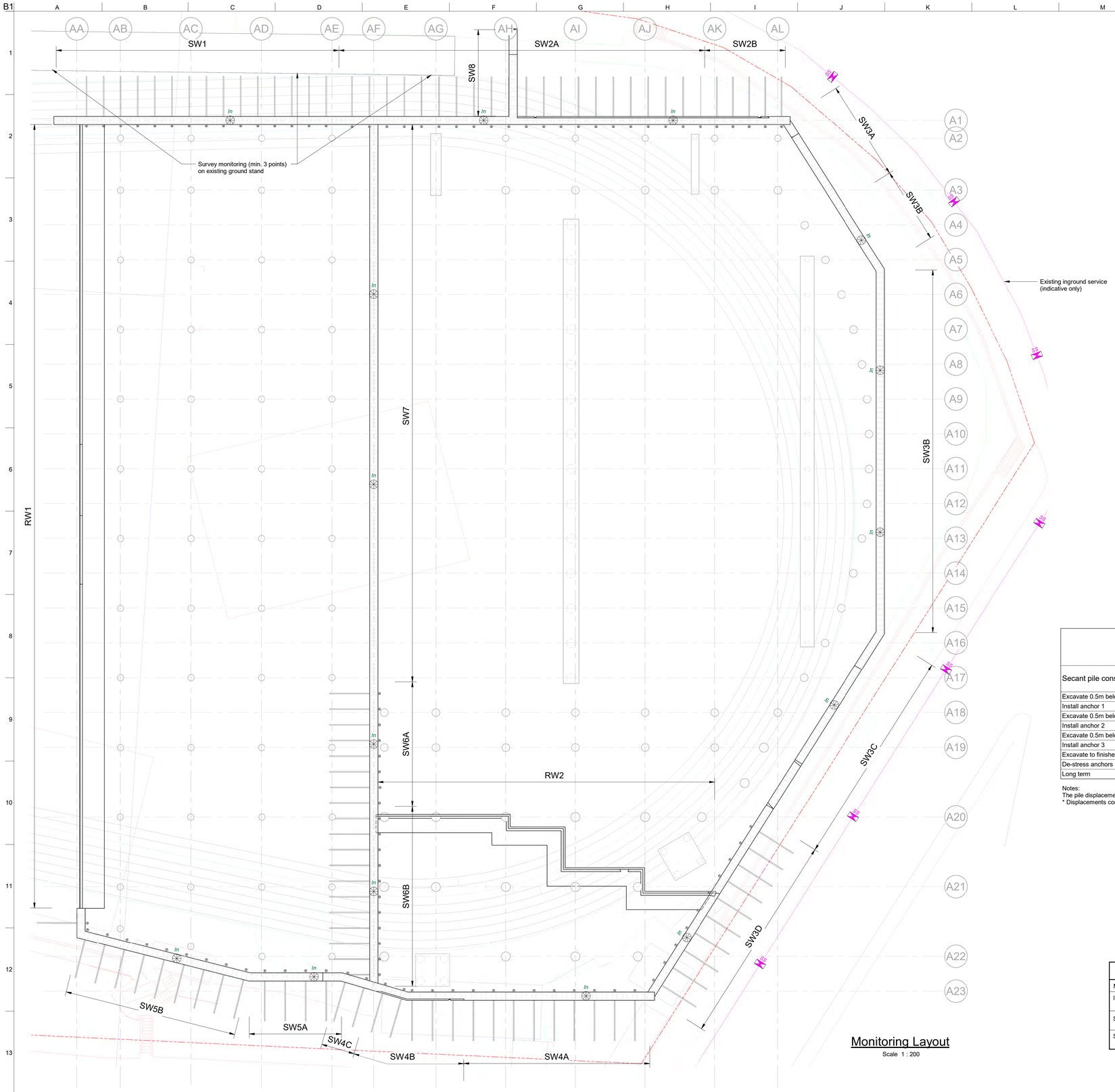

Monitoring Layout

Scale 1 : 200

General Notes

1. The contractor shall carry out the necessary instrumentation and monitoring as indicated in the monitoring schedule or as instructed by the engineer
2. The contractor shall take all necessary precautions to protect the instruments and maintain instruments in good working order after commissioning. For all instruments which project through and above the ground, special precautions shall be taken to provide protection from vehicles and plant.
3. Where instrumentation is obstructed by construction works, public traffic, or other obstruction, an alternative location shall be agreed with the engineer.
4. All necessary precautionary measures shall be implemented during construction works to protect and minimize settlement of ground, structures, batter slopes and buried utilities.
5. The contractor shall take baseline readings at least one (1) month prior to construction/excavation activities and shall not be allowed to commence and construction works until all instrumentation is in place and baseline readings have been submitted and accepted by the engineer.
6. The baseline readings of all instruments shall be agreed with the engineer to suit the sequence of works.
7. The contractor shall prepare an installation record sheet for each instrument installed. The format of the sheet shall be prepared by the contractor and submitted to the engineer for approval at least 28 days before installation commences. The record sheet is to include the level of accuracy of all instrumentation.
8. The contractor shall provide 'as-built' drawings with the exact location of all instrumentation.
9. Monitoring shall follow the Alert', 'Action' and 'Alarm' trigger levels. Contractor shall develop a response action and management plan based on the trigger levels specified on the drawing. The response plans must clearly and comprehensively identify any adjustments to the construction works that are necessary to confirm the impacts of relative movements do not exceed tolerable limits.
10. Refer to drawing CR-ST-000-001, 002, 003 for General Notes and CR-ST-0000-005 for Costing Notes

Secant pile construction stages	Estimated horizontal secant pile wall discplacements (mm)												
	West Wall			North Wall				East Wall		Internal Wall			
	SW1	SW2A Rock RL 6.9mAHD	SW2B Rock RL 4.7mAHD	SW3A Rock RL 4.7mAHD	SW3B* Rock RL 1.8mAHD	SW3C Rock RL -1.7mAHD	SW3D	SW8	SW4A & SW4B	SW5A & 5B	SW6	SW7B Rock RL 1.8mAHD	SW7A Rock RL 6.9mAHD
Excavate 0.5m below anchor 1	8	6	8	-	-	-	5	-	10	18	5	-	-
Install anchor 1	2	2	-1	-	-	-	1	-	2	13	1	-	-
Excavate 0.5m below anchor 2	-	5	2	-	-	-	3	-	4	-	2	-	-
Install anchor 2	-	3	-1	-	-	-	1	-	2	-	1	-	-
Excavate 0.5m below anchor 3	-			-	-	-	-	-	2	-	-	-	-
Install anchor 3	-			-	-	-	-	-	2	-	-	-	-
Excavate to finished excavation level	3	5	1	15	18	15	2	15	2	17	1	15	8
De-stress anchors	3	5	1	-	-	-	2	-	2	17	1	-	-
Long term	3	5	1	20	22	18	2	20	2	17	1	18	10

Notes:
The pile displacement provided in the table is the displacmenet at the top of the pile.
* Displacements consider B3 plenum in front of wall.

Trigger Level	Relative Movement		
	Surface Settlement	Reflective survey/optical target	In place Inclinometers
Alert level	Max ±10mm in vertical movement vector from base measurement	50% of estimated wall displacements, Max ±15mm in three dimensional vector from base measurement	50% of estimated wall displacements, Max ±15mm deflection perpendicular to pile line from base measurement
Action Level	Max ±20mm in vertical movement vector from base measurement	80% of design value, 20mm in three dimensional vector from base measurement	80% of design value, 20mm-25mm deflection perpendicular to pile line from base measurement
Alarm Level	Greater than 20mm in vertical movement vector from base measurement	Greater than 25mm in three dimensional vector from base measurement	Greater than 25mm deflection perpendicular to pile line from base measurement

Monitoring Schedule			
Monitoring Type	Key	Frequency	Comments
Inclinometer	In	Weekly	To be installed through the full depth of the Hard - Reinforced Pile and the Capping Beam
Surface Settlement	SS	Weekly	To be installed along Rose Bay Avenue, typically at 20m spacing, following Existing in Ground Services
Survey		Weekly	Survey Monitoring locations along Secant Piled Wall to be at 5m spacing at the Capping Beam Level. Monitoring to be carried out at alternative spacings, i.e. 10m along the Waler Beams as the Excavation progresses

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Rev	Date	By	Chkd	Appd

Rev	Date	By	Chkd	Appd

Rev	Date	By	Chkd	Appd
3	12/10/18	HT	JN	MK
Issued For Tender - 80%				
2	19/09/18	HT	JN	MK
Issued For Information				
1	10/08/18	HT	JN	MK
CP4 Milestone Issue				

NORTH
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Client
Cranbrook School
5 Victoria Rd
Bellevue Hill
NSW 2023

Project Title
Cranbrook School
Aquatic Fitness Centre

Drawing Title
Monitoring Layout

Scale at B1 1 : 200
Role Structural
Suitability For Review
Arup Job No 256385
Rev 3
Name AF-ST-0960-141

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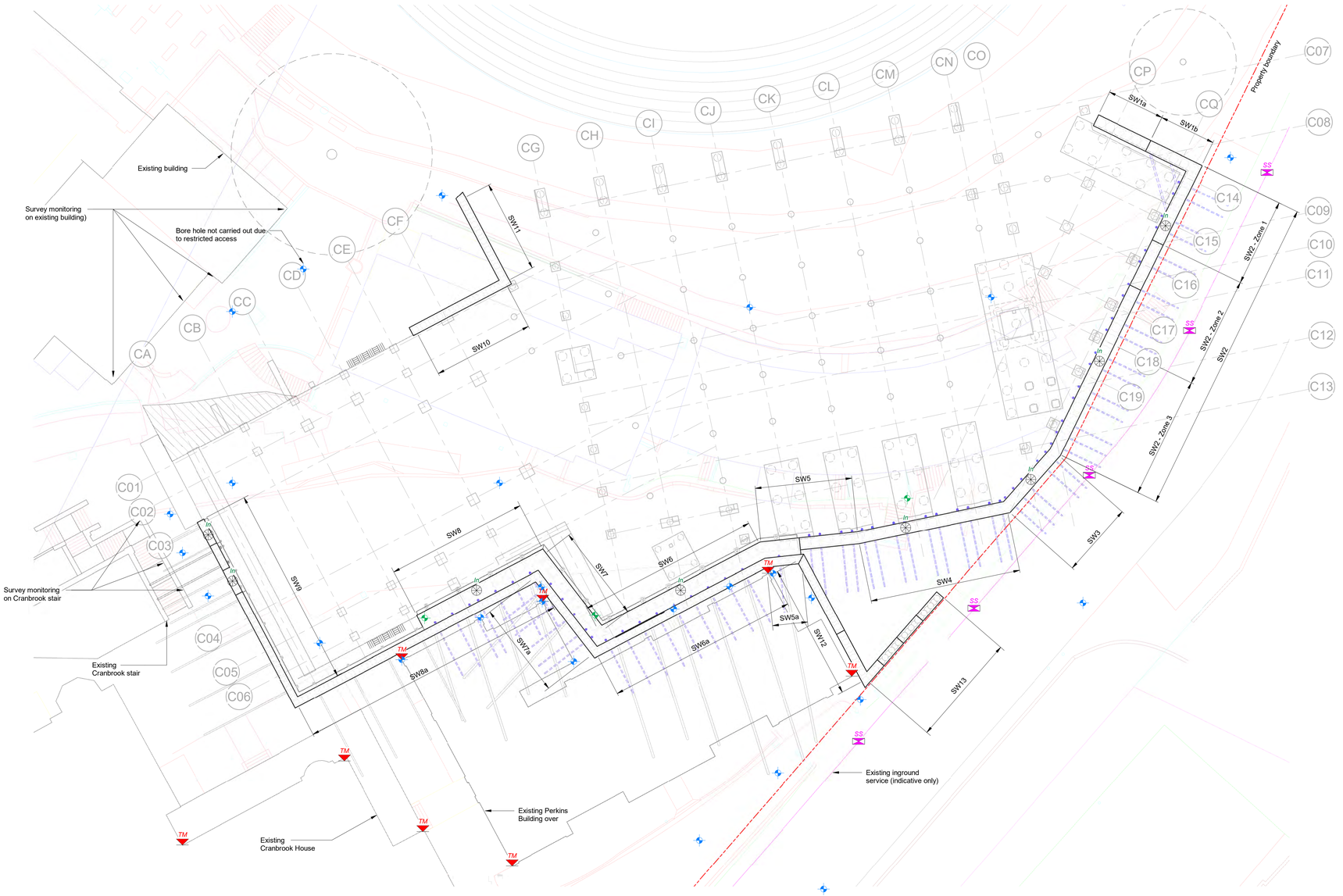

Monitoring Layout

Scale 1 : 200

Rose Bay Avenue Cantilever Piled Walls			
		Total Wall Displacements (mm)	
Phase	RL	SW12	SW13
Install Pile	-	0	3
Excavate to FEL	30.1	20	16
Long term	-	20	16

Temporary Sand Anchor Piled Walls - Buttresses			
	Main Wall Total Displacement (mm)		
Phase	RL	SW4	SW5
Install main wall	30.4	9	9
Excavate below 1st Anchor	28.5	9	8
Install 1st Anchor	29	9	8
Excavate below 2nd Anchor	26.5	7	6
Install 2nd Anchor	27	8	7
Excavate below 3rd Anchor	25	7	6
Install 3rd Anchor	25.5	7	7
Excavate below 4th Anchor	23	6	6
Install 4th Anchor	23.5	6	6
Excavate below 5th Anchor	20	6	5
Install 5th Anchor	20.5	6	5
Excavate to FEL	16.15	22	19
Complete Buttress	-	24	21
Destress Temp Anchors	-	31	28
Long Term	-	30	27

Temporary Sand Anchor Piled Walls								
	Total Displacement (mm)							
Phase	RL	SW1A	RL	SW2A	RL	SW2B	RL	SW2C
Install main wall	22.05	4	26.2	14	26.2	14	30.4	14
Excavate below 1st Anchor	-	-	24.5	14	25	16	28.5	13
Install 1st Anchor	-	-	25	13	25.5	15	29	12
Install 1st struct	-	-	25	13	-	-	-	-
Excavate below 2nd Anchor	-	-	23	13	23	16	26.5	12
Install 2nd Anchor	-	-	23.5	13	23.5	16	27	12
Install 2nd struct	-	-	23.5	13	-	-	-	-
Excavate below 3rd Anchor	-	-	20	12	20	20	25	11
Install 3rd Anchor	-	-	20.5	12	20.5	20	25.5	11
Install 3rd struct	-	-	20.5	12	-	-	-	-
Excavate below 4th Anchor	-	-	-	-	-	-	23	11
Install 4th Anchor	-	-	-	-	-	-	23.5	11
Excavate below 5th Anchor	-	-	-	-	-	-	20	13
Install 5th Anchor	-	-	-	-	-	-	20.5	13
Excavate to FEL	16.15	29	16.15	12	16.15	29	16.15	20
Install Floor Slabs	18.25	29	18.25 / 26.2	12	18.25 / 26.2	29	18.25 / 26.4 / 30.4	20
Destress Temp Anchors	-	-	-	12	-	27	-	21
Long Term	-	29	-	12	-	27	-	21

Permanent Rock Anchor Piled Walls										
		Total Displacement (mm)								
Phase	RL (m)	SW6a	SW7a	SW8a	SW6	SW7	SW8	SW8b	SW9	SW10	SW11
Install Upper Wall	34.55	3	2	2	-	-	-	7	7	6	7
Excavate below 1st Anchor	33	8	5	6	-	-	-	7	7	-	-
Install 1st Anchor	33.55	4	3	1	-	-	-	6	6	-	-
Excavate to Upper Level	31	5	4	2	-	-	-	-	-	-	-
Install main wall	32.2	5	4	3	8	7	6	-	-	-	-
Excavate below 2nd Anchor	30.5	5	4	3	8	7	6	5	4	-	-
Install 2nd Anchor	31.6	7	5	3	9	8	7	5	5	-	-
Excavate below 3rd Anchor	26.9	6	4	2	9	8	8	-	-	-	-
Install 3rd Anchor	27.4	7	4	3	9	8	8	-	-	-	-
Excavate below 4th Anchor	22.75	7	8	3	9	9	8	-	-	-	-
Install 4th Anchor	23.25	7	7	3	8	9	8	-	-	-	-
Excavate below 5th Anchor	19.25	12	-	-	11	-	-	-	-	-	-
Install 5th Anchor	19.75	12	-	-	11	-	-	-	-	-	-
Excavate to FEL	17.4	16	13	6	15	13	7	5	5	23	24
Excavate to Lift Pit	16.25	20	-	-	19	-	-	-	-	-	-
Install Floor Slabs	18	20	-	-	19	-	-	-	-	-	-
Destress Temp Anchors		20	15	7	19	15	8	-	-	-	-
Long Term		20	15	7	19	15	8	5	5	23	25

Trigger Level	Relative Movement		
	Surface Settlement	Reflective survey/optical target	In place Inclinometers
Alert level	Max ±10mm in vertical movement vector from base measurement	50% of design value, Max ±15mm in three dimensional vector from base measurement	50% of design value, Max ±15mm deflection perpendicular to pile line from base measurement
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Alarm Level	Greater than 20mm in vertical movement vector from base measurement	Greater than 25mm in three dimensional vector from base measurement	Greater than 25mm deflection perpendicular to pile line from base measurement

Monitoring Schedule			
Monitoring Type	Key	Frequency	Comments
Inclinometer	In	Weekly	To be installed through the full depth of the Hard - Reinforced Pile and the Capping Beam. Monitoring to continue until the building is completed. Inclinometer positions to remain accessible in the permanent condition to allow the wall movements to be assessed throughout the life of the structure.
Tilt Meters	TM	Fortnightly	To be installed on the Existing Building - Perkins, at 2m above existing ground level plus survey monitoring at Level 01 and the Underside of the Roof. Monitoring to continue until the building is completed.
Surface Settlement	SS	Weekly	To be installed along Rose Bay Avenue, typically at 17.5m spacing, following Existing in Ground Services. Monitoring to continue until the building is completed.
Survey		Weekly	Survey Monitoring locations along Secant Piled Wall to be at 5m spacing at the Capping Beam Level and along Perkins at midheight and underside of roof for length of excavation. Monitoring to be carried out at alternative spacings, i.e. 10m along the Waler Beams as the Excavation progresses. Monitoring to continue until the building is completed.

General Notes

1. The contractor shall carry out the necessary instrumentation and monitoring as indicated in the monitoring schedule or as instructed by the engineer
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10. Refer to drawing CR-ST-000-001, 002, 003 for General Notes and CR-ST-0000-005 for Costing Notes
11. Refer to drawing CB-ST-0960-141 for shoring layout
12. Refer to CB-ST-0960-270 series drawings for Construction Sequence Details

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Client
Cranbrook School
5 Victoria Rd
Bellevue Hill
NSW 2023

Project Title
Cranbrook School
Centenary Building

Drawing Title
Monitoring Layout

Scale at B1 1 : 200
Role Structural
Suitability For Review
Arup Job No 256385
Rev 3
Name CB-ST-0960-142

Do not scale

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