GEOTECHNICAL MEMORANDUM

Date: 15 August 2022

Project: Kurnabinna Gully Bridge – Geotechnical Reassessment and Redesign

Client/Contact: David Guy, Aspect Studios

Proposal No: ADL2022-0229AB, Rev2

1 INTRODUCTION

In response to the provision of revised loads, CMW Geosciences (East Coast) provide the following geotechnical reassessment and redesign for the Kurnabinna Bridge, as part of the Walkway Upgrade Project.

CMW has previously undertaken geotechnical assessments for the location to assess the stability of the bridge footings within the reference report ADL2022-0050AD Rev1 18/3/22. This memorandum provides an update of this report given the revised bridge loadings provided on the 7/7/22.

2 PROJECT UNDERSTANDING

It is understood there has been changed to the design loading since the issue of the 90% design report for the project. These changes are of a large magnitude (especially in a lateral load case) and therefore redesign has been required.

3 REVISED DESIGN

Upon review, it is understood there is no change to the geometry of the bridge foundations, location of the bridge structures (portal, landing and anchor footing) and the size of the footings for these structures. The only change is the design loadings.

These changes have been table below.

Previous:

Mark	Description	X (kN)	Y (kN)	Z (kN)
KP-N-E	Kurnabinna Gully North Portal - East	2	23.3	415.04
KP-N-W	Kurnabinna Gully North Portal - West	2	23.3	415.04
KA-N-E	Kurnabinna Gully North Anchor - East	446.78	0	257.95
KA-N-W	Kurnabinna Gully North Anchor - West	446.78	0	257.95
KE-N-E	Kurnabinna Gully North Extension - East	0	2.14	16.34
KE-N-W	Kurnabinna Gully North Extension - West	0	2.14	-11.07

Revised as of 7/7/22:

MARK	DESCRIPTION	X (kN) Longitudinal	Y (kN) Lateral	Z(kN) Vertical
KP-S-E	KURNABINNA GULLY SOUTH PORTAL (EAST)	64.5	35	514.2
KP-S-W	KURNABINNA GULLY SOUTH PORTAL (WEST)	64.5	35	514.2
KA-S-E	KURNABINNA GULLY SOUTH ANCHOR (EAST)	571	28	330
KA-S-W	KURNABINNA GULLY SOUTH ANCHOR (WEST)	571	28	330
KE-S-E	KURNABINNA GULLY SOUTH EXTENSION (EAST)	0.19	5.08	18.81
KE-S-W	KURNABINNA GULLY SOUTH EXTENSION (WEST)	0.19	5.08	18.81

CMW note we have assumed the lateral loads(Y kN) can be applied in both positive and negative directions.

4 SCOPE OF WORKS

Based on Aspect Studio provision of revised loadings, CMW are proposing the following scope of works

- Undertaken rock anchor design based on provided revised loads from Bridge Designer.
- A design report detailing the outcomes of the redesign.
- Drawings to be drafted and integrated into the 100% design by others.

5 DESIGN RECOMMENDATIONS

Given a redesign assessment the following recommendations provide an update of the existing design report:

Figure 1 and Figure 2 provide section views of the revised reinforcement for each bridge abutment. **Appendix A** has a revision of the existing design drawings with the revised details annotated therein.

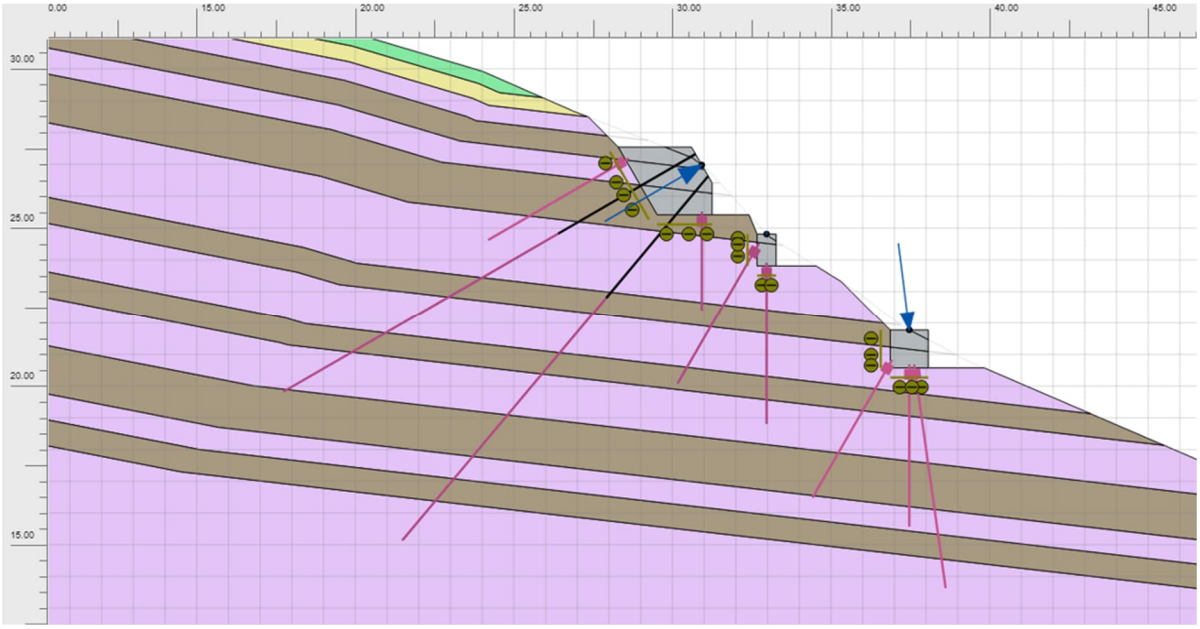


Figure 1: Section view of revised reinforcement – Kurnabinna South.

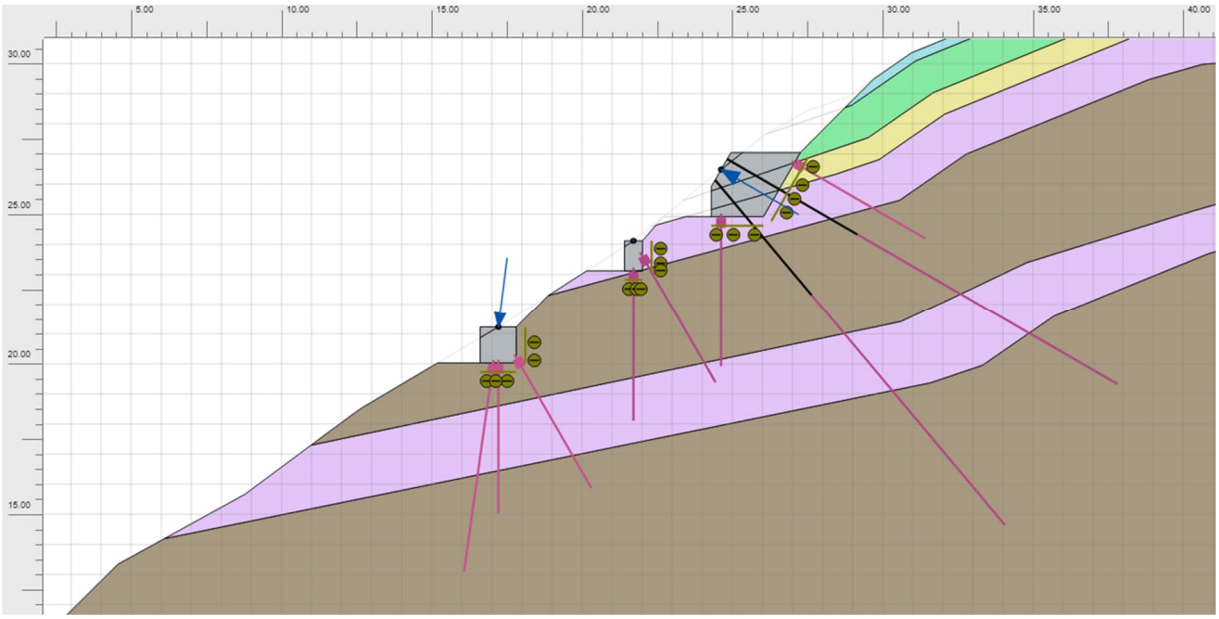


Figure 2: Section view of revised reinforcement – Kurnabinna North.

The following Tables are a direct extract from the CMW design report ADL2022-0050AD Rev1 18/3/22 but are updated for the additional elements given the revised bridge loads.

Table 3, Table 4 and Table 5 apply to both Kurnabinna South and North Anchors, Landing and Portal footings.

Anchors: (elements in red are in addition to the previous design)

Table 3: Bar Details for Anchor Reinforcement

Number	Borehole Depth (m)	Borehole Diameter (m)	Bar length (m)	Bar Diameter (mm)	Free Length (m)	Bond Length (m)	Bearing plate (mm)	Hex Nut	Anticorrosion Compound
~~4~~	~~15~~	~~0.12~~	~~15.6~~	~~40~~	~~5~~	~~10~~	~~240 x 55~~	~~Yes~~	~~Yes~~
4	5	0.12	5	40	0	6	240 x 55	Yes	No

Note:
Strike through items are deleted from the design (~~Strike through~~)
~~600mm extra length required to be protruding above the anchor block to allow for future lift off testing~~
~~Multiple pretension phases are expected during the 12-month construction period to ensure pretension loading (50kN).~~
~~All bars to be pretensioned to 50kN and lift tested periodically (every 5 years).~~
~~The design of fittings to secure cable stays to be undertaken by Innovis. Structural engineer's design for cable stay fastening to not impact on the ground anchor design.~~
~~Protective caps are required. Protective caps are to be replaced at every testing or pre-tensioning of the bar.~~
Bar to be embedded in the anchor block. All bars to be pretensioned to 100kN
Refer to manufacturer's specifications for installation.
Refer to manufacturer's specifications for testing.

Table 3: Bar Details for Anchor Reinforcement (continued)									
Number	**Borehole Depth (m)**	**Borehole Diameter (m)**	**Cable length (m)**	**Cable Strands**	**Free Length (m)**	**Bond Length (m)**	**Bearing plate (mm)**	**Wedge Plate**	**Anticorrosion Compound**
4	15	0.12	15.6	6 x 15.2mm	5	10	290 x 36	Yes	Yes
Note: 1000mm extra length required to be protruding above the anchor block to allow for future lift off testing Multiple pretension phases are expected during the 12-month construction period to ensure pretension loading (100kN). Noting a re-stressable strand anchor requires wedge blocks with an external thread and a customer built jack to screw over the wedge block All bars to be pretensioned to 100kN and lift tested periodically (every 5 years). The design of fittings to secure cable stays to be undertaken by Innovis. Structural engineer's design for cable stay fastening to not impact on the ground anchor design. Protective caps are required. Protective caps are to be replaced at every testing or pre-tensioning of the bar. Refer to manufacturer's specifications for installation. Refer to manufacturer's specifications for testing.									

See Appendix B for specifications for the cable.

Portal: (elements in red are in addition to the previous design)

Table 4: Bar Details for Portal Reinforcement								
Number	**Inclination**	**Borehole Depth (bottom of strip footing) (m)**	**Borehole Diameter (m)**	**Bar length (m)**	**Bar Diameter (mm)**	**Bond Length (m)**	**Bearing plate (mm) and Hex Nut**	**Anticorrosion Compound**
4	Vertical	7	0.12	7	40	7	yes	no
4	Vertical	5	0.12	5	40	7	yes	no
2	Raked	7	0.12	7	40	7	yes	no
Note: Refer to manufacturer's specifications for installation.								

Landing: (elements in red are in addition to the previous design)

Table 5: Bar Details for Landing Reinforcement								
Number	**Inclination**	**Borehole Depth (bottom of strip footing) (m)**	**Borehole Diameter (m)**	**Bar length (m)**	**Bar Diameter (mm)**	**Bond Length (m)**	**Bearing plate (mm) and Hex Nut**	**Anticorrosion Compound**
2	Vertical	6	0.12	6	40	6	Yes	no
2	Vertical	6	0.12	6	40	6	yes	no
Note: Refer to manufacturer's specifications for installation.								

6 LIMITATIONS

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of the ground conditions away from our investigation locations.

If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately.

Additional important information regarding the use of your CMW report is provided in the 'Using your CMW Report' document attached to this report.

This report has been prepared for use by Aspect Studio in relation to the Coastal Walkway Upgrade Project and in accordance with the scope, proposed uses and limitations described in the report. Should you have further questions relating to the use of your report please do not hesitate to contact us.

Where a party other than Aspect Studio seeks to rely upon or otherwise use this report, the consent of CMW should be sought prior to any such use. CMW can then advise whether the report and its contents are suitable for the intended use by the other party

7 CLOSURE

Should there be any questions in relation to this report, please contact the undersigned.

For CMW Geosciences

Yan Wang
Project Geotechnical Engineer

John Slade
Principal Geotechnical Engineer, CPEng

Distribution: 1 copy to Aspect Studio (electronic)
Original held by CMW Geosciences

Attachments: Appendix A: Design Drawings Revised
Appendix B: Cable Specifications
Appendix C: Modelling Analysis

Design Drawings Revised

This area is assumed to be removed during construction

Green line is the new block perimter. This is to embedd the 40mm bar and ensure cover.

2.0m

DEPTH TO BE CONFIRMED BY GEOTECHNICAL ENGINEER FOR EACH SITE.

40mm threaded DCP bar, 5m length plate and nut embedded in the block

30°

CABLE AND CABLE CONNECTION BY OTHERS.

CABLE ANCHOR PLATE SHOWN DASHED FOR CLARITY

1.3m

BEARING PLATE

DIMENSIONS (mm)		
STRAND CONFIGURATIONS	2 – 5	6 – 7
BEARING PLATE (AxT)	250x32	290x36
PROTECTIVE CAP (DcxLc)	161x85	205x95
PIPE SLEEVE (LpxODxTp)	350x114.3x6.0	400x114.3x6.0
CORRUGATED SHEATH (ODxID)	92x78	92x78
STRESSING LENGTH (Ls)	750	1000

N24-100 EW

6 strand cable configuration

2

1

LOAD TRANSFER BLOCK

30°

CABLE EMBEDMENT PLATE

N12 LIGS AT 150 CRS

6 strand cable configuration

4XN16 BENT TRANSFER BLOCK REINFORCEMENT. WITH N10 LIGATURES AT 100 CRS

0.2MM VAPOUR BARRIER. FORTECON OR EQUIVALENT.

N24-100 EW

40mm threaded DCP bar, 5m length plate and nut embedded in the block

4xDYWIDAG WR DCP ACHOR 01 DOUBLE CORROSION PROCECTED (DCP) PERMANENT GROUND ANCHOR GRADE WR (950/1050)
ANCHOR LENGTH: 15.6m MIN. FREE LENGTH 5M
BOND LENGTH 10m
ANCHOR DIAMETER: 47mm
BOREHOLE DIAMETER 0.12m

above text to adjusted to reference the 6 starnd multistrand configuration

EXCAVATION AND BEARING SURFACE TO BE INSPECTED BY GEOTECHNICAL ENGINEER AND DESIGNER TO CONFIRM IN ACCORDANCE WITH ASSUMED SOIL PROFILE AND DESIGN MODEL ASSUMPTIONS..

50°

800 mm

NOTE: ALL REINFORCEMENT AND STEEL TO BE HOT DIP GALVANISED.
NOTE: COVER TO BE MINIMUM 50MM.
REINFORCEMENT TO BE 3D SHOP DRAWN.

ALL CONCRETE TO BE f'c = 50MPa AND COLOURED IN ACCORDANCE WITH LANDSCAPE ARCHITECT REQUIREMENTS

ANCHOR BLOCK SECTION

new 40mm threaded DCP bar.

ANCHOR BEARING PLATE 260 SQ X 50 THK.

CABLE ANCHOR PLATE 4-M36 4.6/S ANCHOR BOLTS 420XSQX50 THK

CABLE ANCHORAGE POINT

1300mm

800 mm

1300mm

new 40mm threaded DCP bar.

ANCHOR BLOCK ELEVATION

Edits 15/08/22 J Slade

CMW have assessed the live and dead design loads and a temporary loading of 0.05g horizontal loading.

Design is predicated on the pull testing of the cable and thread bar anchors at regular intervals to confirm design capacity is meet.

All temporary works excavations and Temporary Anchors are not to interact with these permanent anchor elements

Drawing is to also include the DWG-PermStrand01 - Permanent Strand Anchor Details as attached in this report.

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Physical Properties

Grade	(Mpa)	WR (950 / 1050)					E (835 / 1035)		
Diameter	(mm)	26.5	32	36	40	47	57	65	75
Ultimate	(kN)	579	844	1069	1319	1820	2671	3447	4572
Yield	(kN)	524	764	967	1194	1652	2155	2780	3690
Area	(mm2)	552	804	1018	1257	1735	2581	3331	4418

Dimensions (mm)

Bar Diameter		26.5	32	36	40	47	57	65	75
Bearing plate	A x T	180x40	20x45	220x50	240x55	260x50	330x70	370x75	420x85
Pipe OD	Dp	64	70	76	76	114	127	127	168.3
Nut Length	Ln	60	72	75	83	105	120*	130*	145*
Stressing Length	Ls	90	100	110	130	135	120	130	145
Capped Length	Lsc	210	210	210	240	280	280	280	280
Smooth Sheat OD	Ds	58	63	73	76	85	110	110	125
Corrugated Sheath OD	Dc	50	56	65	65	80	100	100	114

* Hex Nut

CHARACTERISTICS

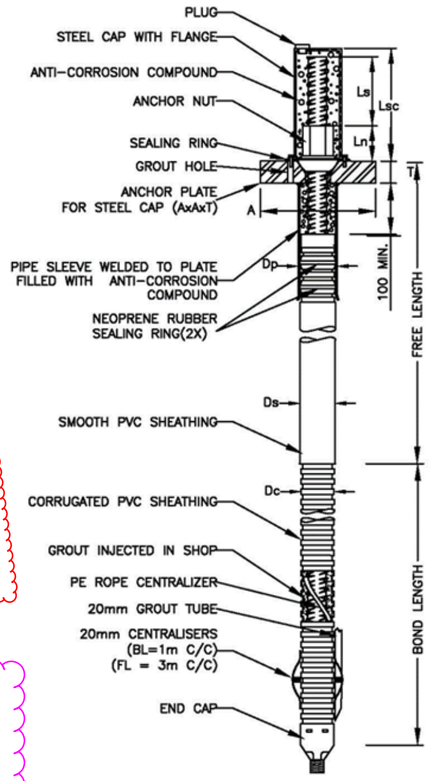
1) POST–TENSIONING TENDONS ARE DSI THREADBAR, DOUBLE CORROSION PROTECTED SYSTEM, SHOP ASSEMBLED AND GROUTED.
2) THREADBARS ARE PROOF STRESSED AND STRESS RELEIVED.
3) SHOP GROUT: CEMENTITIOUS NEAT LEAN GROUT W/O AGGREGATES,
   MAXIMUM WATER CEMENT RATIO=0.36 (BY WEIGHT),
   CEMENT: GENERAL PURPOSE TYPE GP
   ADDITIVE: VISCOCRETE 10, 0.25% (BY WEIGHT).
4) DURING TENSIONING, DRAW IN AT NUT=1mm & COUPLER SLIP=1.5mm.

INSTALLATION PROCEDURE

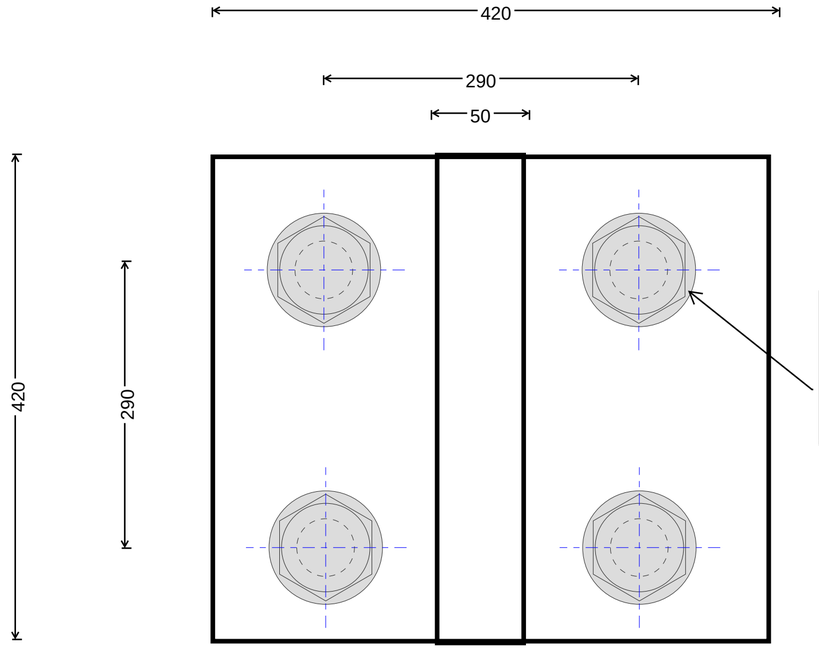
1) DRILL HOLE; GROUT AND RE–DRILL IF REQUIRED.
2) ASSEMBLE PRE–GROUTED BARS WITH PLATES, NUTS, GROUT TUBES, CENTRALISERS AND COUPLERS (IF APPLICABLE) AND INSERT ANCHOR IN HOLE.
3) TREMIE GROUT ALONG ENTIRE ANCHOR LENGTH.
4) ONCE GROUT REACHES REQUIRED STRENGTH, TEST ACCORDING TO SPECIFICATIONS.
5) INSTALL PROTECTIVE CAPS (IF REQUIRED).

Text to be removed as it also written below.

NOTE:
1. Protective caps are required. Protective caps are to be replaced at every testing of the anchor.
2. All bars to be pretensioned (to 50kN) and load tested periodically. Multiple retention phases are expected during the 12 month construction period to ensure pretension loading due to the poor ground near the surface of the anchor block. Periodic lift tests will be required per 5 years of installation.
3. Refer to manufacturers specifications for installation.
4. Refer to manufacturers specifications for testing.
5. Load transfer block to be constructed to allow for testing of each anchor bar at specific inclinations and orientations.



ANCHOR–DETAILS

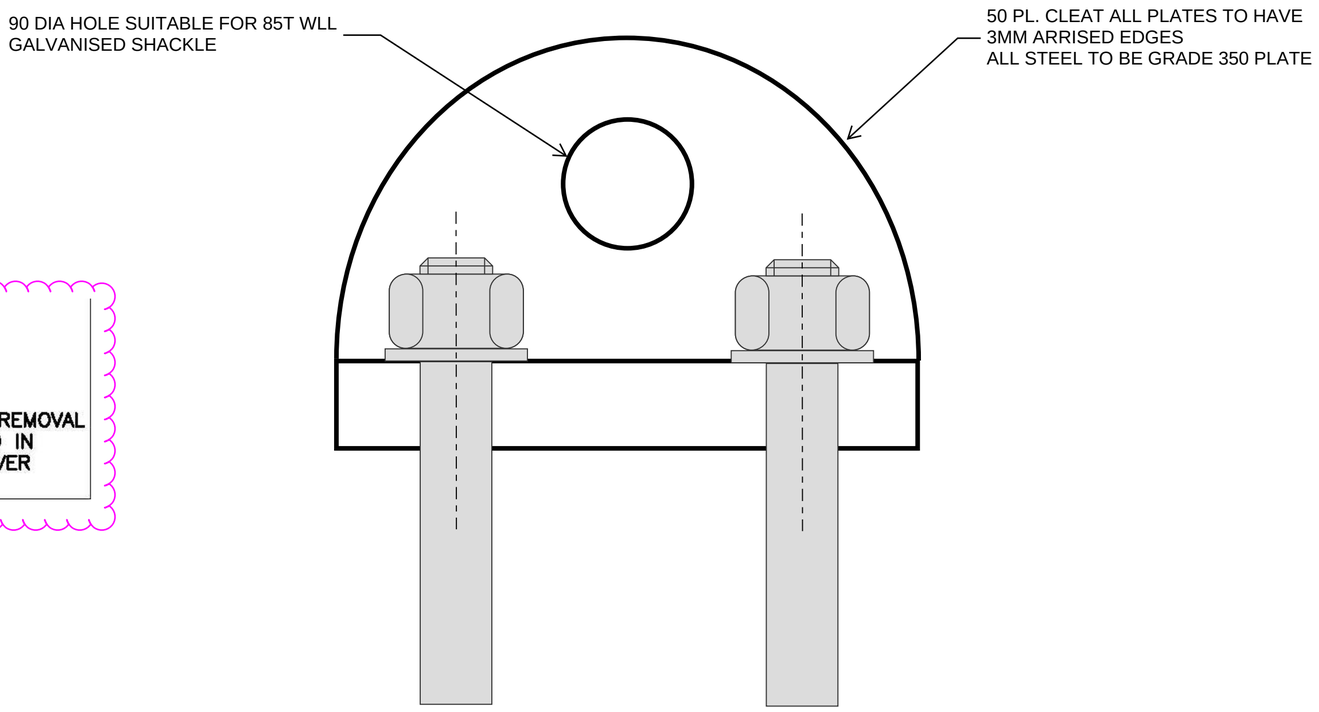


ANCHOR PLATE

Edits 05/08/22 J Slade

Drawing is to also include the DWG-PermStrand01 - Permanent Strand Anchor Details as attached in this report.

DIMENSIONS (mm)			
STRAND CONFIGURATIONS	2 – 5	6 – 7	
BEARING PLATE (AxT)	250x32	290x36	
PROTECTIVE CAP (DcxLc)	161x85	205x95	
PIPE SLEEVE (LpxODxTp)	350x114.3x6.0	400x114.3x6.0	5
CORRUGATED SHEATH (ODxID)	92x78	92x78	
STRESSING LENGTH (Ls)	750	1000	



ANCHOR BLOCK ELEVATION

CAUTION

DO NOT WELD TO BAR
DO NOT USE BAR AS GROUND FOR WELDING
DO NOT ALLOW HOT SLAG OR SPARKS TO TOUCH BAR
DO NOT DAMAGE BAR SURFACE
DO NOT USE BARS WITH KINKS OR SHARP BENDS
FAILURE TO HEED THIS WARNING COULD CAUSE BAR TO BREAK RESULTING IN INJURY OR DAMAGE.

WARNING

AT NO TIME DURING STRESSING AND REMOVAL OF THE JACK, SHALL PERSONS STAND IN LINE WITH THE TENDONS OR BEND OVER ALREADY STRESSED TENDONS.

INSTALLATION PROCEDURE

1) DRILL HOLE; GROUT AND RE–DRILL IF REQUIRED.
2) ASSEMBLE PRE–GROUTED BARS WITH PLATES, NUTS, GROUT TUBES, CENTRALISERS AND COUPLERS (IF APPLICABLE) AND INSERT ANCHOR IN HOLE.
3) TREMIE GROUT ALONG ENTIRE ANCHOR LENGTH.
4) ONCE GROUT REACHES REQUIRED STRENGTH, TEST ACCORDING TO SPECIFICATIONS.
5) INSTALL PROTECTIVE CAPS (IF REQUIRED).

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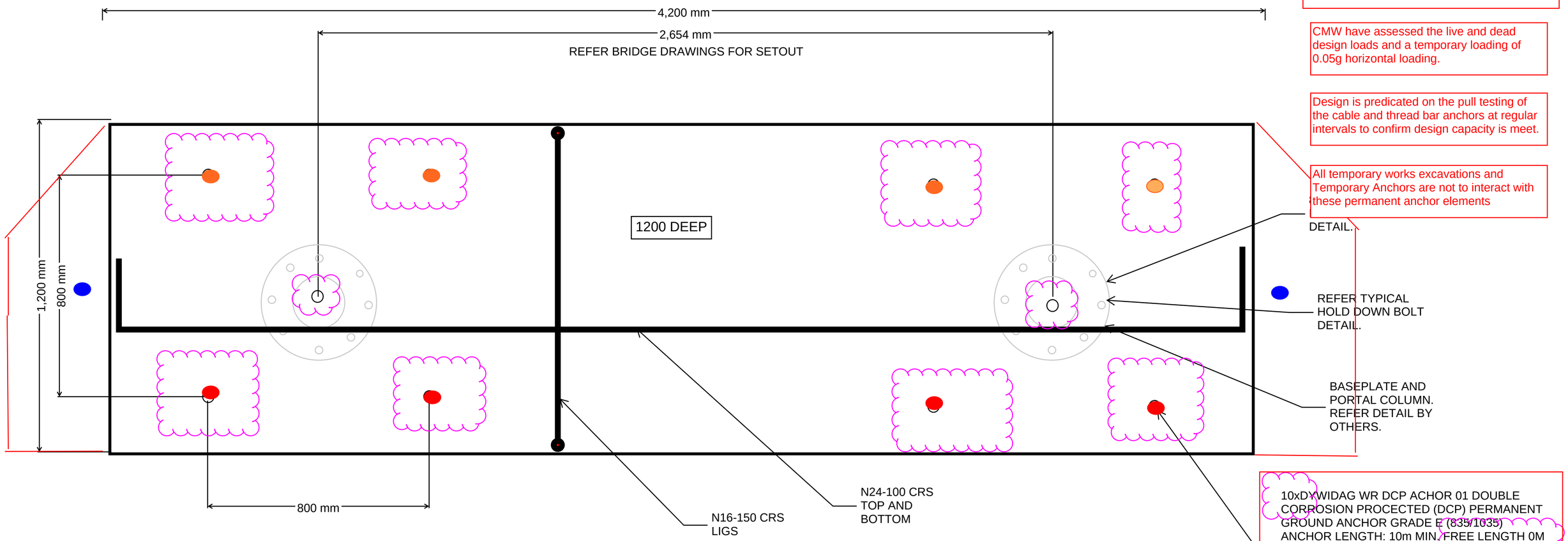
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CMW have assessed the live and dead design loads and a temporary loading of 0.05g horizontal loading.

Design is predicated on the pull testing of the cable and thread bar anchors at regular intervals to confirm design capacity is meet.

All temporary works excavations and Temporary Anchors are not to interact with these permanent anchor elements



PORTAL FOOTING - PLAN

Raked DCP 40mm threaded bar, inclined 60 degree from the horizontal into the slope. Embedded into the strip footing. 7mL.

DCP 40mm threaded bar, inclined 90 degree. Embedded into the strip footing. 5mL.

DCP 40mm threaded bar, inclined 90 degree. Embedded into the strip footing. 7mL.

text to revised to 40mm threaded DCP bar.

NOTE: ALL REINFORCEMENT AND STEEL TO BE HOT DIP GALVANISED.
NOTE: COVER TO BE MINIMUM 50MM.
REINFORCEMENT TO BE 3D SHOP DRAWN.

ALL CONCRETE TO BE f'c = 50MPa AND COLOURED IN ACCORDANCE WITH LANDSCAPE ARCHITECT REQUIREMENTS

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MARION COASTAL WALKWAY UPGRADE

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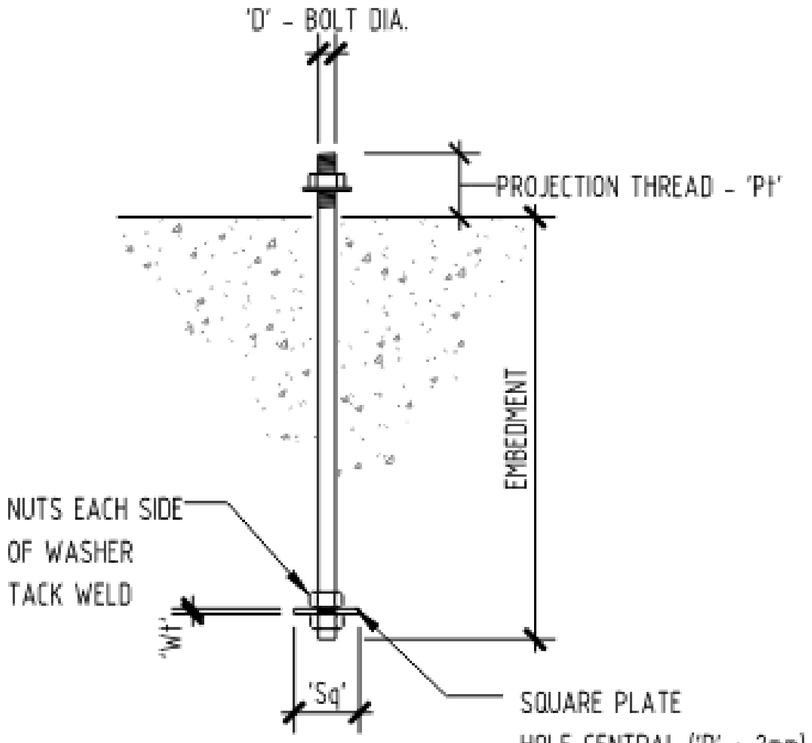
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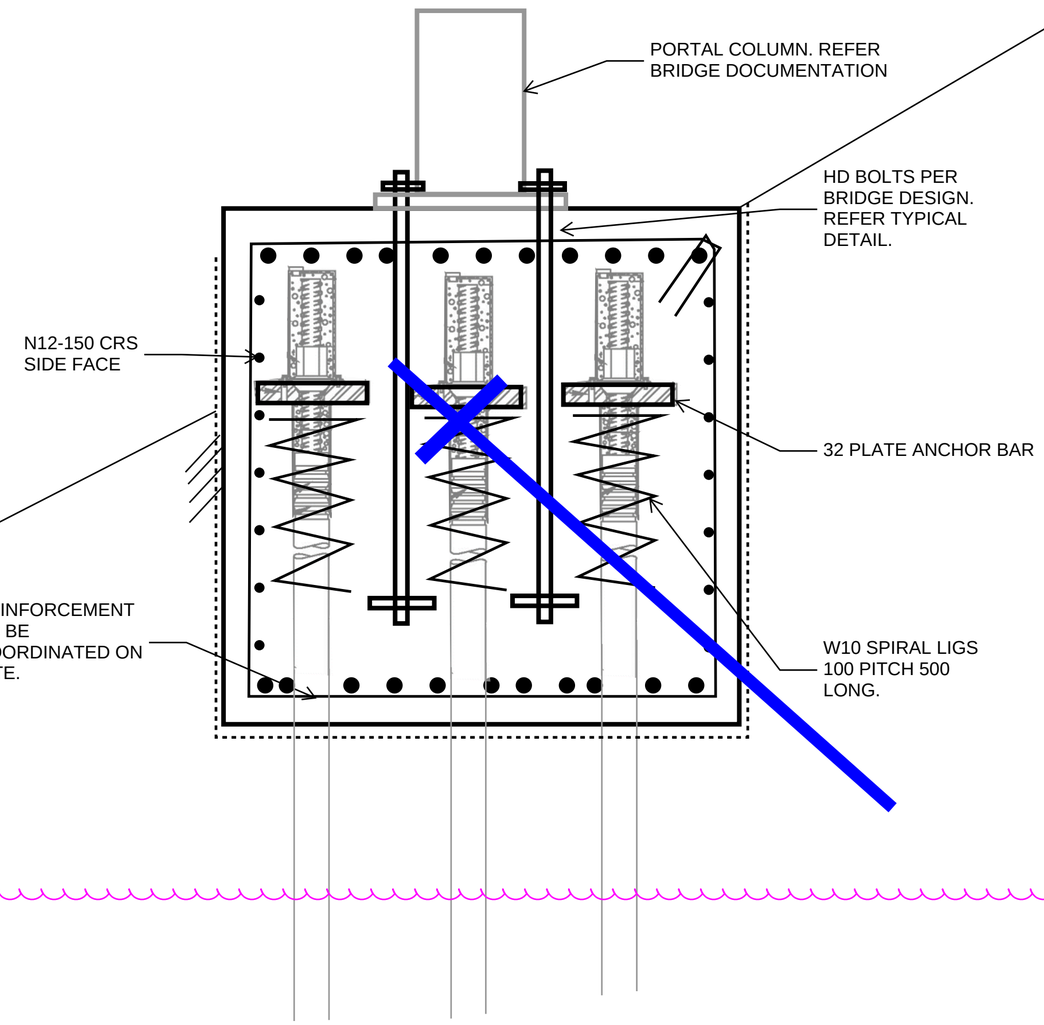
Edits 05/08/22 J Slade



NOTE:
THREADED ROD SHALL BE HOT DIPPED GALVANISED. A MATERIAL CERTIFICATE MUST BE PROVIDED TO THE DESIGN ENGINEER BEFORE USE.

TYPE	'D'	EMBEDMENT	'Pt'	'Wt'	'Sq'
HD1	20DIA 4.6/S	650	100	32	150

TYPICAL HOLD DOWN BOLT DETAIL



PORTAL FOOTING - SECTION

NOTE: ALL REINFORCEMENT AND STEEL TO BE HOT DIP GALVANISED.
NOTE: COVER TO BE MINIMUM 50MM.
REINFORCEMENT TO BE 3D SHOP DRAWN.

ALL CONCRETE TO BE f'c = 50MPa AND COLOURED IN ACCORDANCE WITH LANDSCAPE ARCHITECT REQUIREMENTS

In above section - central 40mm DCP threaded bar is inclined / raked into slope (see blue line)

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						PROJECT MANAGER	XXX

MARION COASTAL WALKWAY UPGRADE

HALLET COVE, SA 5158

CELL 5/6

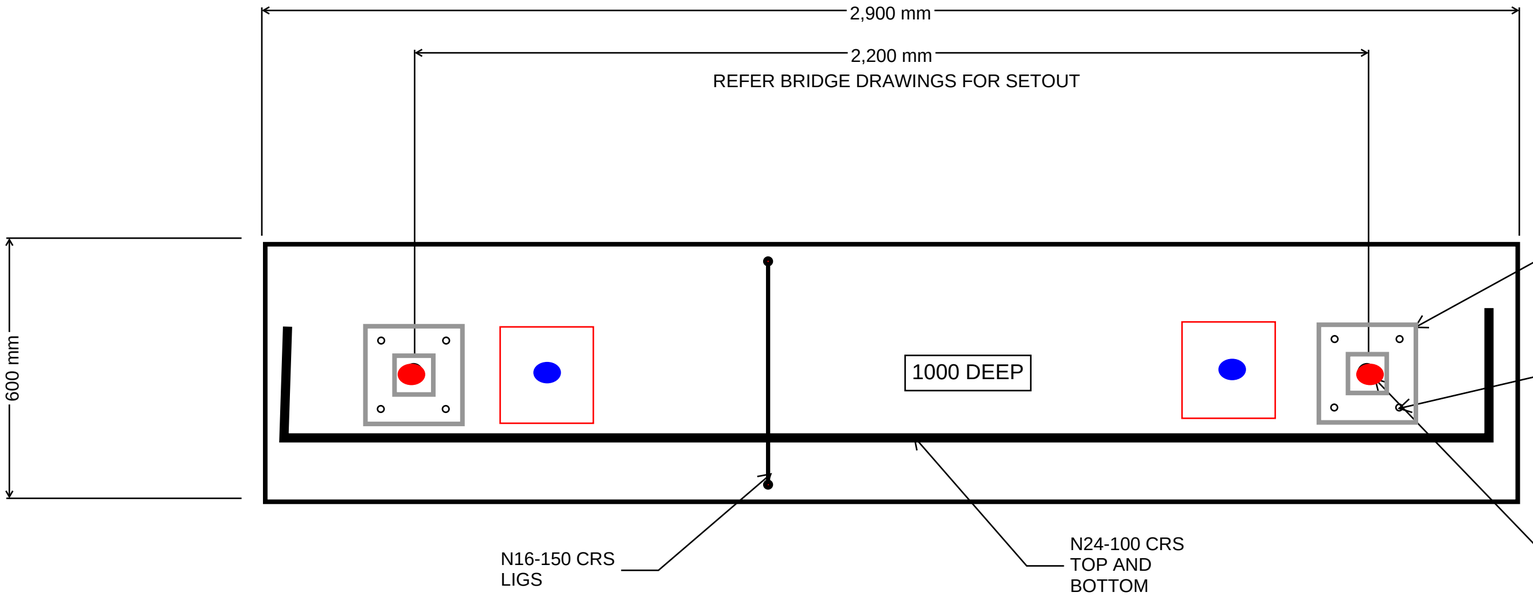
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BRIDGE LANDING FOOTING - PLAN

Raked DCP 40mm threaded bar, inclined 60 degree from the horizontal into the slope. Embedded into the strip footing. 6mL.

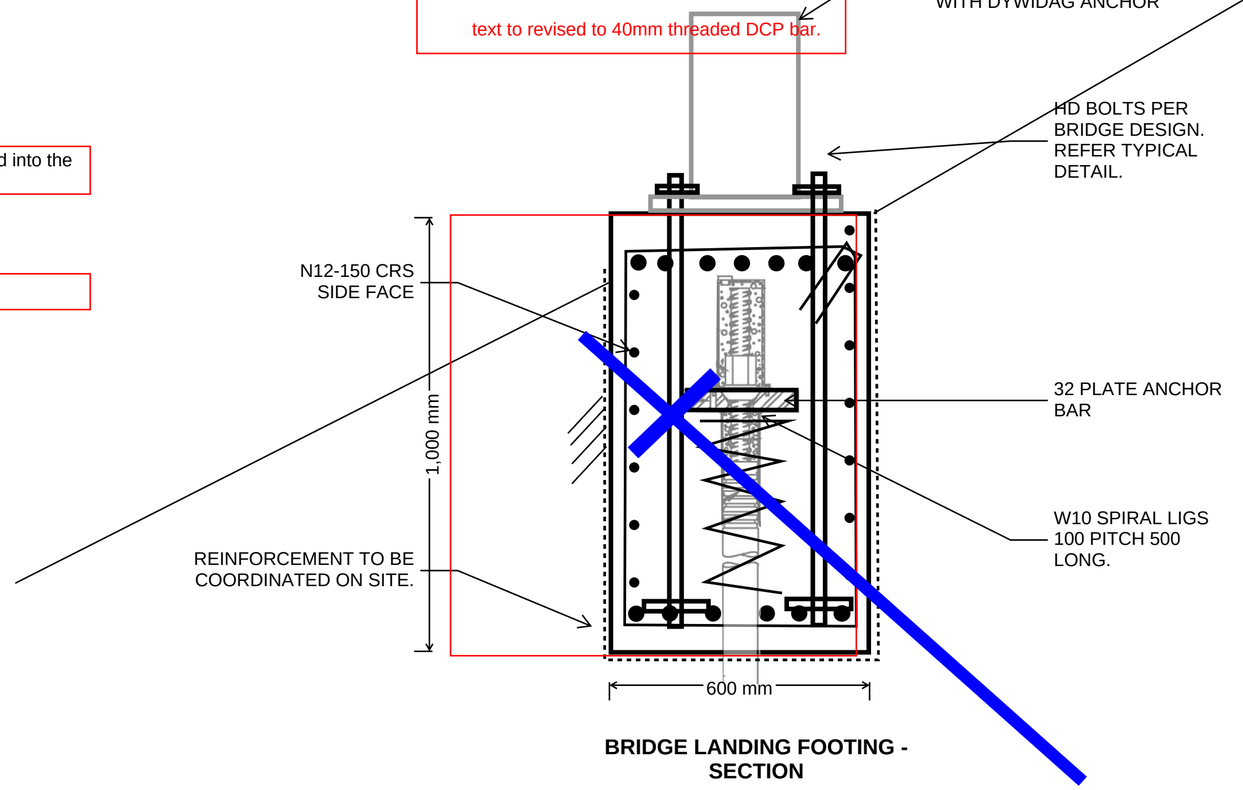
DCP 40mm threaded bar, inclined 90 degree. Embedded into the strip footing. 6mL.

Edits 05/08/22 J Slade

CMW have assessed the live and dead design loads and a temporary loading of 0.05g horizontal loading.

Design is predicated on the pull testing of the cable and thread bar anchors at regular intervals to confirm design capacity is meet.

All temporary works excavations and Temporary Anchors are not to interact with these permanent anchor elements



BRIDGE LANDING FOOTING - SECTION

In above section - add a 40mm DCP threaded bar inclined / raked into slope (see above blue line). This is likely to change the dimensions of the block

NOTE: ALL REINFORCEMENT AND STEEL TO BE HOT DIP GALVANISED.
NOTE: COVER TO BE MINIMUM 50MM.
REINFORCEMENT TO BE 3D SHOP DRAWN.

ALL CONCRETE TO BE f'c = 50MPa AND COLOURED IN ACCORDANCE WITH LANDSCAPE ARCHITECT REQUIREMENTS

PRELIMINARY

CLIENT:	REV:	DATE:	DESCRIPTION:	IVR:	APR'D:	TITLE:	NAME:
ASPECT Studios™	A	11/03/2022	PRELIMINARY FOR PRICING	XXX	XXX	DRAFTER	JCA
	B	11/03/2022	PRELIMINARY FOR PRICING			DRAFTING CHECK	XXX
	C	11/03/2022	PRELIMINARY FOR PRICING			DESIGNER	JCA/CMW
						DESIGN CHECK	XXX
PRINT IN COLOUR:						PROJECT MANAGER	XXX

MARION COASTAL WALKWAY UPGRADE

HALLET COVE, SA 5158

CELL 5/6

INNOVIS Agile Outcomes

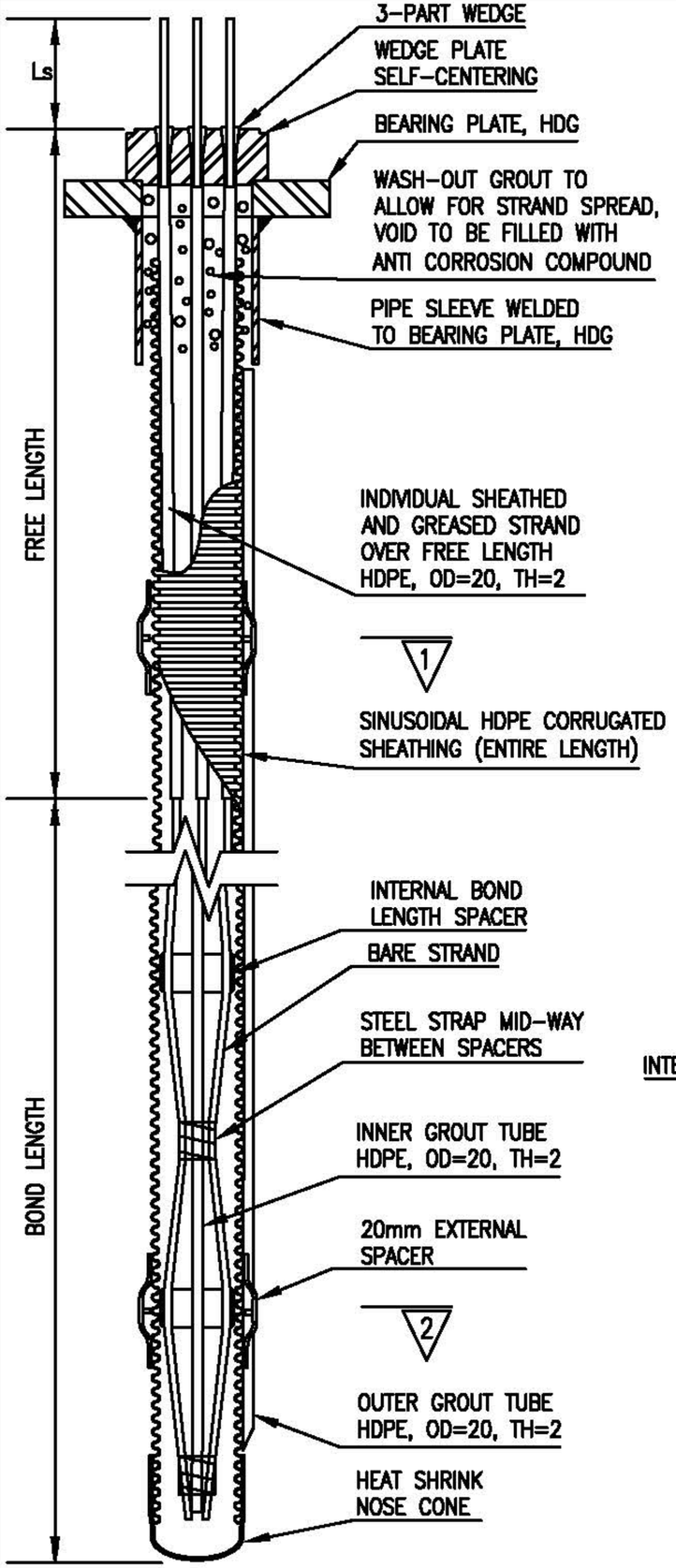
SCALE:	DATE:	PHASE:	SHT SIZE:
N.T.S.	11/03/2022		A2

DRAWING NUMBER: J0439-STR-SKT-0114

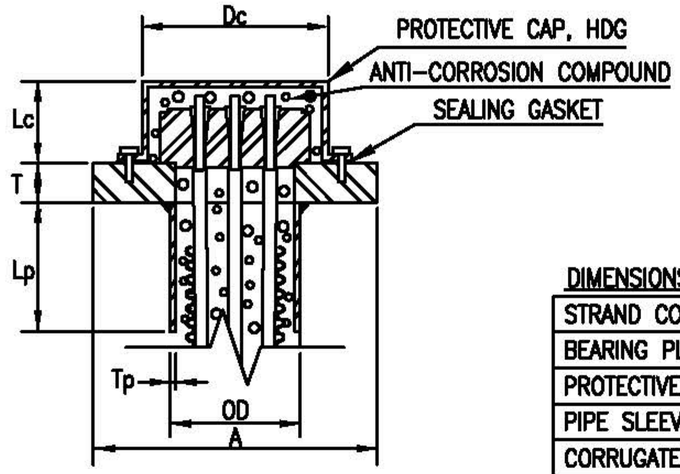
REVISION: C

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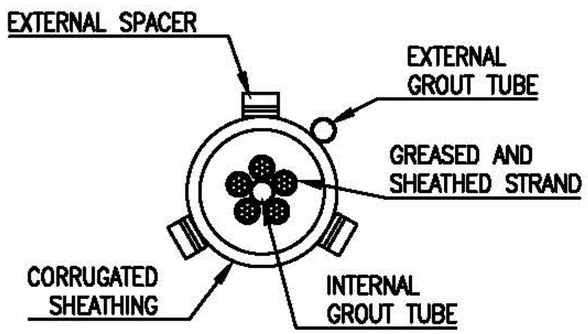
Cable Specifications



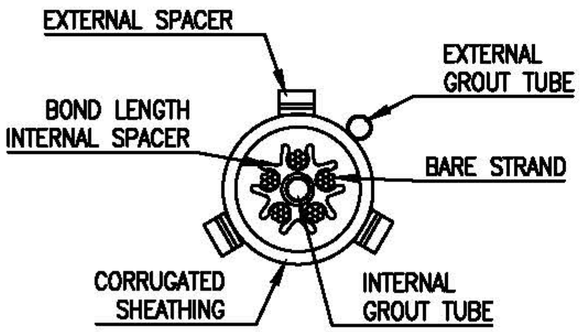
ANCHOR DETAILS



ANCHOR HEAD PROTECTION



SECTION 1 – FREE LENGTH



SECTION 2 – BOND LENGTH

No.	REVISION	DATE	ECN
A	PIPE & CAP CHANGES	OCT' 12	000
B	CORRUGATED SHEATHING UPDATED	AUG' 14	020
C	31 & 37 ADDED	JUL' 15	025

15.2mm STRAND PROPERTIES

EXTRA HIGH TENSILE STRENGTH LOW RELAXATION STRAND
A=143mm2 MBL=261kN

DIMENSIONS (mm)

STRAND CONFIGURATIONS	2 – 5	6 – 7	8 – 9	10 – 12	13 – 15
BEARING PLATE (AxT)	250x32	290x36	330x40	380x45	420x50
PROTECTIVE CAP (DcxLc)	161x85	205x95	205x95	212x170	256.4x120
PIPE SLEEVE (LpxODxTp)	350x114.3x6.0	400x114.3x6.0	500x168.3x6.4	550x168.3x6.4	650x168.3x6.4
CORRUGATED SHEATH (ODxID)	92x78	92x78	92x78	117x101	117x101
STRESSING LENGTH (Ls)	750	1000	1500	1500	1500

DIMENSIONS (mm)

STRAND CONFIGURATIONS	16 – 19	20 – 22	23 – 31	32 – 37
BEARING PLATE (AxT)	470x60	500x70	600x80	650x100
PROTECTIVE CAP (DcxLc)	256.4x120	256.4x120	323.8x150	323.8x150
PIPE SLEEVE (LpxODxTp)	700x219.1x6.4	800x219.1x6.4	1000x273.1x6.4	1000x273.1x6.4
CORRUGATED SHEATH (ODxID)	145x127	145x127	241x203	241x203
STRESSING LENGTH (Ls)	1500	1500	2000	2000

CAUTION

DO NOT WELD TO STRAND
DO NOT USE STRAND AS GROUND FOR WELDING
DO NOT ALLOW HOT SLAG OR SPARKS TO TOUCH STRAND
DO NOT DAMAGE STRAND SURFACE
DO NOT USE STRAND WITH KINKS OR SHARP BENDS
FAILURE TO HEED THIS WARNING COULD CAUSE STRAND TO BREAK RESULTING IN INJURY OR DAMAGE.

INSTALLATION PROCEDURE

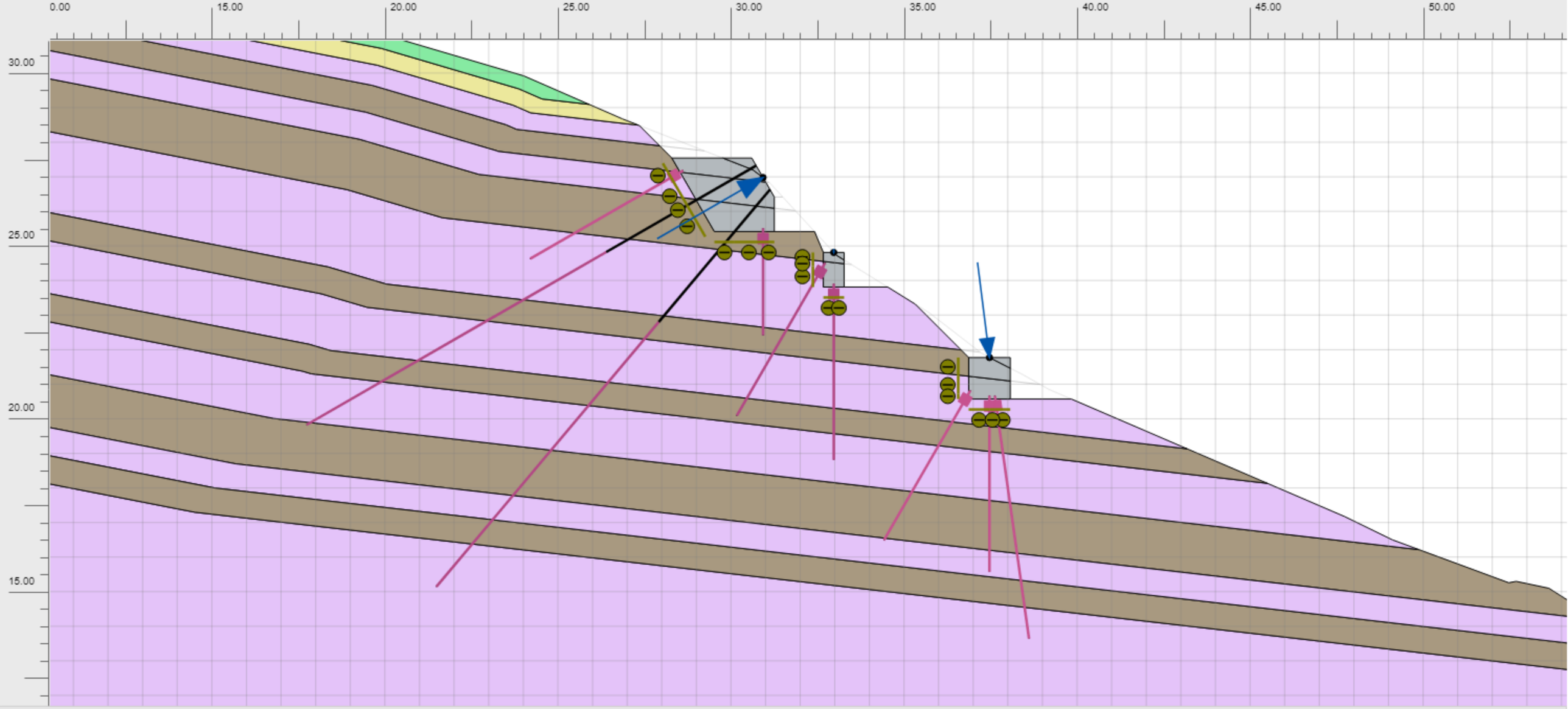
1) DRILL REQUIRED HOLES. IF APPLICABLE, GROUT AND RE-DRILL UNTIL WATER TIGHT.
2) INSERT CORRUGATE SHEATHING WITH PRE-ASSEMBLED OUTER GROUT TUBE & SPACERS.
3) INSERT STRAND ANCHORS PRE-ASSEMBLED WITH INNER SPACERS AND GROUT TUBE.
4) WATER TEST SHEATHING.
5) SIMULTANEOUSLY GROUT THE INNER AND OUTER ANNULUS OF THE ENTIRE ANCHOR.
6) 4 HOURS AFTER GROUTING, WASHOUT 0.5m BELOW PLATE.
7) INSTALL BEARING PLATE WITH PIPE.
8) FILL ANCHOR HEAD WITH GREASE.
9) INSTALL WEDGE PLATE AND WEDGES.
10) ONCE GROUT REACHES MIN. 32MPa AND 7-DAYS, PERFORM TESTING AND LOCKING-OFF.
11) ONCE TESTING & LOCKING-OFF ARE APPROVED, CUT STRANDS AND CAP.

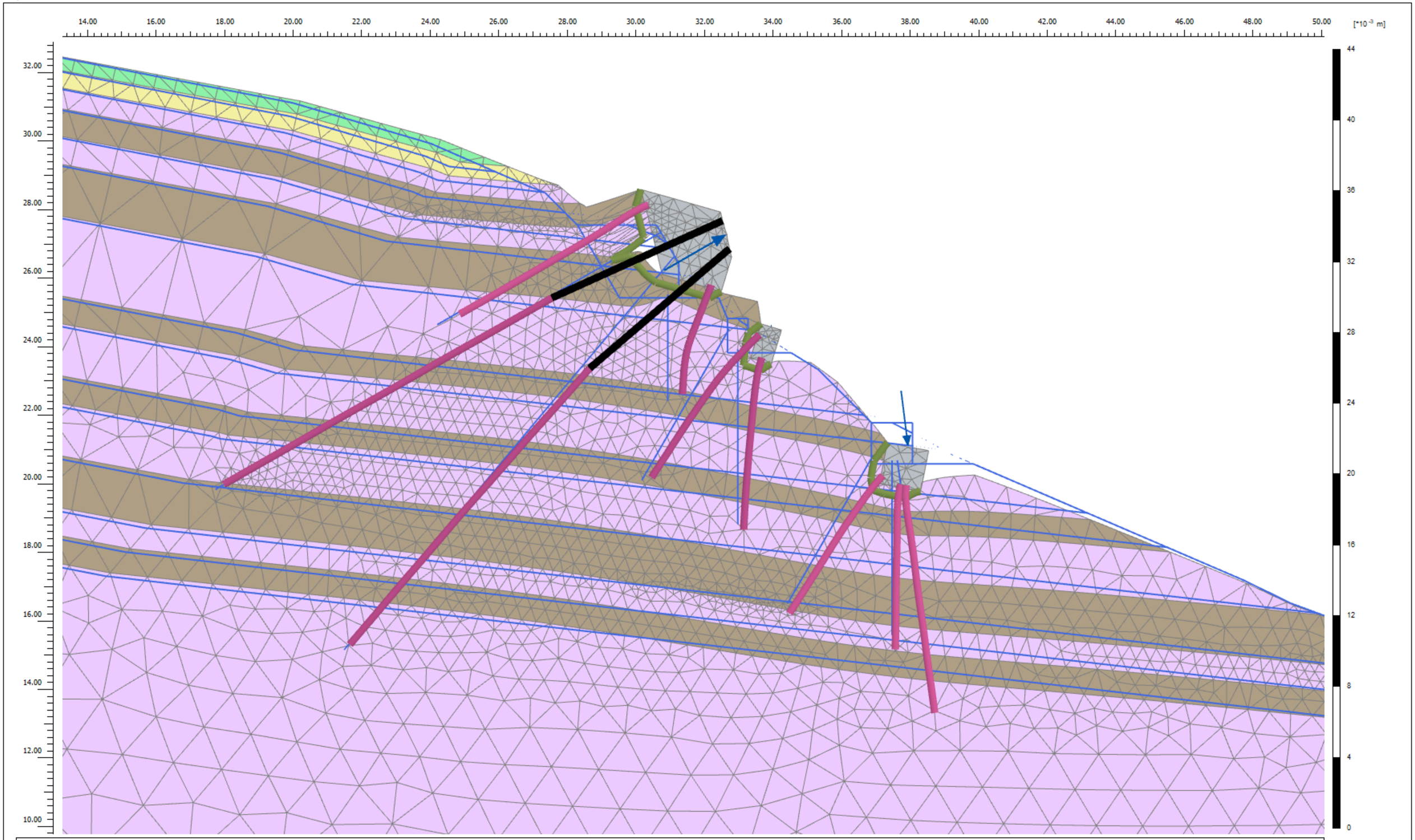
DYWIDAG-Systems International Construction P/L
ABN: 23 630 281 615
PO Box 2034
Gateshead, NSW, 2290
P: +61 2 4081 5501
E: civilenquiries@dywidag-systems.com.au
Office Address:
24 Groves Road
Bennetts Green, NSW, 2290
Australia

DYWIDAG

PROJECT			
	A4	DATE DEC '11	DRAWN MV
		SCALE NTS	CHECKED AUTH
TITLE PERMANENT MULTISTRAND ANCHOR DETAILS	DWG No. PermStrand01		REV. C

Modelling Analysis

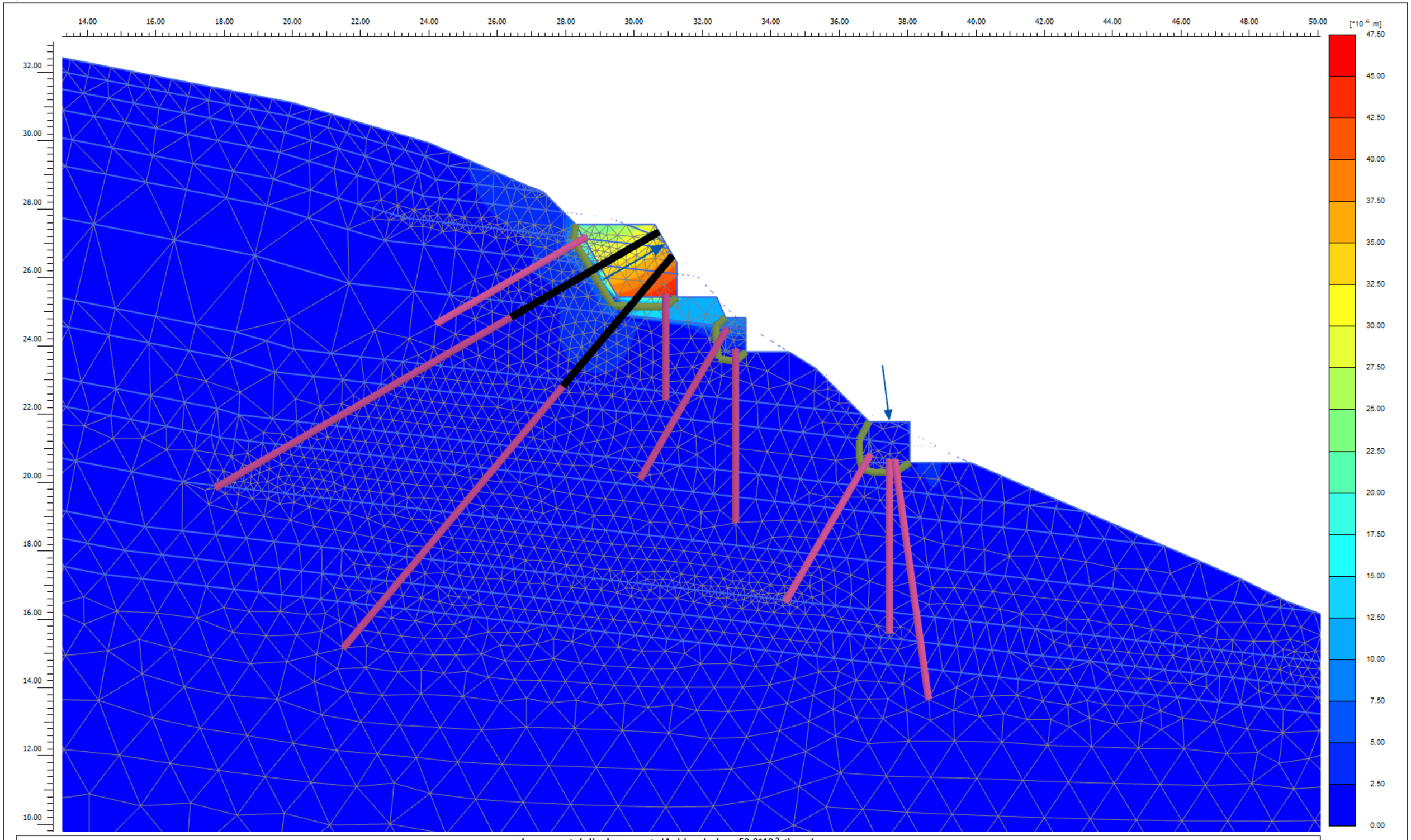

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Deformed mesh |u| (scaled up 500 times)

Maximum value = $4.244*10^{-3}$ m (Element 322 at Node 667)

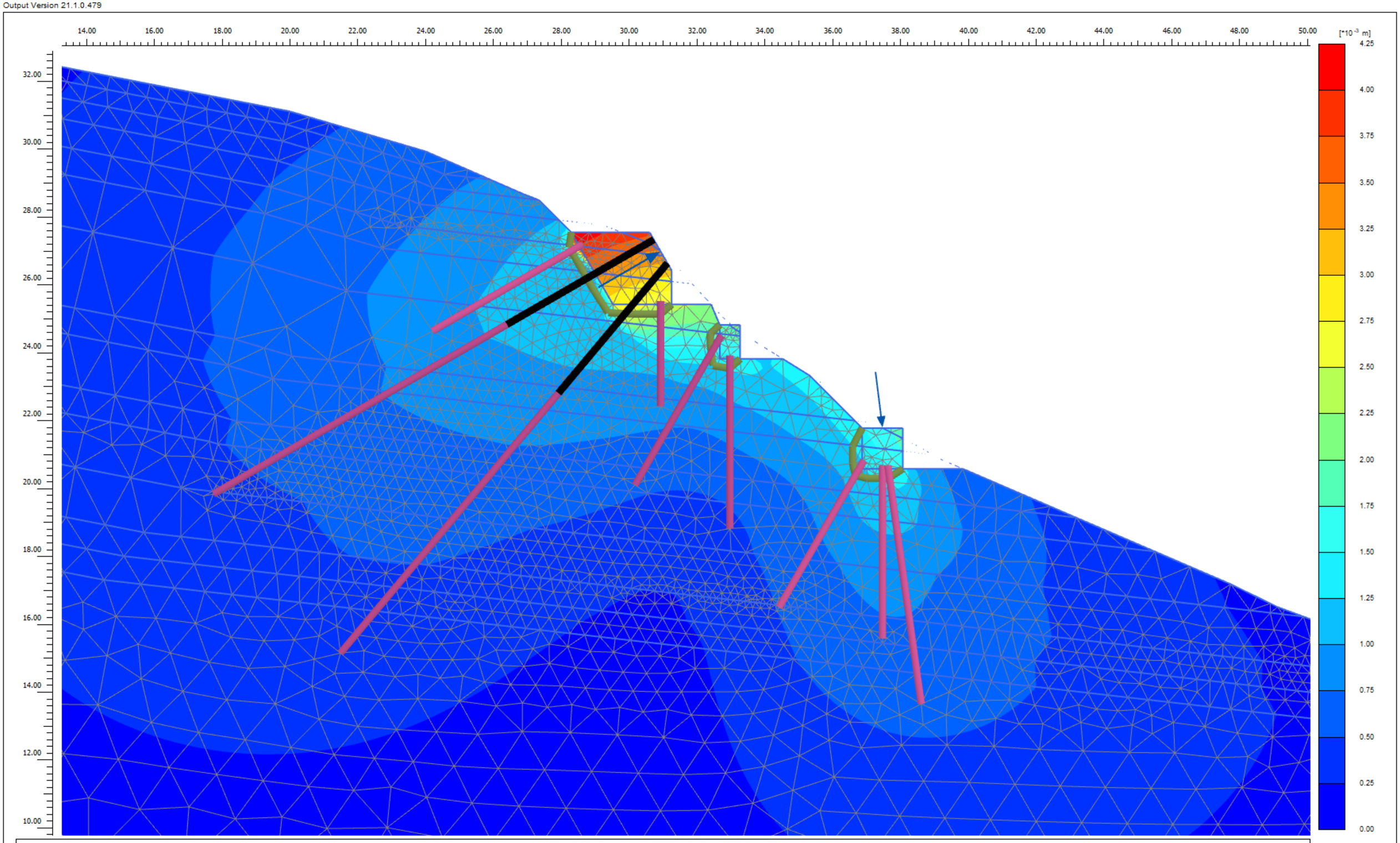
Project description: Marion Costal Walkway Upgrade			Date: 5/08/2022
Project filename: Kurnabinna Gully S - Redesign	Step: 265	Company: CMW Geosciences Pty Ltd	



Incremental displacements |Δu| (scaled up 50.0*10 3 times)

Maximum value = 0.04667*10 -3 m (Element 935 at Node 4915)

Project description: Marion Costal Walkway Upgrade			Date: 5/08/2022
Project filename: Kurnabinna Gully S - Redesign	Step: 365	Company: CMW Geosciences Pty Ltd	

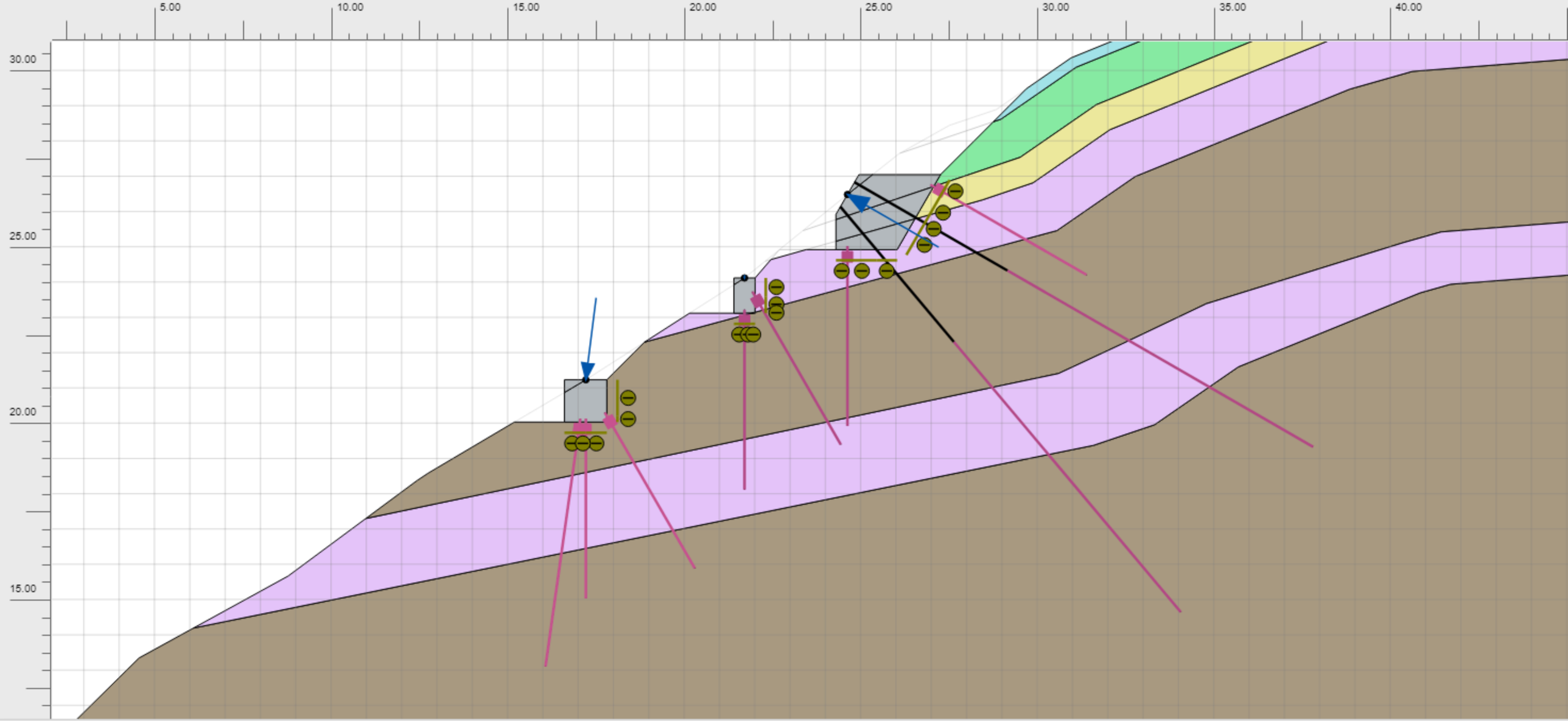


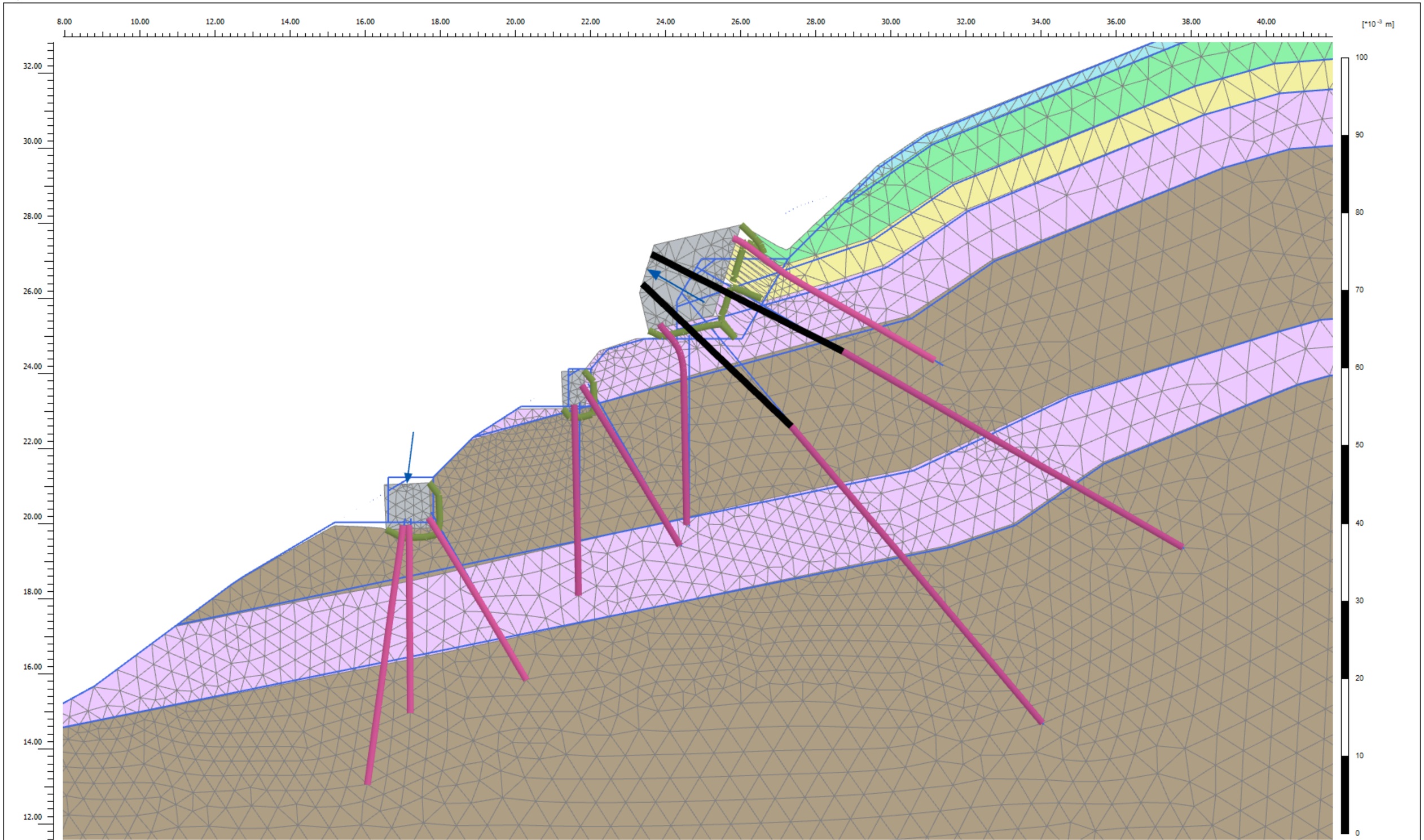
Total displacements |u| (scaled up 500 times)

Maximum value = $4.244 * 10^{-3}$ m (Element 322 at Node 667)

Project description: Marion Costal Walkway Upgrade			Date: 5/08/2022
Project filename: Kurnabinna Gully S - Redesign	Step: 265	Company: CMW Geosciences Pty Ltd	

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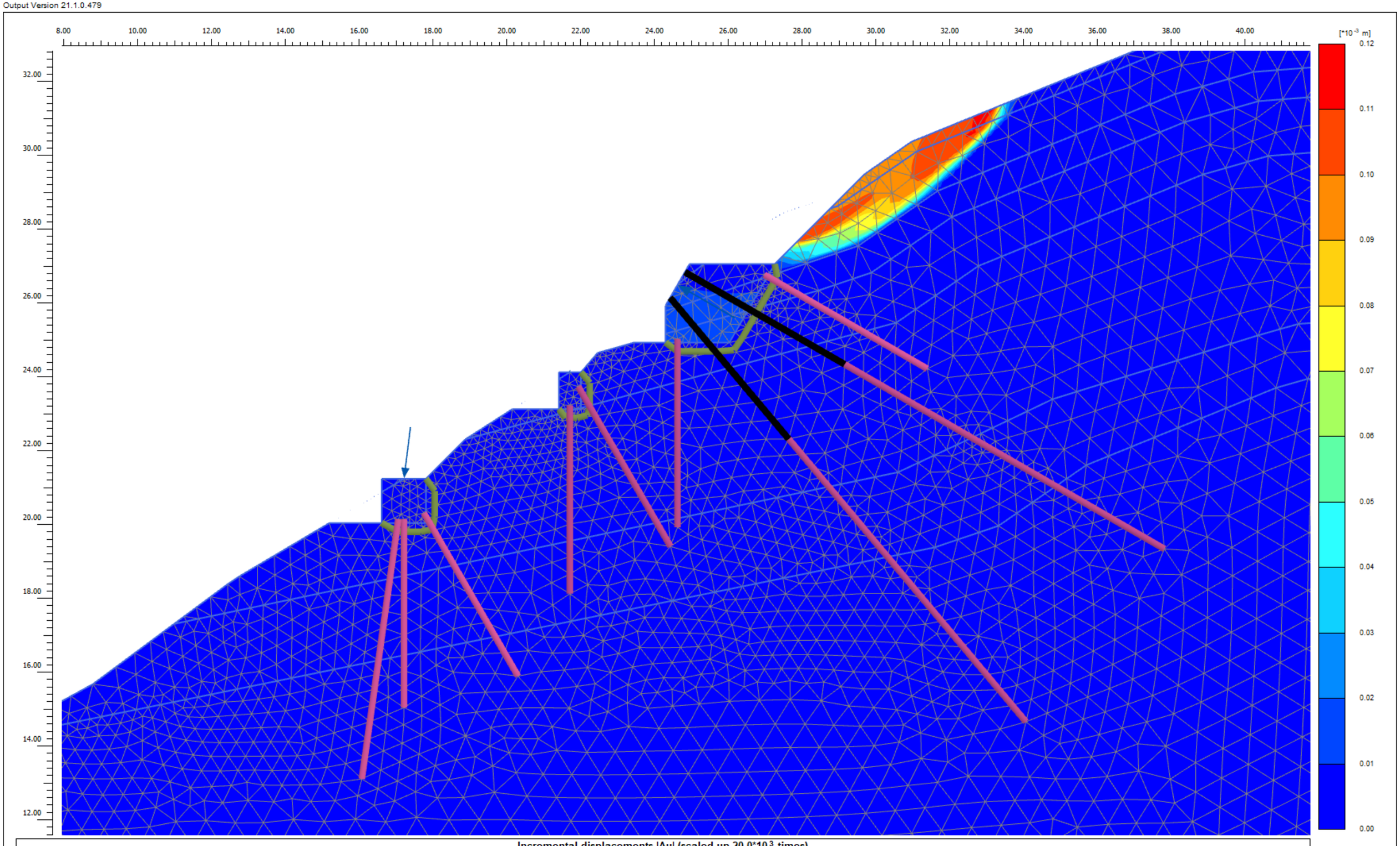


Deformed mesh |u| (scaled up 200 times)

Maximum value = $7.734*10^{-3}$ m (Element 248 at Node 8300)

Project description: Marion Costal Walkway Upgrade			Date: 5/08/2022
Project filename: Kurnabinna Gully N - Redesign	Step: 319	Company: CMW Geosciences Pty Ltd	

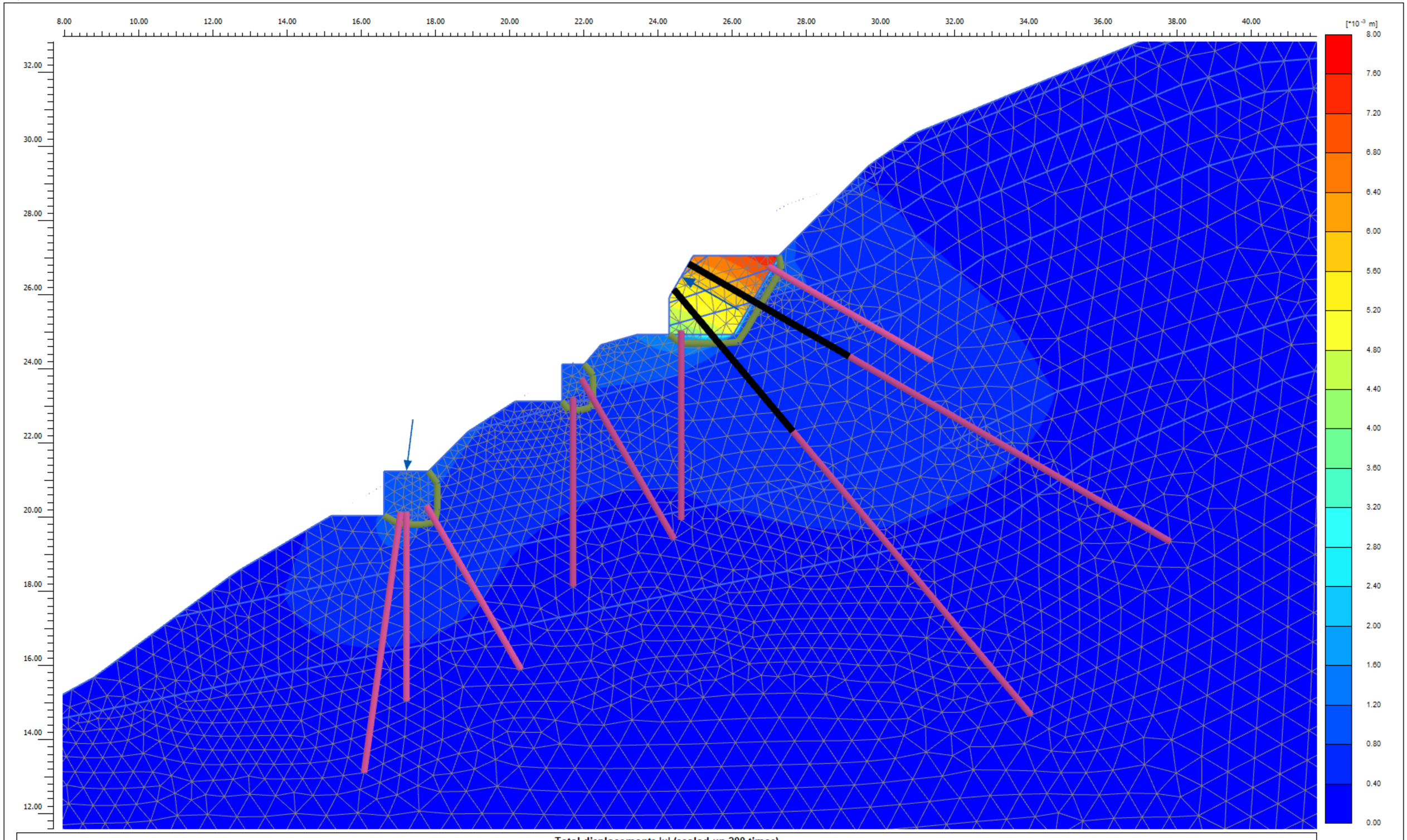
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Incremental displacements |Δu| (scaled up 20.0*10 3 times)

Maximum value = 0.1170*10 -3 m (Element 72 at Node 4081)

Project description: Marion Costal Walkway Upgrade			Date: 5/08/2022
Project filename: Kurnabinna Gully N - Redesign	Step: 419	Company: CMW Geosciences Pty Ltd	



Total displacements |u| (scaled up 200 times)

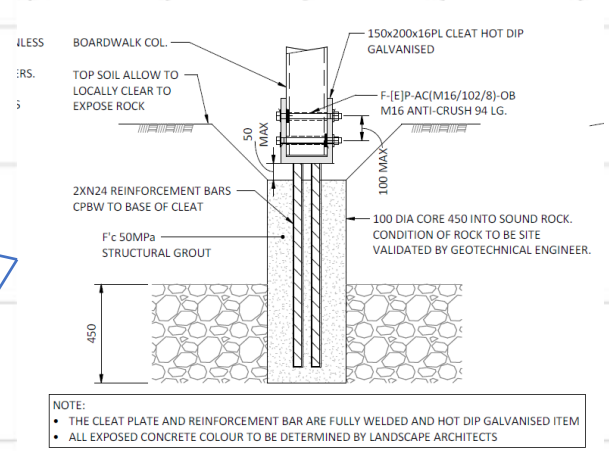
Maximum value = $7.734*10^{-3}$ m (Element 248 at Node 8300)

Project description: Marion Costal Walkway Upgrade			Date: 5/08/2022
Project filename: Kurnabinna Gully N - Redesign	Step: 319	Company: CMW Geosciences Pty Ltd	

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Kurnabinna Methodology – Rock Spoil

Install temporary access platforms

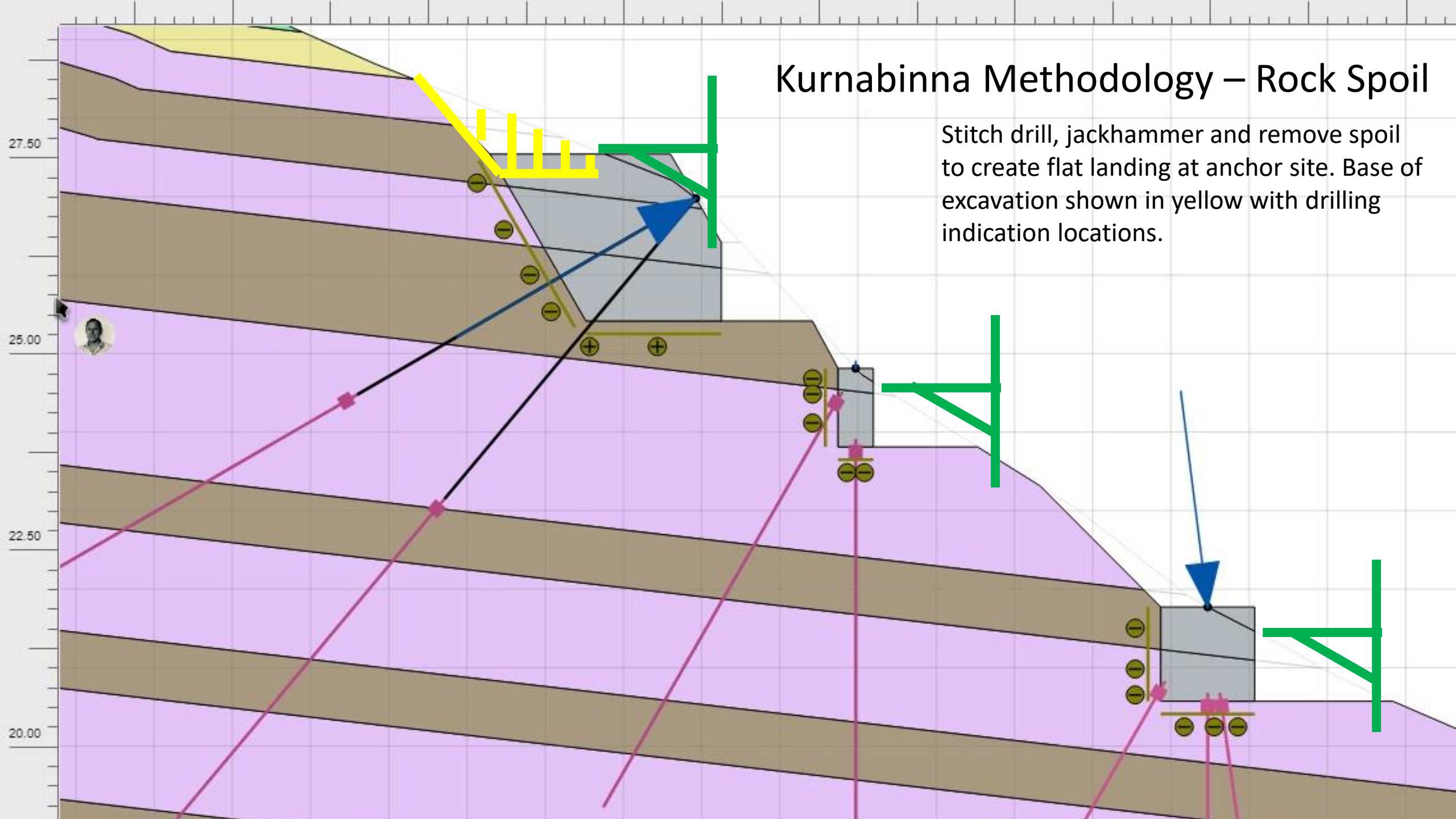


TYPICAL FOOTING IN ROCK DETAIL

SCALE: N.T.S.

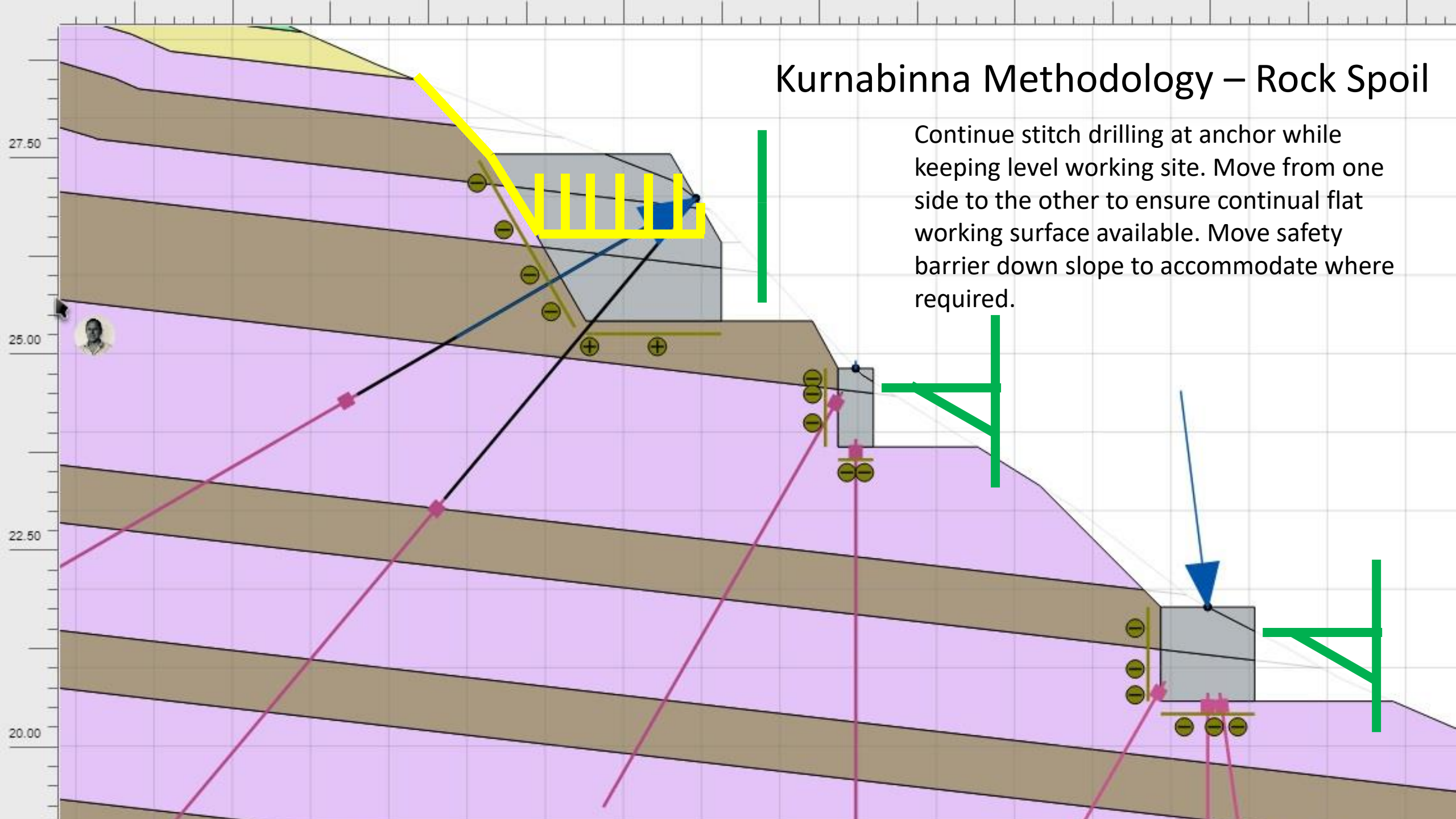
Kurnabinna Methodology – Rock Spoil

Stitch drill, jackhammer and remove spoil to create flat landing at anchor site. Base of excavation shown in yellow with drilling indication locations.



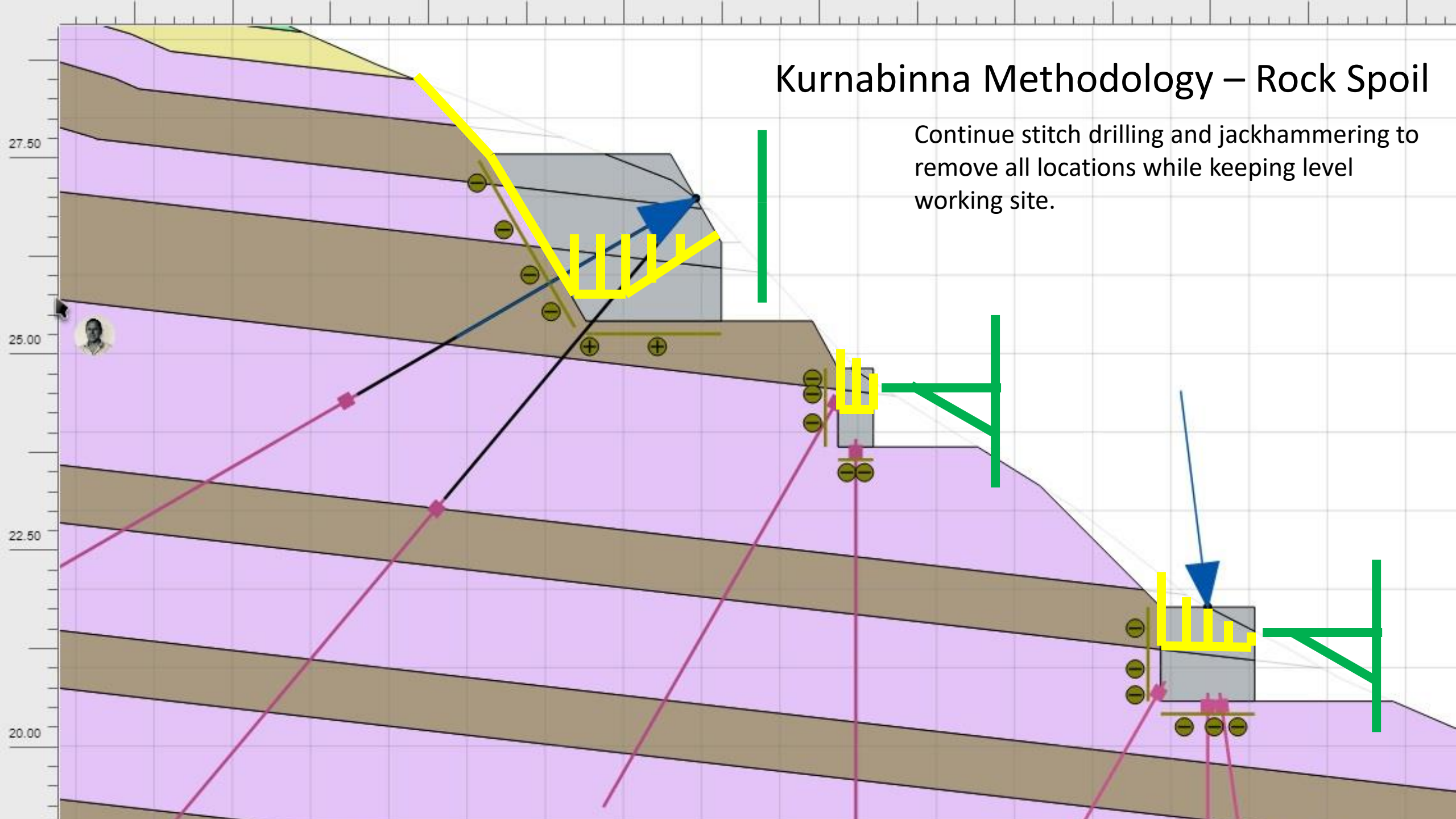
Kurnabinna Methodology – Rock Spoil

Continue stitch drilling at anchor while keeping level working site. Move from one side to the other to ensure continual flat working surface available. Move safety barrier down slope to accommodate where required.



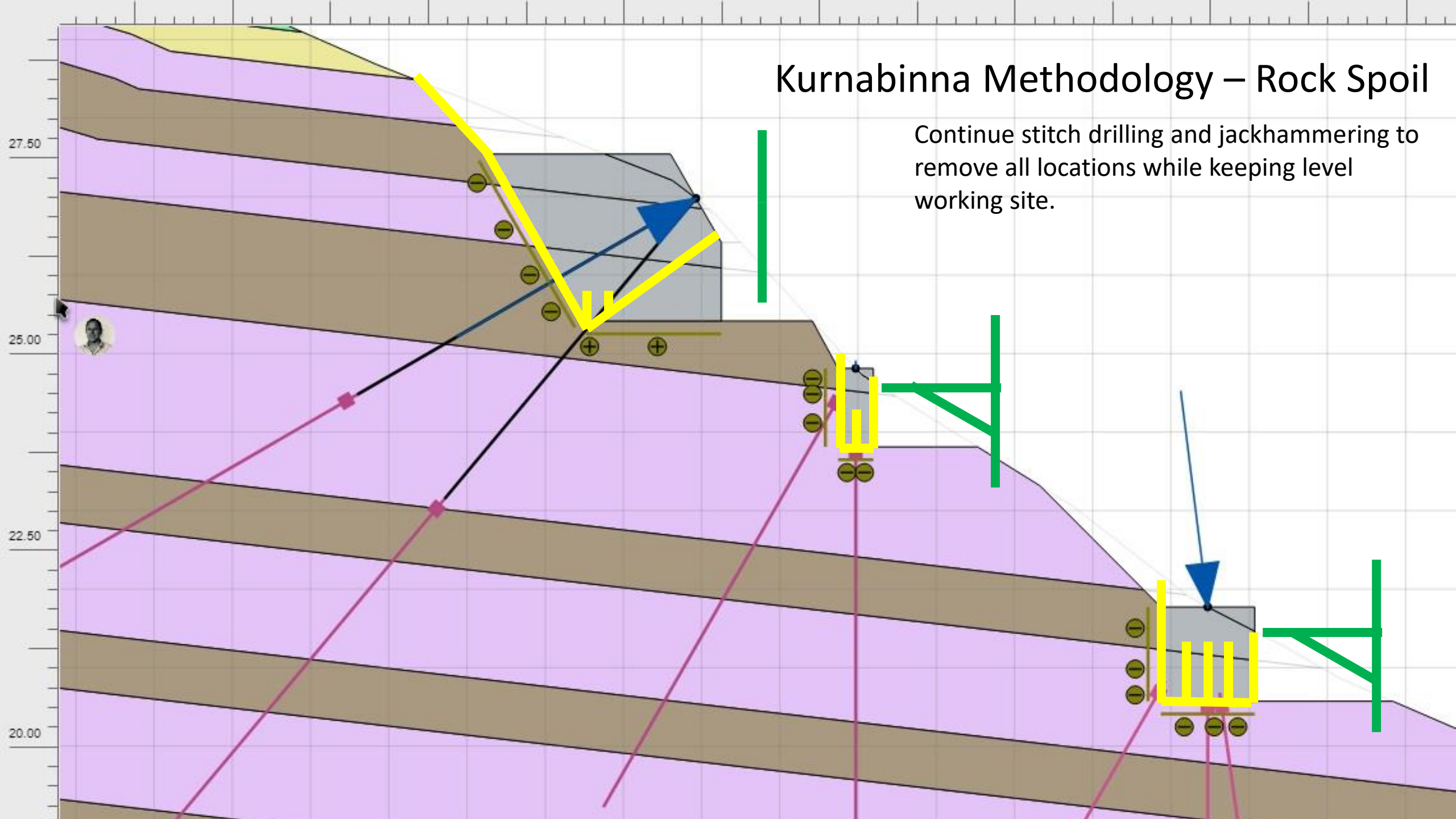
Kurnabinna Methodology – Rock Spoil

Continue stitch drilling and jackhammering to remove all locations while keeping level working site.

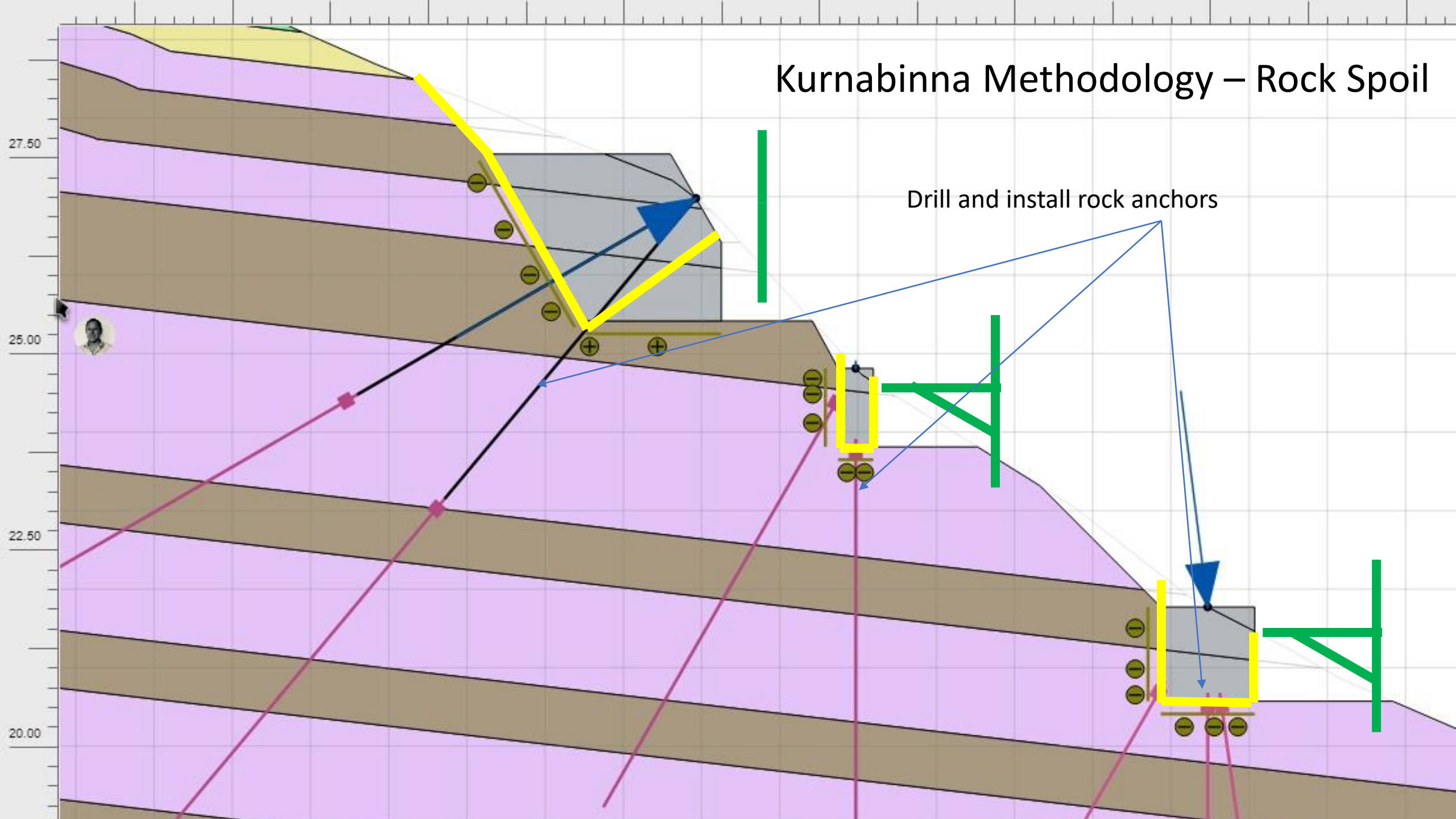


Kurnabinna Methodology – Rock Spoil

Continue stitch drilling and jackhammering to remove all locations while keeping level working site.

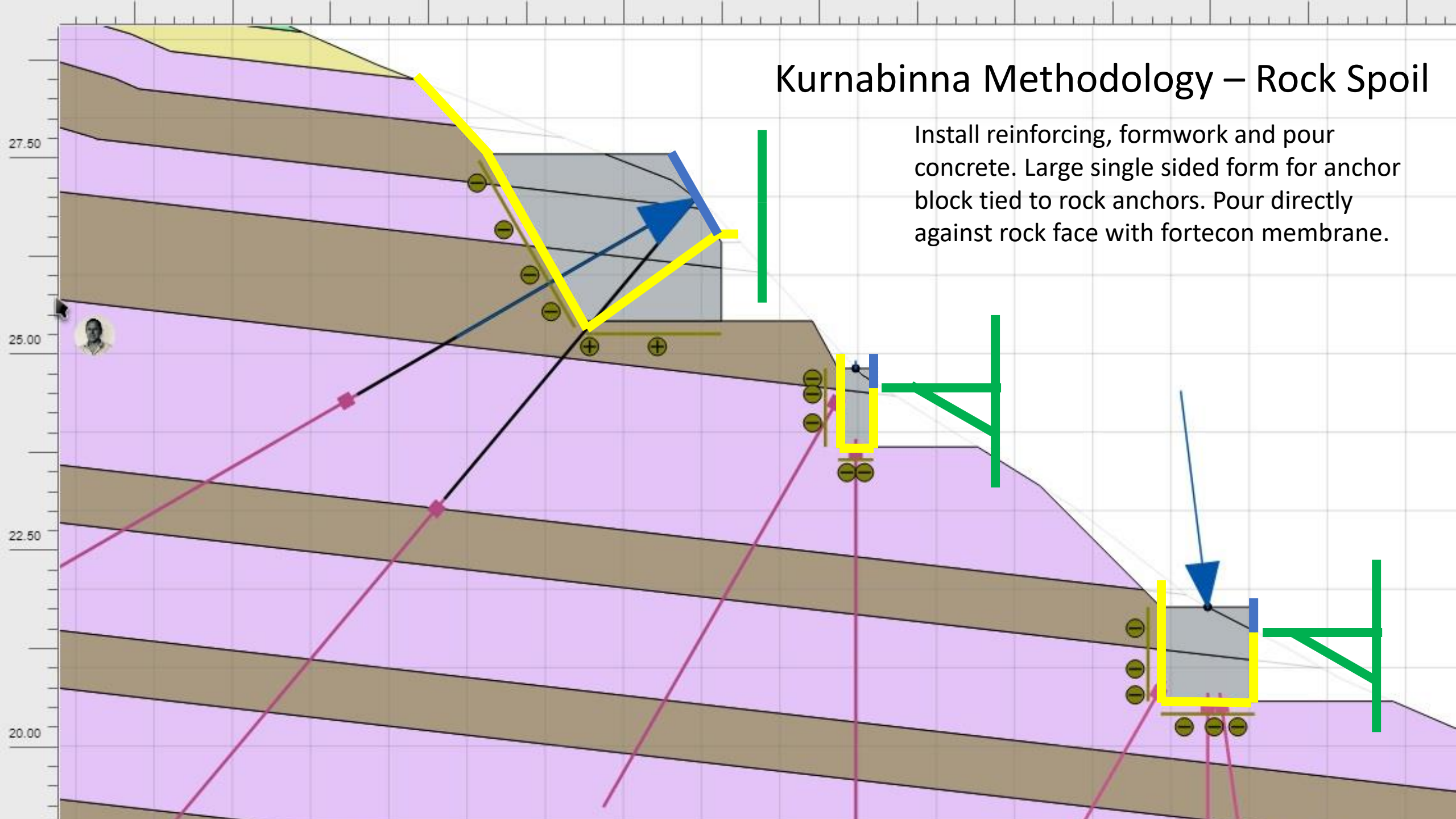


Kurnabinna Methodology – Rock Spoil



Kurnabinna Methodology – Rock Spoil

Install reinforcing, formwork and pour concrete. Large single sided form for anchor block tied to rock anchors. Pour directly against rock face with fortecon membrane.



Kurnabinna Methodology – Rock Spoil

Strip formwork and remove access platforms

