weight per item (kg/m)
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment

Description:	Weight per item (kg)
Driving Cap	7
Quick Release Shackle	19
Standard Extractor	11
Lifting Chain	-

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.
Must NOT be used for lifting purposes

ISSUED FOR CONSTRUCTION
(8 APPROVED BY:)

Groundforce: [Signature]
Date of revision: [Signature]

- DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK
1. Please refer to the section headers of the manual to ensure that the design is suitable for use.
 2. A detailed site specific risk assessment must be carried out prior to commencing work.
 3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 4. Assumed Installation Method: Dig and Lower (See General Method Statement)
 5. Two levels of frame are installed in the excavation at 0.5m and 1.5m B.G.L. respectively.
 6. A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 7. If any of the conditions assumed differ from those encountered on site, re-assessment by a competent person.
 8. Removal is the reverse of the installation process as detailed in this manual and completed in steps as extraction proceeds.

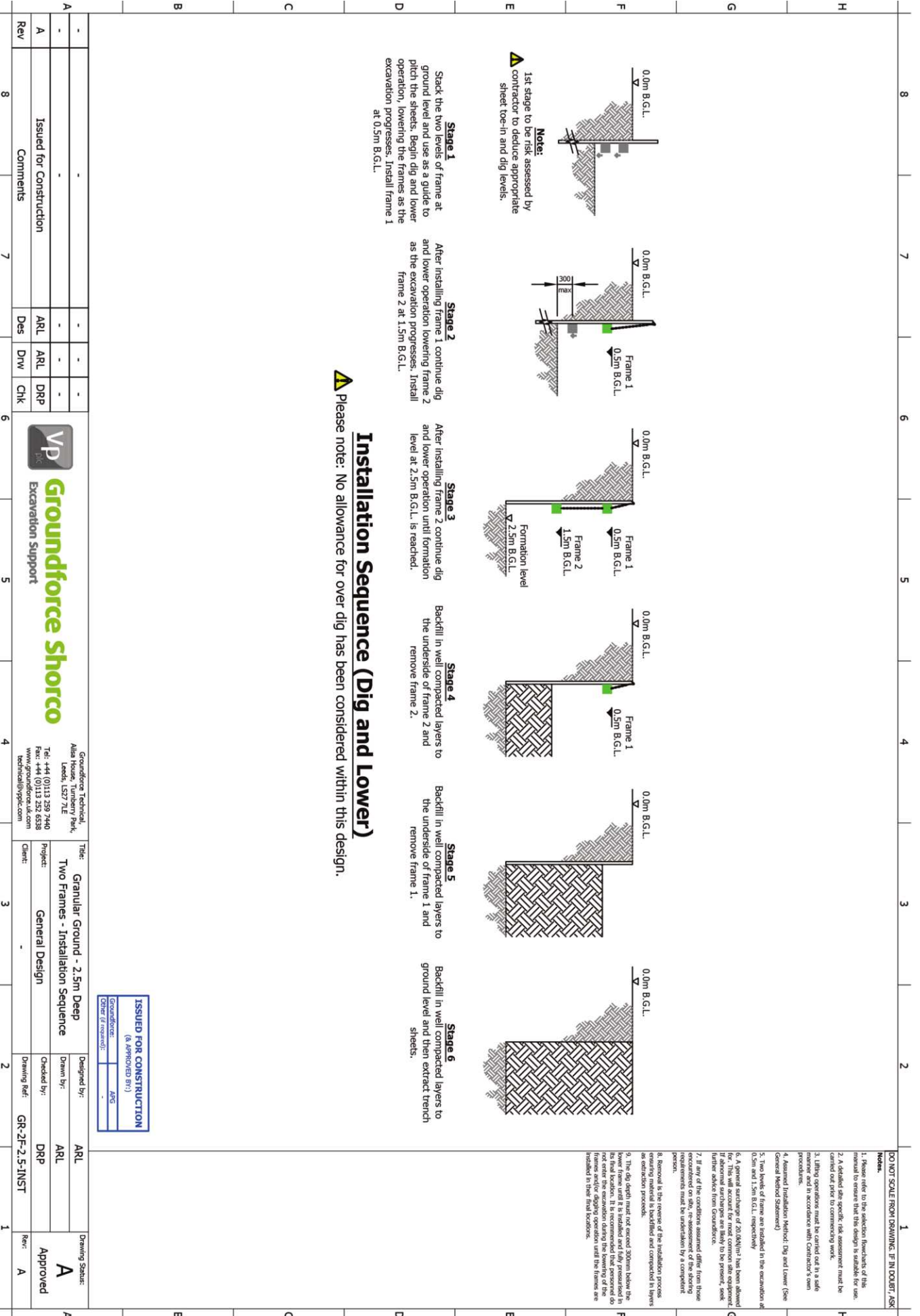
Rev	Comments	Des	DRP	CHK
A	Issued for Construction	ARL	ARL	DRP
-	-	-	-	-



Groundforce Technical, Alisa House, Tunberry Park, Leeds, LS27 7LE Tel: +44 (0)113 339 7440 Fax: +44 (0)113 339 4530 www.groundforce.co.uk technical@vpcc.com	Title: Granular Ground - 2.5m Deep Two Frames - Waterers Project: General Design Client: -	Designed by: ARL Drawn by: ARL Checked by: DRP Drawing Ref: GR-2F-2.5-W	Drawing Status: A Approved
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - GRANULAR (GR-2F-2.5)



Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
DW								
CHK								



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Title: Granular Ground - 2.5m Deep
Project: Two Frames - Installation Sequence
General Design

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-2F-2.5-INST
Rev: A

ISSUED FOR CONSTRUCTION
(APPROVED BY:)
Groundforce: [Signature]
Client (if required): [Signature]

- Please refer to the selection benchmarks of this manual to ensure that this design is suitable for use.
- A detailed site specific risk assessment must be carried out prior to commencing work.
- Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
- Assumed Installation Method: Dig and Lower (See General Method Statement)
- Two levels of frame are installed in the excavation at 0.5m and 1.5m B.G.L. respectively
- A general surcharge of 20kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
- If any of the conditions assumed differ from those encountered on site, re-assessment of the steering parameters must be undertaken by a competent person.
- Removal is the reverse of the installation process and must be carried out in a controlled manner as an extraction process.
- The dig depth must not exceed 500mm below the bottom of the excavation. It is recommended that personnel do not enter the excavation during the lowering of the frames and/or during operation and the frames are removed in their final position.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 3.0m DEEP - COHESIVE (CO-2F-3.0)

TWO FRAMES, NO TOE-IN COHESIVE GROUND – 3.0m DEEP

INPUT

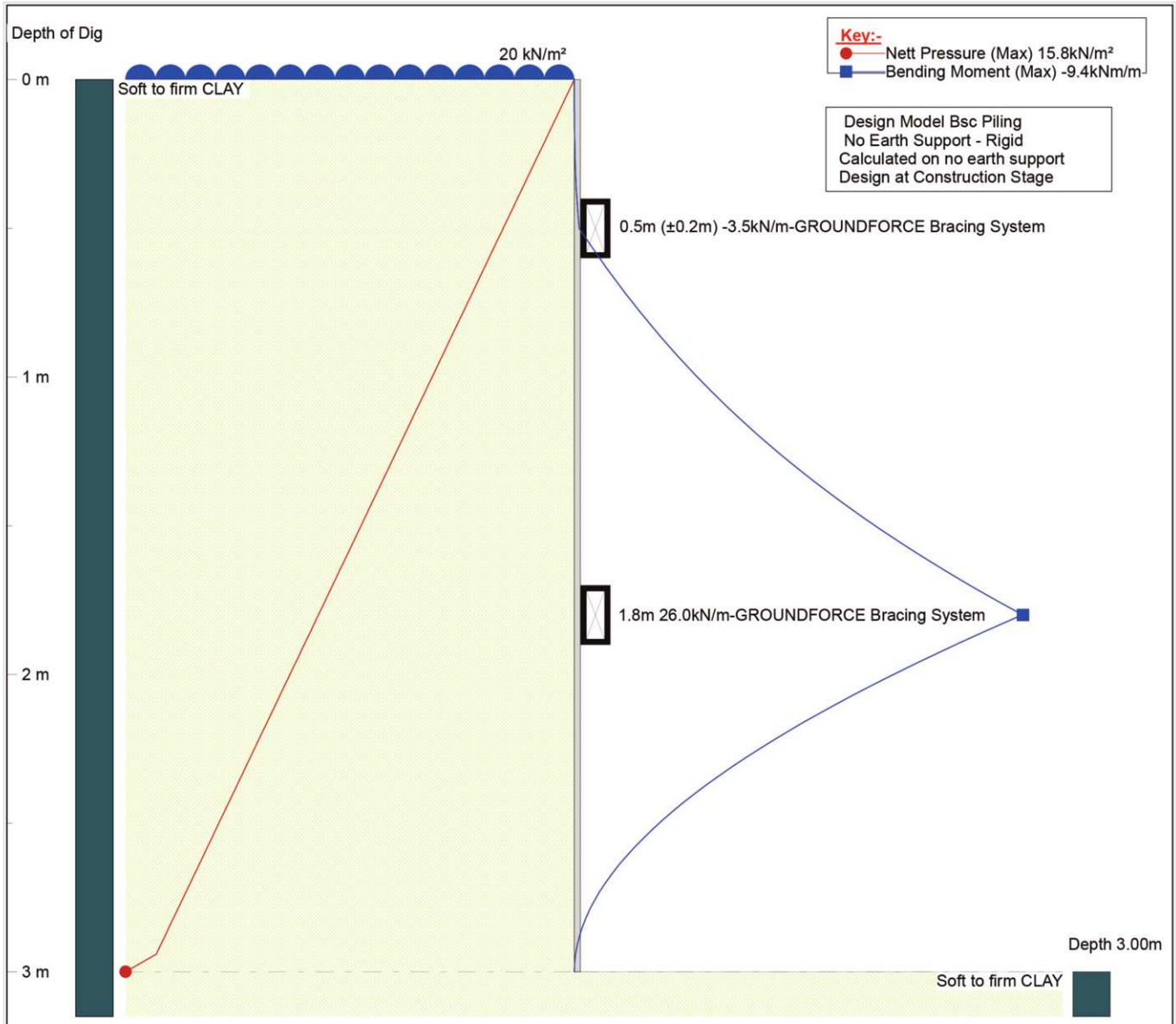
EXCAVATION DEPTH	3.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 3.0	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

3.0m DEEP - COHESIVE (CO-2F-3.0)



Issued for Construction.


Support Information
Frame 1
 Level: 0.50 m
 Load: -3.5 kN/m
Frame 2
 Level: 1.80 m
 Load: 26.0 kN/m

Sheet Pile Definition

19kNm/m > 9.4kNm/m(Bending Capacity is Adequate)

Sheet Type: **Groundforce KD4**
 Allowable Moment = 19.0 kNm/m
 Moment of Inertia = 254.0 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 102.2 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

Groundforce	Designer :Groundforce Reference:CO-2F-3.0 Rev A Issued for Construction	 Excavation Support <small>GFsafe Version 2.0.16 Copyright VP plc 2010</small>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

SUMMARY – TWO FRAMES, NO TOE-IN COHESIVE GROUND – 3.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	9.4kNm/m
MAXIMUM FRAME LOAD	26.0kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 3.0m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. CO-2F-3.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-2F-3.0-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

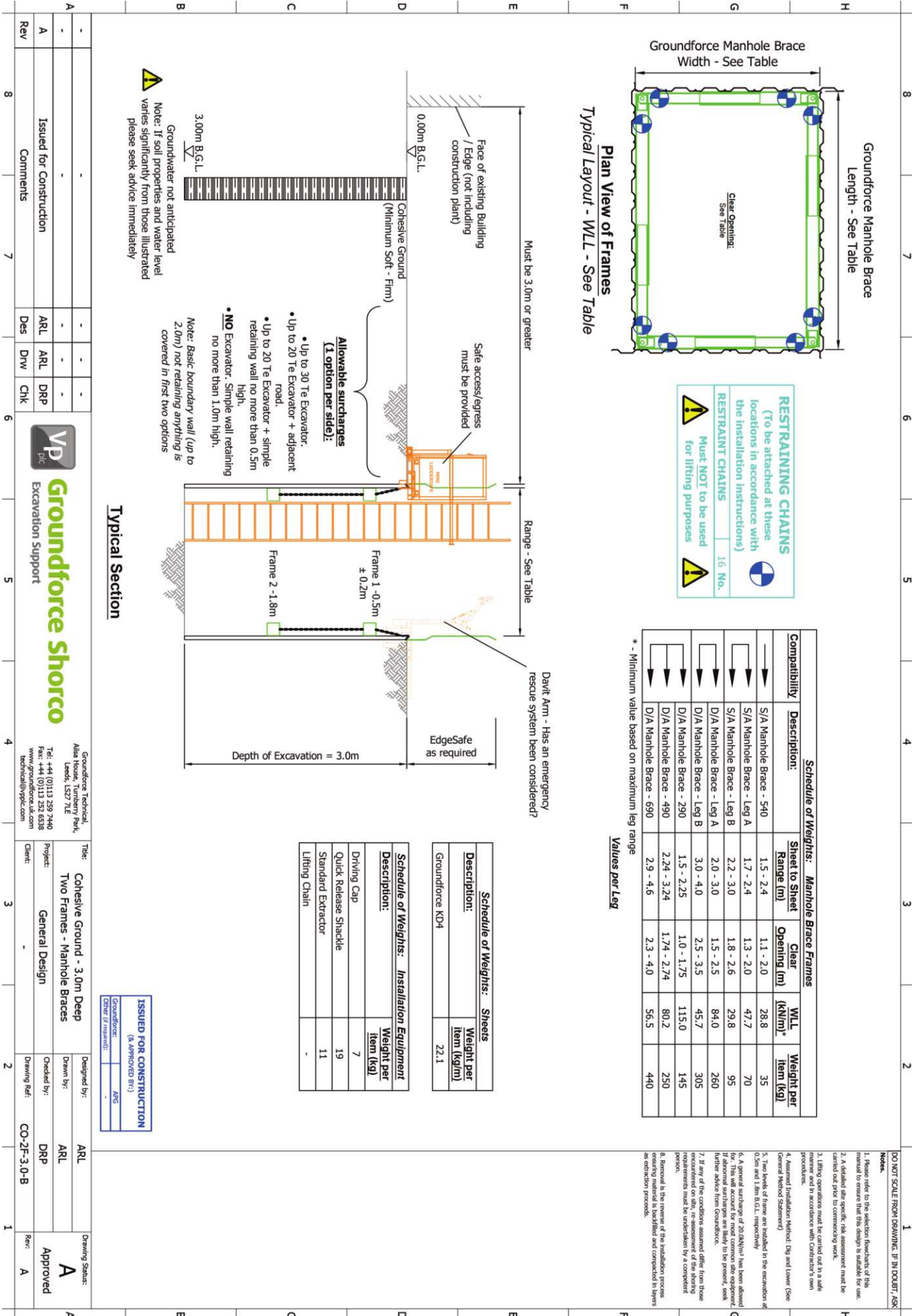
End Bearers for use in conjunction with Aluminium Walers

(not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4

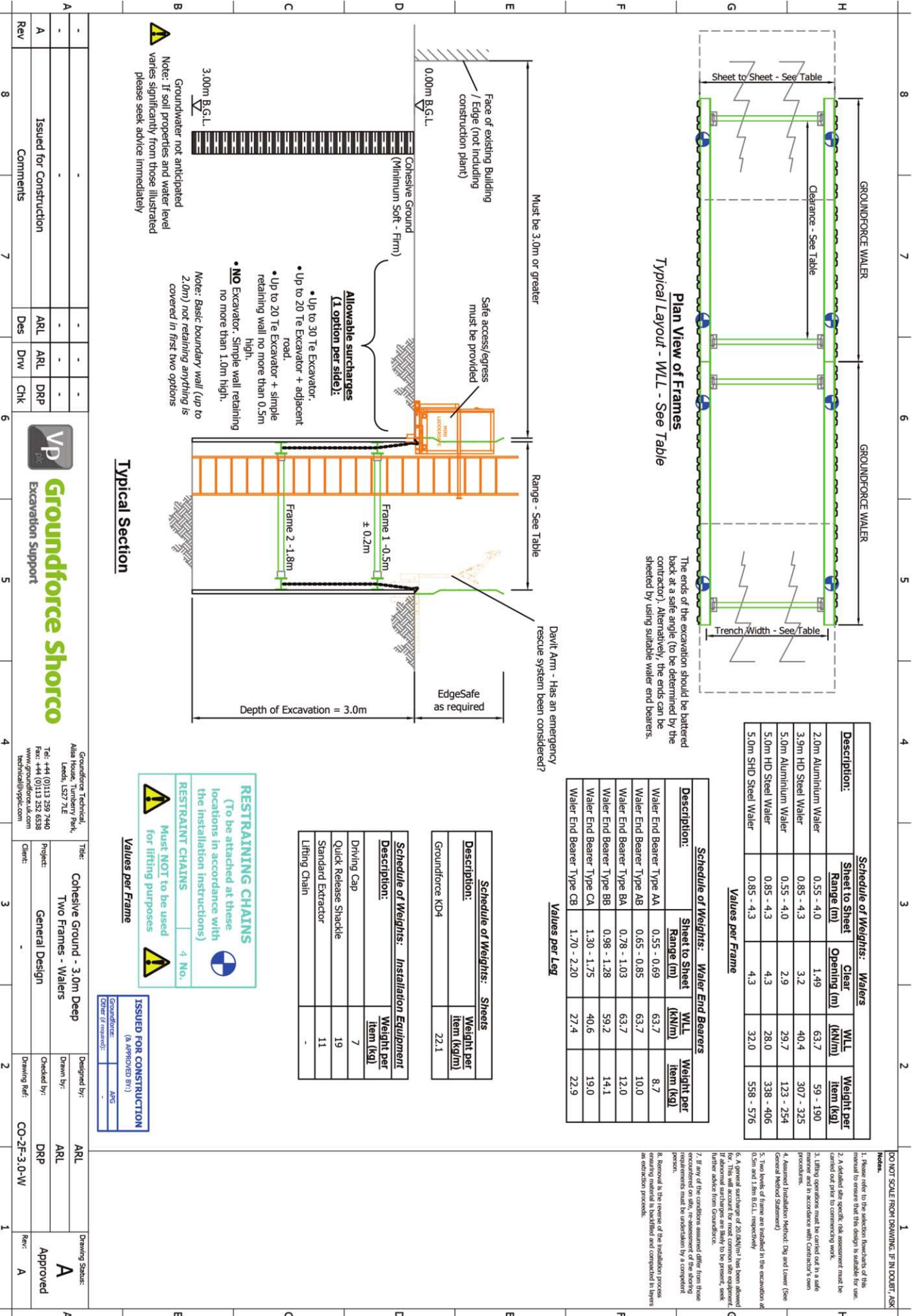
Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

3.0m DEEP - COHESIVE (CO-2F-3.0)



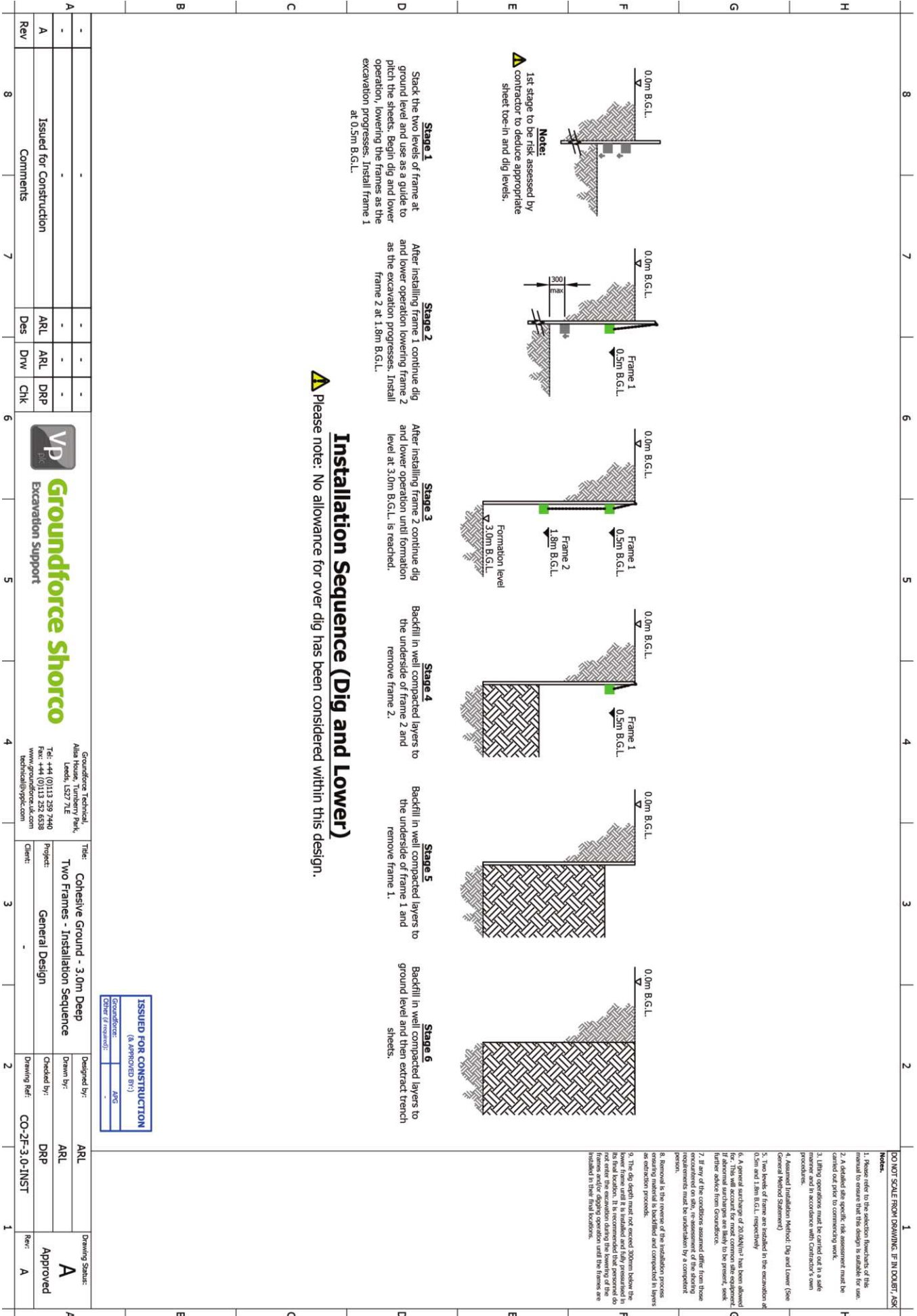
Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

3.0m DEEP - COHESIVE (CO-2F-3.0)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

3.0m DEEP - COHESIVE (CO-2F-3.0)



Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
DW								
CHK								



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www.groundforce.co.uk
technical@vpcc.com

Title: Cohesive Ground - 3.0m Deep
Two Frames - Installation Sequence
Project: General Design
Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: CO-2F-3.0-INST
Rev: A

ISSUED FOR CONSTRUCTION
(8 APPROVED BY:)
Groundforce: [Signature]
Date (if revised): [Signature]

- Notes:**
1. Please refer to the section boundaries of the manual to ensure that this design is suitable for use.
 2. A detailed site specific risk assessment must be carried out prior to commencing work.
 3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 4. Assumed Installation Method: Dig and Lower (See General Method Statement)
 5. Two levels of frame are installed in the excavation at 0.5m and 1.8m B.G.L. respectively.
 6. A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 7. If any of the conditions assumed differ from those encountered on site, re-assessment of the steering requirements must be undertaken by a competent person.
 8. Removal is the reverse of the installation process and must be undertaken in a similar manner to steps as excavation proceeds.
 9. The dig depth must not exceed 300mm below the bottom of the excavation. It is advised that personnel do not enter the excavation during the lowering of the sheets. If any other safety operations and the frames are installed in their final location.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



STANDARD DESIGNS

(TWO FRAMES, NO TOE-IN)

- 3.0m DEEP - GRANULAR (GR-2F-3.0)

3.0m DEEP - GRANULAR (GR-2F-3.0)

TWO FRAMES, NO TOE-IN GRANULAR GROUND – 3.0m DEEP

INPUT

EXCAVATION DEPTH	3.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

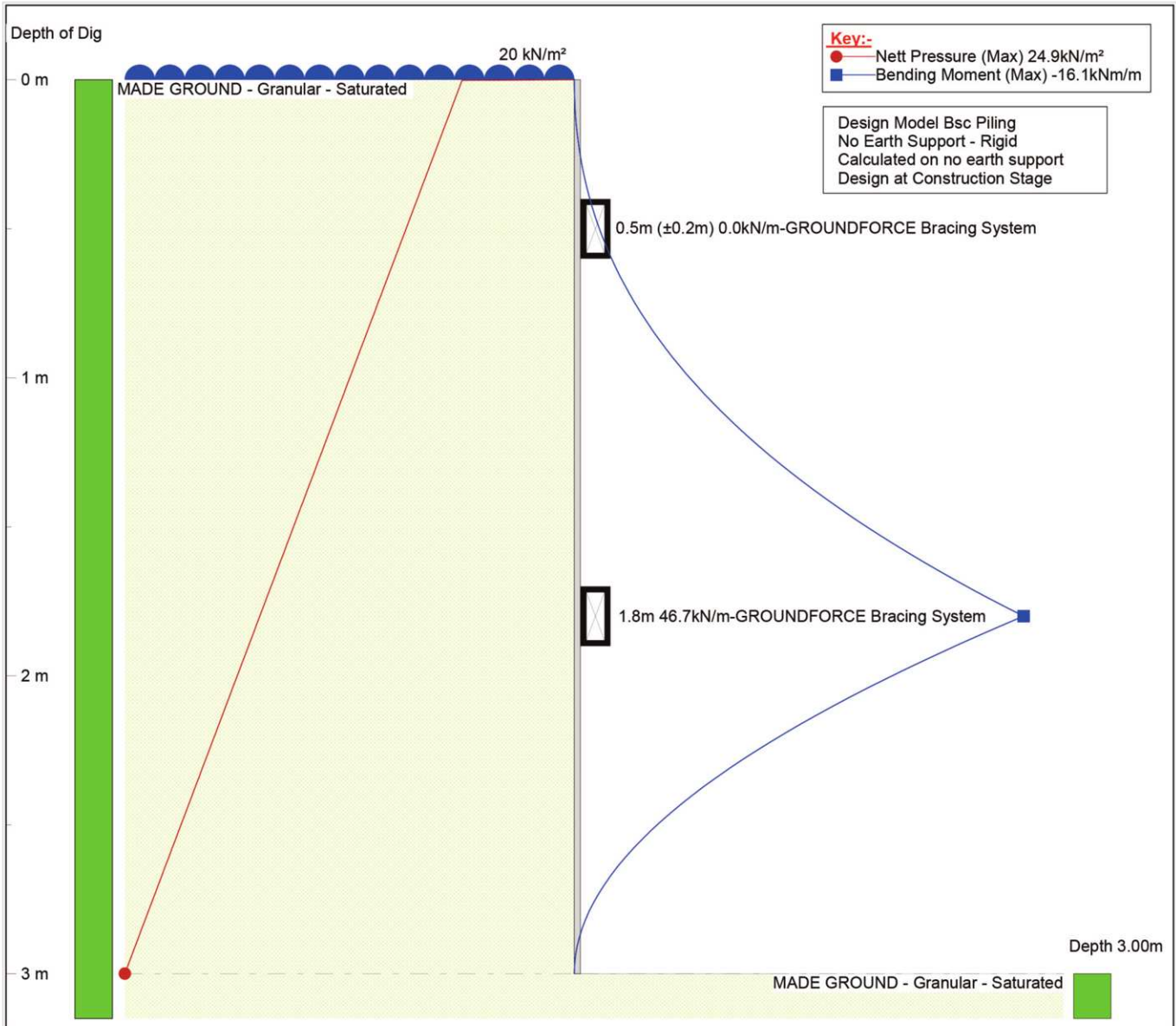
SOIL PROFILE

DEPTH (m)	SOIL NAME	γ_{sat} (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 3.0	MADE GROUND Granular (well compacted)	20.10	10.30	0.00	32.00	0.31	3.25	0.00	0.00	0.00

N.B. This design is based on saturated soil densities to allow for pipe bursts etc.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

3.0m DEEP - GRANULAR (GR-2F-3.0)



Issued for Construction.

Support Information
Frame 1
 Level: 0.50 m
 Load: 0.0 kN/m
Frame 2
 Level: 1.80 m
 Load: 46.7 kN/m

Sheet Pile Definition

19kNm/m > 16.1kNm/m(Bending Capacity is Adequate)

Sheet Type: **Groundforce KD4**
 Allowable Moment = 19.0 kNm/m
 Moment of Inertia = 254.0 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 102.2 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: No Earth Support

Groundforce

Designer :Groundforce
 Reference:GR-2F-3.0
 Rev A
 Issued for Construction



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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

3.0m DEEP - GRANULAR (GR-2F-3.0)

SUMMARY – TWO FRAMES, NO TOE-IN GRANULAR GROUND – 3.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	16.1kNm/m
MAXIMUM FRAME LOAD	46.7kN/m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 3.0m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. GR-2F-3.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

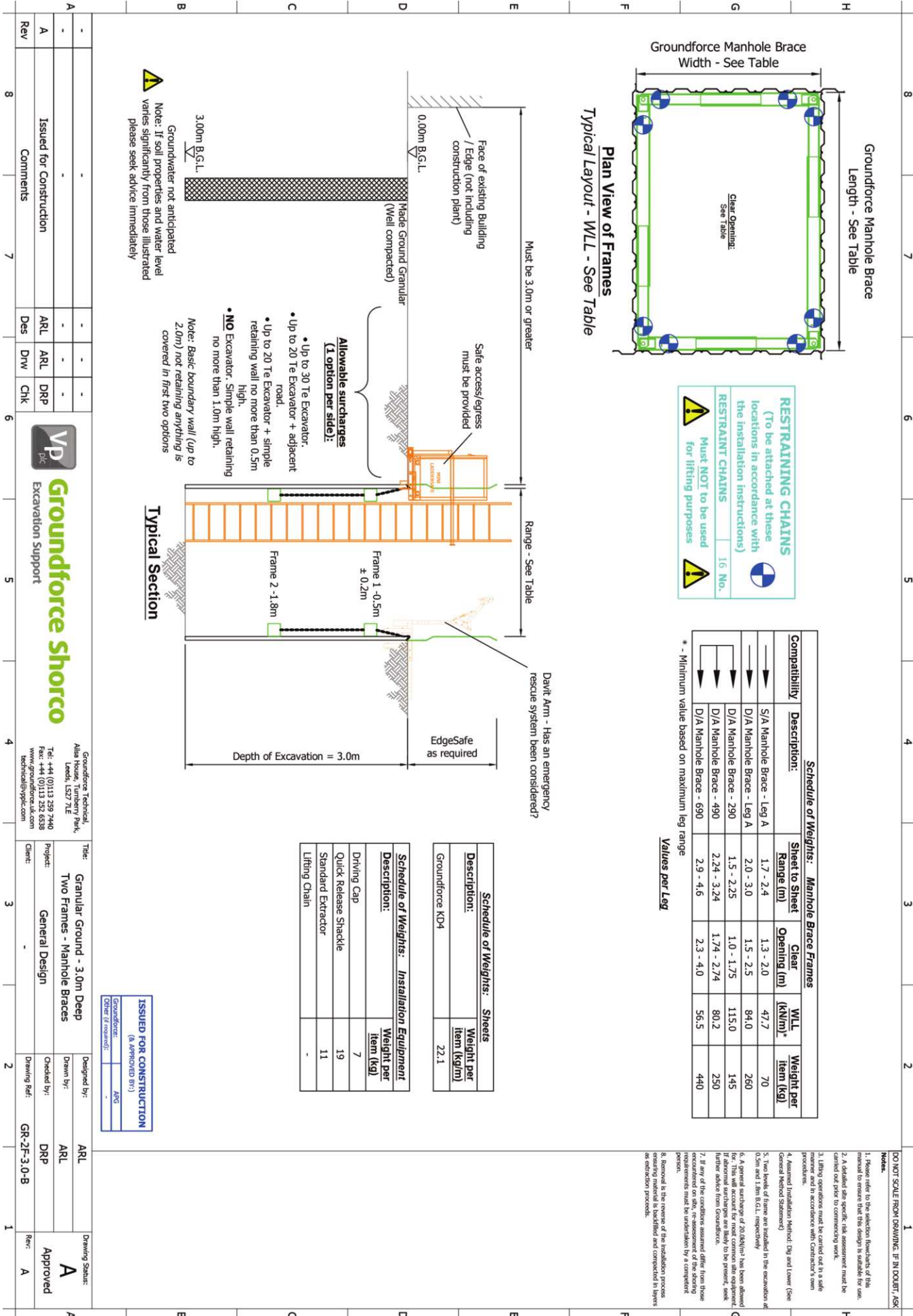
SUITABLE WALERS & END BEARERS (see drawing no. GR-2F-3.0-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



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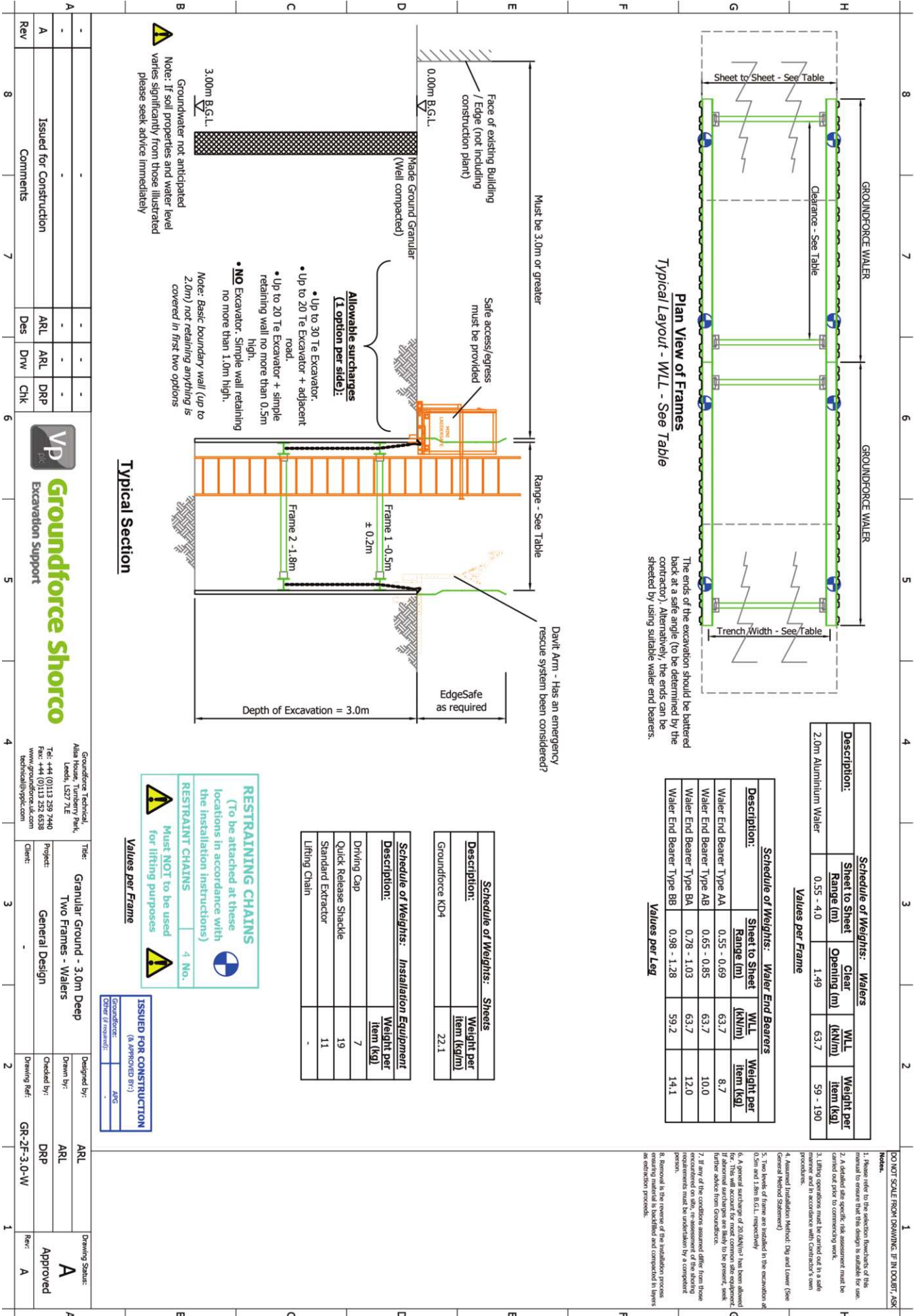
Title: Granular Ground - 3.0m Deep
Two Frames - Manhole Braces
Project: General Design
Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-2F-3.0-B
Rev: A

Drawing Status: Approved

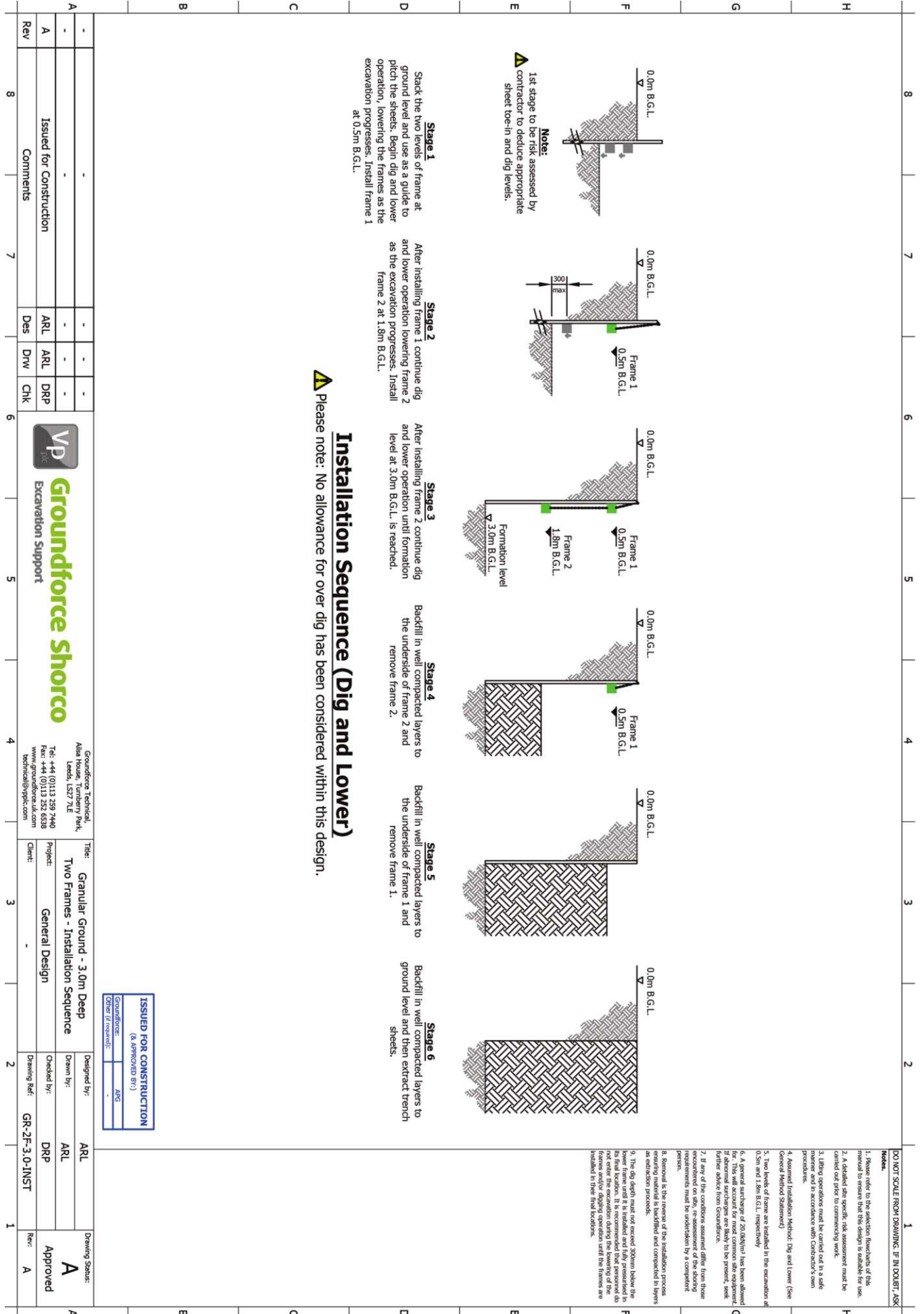
Rev	Comments	Des	DRP	CHK
A	Issued for Construction	ARL	ARL	DRP
8				
7				
6				
5				
4				
3				
2				
1				

3.0m DEEP - GRANULAR (GR-2F-3.0)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

3.0m DEEP - GRANULAR (GR-2F-3.0)



- Notes:**
1. Please refer to the selection benchmarks of the manual to ensure that this design is suitable for use.
 2. A detailed site specific risk assessment must be carried out prior to commencing work.
 3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 4. Assumed Installation Method: Dig and Lower (See General Method Statement)
 5. Two levels of frame are installed in the excavation at 0.5m and 1.8m B.G.L. respectively
 6. A general surcharge of 20kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 7. If any of the conditions assumed differ from those encountered on site, re-assessment of the steering personnel must be undertaken by a competent person.
 8. Removal is the reverse of the installation process and must be carried out in a controlled manner as an extraction procedure.
 9. The dig depth must not exceed 500mm below the bottom of the excavation. The contractor must ensure its final location. It is recommended that personnel do not enter the excavation during the lowering of the frames and/or during operation and the frames are installed in their final location.

ISSUED FOR CONSTRUCTION
(APPROVED BY:)

Groundforce:	ARL
Client (or reviewer):	ARL

Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
DW								
CHK								
Designed by:	ARL							
Drawn by:	ARL							
Checked by:	DRP							
Drawing Ref:	GR-2F-3.0-INST							
Rev:	A							



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Title: Granular Ground - 3.0m Deep
Two Frames - Installation Sequence
Project: General Design
Client: -

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



A technical drawing of a propped cantilever frame structure, showing a vertical column and a horizontal beam. The beam is supported by a prop at its free end, creating a cantilevered section. The drawing includes various components like bolts, nuts, and washers, and is rendered in a light gray color against a dark gray background.

STANDARD DESIGNS

(ONE FRAME, PROPPED CANTILEVER)

- 1.0m DEEP - COHESIVE (CO-PC-1.0)

ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 1.0m DEEP

INPUT

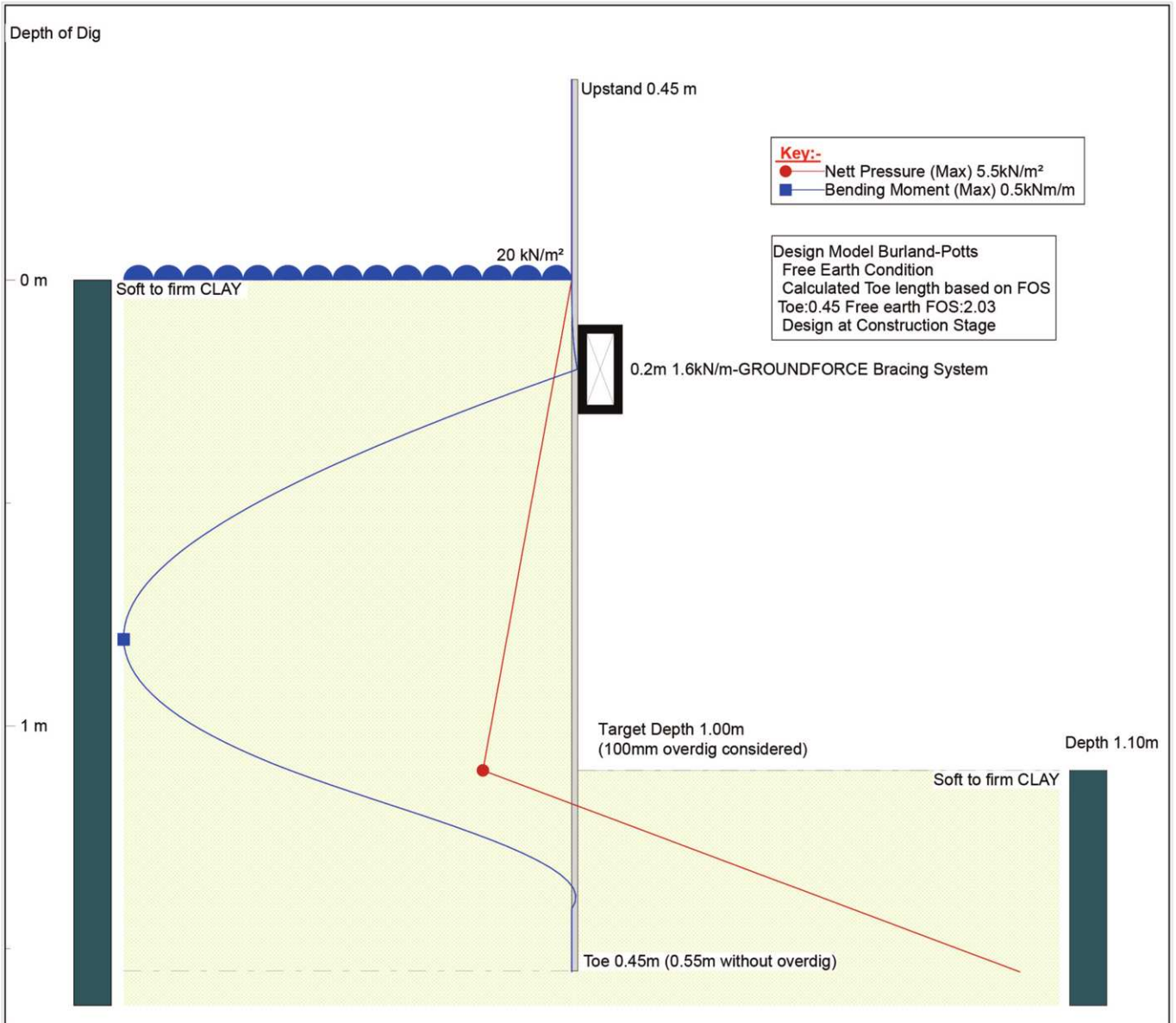
EXCAVATION DEPTH	1.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 1.55	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.0m DEEP - COHESIVE (CO-PC-1.0)



Issued for Construction.


Support Information
 Frame 1
 Type: Bracing System
 Level: 0.20 m
 Load: 1.6 kN/m

Sheet Pile Definition

8.5kNm/m > 0.5kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: Free Earth Toe-In

<p>Groundforce</p>	<p>Designer :Groundforce Reference:CO-PC-1.0 Rev A Issued for Construction</p>	<p> Excavation Support GFSafe Version 2.0.16 Copyright VP plc 2010</p>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

SUMMARY – ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 1.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	0.5kNm/m
MAXIMUM FRAME LOAD	1.6kN/m
REQUIRED TOE-IN	0.55m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 1.55m + Required upstand* (* to be assessed by contractor)
(N.B. Minimum available sheet length = 2.0m)

SUITABLE BRACES (see drawing no. CO-PC-1.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-PC-1.0-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2
C2	2.50 – 3.40	10.6

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.0m DEEP - COHESIVE (CO-PC-1.0)

8
7
6
5
4
3
2
1

Plan View of Frames
Typical Layout - WLL - See Table

8
7
6
5
4
3
2
1

Groundforce Manhole Brace
Length - See Table
Width - See Table

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)
RESTRAINT CHAINS 8 No.
Must NOT to be used for lifting purposes

Schedule of Weights: Manhole Brace Frames

Compatibility	Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)*	Weight per item (kg)
→	S/A Manhole Brace - 540	1.5 - 2.4	1.1 - 2.0	28.8	35
→	S/A Manhole Brace - Leg A	1.7 - 2.4	1.3 - 2.0	47.7	70
→	S/A Manhole Brace - Leg B	2.2 - 3.0	1.8 - 2.6	29.8	95
→	D/A Manhole Brace - Leg A	2.0 - 3.0	1.5 - 2.5	84.0	260
→	D/A Manhole Brace - Leg B	3.0 - 4.0	2.5 - 3.5	45.7	305
→	D/A Manhole Brace - 290	1.5 - 2.25	1.0 - 1.75	115.0	145
→	D/A Manhole Brace - 490	2.24 - 3.24	1.74 - 2.74	80.2	250
→	D/A Manhole Brace - 690	2.9 - 4.6	2.3 - 4.0	56.5	440

* - Minimum value based on maximum leg range

Values per Leg

Description:	Weight per item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment

Description:	Weight per item (kg)
Driving Cap	7
Quick Release Shackles	19
Standard Extractor	11
Lifting Chain	-

Typical Section

Must be 1.55m or greater

Range - See Table

Note: If soil properties and water level varies significantly from those illustrated please seek advice immediately

Groundwater not anticipated

Allowable surcharges (1 option per side):

- Up to 30 Te Excavator.
- Up to 20 Te Excavator + adjacent road.
- Up to 20 Te Excavator + simple retaining wall no more than 0.5m high.
- NO Excavator. Simple wall retaining no more than 1.0m high.

Note: Basic boundary wall (up to 2.0m) not retaining anything is covered in first two options

ISSUED FOR CONSTRUCTION
(& APPROVED BY:)

Groundforce:	ARG
Client (reference):	-

Notes:

- Please refer to the section headers of the manual to ensure that the design is suitable for use.
- A detailed site specific risk assessment must be carried out prior to commencing work.
- Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
- Assumed Installer Method: Dig and Push (See General Method Statement)
- A single level of frame is installed in the excavation at 0.2m B.G.L.
- A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
- If any of the conditions assumed differ from those encountered on site, re-assessment of the standing person must be undertaken by a competent person.
- Removal is the reverse of the installation process and must be carried out in a safe manner and in accordance with the installation procedure.

Rev | **Comments** | **Des** | **DRP** | **CHK**

A	Issued for Construction	ARL	ARL	DRP
-	-	-	-	-

VP **Groundforce Shorco** Excavation Support

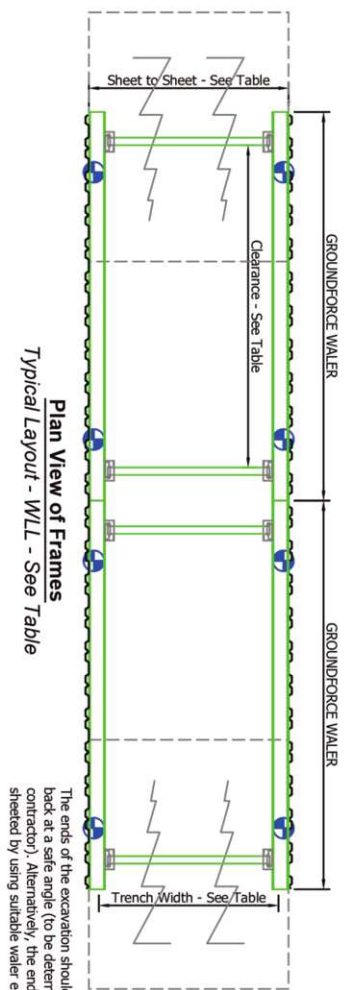
Groundforce Technical, Atlas House, Tunberry Park, Leeds, LS27 7JE
Tel: +44 (0)113 393 3440
Fax: +44 (0)113 393 4530
www.groundforce.co.uk
technical@vp.co.uk

Title: Cohesive Ground - 1.0m Deep
Project: Propped Cantilever - Manhole Braces
Client: General Design

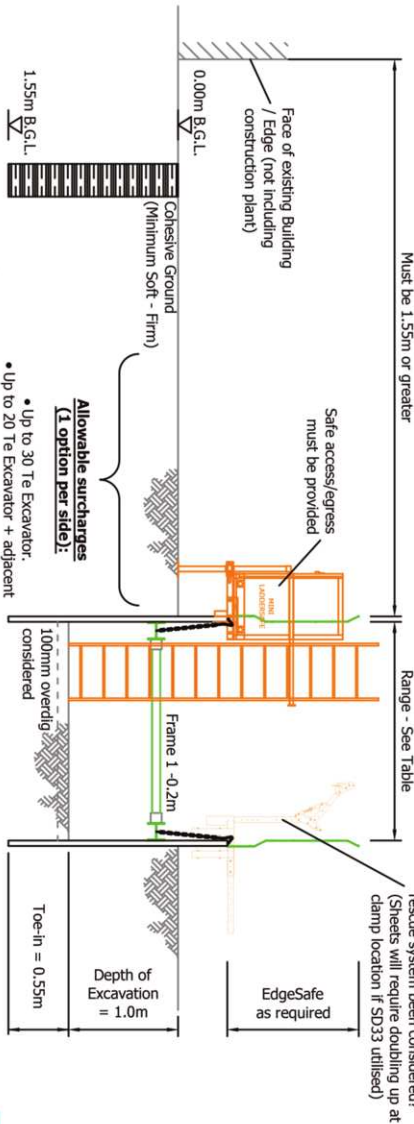
Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: CO-PC-1.0-B

Drawing Status: **A** Approved
Rev: A

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Plan View of Frames
Typical Layout - WLL - See Table



Typical Section

Groundwater not anticipated
Note: If soil properties and water level varies significantly from those illustrated please seek advice immediately

- Allowable surcharges (1 option per side):**
- Up to 30 Te Excavator.
 - Up to 20 Te Excavator + adjacent road.
 - Up to 20 Te Excavator + simple retaining wall no more than 0.5m high.
 - **NO** Excavator. Simple wall retaining no more than 1.0m high.

Note: Basic boundary wall (up to 2.0m) not retaining anything is covered in first two options

Schedule of Weights: Walers				
Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)	Weight per Item (kg)
2.0m Aluminium Waler	0.55 - 4.0	1.49	63.7	59 - 190
3.0m Aluminium Waler	0.55 - 4.0	2.45	23.6	81 - 212
4.0m Aluminium Waler	0.55 - 4.0	3.3	13.2	102 - 234
3.9m HD Steel Waler	0.85 - 4.3	3.2	40.4	307 - 325
5.0m Aluminium Waler	0.55 - 4.0	2.9	29.7	123 - 254
5.0m STD Steel Waler	0.75 - 4.2	4.3	18.0	454 - 472
5.0m HD Steel Waler	0.85 - 4.3	4.3	28.0	338 - 406
5.0m SHD Steel Waler	0.85 - 4.3	4.3	32.0	558 - 576

Values per Frame

Schedule of Weights: Water End Bearers			
Description:	Sheet to Sheet Range (m)	WLL (kN/m)	Weight per Item (kg)
Waler End Bearer Type AA	0.55 - 0.69	63.7	8.7
Waler End Bearer Type AB	0.65 - 0.85	63.7	10.0
Waler End Bearer Type BA	0.78 - 1.03	63.7	12.0
Waler End Bearer Type BB	0.98 - 1.28	59.2	14.1
Waler End Bearer Type CA	1.30 - 1.75	40.6	19.0
Waler End Bearer Type CB	1.70 - 2.20	27.4	22.9
Waler End Bearer Type CI	1.90 - 2.80	14.2	28.7
Waler End Bearer Type C2	2.50 - 3.40	10.6	34.0

Values per Leg

Schedule of Weights: Sheets	
Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment	
Description:	Weight per Item (kg)
Driving Cap	7
Quick Release Shackles	19
Standard Extractor	11
Lifting Chain	-

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.
Must NOT be used for lifting purposes

ISSUED FOR CONSTRUCTION
(APPROVED BY:)

Groundforce:	ARG
Client (if relevant):	-

DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK
Notes:
1. Please refer to the section headers of this manual to ensure that this design is suitable for use.
2. A detailed site specific risk assessment must be carried out prior to commencing work.
3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
4. Assumed Installer Method: Dig and Push (See General Method Statement)
5. A single level of frame is installed in the excavation at 0.2m B.G.L.
6. A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
7. If any of the conditions assumed differ from those encountered on site, re-assessment by a competent person.
8. Removal is the reverse of the installation process as detailed in this manual and completed in steps as construction proceeds.

Rev	Comments	Des	DW	CHK	6	5	4	3	2	1
-	-	-	-	-	-	-	-	-	-	-
A	Issued for Construction	ARL	ARL	DRP	-	-	-	-	-	-

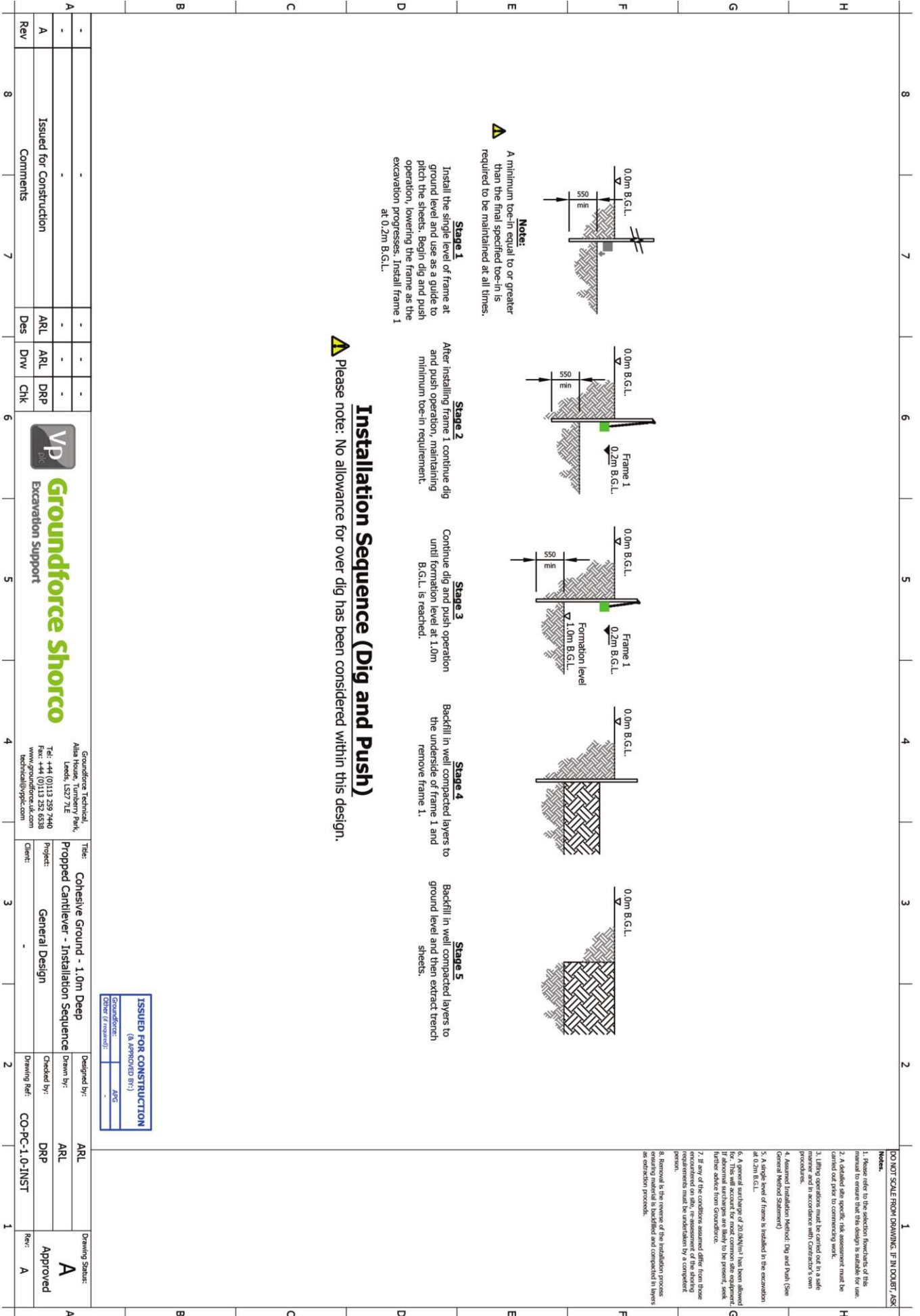


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Lands, LS27 7LE
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Fax: +44 (0)113 232 6538
www.vpgroundforce.com
technical@vpground.com

Title: Cohesive Ground - 1.0m Deep
Propped Cantilever - Walers
Project: General Design
Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: CO-PC-1.0-W
Rev: A
Drawing Status: Approved

1.0m DEEP - COHESIVE (CO-PC-1.0)



Rev	8	7	6	5	4	3	2	1
Des	ARL	ARL	DRP	DRP	DRP	DRP	DRP	DRP
DRW	ARL	ARL	DRP	DRP	DRP	DRP	DRP	DRP
CHK	ARL	ARL	DRP	DRP	DRP	DRP	DRP	DRP
Comments	Issued for Construction							



Groundforce Technical, Alisa House, Turnberry Park, Leeds, LS27 7JE	Tel: +44 (0)113 299 2440 Fax: +44 (0)113 299 2450 www.groundforce.co.uk technical@vpgc.com
Client:	General Design
Project:	Propped Cantilever - Installation Sequence
Title:	Cohesive Ground - 1.0m Deep
Designed by:	ARL
Drawn by:	ARL
Checked by:	DRP
Drawing Ref:	CO-PC-1.0-INST
Rev:	A
Drawing Status:	Approved

ISSUED FOR CONSTRUCTION
 (APPROVED BY: ARG)
 Groundforce
 (Date of revision):

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

A technical drawing of a mechanical assembly, possibly a propeller or a similar rotating component, shown in a perspective view. The drawing is rendered in light gray lines on a dark gray background. It features a central hub with several blades or arms extending outwards. There are various circular features, likely bearings or seals, and a complex arrangement of structural elements. The drawing is oriented diagonally across the page.

STANDARD DESIGNS

(ONE FRAME, PROPPED CANTILEVER)

- 1.0m DEEP - GRANULAR (GR-PC-1.0)

1.0m DEEP - GRANULAR (GR-PC-1.0)

ONE FRAME, PROPPED CANTILEVER GRANULAR GROUND – 1.0m DEEP

INPUT

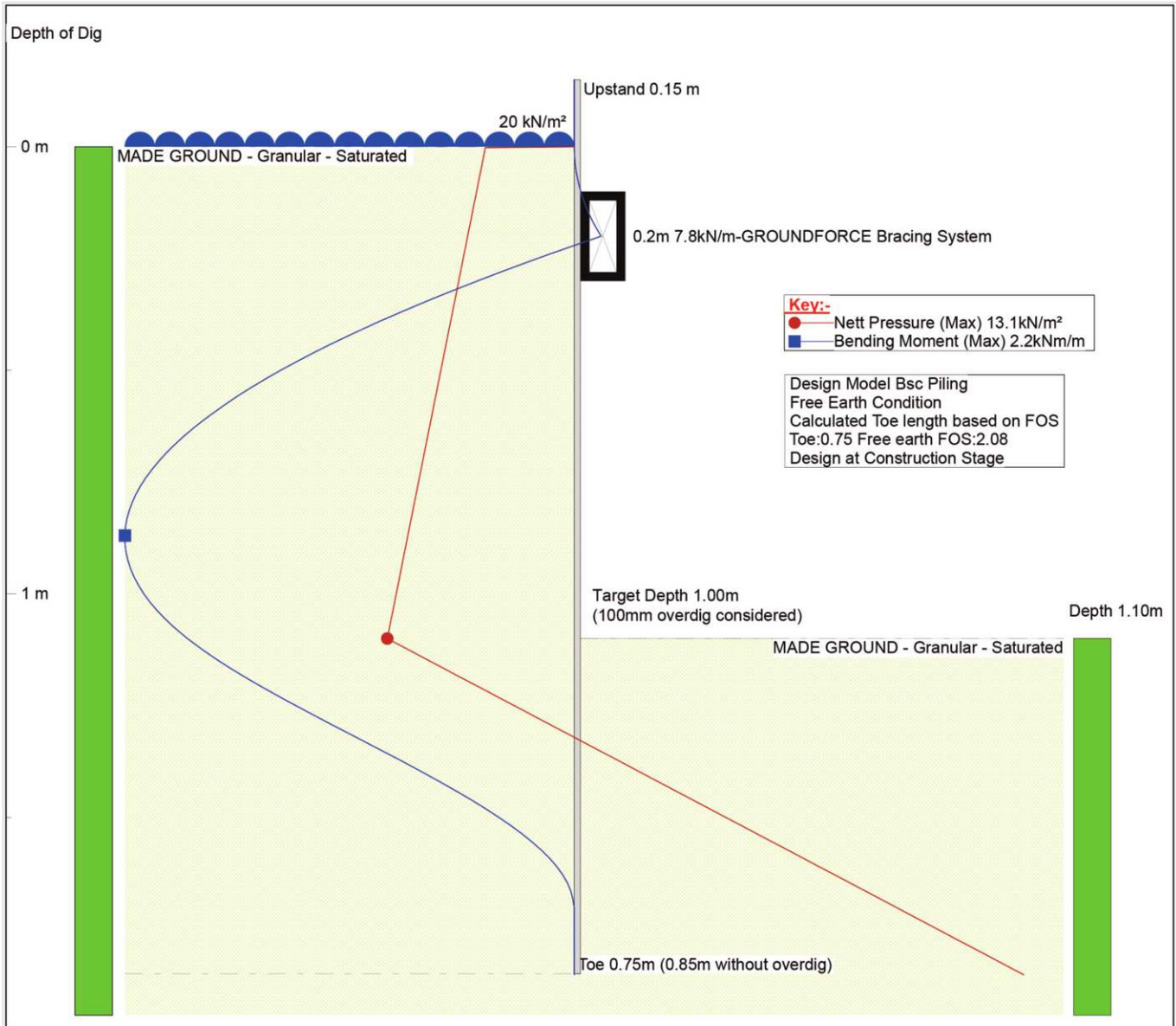
EXCAVATION DEPTH	1.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ_{sat} (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 1.85	MADE GROUND Granular (well compacted)	20.10	10.30	0.00	32.00	0.31	3.25	0.00	0.00	0.00

N.B. This design is based on saturated soil densities to allow for pipe bursts etc.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Issued for Construction.

Support Information
 Frame 1
 Type: Bracing System
 Level: 0.20 m
 Load: 7.8 kN/m

Sheet Pile Definition

8.5kNm/m > 2.2kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: Free Earth Toe-In

Groundforce

Designer :Groundforce
 Reference:GR-PC-1.0
 Rev A
 Issued for Construction



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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.0m DEEP - GRANULAR (GR-PC-1.0)

SUMMARY – ONE FRAME, PROPPED CANTILEVER GRANULAR GROUND – 1.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	2.2kNm/m
MAXIMUM FRAME LOAD	7.8kN/m
REQUIRED TOE-IN	0.85m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 1.85m + Required upstand*
(N.B. Minimum available sheet length = 2.0m)

(* to be assessed by contractor)

SUITABLE BRACES (see drawing no. GR-PC-1.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. GR-PC-1.0-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

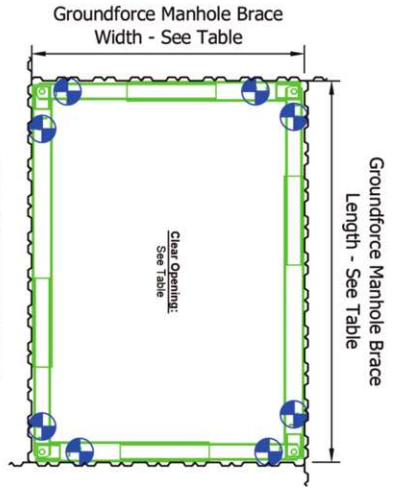
End Bearers for use in conjunction with Aluminium Walers

(not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2
C2	2.50 – 3.40	10.6

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.0m DEEP - GRANULAR (GR-PC-1.0)



RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

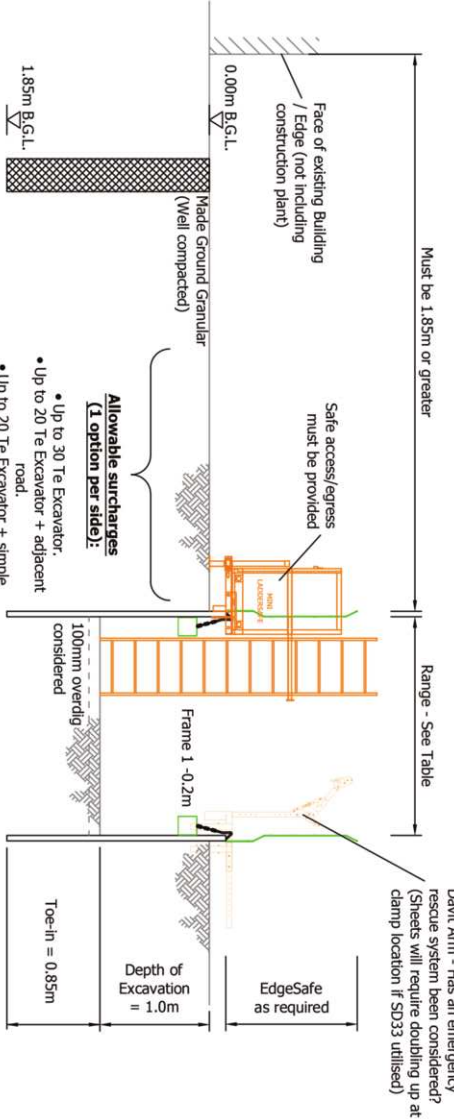
RESTRAINT CHAINS 8 No.

Must NOT be used for lifting purposes

Schedule of Weights: Manhole Brace Frames					
Compatibility	Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m) [*]	Weight per Item (kg)
→	S/A Manhole Brace - 540	1.5 - 2.4	1.1 - 2.0	28.8	35
→	S/A Manhole Brace - Leg A	1.7 - 2.4	1.3 - 2.0	47.7	70
→	S/A Manhole Brace - Leg B	2.2 - 3.0	1.8 - 2.6	29.8	95
→	D/A Manhole Brace - Leg A	2.0 - 3.0	1.5 - 2.5	84.0	260
→	D/A Manhole Brace - Leg B	3.0 - 4.0	2.5 - 3.5	45.7	305
→	D/A Manhole Brace - 290	1.5 - 2.25	1.0 - 1.75	115.0	145
→	D/A Manhole Brace - 490	2.24 - 3.24	1.74 - 2.74	80.2	250
→	D/A Manhole Brace - 690	2.9 - 4.6	2.3 - 4.0	56.5	440

* - Minimum value based on maximum leg range

Values per Leg



Schedule of Weights: Sheets		
Description:	Weight per Item (kg/m)	
Groundforce SD33	10.9	
Groundforce KD4	22.1	

Schedule of Weights: Installation Equipment		
Description:	Weight per Item (kg)	
Driving Cap	7	
Quick Release Shackles	19	
Standard Extractor	11	
Lifting Chain	-	

ISSUED FOR CONSTRUCTION
(APPROVED BY:)

Groundforce: Approved By:

Client (if required): Approved By:

- Notes:**
- Please refer to the selection handbooks of the manual to ensure that this design is suitable for use.
 - A detailed site specific risk assessment must be carried out prior to commencing work.
 - Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 - Assumed Installer Method: Dig and Push (See General Method Statement)
 - A single level of frame is installed in the excavation at 0.2m B.G.L.
 - A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If additional surcharges are likely to be present, seek further advice from Groundforce.
 - If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring process must be undertaken by a competent person.
 - Removal is the reverse of the installation process as detailed and completed in steps as extraction proceeds.

Rev	Comments	Des	DRP	CHK	6	5	4	3	2	1
A	Issued for Construction	ARL	ARL	DRP						
8										



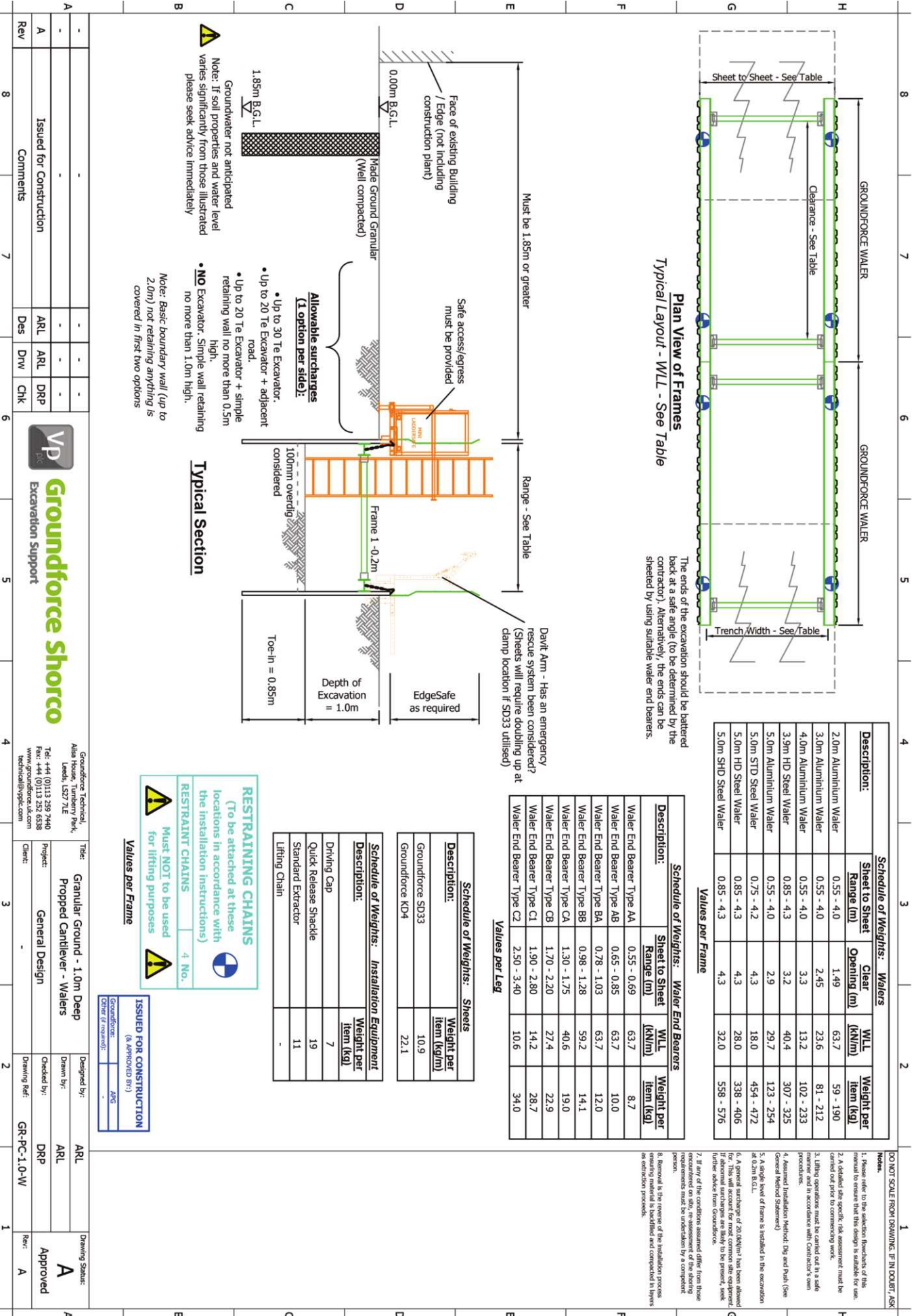
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Aliaa House, Tumberry Park,
Lisnally, LS27 7LE
Tel: +44 (0)113 259 7440
Fax: +44 (0)113 252 6538
technical@vgpc.com

Title: Granular Ground - 1.0m Deep
Propped Cantilever - Manhole Braces
Project: General Design
Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-PC-1.0-B
Rev: A

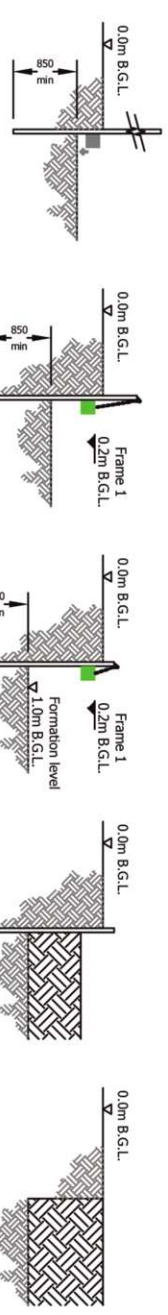
Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.0m DEEP - GRANULAR (GR-PC-1.0)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.0m DEEP - GRANULAR (GR-PC-1.0)



Note:
 A minimum toe-in equal to or greater than the final specified toe-in is required to be maintained at all times.

Stage 1
 Install the single level of frame at ground level and use as a guide to pitch the sheets. Begin dig and push operation, lowering the frame as the excavation progresses. Install frame 1 at 0.2m B.G.L.

Stage 2
 After installing frame 1 continue dig and push operation, maintaining minimum toe-in requirement.

Stage 3
 Continue dig and push operation until formation level at 1.0m B.G.L. is reached.

Stage 4
 Backfill in well compacted layers to the underside of frame 1 and remove frame 1.

Stage 5
 Backfill in well compacted layers to ground level and then extract trench sheets.

Installation Sequence (Dig and Push)
 Please note: No allowance for over dig has been considered within this design.

1. Please refer to the selection requirements of the manual to ensure that this design is suitable for use.
2. A detailed site specific risk assessment must be carried out prior to commencing work.
3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
4. Assumed Installation Method: Dig and Push (See General Method Statement)
5. A single level of frame is installed in the excavation at 0.2m B.G.L.
6. A general surcharge of 200 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
7. If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring provisions must be undertaken by a competent person.
8. Removal is the reverse of the installation process as detailed and completed in steps as extraction proceeds.

ISSUED FOR CONSTRUCTION
 (APPROVED BY:)
 Groundforce: [Signature]
 Client (if required): [Signature]

Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
DRW								
CHK								
Designed by:	ARL							
Drawn by:	ARL							
Checked by:	DRP							
Drawing Ref:	GR-PC-1.0-INST							
Drawing Status:	Approved							



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Client: -
 Project: General Design
 Title: Granular Ground - 1.0m Deep
 Propped Cantilever - Installation Sequence

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



A technical drawing of a propped cantilever frame structure, showing a vertical column and a horizontal beam. The drawing includes various components like joints, bolts, and supports, rendered in a light gray line-art style against a dark gray background. A green vertical bar is on the left side of the page.

STANDARD DESIGNS

(ONE FRAME, PROPPED CANTILEVER)

- 1.5m DEEP - COHESIVE (CO-PC-1.5)

ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 1.5m DEEP

INPUT

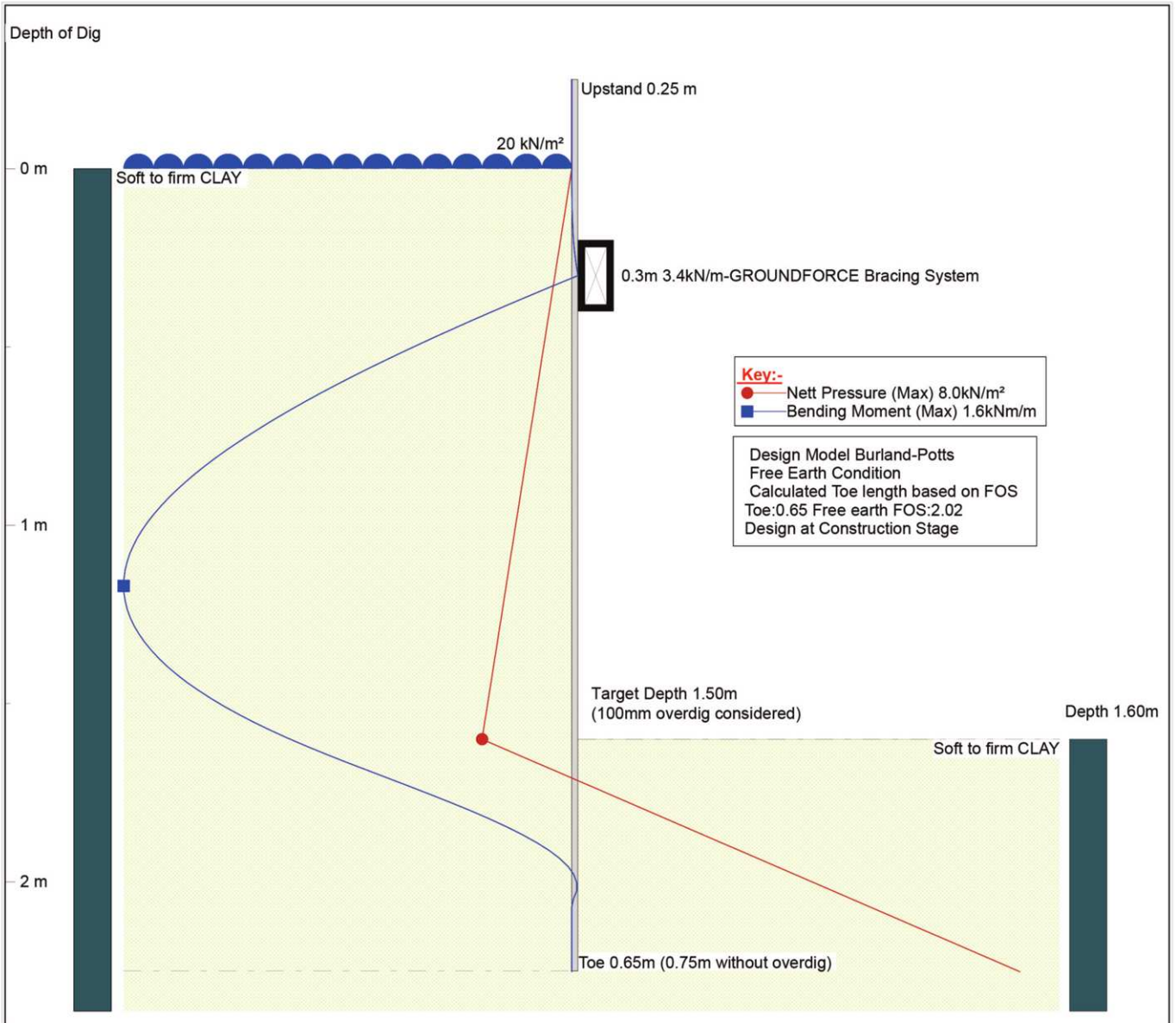
EXCAVATION DEPTH	1.5 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 2.25	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - COHESIVE (CO-PC-1.5)



Issued for Construction.

Support Information
Frame 1
Type: Bracing System/
Level: 0.30 m
Load: 3.4 kN/m

Sheet Pile Definition

8.5kNm/m > 1.6kNm/m(Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
Allowable Moment = 8.5 kNm/m
Moment of Inertia = 81.9 cm⁴/m
Youngs Modulus (E) = 210.0 kN/mm²
Allowable Stress = 186.0 kN/mm²
Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
Load Model: Rigid sheet about lower frame
Support Type: Free Earth Toe-In

Groundforce

Designer :Groundforce
Reference:CO-PC-1.5
Rev A
Issued for Construction

vp Groundforce Shorco
Excavation Support

GFsafe Version 2.0.16 Copyright VP plc 2010

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

SUMMARY – ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 1.5m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	1.6kNm/m
MAXIMUM FRAME LOAD	3.4kN/m
REQUIRED TOE-IN	0.75m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 2.25m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. CO-PC-1.5-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-PC-1.5-W)

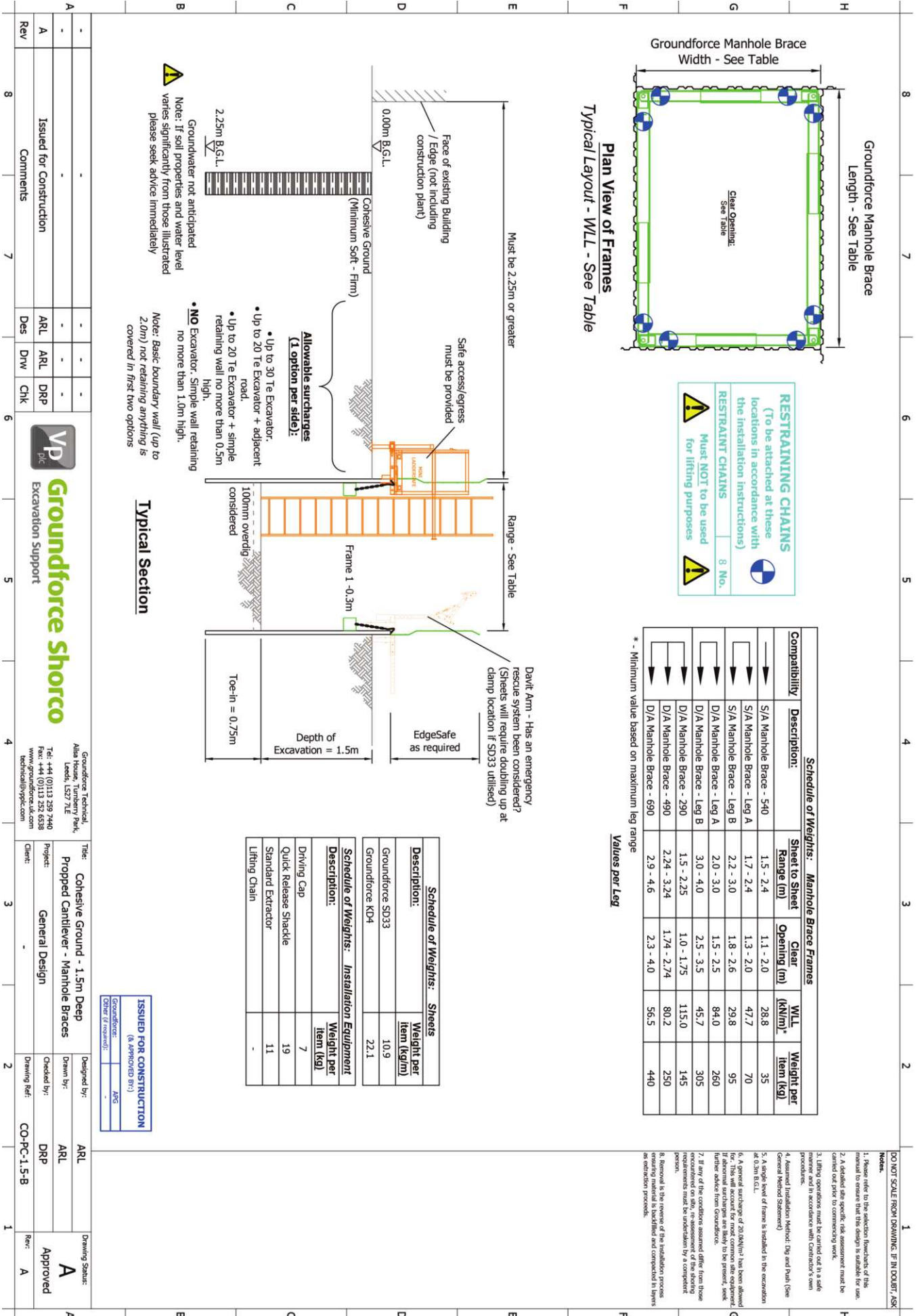
WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

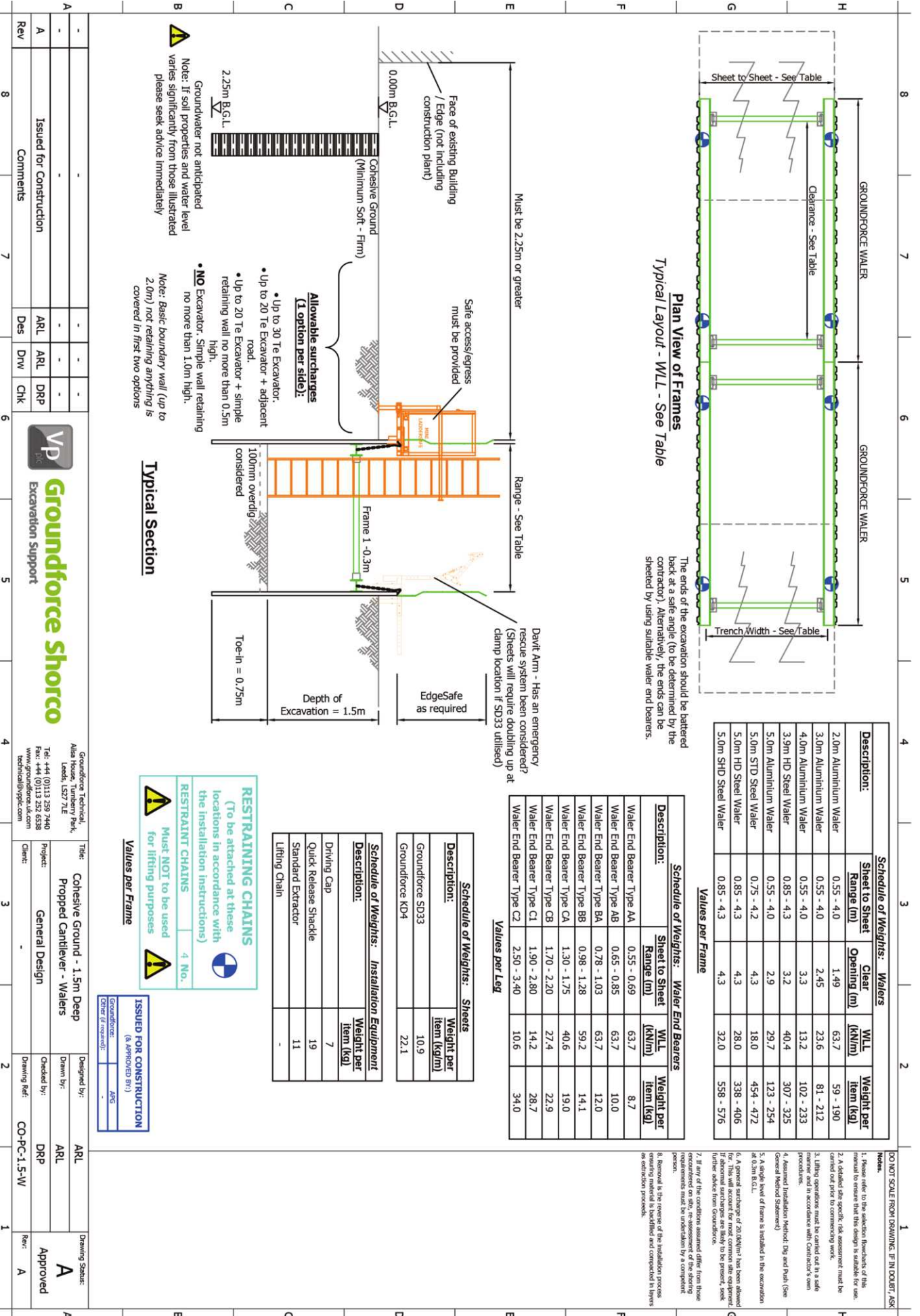
END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2
C2	2.50 – 3.40	10.6

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - COHESIVE (CO-PC-1.5)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
CHK								



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 technical@vpc.com

Title: Cohesive Ground - 1.5m Deep
 Project: Propped Cantilever - Walers
 Client: General Design

Designed by: ARL
 Drawn by: ARL
 Checked by: DRP
 Drawing Ref: CO-PC-1.5-W
 Rev: A
 Drawing Status: Approved

RESTRAINING CHAINS
 (To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.
 Must NOT be used for lifting purposes

Values per Frame

ISSUED FOR CONSTRUCTION
 (APPROVED BY:)

Groundforce: [Signature]
 Date (or revision): [Signature]

Schedule of Weights: Sheets

Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment

Description:	Weight per Item (kg)
Drying Cap	7
Quick Release Shackles	19
Standard Extractor	11
Lifting Chain	-

Schedule of Weights: Water End Bearers

Description:	Sheet to Sheet Range (m)	WLL (kN/m)	Weight per Item (kg)
Water End Bearer Type AA	0.55 - 0.69	63.7	8.7
Water End Bearer Type AB	0.65 - 0.85	63.7	10.0
Water End Bearer Type BA	0.78 - 1.03	63.7	12.0
Water End Bearer Type BB	0.98 - 1.28	59.2	14.1
Water End Bearer Type CA	1.30 - 1.75	40.6	19.0
Water End Bearer Type CB	1.70 - 2.20	27.4	22.9
Water End Bearer Type CI	1.90 - 2.80	14.2	28.7
Water End Bearer Type CZ	2.50 - 3.40	10.6	34.0

Values per Leg

Values per Frame

Schedule of Weights: Walers

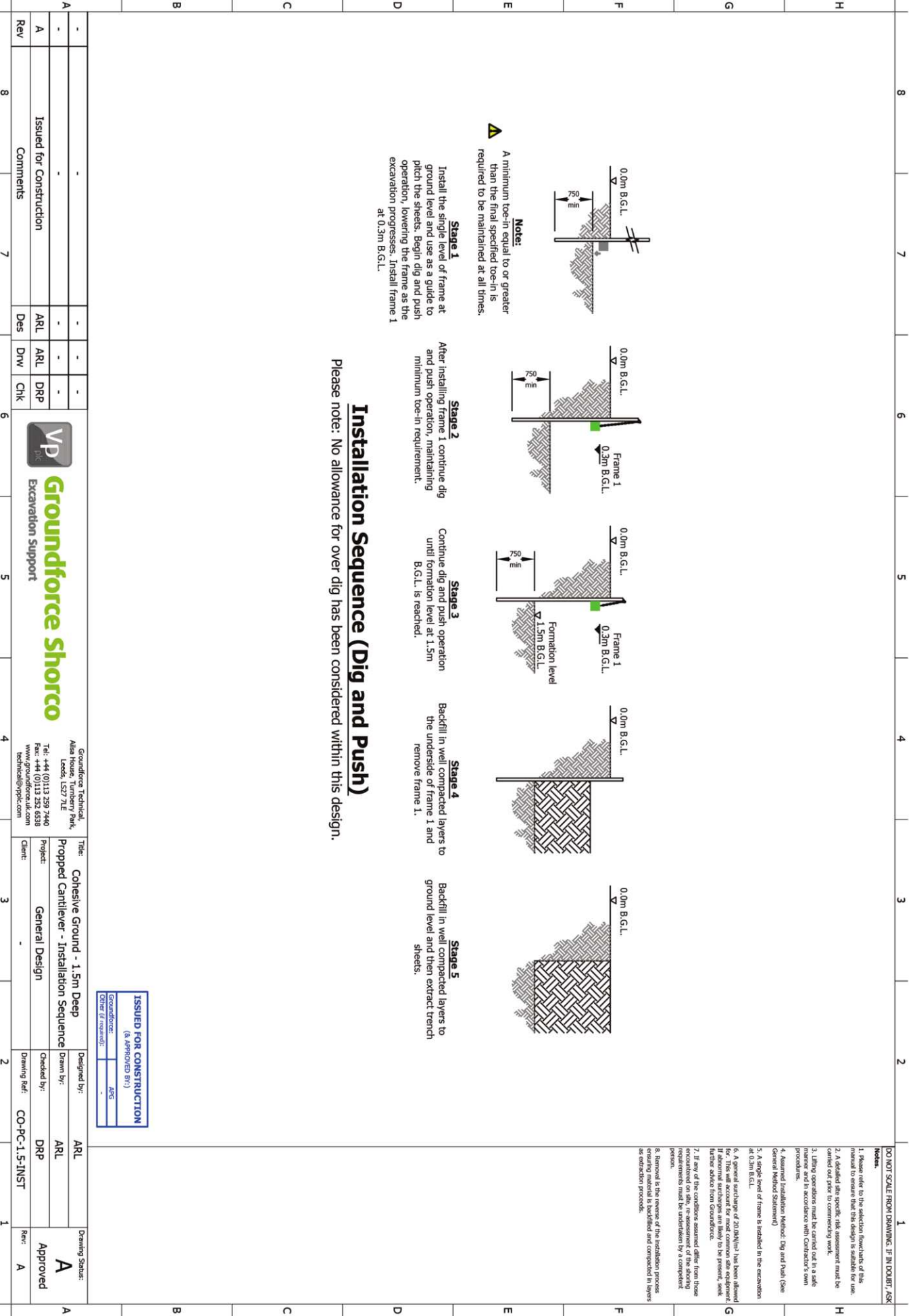
Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)	Weight per Item (kg)
2.0m Aluminium Waler	0.55 - 4.0	1.49	63.7	59 - 190
3.0m Aluminium Waler	0.55 - 4.0	2.45	23.6	81 - 212
4.0m Aluminium Waler	0.55 - 4.0	3.3	13.2	102 - 233
3.9m HD Steel Waler	0.85 - 4.3	3.2	40.4	307 - 325
5.0m Aluminium Waler	0.55 - 4.0	2.9	29.7	123 - 254
5.0m STD Steel Waler	0.75 - 4.2	4.3	18.0	454 - 472
5.0m HD Steel Waler	0.85 - 4.3	4.3	28.0	338 - 406
5.0m SHD Steel Waler	0.85 - 4.3	4.3	32.0	558 - 576

Values per Frame

- DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK
- Please refer to the section headers of this manual to ensure that this design is suitable for use.
 - A detailed site specific risk assessment must be carried out prior to commencing work.
 - Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 - Assumed Installer Method: Dig and Push (See General Method Statement)
 - A single level of frame is installed in the excavation at 0.3m B.G.L.
 - A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 - If any of the conditions assumed differ from those encountered on site, re-assessment by a competent person.
 - Removal is the reverse of the installation process as set out in this manual and completed in the same order.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - COHESIVE (CO-PC-1.5)



Please note: No allowance for over dig has been considered within this design.

Installation Sequence (Dig and Push)

1	2	3	4	5	6	7	8
A	B	C	D	E	F	G	H

NOTES:

1. Please refer to the section headings of the manual to ensure that this design is suitable for use.
2. A detailed site specific risk assessment must be carried out prior to commencing work.
3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
4. Assumed Installation Method: Dig and Push (See General Method Statement)
5. A single level of frame is installed in the excavation at 0.2m B.G.L.
6. A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
7. If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring provisions must be undertaken by a competent person.
8. Removal is the reverse of the installation process and should be installed and compacted in layers as extraction proceeds.

ISSUED FOR CONSTRUCTION (AS APPROVED BY:)		Signature: [Blank]	ARDG
Groundforce: Sales & Reservations:			

Title:	Cohesive Ground - 1.5m Deep Propped Cantilever - Installation Sequence
Client:	General Design
Project:	CO-PC-1.5-INST
Designed By:	ARL
Drawn By:	ARL
Checked By:	DRP
Drawing Ref:	CO-PC-1.5-INST
Revision Status:	A Approved

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

A technical drawing of a mechanical assembly, possibly a propeller or a similar rotating component, shown in a perspective view. The drawing is rendered in light gray lines on a dark gray background. It features a central hub with several blades or arms extending outwards. There are various circular features, likely bearings or seals, and a complex arrangement of structural elements. The drawing is oriented diagonally across the page.

STANDARD DESIGNS

(ONE FRAME, PROPPED CANTILEVER)

- 1.5m DEEP - GRANULAR (GR-PC-1.5)

1.5m DEEP - GRANULAR (GR-PC-1.5)

ONE FRAME, PROPPED CANTILEVER GRANULAR GROUND – 1.5m DEEP

INPUT

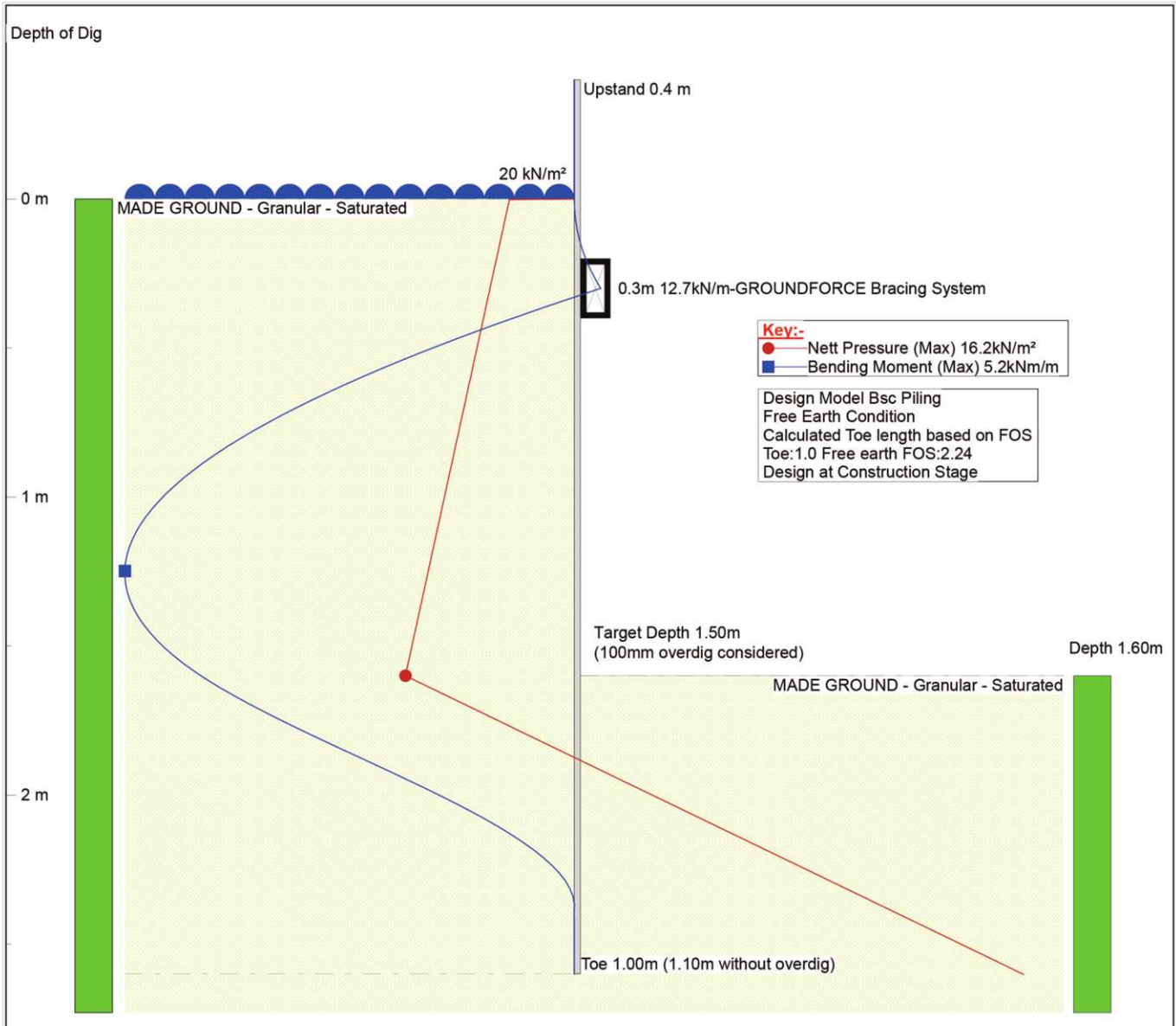
EXCAVATION DEPTH	1.5 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ_{sat} (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 2.6	MADE GROUND Granular (well compacted)	20.10	10.30	0.00	32.00	0.31	3.25	0.00	0.00	0.00

N.B. This design is based on saturated soil densities to allow for pipe bursts etc.

1.5m DEEP - GRANULAR (GR-PC-1.5)



Issued for Construction.


Support Information
 Frame 1
 Type: Bracing System/
 Level: 0.30 m
 Load: 12.7 kN/m

Sheet Pile Definition

8.5kNm/m > 5.2kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: Free Earth Toe-In

<p>Groundforce</p>	<p>Designer :Groundforce Reference:GR-PC-1.5 Rev A Issued for Construction</p>	<p> Excavation Support</p> <p>GFsafe Version 2.0.16 Copyright VP plc 2010</p>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - GRANULAR (GR-PC-1.5)

SUMMARY – ONE FRAME, PROPPED CANTILEVER GRANULAR GROUND – 1.5m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	5.2kNm/m
MAXIMUM FRAME LOAD	12.7kN/m
REQUIRED TOE-IN	1.1m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 2.6m + Required upstand*

(* to be assessed by contractor)

SUITABLE BRACES (see drawing no. GR-PC-1.5-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. GR-PC-1.5-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

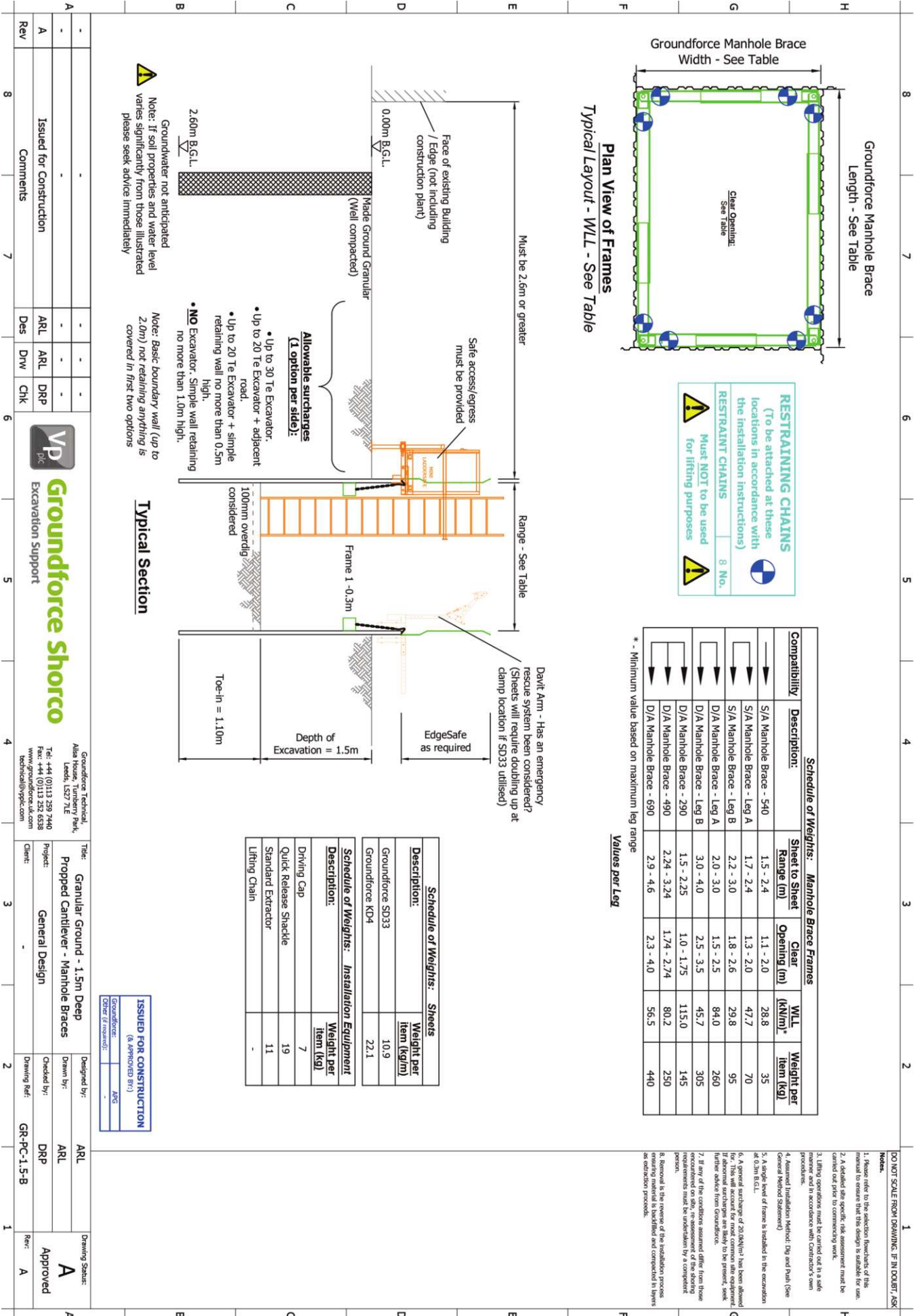
End Bearers for use in conjunction with Aluminium Walers

(not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - GRANULAR (GR-PC-1.5)



Rev	Comments	Des	DRP	CHK
A	Issued for Construction	ARL	ARL	DRP

VP
Excavation Support

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Fax: +44 (0)113 252 6538
technical@vpc.com

This: Granular Ground - 1.5m Deep
Project: Propped Cantilever - Manhole Braces
Client: General Design

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-PC-1.5-B

Drawing Status: **A** Approved

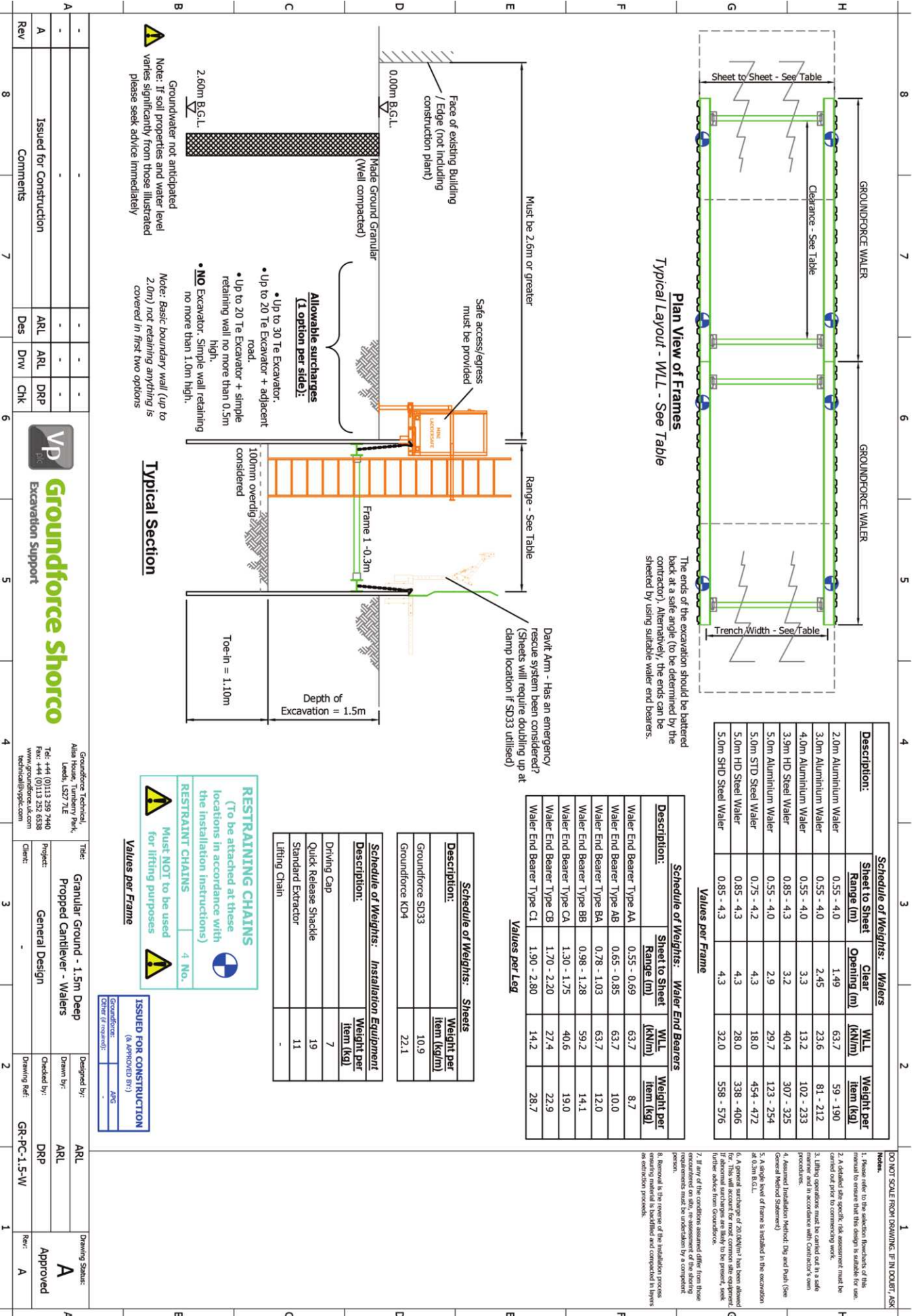
DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK

Notes:

- Please refer to the selection handbooks of the material to ensure that the design is suitable for use.
- A detailed site specific risk assessment must be carried out prior to commencing work.
- Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
- Assumed Installer Method: Dig and Push (See General Method Statement)
- A single level of frame is installed in the excavation at 0.3m B.S.L.
- A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If additional surcharges are likely to be present, seek further advice from Groundforce.
- If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring system must be undertaken by a competent person.
- Removal is the reverse of the installation process as set out in the General Method Statement and completed in 10 days as erection proceeds.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

1.5m DEEP - GRANULAR (GR-PC-1.5)



Typical Layout of Frames - See Table

The ends of the excavation should be battered back at a safe angle (to be determined by the contractor). Alternatively, the ends can be sheeted by using suitable water end bearers.

Schedule of Weights: Walers				
Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)	Weight per Item (kg)
2.0m Aluminium Waler	0.55 - 4.0	1.49	63.7	59 - 190
3.0m Aluminium Waler	0.55 - 4.0	2.45	23.6	81 - 212
4.0m Aluminium Waler	0.55 - 4.0	3.3	13.2	102 - 233
3.9m HD Steel Waler	0.85 - 4.3	3.2	40.4	307 - 325
5.0m Aluminium Waler	0.55 - 4.0	2.9	29.7	123 - 254
5.0m STD Steel Waler	0.75 - 4.2	4.3	18.0	454 - 472
5.0m HD Steel Waler	0.85 - 4.3	4.3	38.0	338 - 406
5.0m SHD Steel Waler	0.85 - 4.3	4.3	32.0	558 - 576

Values per Frame

Schedule of Weights: Waler End Bearers			
Description:	Sheet to Sheet Range (m)	WLL (kN/m)	Weight per Item (kg)
Waler End Bearer Type AA	0.55 - 0.69	63.7	8.7
Waler End Bearer Type AB	0.65 - 0.85	63.7	10.0
Waler End Bearer Type BA	0.78 - 1.03	63.7	12.0
Waler End Bearer Type BB	0.98 - 1.28	59.2	14.1
Waler End Bearer Type CA	1.30 - 1.75	40.6	19.0
Waler End Bearer Type CB	1.70 - 2.20	27.4	22.9
Waler End Bearer Type CI	1.90 - 2.80	14.2	28.7

Values per Leg

Schedule of Weights: Steels	
Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment	
Description:	Weight per Item (kg)
Drying Cap	7
Quick Release Shackle	19
Standard Extractor	11
Lifting Chain	-

RESTRAINING CHAINS

(To be attached at these locations in accordance with the installation instructions)

RESTRAINING CHAINS 4 No.

Must NOT be used for lifting purposes

Values per Frame

ISSUED FOR CONSTRUCTION
(8 APPROVED BY:)

Rev	A	Issued for Construction	Des	ARL	DRP	CHK	ARL	DRP	CHK
Comments	-								



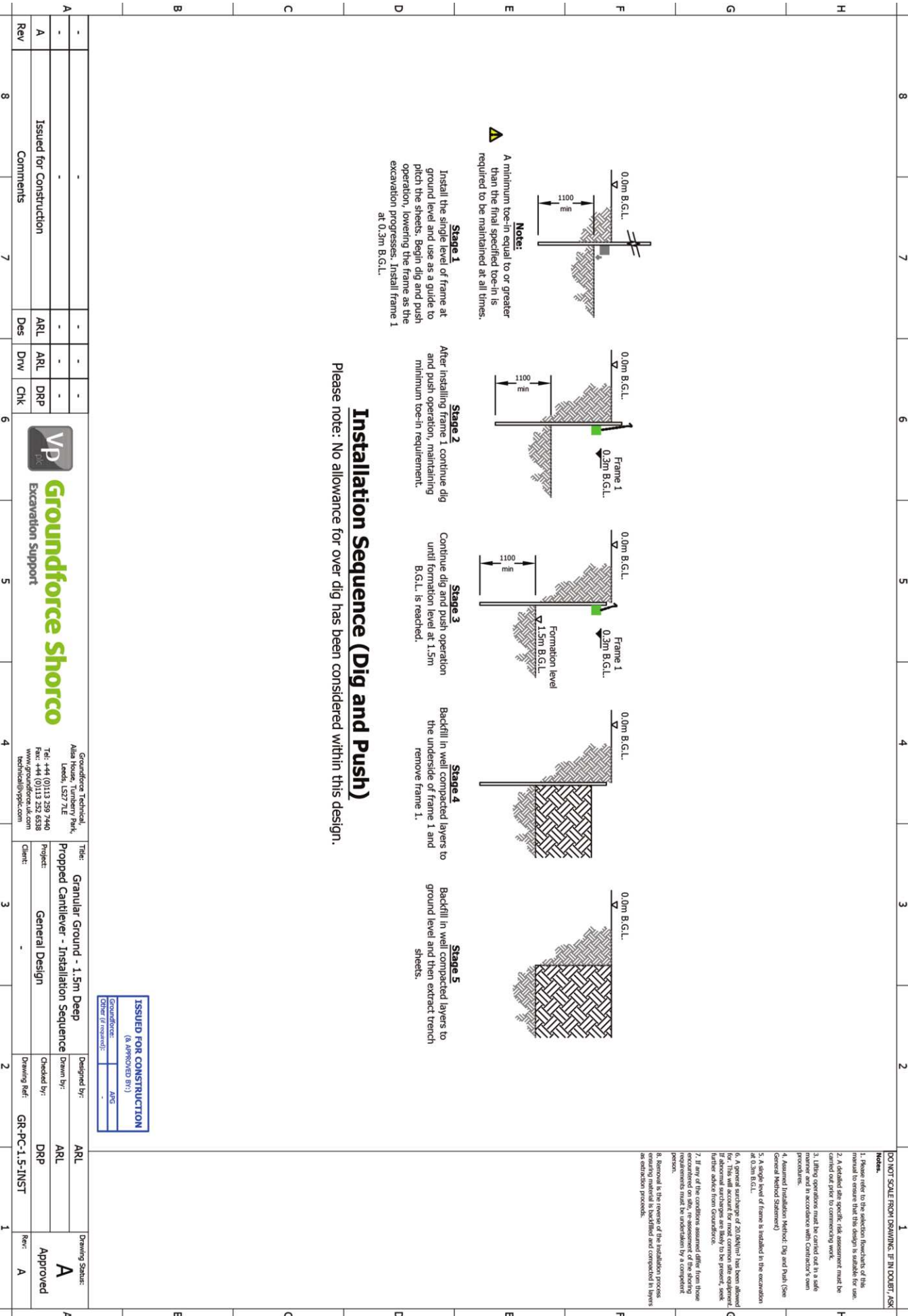
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technical@vpc.com

Title: Granular Ground - 1.5m Deep
Propped Cantilever - Walers
Project: General Design
Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-PC-1.5-W
Rev: A

- DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK
1. Please refer to the section headers of this manual to ensure that this design is suitable for use.
 2. A detailed site specific risk assessment must be carried out prior to commencing work.
 3. Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 4. Assumed Installation Method: Dig and Push (See General Method Statement)
 5. A single level of frame is installed in the excavation at 0.3m B.G.L.
 6. A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 7. If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring personnel.
 8. Removal is the reverse of the installation process and should be carried out in a controlled and planned manner.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
DRW								
CHK								



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technical@vpcc.com

Title: Granular Ground - 1.5m Deep
Proposed Cantilever - Installation Sequence
Project: General Design
Client: -

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: GR-PC-1.5-INST
Rev: A
Drawing Status: Approved

ISSUED FOR CONSTRUCTION
(APPROVED BY:)
Groundforce: [Signature]
Client (if required): [Signature]

- Notes:**
- Please refer to the selection requirements of the manual to ensure that this design is suitable for use.
 - A detailed site specific risk assessment must be carried out prior to commencing work.
 - Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 - Assumed Installation Method: Dig and Push (See General Method Statement)
 - A single level of frame is installed in the excavation at 0.3m B.G.L.
 - A general surcharge of 200 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 - If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring provisions must be undertaken by a competent person.
 - Removal is the reverse of the installation process as detailed and completed in steps as extraction proceeds.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



A technical drawing of a propped cantilever frame structure, showing a vertical column and a horizontal beam. The drawing includes various components like joints, supports, and structural members, rendered in a light gray color against a dark gray background. The drawing is oriented diagonally, with the vertical column on the left and the horizontal beam extending towards the right.

STANDARD DESIGNS

(ONE FRAME, PROPPED CANTILEVER)

- 2.0m DEEP - COHESIVE (CO-PC-2.0)

ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 2.0m DEEP

INPUT

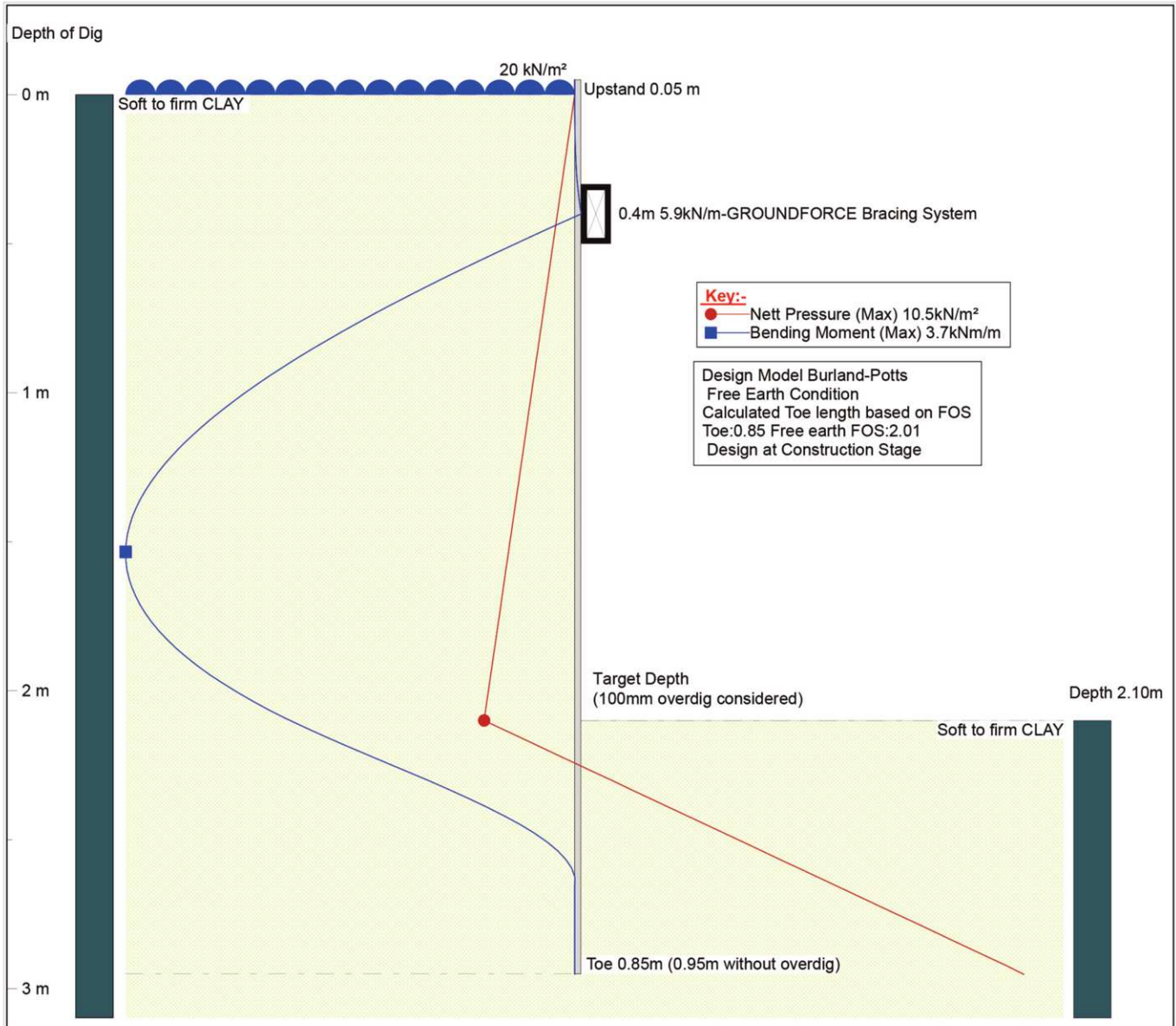
EXCAVATION DEPTH	2.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 2.95	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - COHESIVE (CO-PC-2.0)




Issued for Construction.

Support Information
 Frame 1
 Type: Bracing System/
 Level: 0.40 m
 Load: 5.9 kN/m

Sheet Pile Definition
 8.5kNm/m > 3.7kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: Free Earth Toe-In

<p>Groundforce</p>	<p>Designer :Groundforce Reference:CO-PC-2.0 Rev A Issued for Construction</p>	<p> Excavation Support</p> <p>GFsafe Version 2.0.16 Copyright VP plc 2010</p>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

SUMMARY – ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 2.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	3.7kNm/m
MAXIMUM FRAME LOAD	5.9kN/m
REQUIRED TOE-IN	0.95m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 2.95m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. CO-PC-2.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-PC-2.0-W)

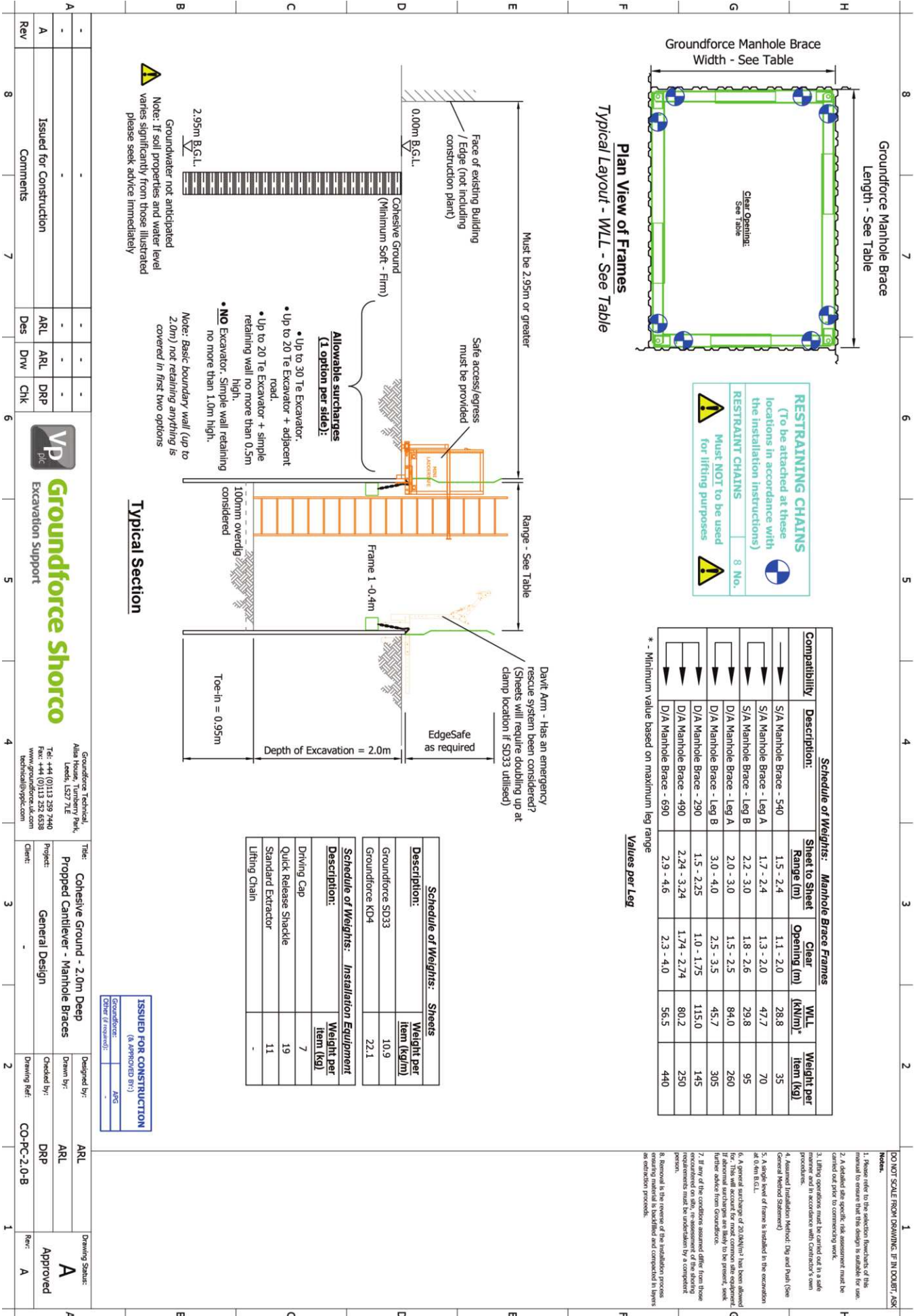
WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2
C2	2.50 – 3.40	10.6

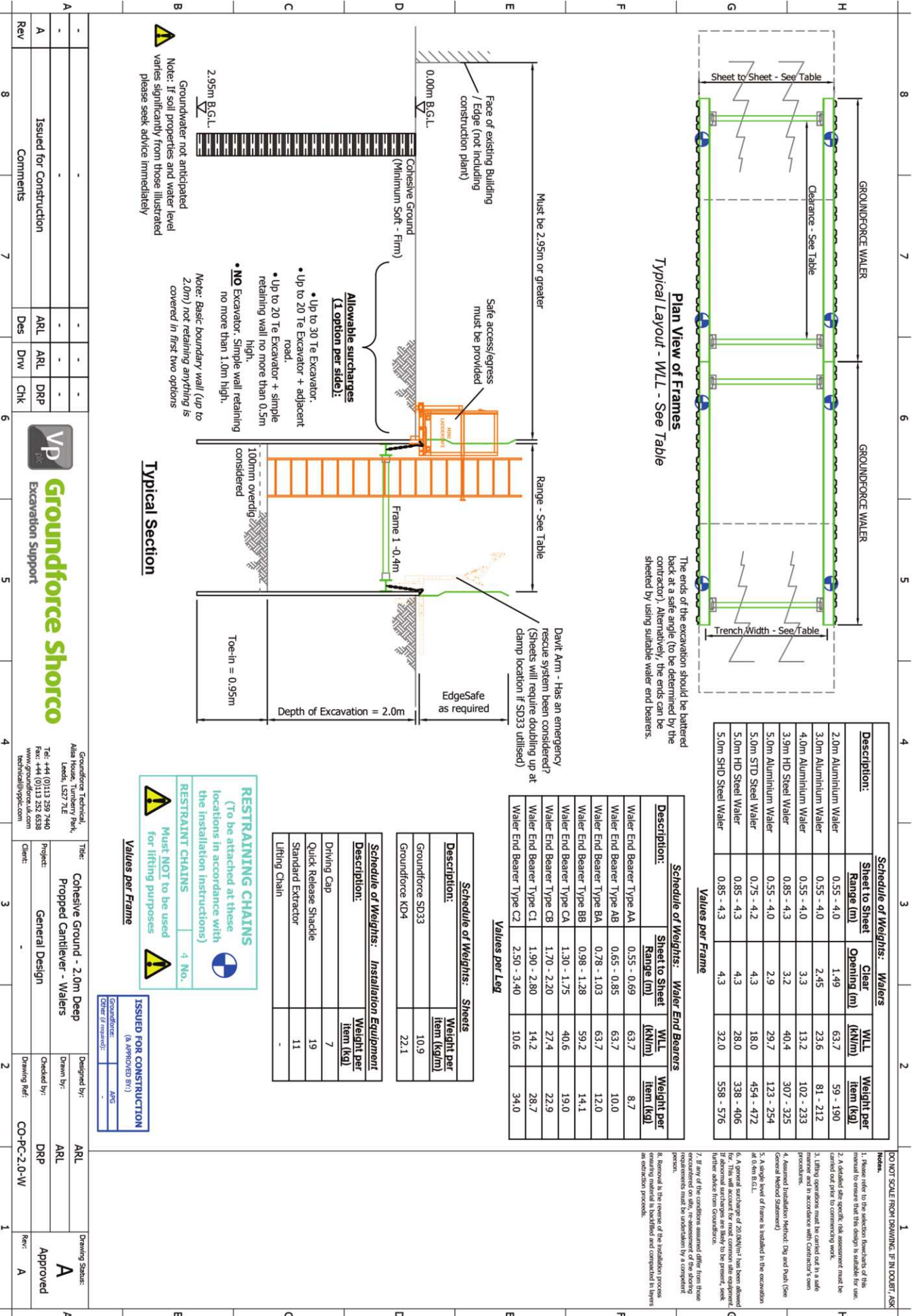
Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - COHESIVE (CO-PC-2.0)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - COHESIVE (CO-PC-2.0)



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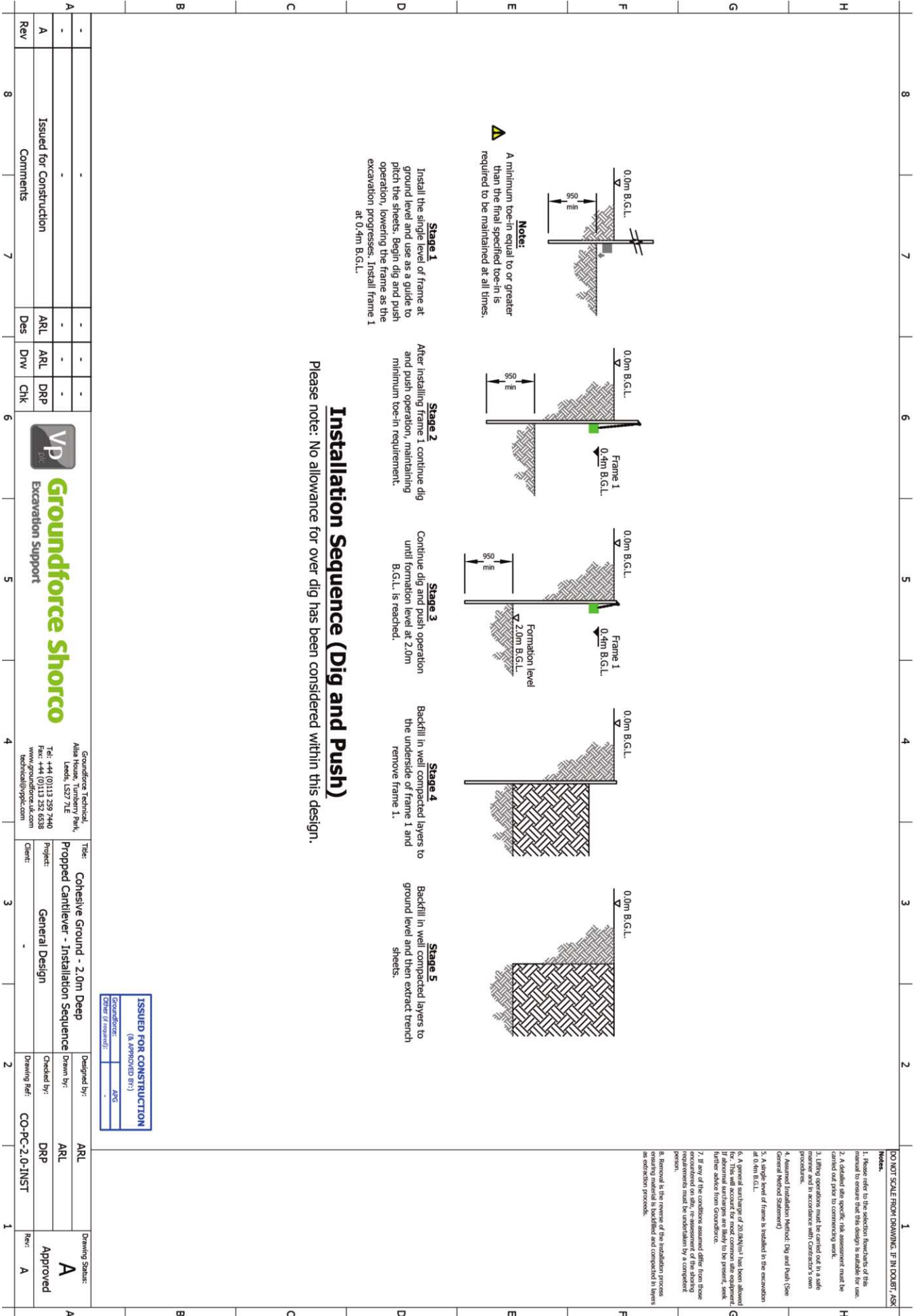
Title: Cohesive Ground - 2.0m Deep
Project: Propped Cantilever - Walers
Client: General Design

Designed by: ARL
Drawn by: ARL
Checked by: DRP
Drawing Ref: CO-PC-2.0-W
Rev: A

Drawing Status: Approved

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - COHESIVE (CO-PC-2.0)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

A technical drawing of a mechanical assembly, possibly a propeller or a similar rotating component, shown in a perspective view. The drawing is rendered in light gray lines on a dark gray background. It features a central hub with several blades or arms extending outwards. There are various circular features, likely bearings or seals, and structural reinforcements. The drawing is oriented diagonally across the page.

STANDARD DESIGNS

(ONE FRAME, PROPPED CANTILEVER)

■ 2.0m DEEP - GRANULAR (GR-PC-2.0)

2.0m DEEP - GRANULAR (GR-PC-2.0)

ONE FRAME, PROPPED CANTILEVER GRANULAR GROUND – 2.0m DEEP

INPUT

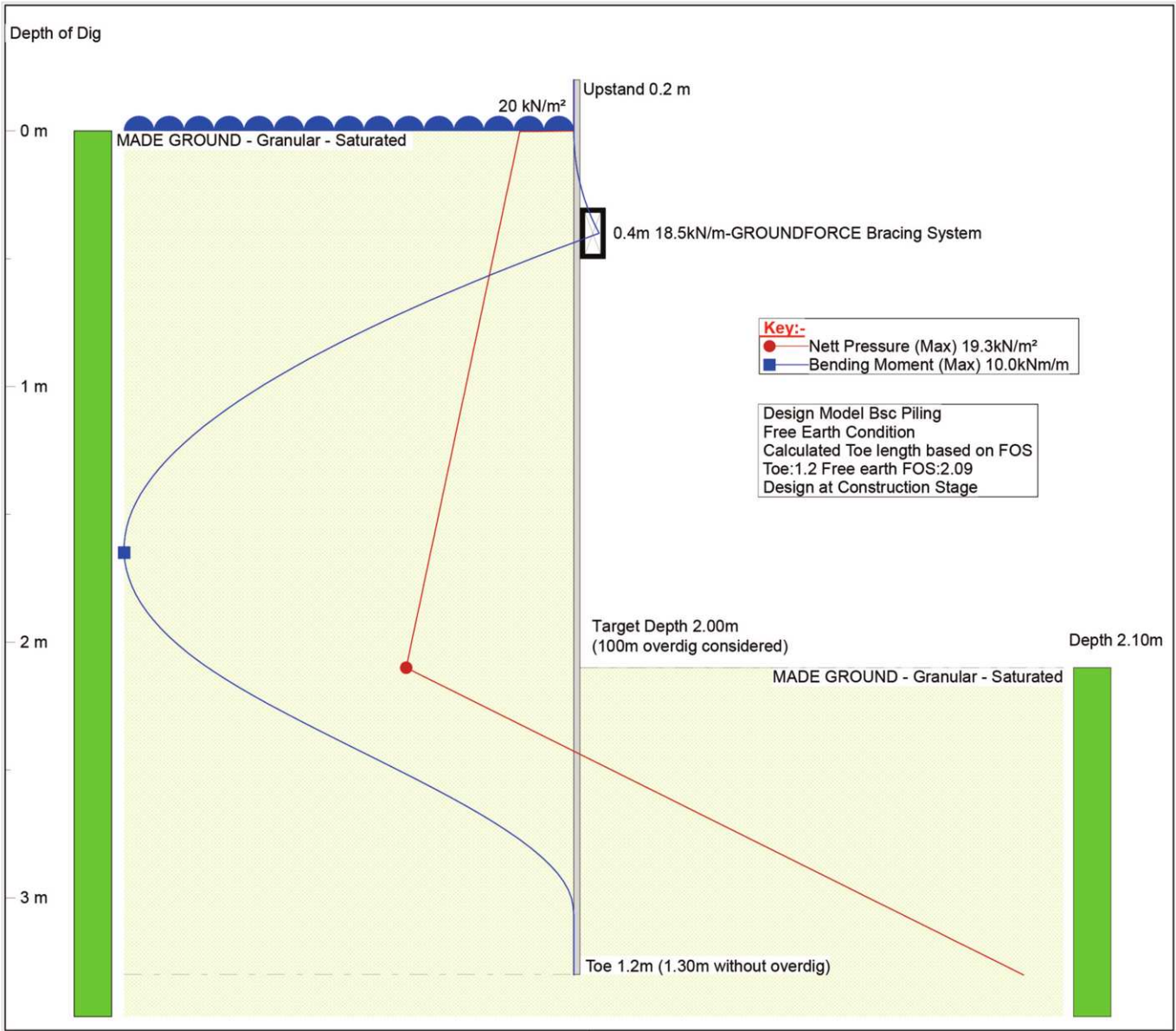
EXCAVATION DEPTH	2.0 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ_{sat} (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 3.3	MADE GROUND Granular (well compacted)	20.10	10.30	0.00	32.00	0.31	3.25	0.00	0.00	0.00

N.B. This design is based on saturated soil densities to allow for pipe bursts etc.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Issued for Construction.

Support Information
 Frame 1
 Type: Bracing System/
 Level: 0.40 m
 Load: 18.5 kN/m

Sheet Pile Definition

19kNm/m > 10.0kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce KD4**
 Allowable Moment = 19.0 kNm/m
 Moment of Inertia = 254.0 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 102.2 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: Free Earth Toe-In

Groundforce

Designer :Groundforce
 Reference:GR-PC-2.0
 Rev A
 Issued for Construction



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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - GRANULAR (GR-PC-2.0)

SUMMARY – ONE FRAME, PROPPED CANTILEVER GRANULAR GROUND – 2.0m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	10.0kNm/m
MAXIMUM FRAME LOAD	18.5kN/m
REQUIRED TOE-IN	1.3m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 3.3m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. GR-PC-2.0-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. GR-PC-2.0-W)

WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

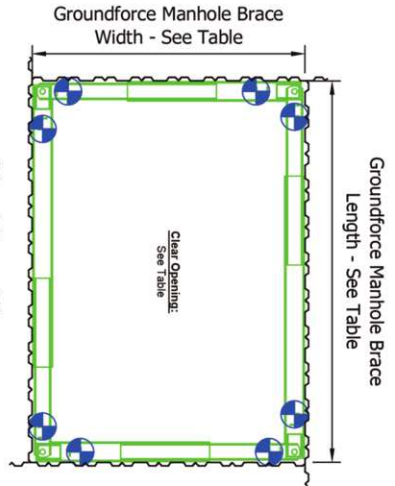
End Bearers for use in conjunction with Aluminium Walers

(not suitable for use with Steel Walers)

END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only.
This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - GRANULAR (GR-PC-2.0)



RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS - 8 No.

Must NOT to be used for lifting purposes

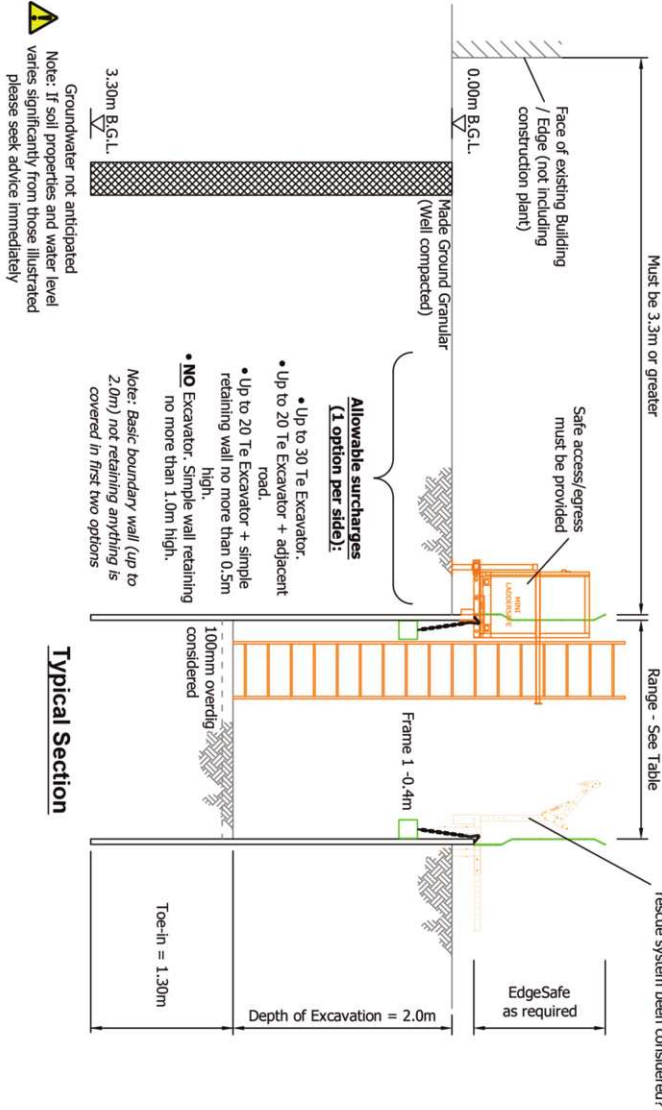
Schedule of Weights: Manhole Brace Frames			
Compatibility	Description:	Clear Opening (m)	WLL (kN/m) [*]
→	S/A Manhole Brace - 540	1.1 - 2.0	28.8
→	S/A Manhole Brace - Leg A	1.7 - 2.4	47.7
→	S/A Manhole Brace - Leg B	2.2 - 3.0	29.8
→	D/A Manhole Brace - Leg A	2.0 - 3.0	84.0
→	D/A Manhole Brace - Leg B	3.0 - 4.0	45.7
→	D/A Manhole Brace - 290	1.5 - 2.25	115.0
→	D/A Manhole Brace - 490	2.24 - 3.24	80.2
→	D/A Manhole Brace - 690	1.74 - 2.74	250
→	D/A Manhole Brace - 690	2.9 - 4.6	56.5
→	D/A Manhole Brace - 690	2.3 - 4.0	440

* - Minimum value based on maximum leg range

Values per Leg

Schedule of Weights: Sheets		
Description:	Weight per item (kg/m)	
Groundforce KD4	22.1	

Schedule of Weights: Installation Equipment		
Description:	Weight per item (kg)	
Driving Cap	7	
Quick Release Shackles	19	
Standard Extractor	11	
Lifting Chain	-	



Groundwater not anticipated
Note: If soil properties and water level varies significantly from those illustrated please seek advice immediately

Rev	Comments	Des	DRP	CHK
8	Issued for Construction	ARL	ARL	DRP



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Client:		Designed By:		Drawing Status:	
General Design	Propped Cantilever - Manhole Braces	ARL	ARL	Approved	ARL
Client:		Checked By:	DRP	Rev:	A
		Drawing Ref:	GR-PC-2.0-B		

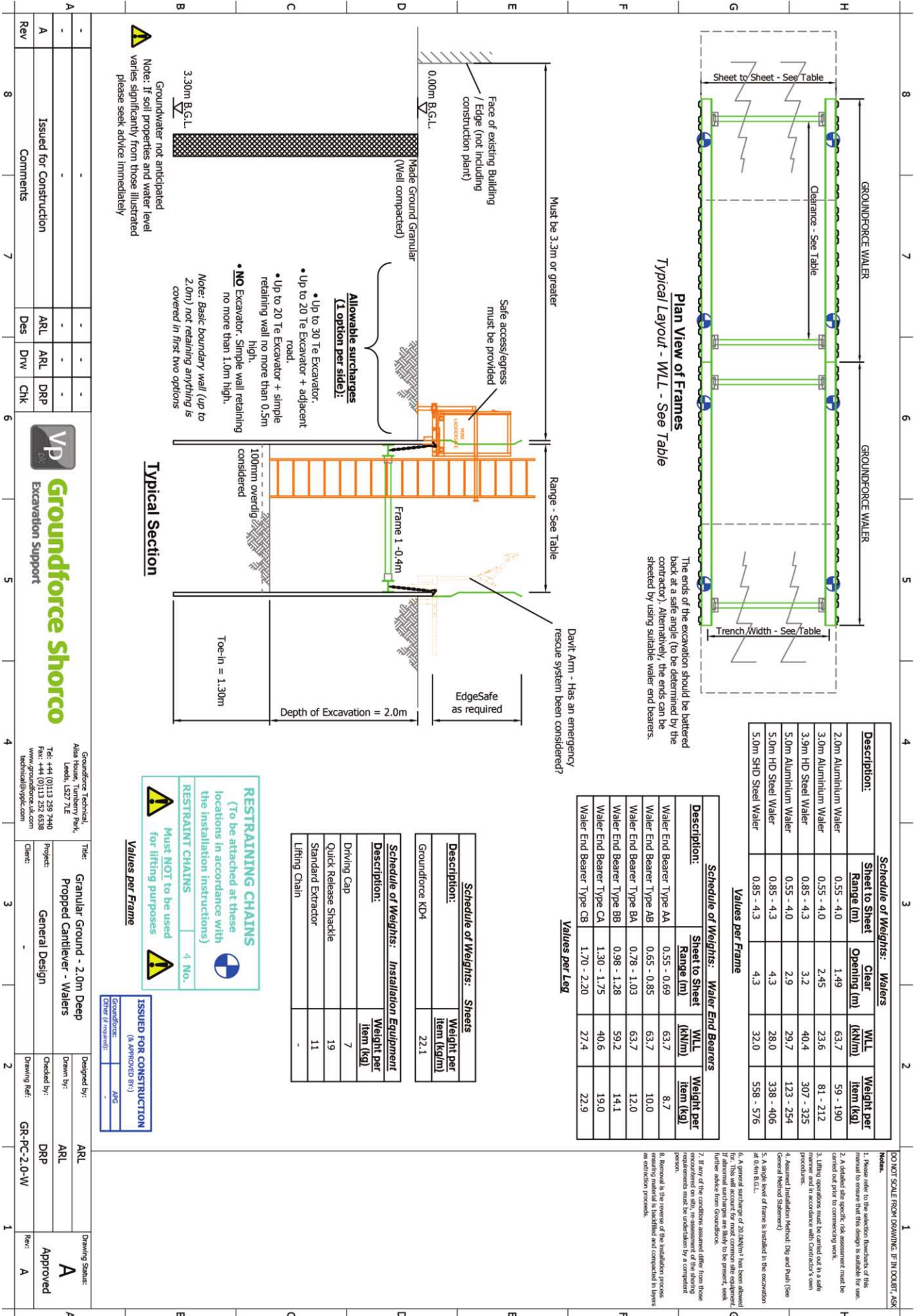
ISSUED FOR CONSTRUCTION
(As Approved By:)

Groundforce: [Signature]
Client (if required): [Signature]

- Notes:**
- Please refer to the selection handbooks of the material to ensure that this design is suitable for use.
 - A detailed site specific risk assessment must be carried out prior to commencing work.
 - Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 - Assumed Installer Method: Dig and Push (See General Method Statement)
 - A single level of frame is installed in the excavation at 0.4m B.G.L.
 - A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 - If any of the conditions assumed differ from those encountered on site, re-assessment of the steering person.
 - Removal is the reverse of the installation process as extraction proceeds.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.0m DEEP - GRANULAR (GR-PC-2.0)



Schedule of Weights: Walers

Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)	Weight per Item (Kg)
2.0m Aluminium Waler	0.55 - 4.0	1.49	63.7	59 - 190
3.0m Aluminium Waler	0.55 - 4.0	2.45	23.6	81 - 212
3.0m HD Steel Waler	0.85 - 4.3	3.2	40.4	307 - 325
5.0m Aluminium Waler	0.55 - 4.0	2.9	29.7	123 - 254
5.0m HD Steel Waler	0.85 - 4.3	4.3	28.0	338 - 406
5.0m SHD Steel Waler	0.85 - 4.3	4.3	32.0	558 - 576

Schedule of Weights: Waler End Bearers

Description:	Sheet to Sheet Range (m)	WLL (kN/m)	Weight per Item (Kg)
Waler End Bearer Type AA	0.55 - 0.69	63.7	8.7
Waler End Bearer Type AB	0.65 - 0.85	63.7	10.0
Waler End Bearer Type BA	0.78 - 1.03	63.7	12.0
Waler End Bearer Type BB	0.98 - 1.28	59.2	14.1
Waler End Bearer Type CA	1.30 - 1.75	40.6	19.0
Waler End Bearer Type CB	1.70 - 2.20	27.4	22.9

Schedule of Weights: Sheets

Description:	Weight per Item (kg/m)
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment

Description:	Weight per Item (kg)
Driving Cap	7
Quick Release Shackles	19
Standard Extractor	11
Lifting Chain	-

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.

Must NOT to be used for lifting purposes

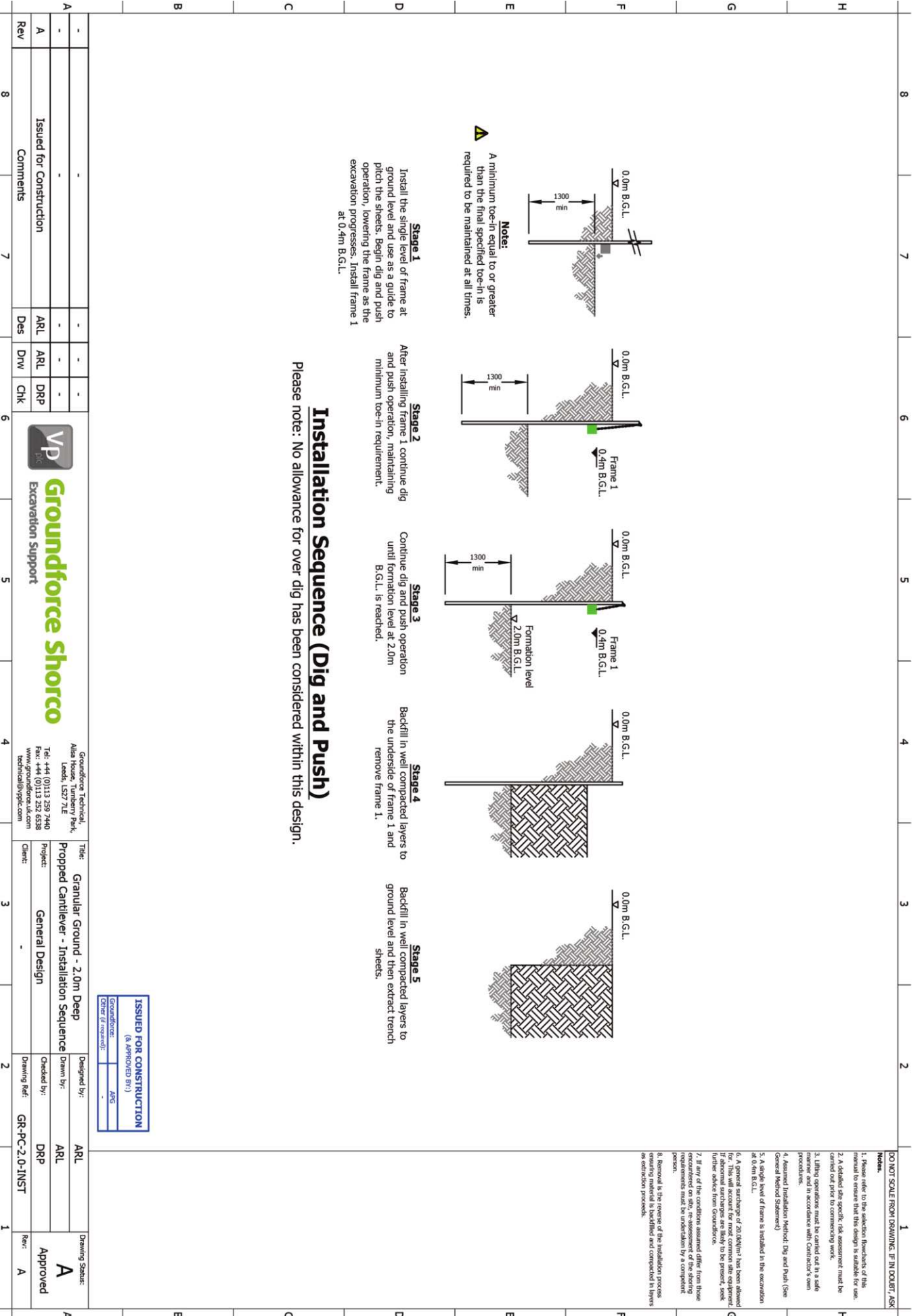
ISSUED FOR CONSTRUCTION
(8 APPROVED BY)

Rev	A	Issued for Construction	Des	ARL	DRP
Comments			Des	ARL	DRP
			DRW	CHK	

VP Groundforce Shorco
Excavation Support

Title:	Granular Ground - 2.0m Deep Propped Cantilever - Walers	Designed by:	ARL
Project:	General Design	Drawn by:	ARL
Client:		Checked by:	DRP
		Drawing Ref:	GR-PC-2.0-W
		Rev:	A

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Installation Sequence (Dig and Push)

Please note: No allowance for over dig has been considered within this design.

Rev	8	7	6	5	4	3	2	1
Comments	Issued for Construction							
Des	ARL	ARL	DRP					
DRW								
CHK								



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 www.groundforce.co.uk
 technical@vpc.com

Title: Granular Ground - 2.0m Deep
 Project: Propped Cantilever - Installation Sequence
 Client: General Design

Designed by: ARL
 Drawn by: ARL
 Checked by: DRP
 Drawing Ref: GR-PC-2.0-INST
 Rev: A
 Drawing Status: Approved

ISSUED FOR CONSTRUCTION
 (APPROVED BY:)
 Groundforce: [Signature]
 Client (if required): [Signature]

- Notes:**
- Please refer to the selection benchmarks of this manual to ensure that this design is suitable for use.
 - A detailed site specific risk assessment must be carried out prior to commencing work.
 - Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
 - Assumed Installation Method: Dig and Push (See General Method Statement)
 - A single level of frame is installed in the excavation at 0.4m B.G.L.
 - A general surcharge of 20kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
 - If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring provisions must be undertaken by a competent person.
 - Removal is the reverse of the installation process and must be carried out in a controlled and planned manner as extraction proceeds.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

A technical drawing of a mechanical assembly, possibly a propeller or a similar rotating component, shown in a perspective view. The drawing is rendered in light gray lines on a dark gray background. It features a central hub with several blades or arms extending outwards. There are various circular features, likely bearings or seals, and a complex arrangement of structural elements. The drawing is oriented diagonally across the page.

STANDARD DESIGNS

(ONE FRAME, PROPPED CANTILEVER)

- 2.5m DEEP - COHESIVE (CO-PC-2.5)

ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 2.0m DEEP

INPUT

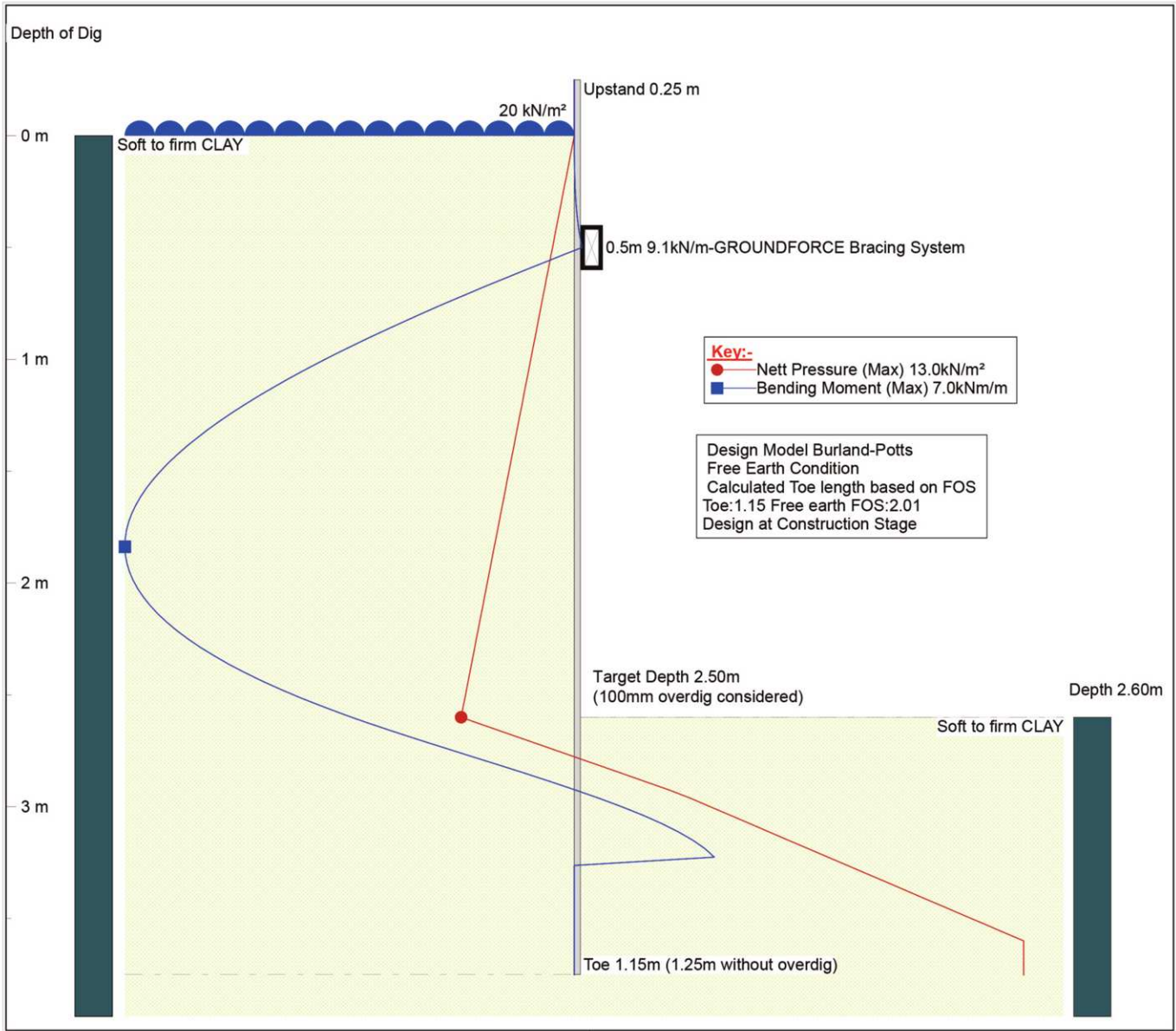
EXCAVATION DEPTH	2.5 m
SURCHARGE	20.0 kN/m ²
GROUND WATER	NONE ENCOUNTERED
WATER DENSITY	9.81 kN/m ³
MIN FLUID DENSITY	5.0 kN/m ³

SOIL PROFILE

DEPTH (m)	SOIL NAME	γ (kN/m ³)	γ' (kN/m ³)	C_u (kN/m ²)	Φ (°)	K_a	K_p	K_{ac}	K_{pc}	δ
0.0 - 3.75	COHESIVE GROUND (Minimum Soft to Firm)	18.60	8.80	30.00	0.00	1.00	1.00	2.00	2.00	0.00

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - COHESIVE (CO-PC-2.5)



Issued for Construction.


Support Information
 Frame 1
 Type: Bracing System/
 Level: 0.50 m
 Load: 9.1 kN/m

Sheet Pile Definition

8.5kNm/m > 7.0kNm/m (Bending Capacity is Adequate)

Sheet Type: **Groundforce Std. SD33**
 Allowable Moment = 8.5 kNm/m
 Moment of Inertia = 81.9 cm⁴/m
 Youngs Modulus (E) = 210.0 kN/mm²
 Allowable Stress = 186.0 kN/mm²
 Section Modulus = 48.4 cm³/m

Pressure Model: BSC Piling
 Load Model: Rigid sheet about lower frame
 Support Type: Free Earth Toe-In

<p>Groundforce</p>	<p>Designer :Groundforce Reference:CO-PC-2.5 Rev A Issued for Construction</p>	<p> Excavation Support</p> <p>GFsafe Version 2.0.16 Copyright VP plc 2010</p>
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Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

SUMMARY – ONE FRAME, PROPPED CANTILEVER COHESIVE GROUND – 2.5m DEEP

SUMMARY

MAXIMUM SHEET BENDING MOMENT	7.0kNm/m
MAXIMUM FRAME LOAD	9.1kN/m
REQUIRED TOE-IN	1.25m

SUITABLE SHEETS

SHEET TYPE	WIDTH (mm)	THICKNESS (mm)	CAPACITY (kNm/m)
GROUNDFORCE STD SD33 TRENCH SHEETS	330	3.4	8.5
GROUNDFORCE KD4 TRENCH SHEETS	400	6.0	19.0

Length = 3.75m + Required upstand* (* to be assessed by contractor)

SUITABLE BRACES (see drawing no. CO-PC-2.5-B)

MANHOLE BRACE TYPE (COMPATIBLE LEGS SHOWN TOGETHER)	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG 540	1.5 – 2.4	28.8
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG A	1.7 – 2.4	47.7
GROUNDFORCE SINGLE ACTING MANHOLE BRACE LEG B	2.2 – 3.0	29.8
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG A	2.0 – 3.0	84.0
GROUNDFORCE DOUBLE ACTING MANHOLE BRACE LEG B	3.0 – 4.0	45.7
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 290	1.5 – 2.25	115.0
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 490	2.24 – 3.24	80.2
MECHSHORE DOUBLE ACTING MANHOLE BRACE LEG 690	2.9 – 4.6	56.5

SUITABLE WALERS & END BEARERS (see drawing no. CO-PC-2.5-W)

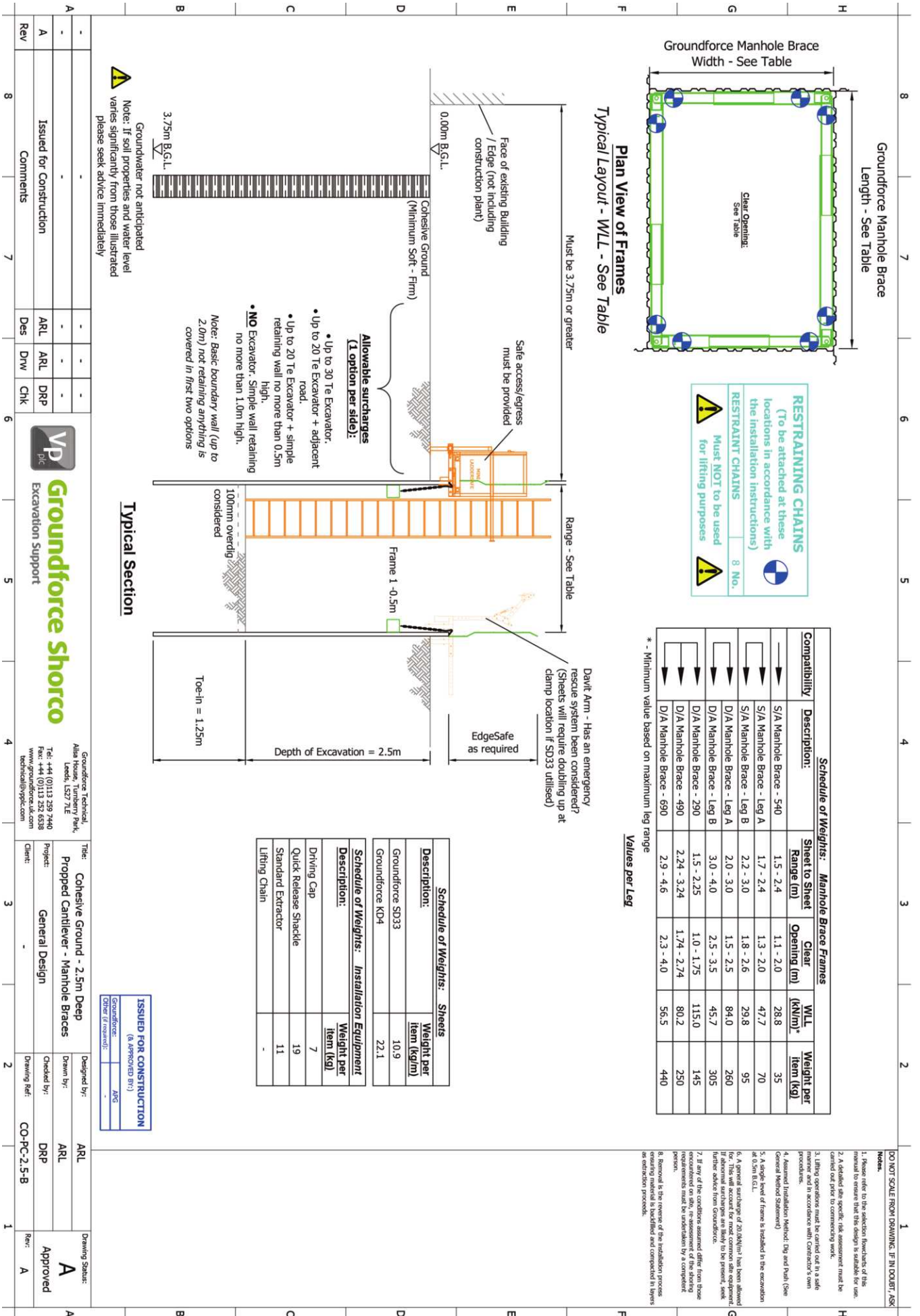
WALER TYPE	LENGTH (m)	WLL (kN/m)
GROUNDFORCE 2.0m ALUMINIUM WALER	2.0	63.7
GROUNDFORCE 3.0m ALUMINIUM WALER	3.0	23.6
GROUNDFORCE 4.0m ALUMINIUM WALER	4.0	13.2
GROUNDFORCE 5.0m ALUMINIUM WALER	5.0	29.7
GROUNDFORCE 3.9m HD STEEL WALER	3.9	40.4
GROUNDFORCE 5.0m STANDARD STEEL WALER	5.0	18.0
GROUNDFORCE 5.0m HD STEEL WALER	5.0	28.0
GROUNDFORCE 5.0m SUPER HD STEEL WALER	5.0	32.0

End Bearers for use in conjunction with Aluminium Walers (not suitable for use with Steel Walers)

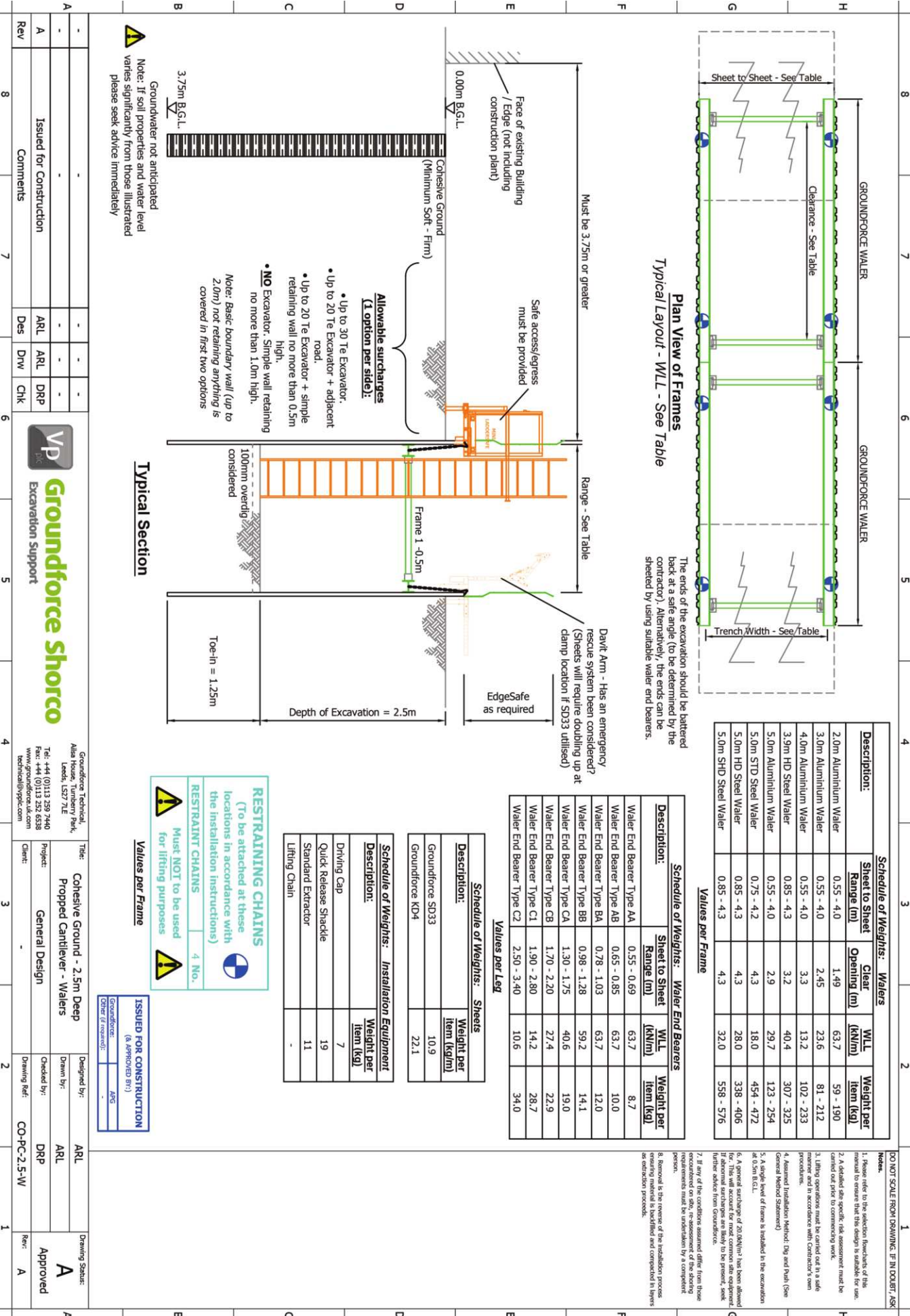
END BEARER TYPE	LENGTH (m) (Sheet-to-Sheet)	WLL (kN/m)
AA	0.55 – 0.69	63.7
AB	0.65 – 0.85	63.7
BA	0.78 – 1.03	63.7
BB	0.98 – 1.28	59.2
CA	1.30 – 1.75	40.6
CB	1.70 – 2.20	27.4
C1	1.90 – 2.80	14.2
C2	2.50 – 3.40	10.6

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - COHESIVE (CO-PC-2.5)



Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.



Schedule of Weights: Walkers				
Description:	Sheet to Sheet Range (m)	Clear Opening (m)	WLL (kN/m)	Weight per Item (kg)
2.0m Aluminium Walker	0.55 - 4.0	1.49	63.7	59 - 190
3.0m Aluminium Walker	0.55 - 4.0	2.45	23.6	81 - 212
4.0m Aluminium Walker	0.55 - 4.0	3.3	13.2	102 - 233
3.9m HD Steel Walker	0.85 - 4.3	3.2	40.4	307 - 325
5.0m Aluminium Walker	0.55 - 4.0	2.9	29.7	123 - 254
5.0m STD Steel Walker	0.75 - 4.2	4.3	18.0	454 - 472
5.0m HD Steel Walker	0.85 - 4.3	4.3	28.0	338 - 406
5.0m SHD Steel Walker	0.85 - 4.3	4.3	32.0	558 - 576

Schedule of Weights: Water End Bearers				
Description:	Sheet to Sheet Range (m)	WLL (kN/m)	Weight per Item (kg)	
Water End Bearer Type AA	0.55 - 0.69	63.7	8.7	
Water End Bearer Type AB	0.65 - 0.85	63.7	10.0	
Water End Bearer Type BA	0.78 - 1.03	63.7	12.0	
Water End Bearer Type BB	0.98 - 1.28	59.2	14.1	
Water End Bearer Type CA	1.30 - 1.75	40.6	19.0	
Water End Bearer Type CB	1.70 - 2.20	27.4	22.9	
Water End Bearer Type C1	1.90 - 2.80	14.2	28.7	
Water End Bearer Type C2	2.50 - 3.40	10.6	34.0	

Schedule of Weights: Sheets	
Description:	Weight per Item (kg/m)
Groundforce SD33	10.9
Groundforce KD4	22.1

Schedule of Weights: Installation Equipment	
Description:	Weight per Item (kg)
Drying Cap	7
Quick Release Shackles	19
Standard Extractor	11
Lifting Chain	-

RESTRAINING CHAINS
(To be attached at these locations in accordance with the installation instructions)

RESTRAINT CHAINS 4 No.

Must NOT to be used for lifting purposes

ISSUED FOR CONSTRUCTION
(As Approved By)

Groundforce: [Signature]
Client (or reviewer): [Signature]

Rev	Comments	Des	DRP	CHK
A	Issued for Construction	ARL	ARL	DRP

VP Groundforce Shorco
Excavation Support

Groundforce Technical, Alias House, Tumberry Park, Leeds, LS27 7LE	Title: Cohesive Ground - 2.5m Deep
Tel: +44 (0)113 259 7440	Project: Propped Cantilever - Walkers
Fax: +44 (0)113 232 6538	Client: General Design
technical@vgpc.com	

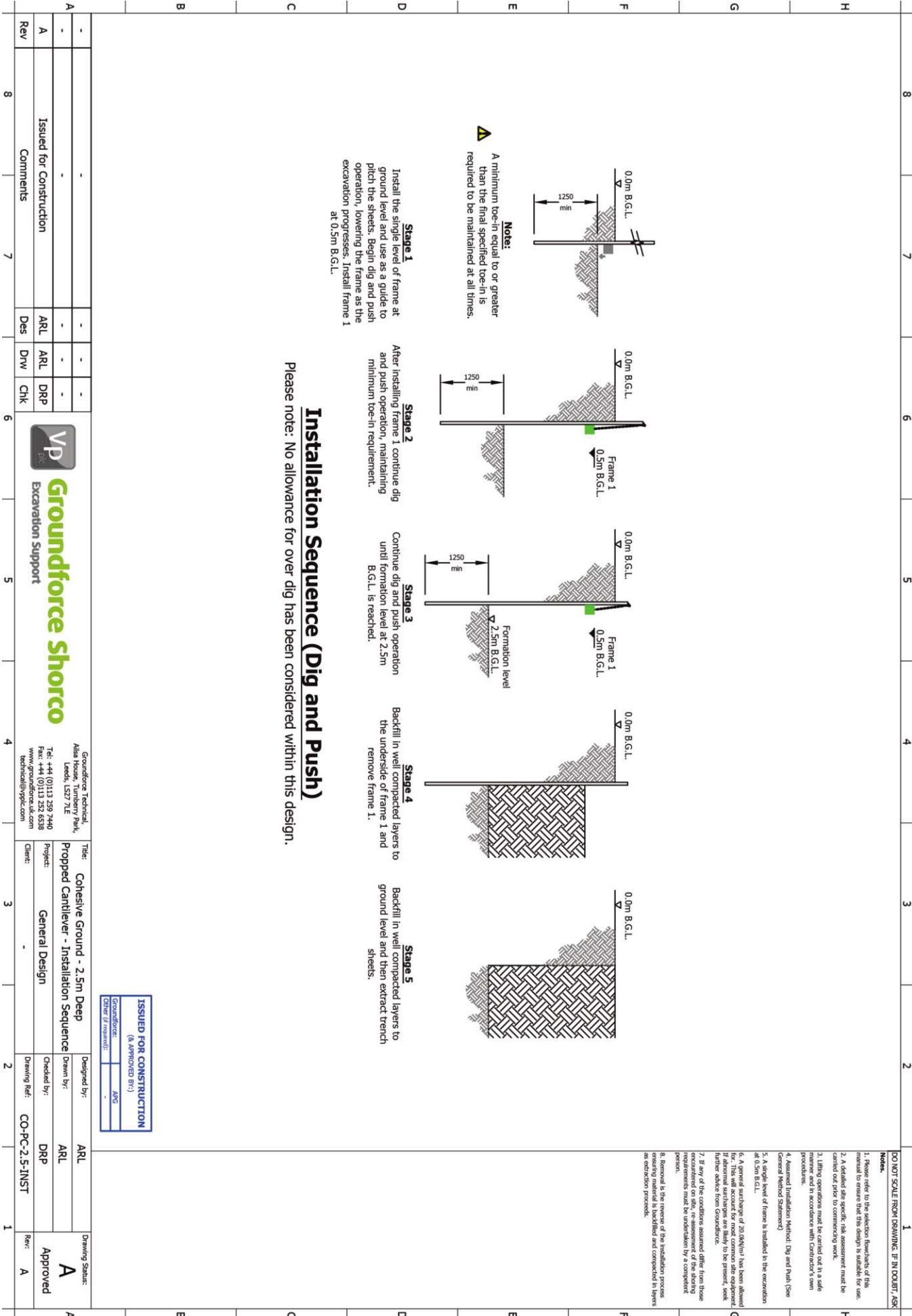
Designed by: ARL	Drawing Status: A
Drawn by: ARL	Approved
Checked by: DRP	
Drawing Ref: CO-PC-2.5-W	Rev: A

DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK

- Please refer to the section headers of this manual to ensure that this design is suitable for use.
- A detailed site specific risk assessment must be carried out prior to commencing work.
- Lifting operations must be carried out in a safe manner and in accordance with Contractor's own procedures.
- Assumed Installer Method: Dig and Push (See General Method Statement)
- A single level of frame is installed in the excavation at 0.5m B.G.L.
- A general surcharge of 20 kN/m² has been allowed for. This will account for most common site equipment. If abnormal surcharges are likely to be present, seek further advice from Groundforce.
- If any of the conditions assumed differ from those encountered on site, re-assessment of the shoring system must be undertaken by a competent person.
- Removal is the reverse of the installation process and must be carried out in a safe manner and in accordance with Contractor's own procedures.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

2.5m DEEP - COHESIVE (CO-PC-2.5)



Rev	A	Issued for Construction	Des	ARL	DRP	CHK	ARL	DRP	CHK
Comments									

VP
Groundforce Shorco
Excavation Support

Groundforce Technical,
Alisa House, Turnberry Park,
Leeds, LS27 7JE
Tel: +44 (0)113 299 3440
Fax: +44 (0)113 299 4750
www.groundforce.co.uk
technical@vpcc.com

ISSUED FOR CONSTRUCTION
(& APPROVED BY:)
Checked By: ARL
Drawing Ref: CO-PC-2.5-INST

Title:	Cohesive Ground - 2.5m Deep Propped Cantilever - Installation Sequence		
Client:	General Design		
Designed by:	ARL	Checked by:	DRP
Drawn by:	ARL	Checked by:	DRP
Drawing Ref:	CO-PC-2.5-INST		
Rev:	A		

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

A technical drawing of a mechanical assembly, possibly a pump or engine component, rendered in light gray lines on a dark gray background. The drawing shows various parts like a cylinder, a piston, and a crankshaft, with some circular features and a central shaft. The drawing is oriented diagonally from the top-left to the bottom-right.

DESIGN DOCUMENTATION

- DESIGN REQUEST FORM
- CUSTOMER VERBAL SOIL PROFILE FORM
- GENERAL METHOD STATEMENT
- GENERIC RISK ASSESSMENT

DESIGN REQUEST FORM - PAGE 1

DESIGN REQUEST FORM

(v3.2 12/17)



Groundforce Shorco

Excavation Support

Technical Department - Tel. +44(0) 845 602 9963 Email. technical@vpplc.com

DESIGN REF:					
CREATOR:		AREA:		HANDLER:	

****GROUNDFORCE USE ONLY****

1. GENERAL INFORMATION

GROUNDFORCE CLIENT:		ACCOUNT NUMBER:	
SITE:		DATE DESIGN IS REQUIRED:	
PRINCIPAL/MAIN CONTRACTOR :		APPROXIMATE START DATE:	
POSTCODE:		Tender <input type="checkbox"/>	Live Scheme <input type="checkbox"/>
SITE CONTACT DETAILS: (NAME + FAX + TEL)			
CONTACT EMAIL:			
PRINCIPAL DESIGNER : Name and Email		TWKS CO-ORDINATOR(S): Name and Email	

1a. Please ensure that all the contact and site details are completed.

1b. We will generally need a minimum notice period of 48 hrs for design turnaround. **NOTE:** More complex designs will probably take longer to complete.



1c. This information is mandatory for us to comply with CDM 2015 requirements. Note that a Principle Designer (s) has to be appointed by the client for all notifiable projects.

INDEPENDENT £200 / €270	<input type="checkbox"/>	EXTERNAL £ / € Variable	<input type="checkbox"/>	NETWORK RAIL £300 / €405	<input type="checkbox"/>	N/A	<input type="checkbox"/>	IRISH HSA CERTIFICATE REQUIRED	<input type="checkbox"/>
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DESIGN CHECKS (CHARGEABLE)

2. EXCAVATION INFORMATION

DESIGN NAME:				
SUPPORT SYSTEM TYPE: (Other please specify in section 7)	CLIENT SPECIFIED FRAME LOAD(S): <input type="checkbox"/>	MULTIPLE FRAMES: <input type="checkbox"/>	PROPPED CANTILEVER: <input type="checkbox"/>	CANTILEVER: <input type="checkbox"/>
EXCAVATION DIMENSIONS:	LENGTH: (m)	WIDTH: (m)	DEPTH: (m)	OVERDIG: (m)
APPROX EXCAVATION DURATION:				N/A <input type="checkbox"/>
Weeks	MUCK TO MUCK <input type="checkbox"/>	SHEET TO SHEET <input type="checkbox"/>	CLEAR OPENING INSIDE FRAMING <input type="checkbox"/>	

2a. Please only select one of the excavation type options. Also note that all cantilever schemes or excavations > 6m deep will not be undertaken on a verbal soil description i.e. a relevant borehole to an appropriate depth is required.

2b. For durations > 12 weeks more onerous design parameters may apply. Refer to Technical Services for clarification.

2c. If clear opening dimensions are specified, we will make an additional allowance for deflection when specifying the overall excavation size.

3. SHEET & FRAME DETAILS

EQUIPMENT TYPE: (Specify preference below subject to stock location and holdings)	MOST ECONOMICAL:	<input type="checkbox"/>	LIGHTEST:	<input type="checkbox"/>
BOXES:	STRUTS ALLOWED:	NO <input type="checkbox"/>	YES <input type="checkbox"/>	LOWER FRAME(S) ONLY <input type="checkbox"/>
FRAMES:	CLEARANCE BELOW LOWEST FRAME: (m)		N/A <input type="checkbox"/>	CORNER PILES REQUIRED**:
STRUTS:	MAX SHEET LENGTH: (m)		N/A <input type="checkbox"/>	SHEET UPSTAND*: (m)
SHEETS:	MAX SHEET TOE IN: (m)		N/A <input type="checkbox"/>	NO TOE SOLUTION:
				<input type="checkbox"/>

3a. The options specified are to assist with ensuring we provide the most cost effective design proposal, however it must be stressed that the solution will be subject to design approval.

3b. This information is only required if limitations apply.

* Specify any additional handrail requirements if applicable Section 8.

** Interlocking sheet piles only

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

DESIGN REQUEST FORM - PAGE 2

4. PREFERRED METHOD OF SHEET INSTALLATION (PRE-DRIVEN WILL BE THE DEFAULT METHOD)

PRE DRIVEN:	<input type="checkbox"/>	DIG & PUSH:	<input type="checkbox"/>	SLIT TRENCH:	<input type="checkbox"/>	2 STAGE: (See note 4)	<input type="checkbox"/>
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4. The 2 stage option is when the lower frame(s) is removed once a blinding slab has been cast and cured.

5. GROUND INFORMATION

INFO PROVIDED:		BH OR TP REF TO BE USED FOR THIS DESIGN:		GROUND REDUCTION / REDUCED LEVEL: (Specify or indicate below)	
BH/TP or WS:	<input type="checkbox"/>				
Distance from excavation:					
VERBAL: (Fill out verbal Soil Description sheet)	<input type="checkbox"/>	GROUND DATUM LEVEL: (m AOD)		DE-WATERING METHOD:	
WATER LEVEL: (m BGL)		REDUCED DATUM LEVEL: (m AOD)		LEVEL OF EXTERNAL DE-WATERING	

5a. Please ensure that ONLY the relevant ground information is supplied. It is the contractors responsibility to provide representative ground information on which the design will be based.

5b. Borehole to relevant depth required for the following:

1. Cantilever design
2. Depth greater than 6.0
3. Thrust Block Designs

6. SURCHARGE / SITE INFORMATION

PLANT SURCHARGE:	<input type="checkbox"/>	≤ 30 TONNE (10kN/m ²)	<input type="checkbox"/>	≤ 45 TONNE (15kN/m ²)	<input type="checkbox"/>	≤ 60 TONNE (20kN/m ²)	<input type="checkbox"/>
SPECIFIC SURCHARGE:		DISTANCE FROM EXCAVATION (m)		SURCHARGE DETAILS			
RAILWAY:	<input type="checkbox"/>						
ROAD:	<input type="checkbox"/>						
BUILDING:	<input type="checkbox"/>			Type of Foundation: Depth of Foundation : No. of Storeys:			
CRANE:	<input type="checkbox"/>			>60Te Crane - specification of crane required			
EMBANKMENT:	<input type="checkbox"/>						
OTHER:	<input type="checkbox"/>						

6a. The excavator size / type should be specified.

6b. Please ensure that if a surcharge is present this section is completed to the fullest extent to ensure economic design.

6c. Provide specific details of building loads e.g. foundation details.

6d. The cranes outrigger specifications **MUST** be provided to ensure an accurate surcharge is allowed for.

7. For all additional information and specific requirements not allowed for on the request form please complete in this section.

7. ADDITIONAL INFORMATION

8. ANCILLARY REQUIREMENTS (FOR QUOTATION PURPOSES)

INST KIT:	<input type="checkbox"/>	LIFTING CHAIN:	<input type="checkbox"/>	EXTRACTOR:	<input type="checkbox"/>
QRS:	<input type="checkbox"/>	DRIVING CAP:	<input type="checkbox"/>	DAVIT ARM:	<input type="checkbox"/>
EDGESAFE:	<input type="checkbox"/>	LADDER SAFE: (Specify Type)		HANDRAILS:	<input type="checkbox"/>
LADDER:	<input type="checkbox"/>	LADDER SIZE:		SLEDGESAFE:	<input type="checkbox"/>

8. If this section is not completed it will be assumed that no ancillaries are required and therefore not included on the quotation.

9. CUSTOMER DECLARATION (SEE NOTE 9)



IMPORTANT NOTE: A FULL DESIGN WILL NOT BE PREPARED UNLESS A VALID CUSTOMER SIGNATURE IS PROVIDED BELOW

CUSTOMER SIGNATURE: (print name underneath)	POSITION:	DATE:

9. This signature authorises Groundforce to prepare a temporary works design scheme and that the information contained in the brief is a true representation of site conditions.

Note: charges may apply for subsequent revisions requiring lengthy re-design work.

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CUSTOMER VERBAL SOIL PROFILE FORM

CUSTOMER VERBAL SOIL PROFILE FORM

(V 2.2 12/17)

Technical Department, Alisa House, Turnberry Park, Wakefield Road, Gildersome, LS27 7LE
Tel. +44(0) 845 602 9963 Email. technical@vpplc.com



1. GENERAL INFORMATION

COMPANY:	
SITE CONTACT DETAILS: (NAME + TEL)	
CONTACT EMAIL:	
SITE:	
PURPOSE OF EXCAVATION:	

2. VERBAL SOIL PROFILE

SOIL LAYER ID:	VERBAL SOIL LAYER DESCRIPTION:	STARTING DEPTH: (m BGL)	THICKNESS OF LAYER: (m)
LAYER 1:			
LAYER 2:			
LAYER 3:			
LAYER 4:			
Is water Present?	Yes / No	If "Yes" WATER LEVEL: (m BGL)	De-Watering Method (if applicable):
*Please ensure all layers and water information are correctly entered to ensure no additional delays are encountered due to further clarification being sought.			



I am satisfied that the "verbal" description of the soils profile is in accordance with my / our onsite investigations. I / we confirm, being the "responsible" contractor, that adequate controls and monitoring of the "actual" soils encountered will be maintained. Liability for inaccurate information provided to the designer or failure to advise the designer of any changes in condition which may affect the design or the assumptions made by the designer shall remain with the "Hirer" (as named above).

3. CUSTOMER DECLARATION

CUSTOMER SIGNATURE: (print name underneath)	POSITION:	DATE:

SOILS DESCRIPTION CHART

SOIL TYPE	SIZE (mm)	COMPACTNESS / STRENGTH	Secondary constituent of coarse soils	Secondary constituent of fine soils
VERY COARSE	BOULDERS	Term Field Identification of Compactness for Very Coarse Soils.		
	COBBLES	Loose Dense By inspection of voids and particle packing.		
COARSE GRAVELS	COARSE	Term Field Identification of Compactness for Coarse Soils.		
	MEDIUM			
	FINE			
SANDS	COARSE	Loose Dense Slightly cemented	Prefix Suffix	Proportion (%) coarse fine
	MEDIUM			
	FINE			
SILTS	COARSE	Term Field Identification of Compactness/Strength for Silts.		
	MEDIUM			
	FINE			
CLAYS	COARSE	Term Field Identification of Strength for Clays.		
	MEDIUM			
	FINE			
ORGANIC clay, silt, sand	See Van Post. Grade	Firm Spongy Plastic		
ORGANIC PEAT				

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GENERAL METHOD STATEMENT

To be read in conjunction with any relevant notes relating to the specific scheme within the full design submission and the contractor's own site specific safety method statement.

1 GENERAL STATEMENT

- 1.1 Identify the works area, safety zones & access requirements prior to commencing work on the excavation.
- 1.2 Survey the works area for overhead / buried services prior to commencing work on the excavation & take appropriate action as deemed necessary.
- 1.3 Enclose the total works area using suitable barriers & provide appropriate pedestrian / vehicle barriers where necessary.
- 1.4 Identify a suitably qualified & competent person to inspect the works at regular intervals and to ensure that the design parameters as stated in the design brief are not exceeded
- 1.5 Set out the extent of the excavations.
- 1.6 Ensure adequate lifting facilities are available for all stages of the support operation.
- 1.7 Carry out additional risk assessments as appropriate. Also refer the generic risk assessment attached in this manual.
- 1.8 All equipment is to be installed in conjunction with the specific equipment installation instructions as supplied with the delivery documentation.

2 SUPPORT SEQUENCE – PRE – DRIVE METHOD OF INSTALLATION

INSTALLATION

- 2.1 Pitch, plumb & align each trench sheet / pile and drive to full depth using the appropriate piling hammer ensuring that the minimum specified toe in has been achieved below formation level.
- 2.2 Excavate down inside the sheets and create a level working platform at the first frame level.
- 2.3 Install and fully pressurise the first frame.
- 2.4 Secure the first frame at the approximate positions indicated by hanging from the top of the trench sheets / piles using the primary hanging chains provided.
- 2.5 Excavate down through the frame(s) and create a level working platform at the next frame level (if applicable).
- 2.6 Install and fully pressurise the lower frame as shown on the relevant drawings supplied by Groundforce Shorco (if applicable).

- 2.7 Hang the lower frame from the first frame using the secondary hanging chains provided (if applicable).
- 2.8 Excavate down through the shoring frame(s) to formation level, complete the excavation by manual trimming to avoid over digging & undermining the trench sheet / pile toe in.
- 2.9 Ensure that the trench sheets / piles have been pushed / driven down to achieve the specified toe-in.
- 2.10 It is recommended that at the first opportunity cast a blinding layer across the full base of the excavation (preferably within the same shift) to protect the base from passive softening caused by surface / groundwater ingress.

REMOVAL

- 2.11 Backfill the excavation to the underside of each shoring frame in sequence depressurising and removing each frame in turn. If the backfill material is concrete ensure a suitable de-bonding agent is applied to the trench sheets / piles.
- 2.12 Backfill to existing ground level.
- 2.13 Extract the trench sheets / piles.

3 SUPPORT SEQUENCE – SLIT TRENCH METHOD OF INSTALLATION

INSTALLATION

- 3.1 In small sections (say 3.0m) excavate a narrow trench to formation level.
- 3.2 Pitch the trench sheets / piles against the back face of the trench and backfill the trench with the previously excavated material.
- 3.3 Repeat steps 3.1 & 3.2 until all the trench sheets / piles are in position around the perimeter of the excavation.
- 3.4 Using the excavator & driving cap provided push / drive the trench sheets / piles down to achieve the minimum specified toe-in. Note:- If the specified sheet toe-in cannot be achieved using the excavator bucket then use either a air driven impact hammer or machine mounted vibratory hammer to achieve the specified toe-in.

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GENERAL METHOD STATEMENT CONT.

- 3.5 Excavate down inside the sheets and create a level working platform at the first frame level.
 - 3.6 Install and fully pressurise the first frame.
 - 3.7 Secure the first frame at the approximate positions indicated by hanging from the top of the trench sheets / piles using the primary hanging chains provided.
 - 3.8 Excavate down through the frame(s) and create a level working platform at the next frame level (if applicable).
 - 3.9 Install and fully pressurise the next frame as shown on the relevant drawings supplied by Groundforce Shorco (if applicable).
 - 3.10 Hang the lower frame from the first frame using the secondary hanging chains provided (if applicable).
 - 3.11 Excavate down through the shoring frame(s) to formation level, complete the excavation by manual trimming to avoid over digging & undermining the trench sheet / pile toe-in.
 - 3.12 Ensure that the trench sheets / piles have been pushed / driven down to achieve the specified toe-in.
 - 3.13 It is recommended that at the first opportunity cast a blinding layer across the full base of the excavation (preferably within the same shift) to protect the base from passive softening caused by surface / groundwater ingress.
- 4.4 Pressurise the frame such that the trench sheets / piles can just be pushed down behind the frame, alternatively place wedges between the frame and the trench sheets / piles at the corners of the frame to allow the remaining central trench sheets / piles to be pushed down.
 - 4.5 Hang the frame from the corner trench sheets using the primary hanging chains provided.
 - 4.6 Carefully excavate down inside the frame until it is possible to install the next frame (if applicable) ensuring that the central trench sheets / piles are pushed down as the excavation proceeds maintaining the minimum specified toe-in.
 - 4.7 Once the lower frame level has been reached pressurise the frame as detailed in step 4.4 (if applicable).
 - 4.8 Hang the lower frame from the first frame using the secondary hanging chains provided (if applicable).
 - 4.9 Excavate down through the shoring frame(s) to formation level, complete the excavation by manual trimming to avoid over digging & undermining the trench sheet / pile toe-in.
 - 4.10 Ensure that the trench sheets / piles have been pushed / driven down to achieve the specified toe-in.
 - 4.11 Now secure the first frame from the top of the central trench sheets / piles using the additional primary hanging chains provided.
 - 4.12 Remove hanging chains and any wedges from the corner sheets and remove the remaining earth from the corners of the excavation whilst at the same time pushing down the corner trench sheets / piles.
 - 4.13 Ensure that the corner trench sheets / piles have been pushed / driven down below formation level to achieve the specified toe-in.
 - 4.14 Pressurise all of the shoring frames fully.
 - 4.15 It is recommended that at the first opportunity cast a blinding layer across the full base of the excavation (preferably within the same shift) to protect the base from passive softening caused by surface / groundwater ingress.

REMOVAL

- 3.14 Backfill the excavation to the underside of each shoring frame in sequence depressurising and removing each frame in turn. If the backfill material is concrete ensure a suitable de-bonding agent is applied to the trench sheets / piles.
- 3.15 Backfill to existing ground level.
- 3.16 Extract the trench sheets / piles.

4 SUPPORT SEQUENCE – DIG & PUSH METHOD OF INSTALLATION

INSTALLATION

- 4.1 From existing ground level excavate down approximately 0.5m around the perimeter of the excavation.
- 4.2 Place the first level of shoring in the excavation and extend out to the approximate size of the excavation.
- 4.3 Pitch the trench sheets / piles between the frame and the face of the excavation and push / drive down to refusal using the excavator & driving cap provided. (Note:- on deeper excavations it may prove more practical to start excavation with shorter sheets / piles to ease machine bucket access).

REMOVAL

- 4.16 Backfill the excavation to the underside of each shoring frame in sequence de-pressurising and removing each frame in turn. If the backfill material is concrete ensure a suitable de-bonding agent is applied to the trench sheets / piles.
- 4.17 Backfill to existing ground level.
- 4.18 Extract the trench sheets / piles.

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GENERAL METHOD STATEMENT CONT.

5 SUPPORT SEQUENCE – DIG & LOWER METHOD OF INSTALLATION

INSTALLATION

- 5.1 From existing ground level excavate down approximately 0.5m around the perimeter of the excavation.
- 5.2 Place the both levels of shoring in the excavation and extend out to the approximate size of the excavation.
- 5.3 Pitch the trench sheets / piles between the frame and the face of the excavation and push / drive down to refusal using the excavator & driving cap provided. (Note:- on deeper excavations it may prove more practical to start excavation with shorter sheets / piles to ease machine bucket access).
- 5.4 Pressurise the top frame such that the trench sheets / piles can just be pushed down behind the frame, alternatively place wedges between the frame and the trench sheets / piles at the corners of the frame to allow the remaining central trench sheets / piles to be pushed down.
- 5.5 Hang the first frame from the corner trench sheets using the primary hanging chains provided.
- 5.6 Carefully excavate down inside the frames, until it is possible to install the next frame. Ensure that the lower frame is gradually lowered as the excavation proceeds and that the dig depth does not exceed 300mm below the frame until it is installed and fully pressurised in its final location. It is recommended that personnel do not enter the excavation during the lowering of the frames and the digging operation until the frames are installed in their final locations.
- 5.7 Once the lower frame level has been reached pressurise the frame as detailed in step 5.4.

- 5.8 Hang the lower frame from the first frame using the secondary hanging chains provided.
- 5.9 Excavate down through the shoring frame(s) to formation level, complete the excavation by manual trimming to avoid over digging & undermining the trench sheet / pile toe-in.
- 5.10 Now secure the first frame from the top of the central trench sheets / piles using the additional primary hanging chains provided.
- 5.11 Remove hanging chains and any wedges from the corner sheets and remove the remaining earth from the corners of the excavation whilst at the same time pushing down the corner trench sheets / piles.
- 5.12 Ensure that the corner trench sheets / piles have been pushed / driven down to formation level.
- 5.13 Pressurise all of the shoring frames fully.
- 5.14 It is recommended that at the first opportunity cast a blinding layer across the full base of the excavation (preferably within the same shift) to protect the base from passive softening caused by surface / groundwater ingress.

REMOVAL

- 5.15 Backfill the excavation to the underside of each shoring frame in sequence de-pressurising and removing each frame in turn. If the backfill material is concrete ensure a suitable de-bonding agent is applied to the trench sheets / piles.
- 5.16 Backfill to existing ground level.
- 5.17 Extract the trench sheets / piles.

Note: This shoring manual has been produced for use with Groundforce Shorco equipment only. This design is not suitable for use with any other supplier's equipment and no liability shall be accepted by Groundforce for such use.

GENERIC RISK ASSESSMENT

ACTIVITY:		TEMPORARY WORKS DESIGN FOR EXCAVATION:
Risk Associated with Activity:	Precautions to be taken to reduce the risk:	Comments:
1. General stability or failure of the shoring system due to incorrect installation and/or lack of supervision and co-ordination on site.	<p>Read and understand ALL the accompanying documentation, including installation instructions, design drawings, design notes, method statements, risk assessments and all other information supplied by Groundforce Shorco.</p> <p>Appoint a Temporary Works Co-ordinator (or responsible person), to supervise the whole of the works, ensuring that the final 'end-user' (if not the co-ordinator) is fully briefed and conversant with the equipment, the method of installation and scheme layout.</p> <p>Note: Ancillary equipment such as Restraining Chains are provided to safeguard against accidental system failure. These must be used at ALL times and in accordance with the design and installation instructions.</p>	<p>Ensure full and correct receipt of all supporting information. Additional copies of any documents can be supplied upon request.</p> <p>Responsibilities should include:</p> <ul style="list-style-type: none"> - Checking the temporary works design and its appropriateness to actual site conditions. - Compliance to the temporary works design and ALL other scheme documentation. - Site monitoring of the works and continual assessment of risk. - Efficient flow of information between the site and Groundforce representatives.
2a. Contaminated ground. 2b. Failure of shoring system due to effect of contamination.	<ul style="list-style-type: none"> - Check with planning supervisor if contaminated ground is to be expected in location of excavation. - Continually monitor by sight, smell and use of gas detection equipment of excavated profile and excavated material for possible contamination. - If excavation is known to be in contaminated land check with shoring supplier that structural integrity of shoring equipment will not be compromised through contact. 	<ul style="list-style-type: none"> - Method of work to be specified to accommodate contamination. - If suspected contaminated ground is encountered cease work immediately and inform safety co-ordinator.
3. Position of excavation relocated.	<ul style="list-style-type: none"> - Check if appropriate borehole log has been used. - Check if surcharge details have changed. - Check if depth has changed - REFER BACK TO TEMPORARY WORKS DESIGNER TO RE-WORK DESIGN. 	
4. Soil profile encountered different to that used in temporary works design.	<ul style="list-style-type: none"> - Continually monitor soil profile. - Temporary Works Co-ordinator to check 'actual' profile against 'design' profile. 	<ul style="list-style-type: none"> - If 'actual' varies from design immediately inform temporary works designer to check design stability. - If variance in profile is deemed to be significant ceases work until design has been re-checked.
5. Groundwater characteristics.	<ul style="list-style-type: none"> - Continually monitor and record groundwater characteristics, i.e. rate of flow, strike levels. - Temporary Works Co-ordinator to check 'actual' groundwater parameter with 'design' characteristics. 	<ul style="list-style-type: none"> - If 'actual' varies from design immediately inform temporary works designer to check design stability. - If variance in characteristics is deemed to be significant ceases work until design has been re-checked.
6. Change in depth of excavation.	<ul style="list-style-type: none"> - If depth is to be varied immediately inform Temporary Works Designer to re-work design based on altered depth. 	<ul style="list-style-type: none"> - Do not exceed design depth without design being re-worked.

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GENERIC RISK ASSESSMENT

ACTIVITY:	TEMPORARY WORKS DESIGN FOR EXCAVATION:	
Risk Associated with Activity:	Precautions to be taken to reduce the risk:	Comments:
7. Change in plan dimensions (trench width) of excavation.	<ul style="list-style-type: none"> - If dimensions are to be varied immediately inform Temporary Works Designer to re-work design based on altered depth. 	<ul style="list-style-type: none"> - Do not exceed dimensions without design being re-worked.
8a. Change in surcharge. 8b. Introduction of new surcharge.	<ul style="list-style-type: none"> - Ensure that surcharge assumptions are correct eg.: <ol style="list-style-type: none"> weight of excavator. position of spoil. position of adjacent roads and batters. - Monitor if new surcharges are introduced eg.: <ol style="list-style-type: none"> new haul road adjacent. large plant positioned near dig. spoil dumped near dig excavation. 	<ul style="list-style-type: none"> - Immediately inform Temporary Works Designer of change so design can be reworked.
9. Unknown structures/ services encountered.	<ul style="list-style-type: none"> - Note position and nature of structure and services and inform Temporary Works Designer to assess impact on design. 	
10. Ground reduction details.	<ul style="list-style-type: none"> - Ensure all ground reduction details (batters, etc) as specified in temporary works design are complied with. If not, inform Temporary Works Designer to re-work design. 	
11. Groundwater control.	<ul style="list-style-type: none"> - Ensure the proposed method of groundwater control is as per that used in the 'basis of design', i.e. do not sump pump when well point de-watering has been specified. - See activity number 5 - Groundwater Characteristics. 	
12. Stability of shoring system during use.	<ul style="list-style-type: none"> - Ensure system has been installed as per the Temporary works design. - Continually monitor equipment for signs of overloading e.g. deflection, deformation. 	<ul style="list-style-type: none"> - IF IN DOUBT REFER BACK TO TEMPORARY WORKS DESIGNER.
13. Stability of adjacent structure/batter.	<ul style="list-style-type: none"> - Continually monitor adjacent structures/batters for movement. - If excavation in or around embankments/batters carry out stability analysis, e.g. slip circle checks. 	<ul style="list-style-type: none"> - IF IN DOUBT REFER BACK TO TEMPORARY WORKS DESIGNER.
14. Instability of excavation during extraction of shoring system.	<ul style="list-style-type: none"> - Work to an approved method of work to ensure stability of excavation during extraction of equipment. - Identify where 'short term stability' is being assumed when considering the stability of the excavation during extraction. 	
15. Temporary Works Design checked by external organisation.	<ul style="list-style-type: none"> - Prior to commencing work ensure all relevant external organisation are issued with temporary works design for checking purposes. 	
16. Change of Method Statement.	<ul style="list-style-type: none"> - If method statements incorporating temporary works designs are amended, ensure the original design assumptions are not compromised. 	

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