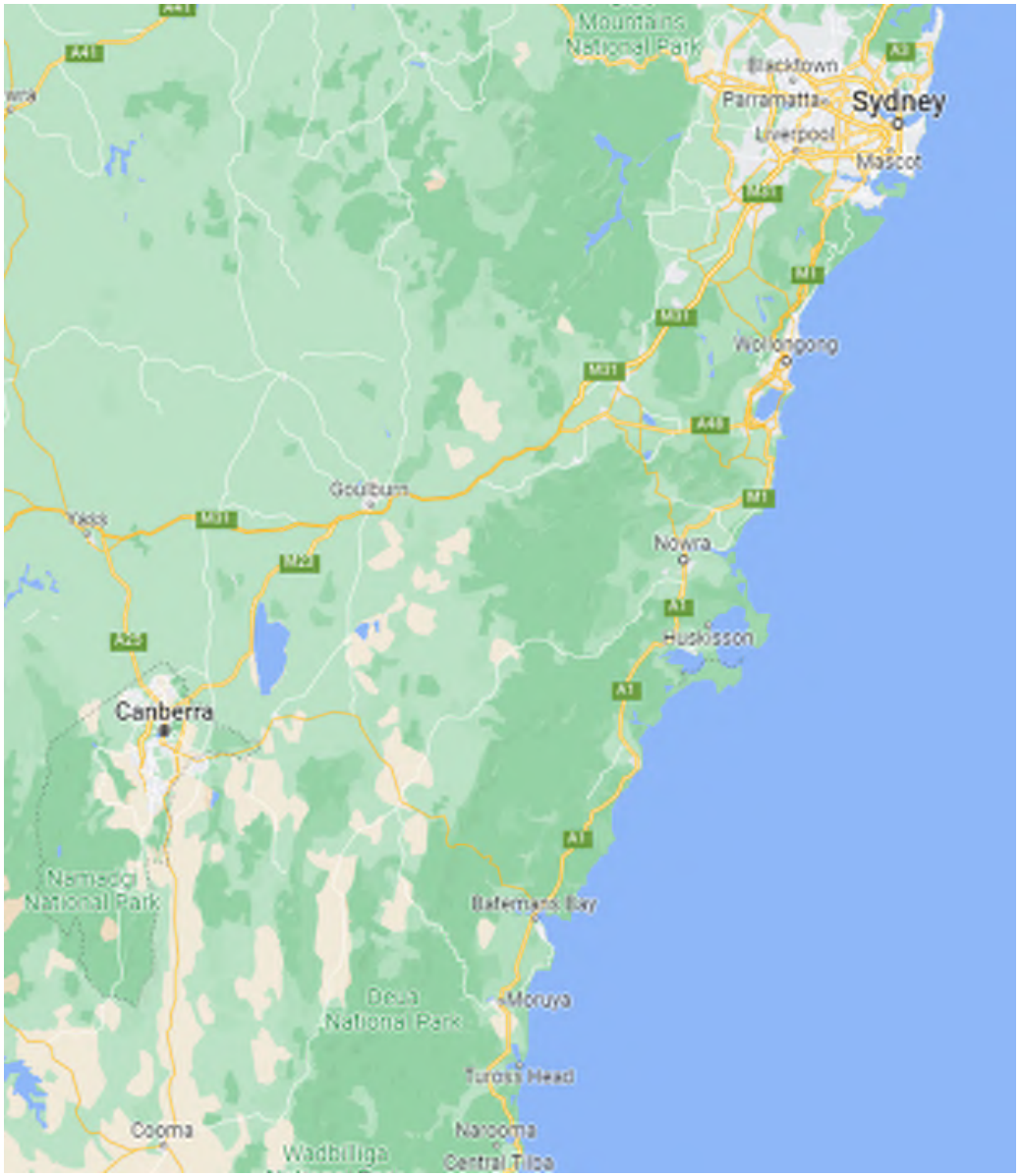
Landsvirkjun

Jarðgangafélag Íslands
2024-06-20
Snowy2-Kynning



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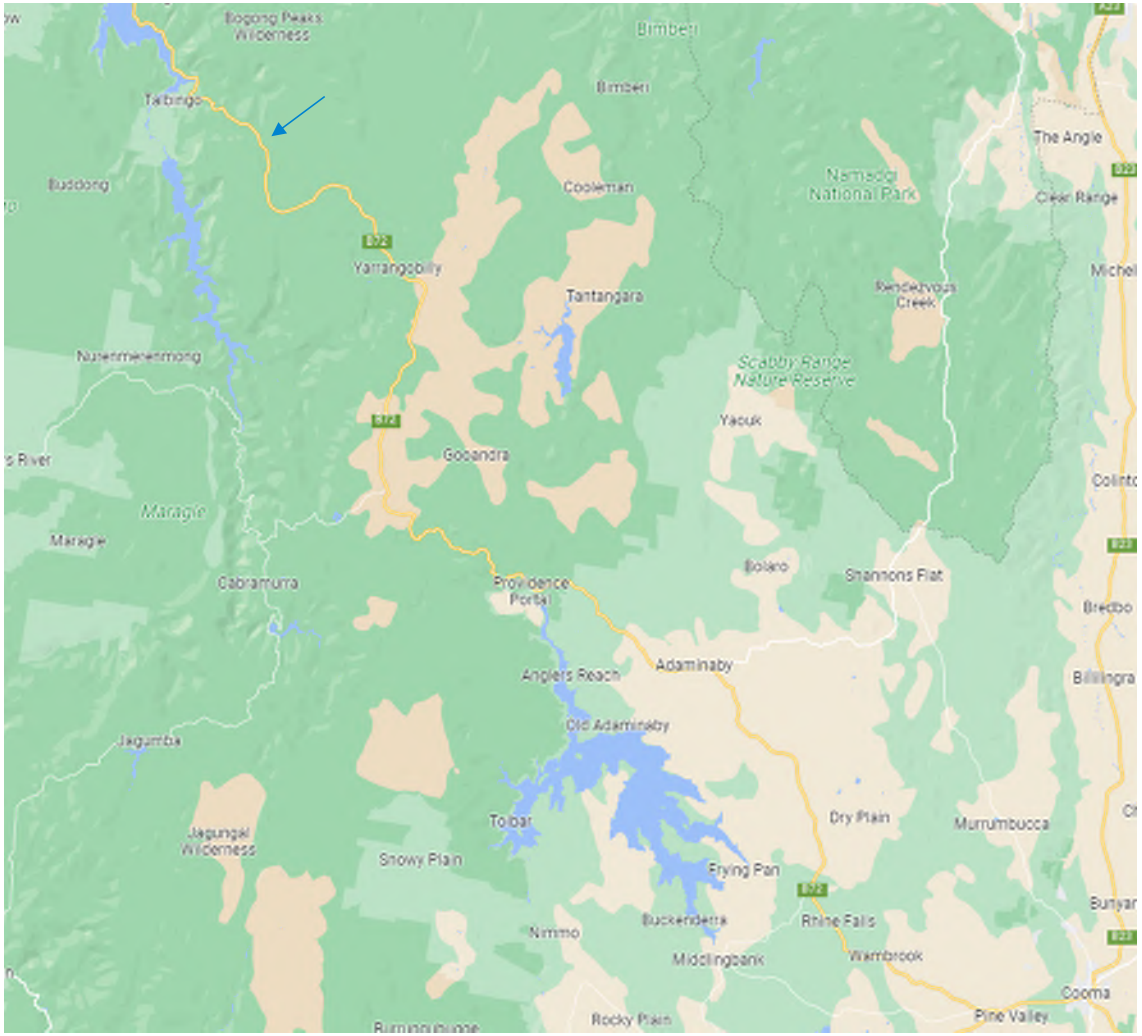
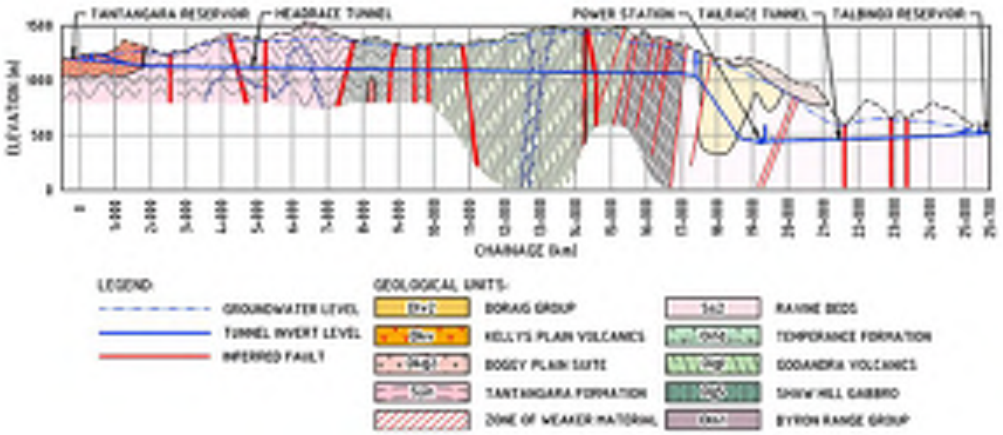
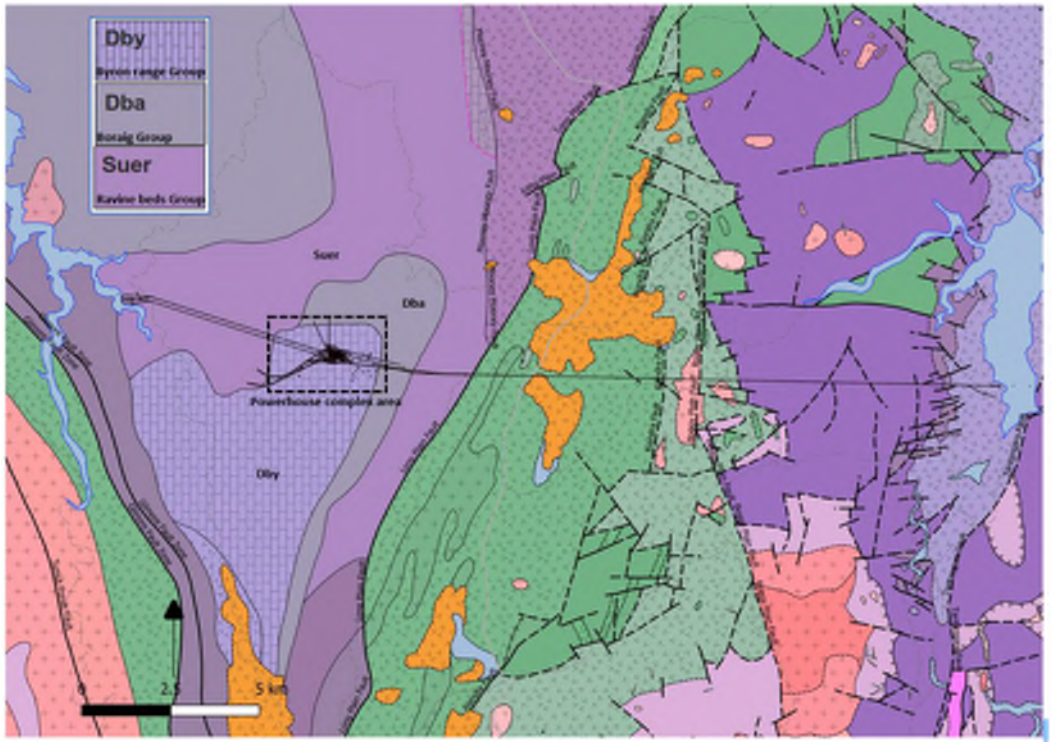


- Framkvæmdasvæðið er staðsett innan suðausturhluta Lachlan Origon fellingabeltisins í Nýja Suður-Wales, 550-350M ára gamals.
- Þetta svæði felur í sér forn eldfjallaberg, setvatnsröð og berginnskot.
- Svæðið hefur gengið í gegnum nokkra hrubgui af uppbyggingar-og roffösum ásamt ummyndunum. Meira en 28 mismunandi jarðmyndanir hafa verið kortlagðar.
- Stöðvarhússvæðið er mestmegnis í Ravine jarðfræðimynduninni frá Silur jarðfræðiskeiðinu. Um er að ræða neðansjávar setmyndanir samanstandandi af skífum, sand og siltsteini.
- Stöðvarhússvæðið er 600-720m neðan yfirborðs grafið 80% setlaga þar af í siltstein /sandstein 80/20 %





Landsvirkjun

The Snowy 2.0 has now undertaken three years of geotechnical investigations with GHD and SMEC.
Here are the stats!

Borehole drilling:

> 30,000 m of borehole drilling

63 boreholes

13 boreholes deeper than 800 m

Longest hole - BHIPS 2001.38m

Geophysics:

~15000 m (electrical resistivity, seismic refraction, seismic reflection)

Laboratory tests:

3500+ geotechnical tests, including:

- 800+ UCS
- 115 single and multi-stage rock triaxial tests
- 335 NOA, 166 petrography, 360 AMD

In situ stress tests:

270+ attempted in situ stress tests

179 successful tests:

- 92 cover coring (IST) tests
- 44 hydro-fracturing/hydro-jacking tests
- 19 ANZI-cell tests
- 24 Dilatometer tests

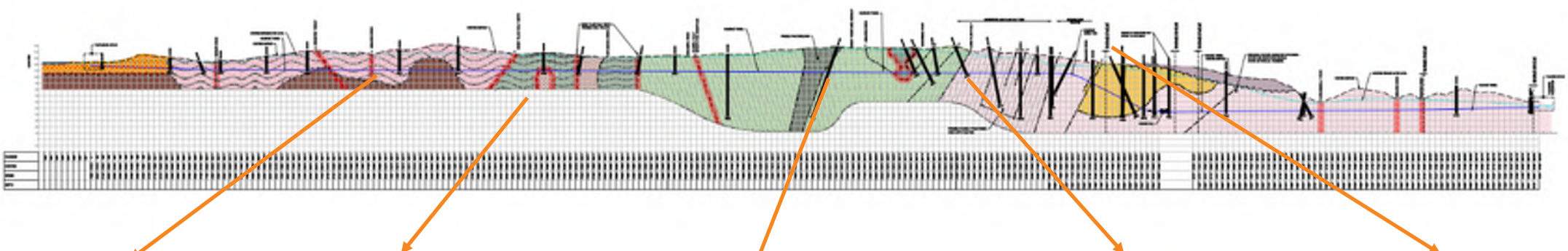
Groundwater testing and monitoring:

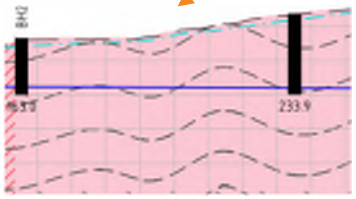
141 packer tests

50 drill stem tests

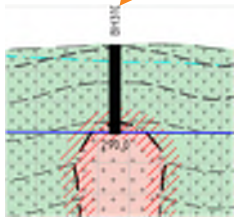
+24000 m vibrating wire piezometer cable

1538 m of standpipe monitoring well

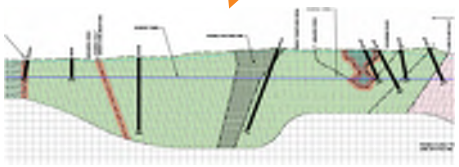




Squeezing ground

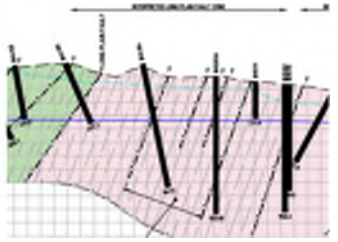


Granite intrusions with very high strength and abrasivity. Mixed face conditions and high groundwater ingress at contact.



Potential for naturally occurring asbestos and groundwater ingress

Groundwater ingress expected to be high for shorter periods
Slurry machine for NOA



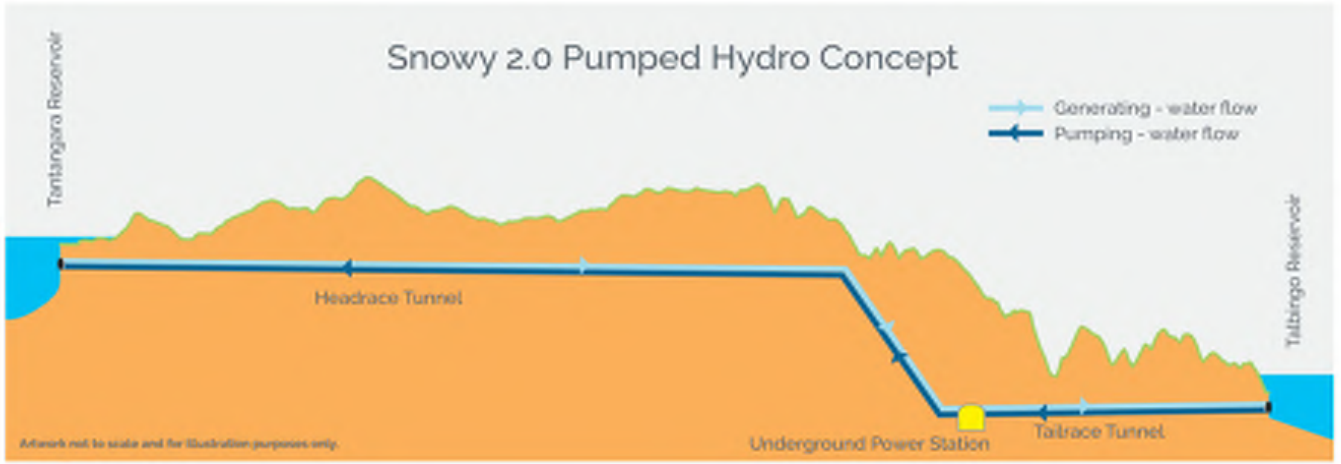
Large fault. (approx 250m in length)
Wide disturbed zone, highly fractured, possible squeezing ground.
High groundwater flows and volume.

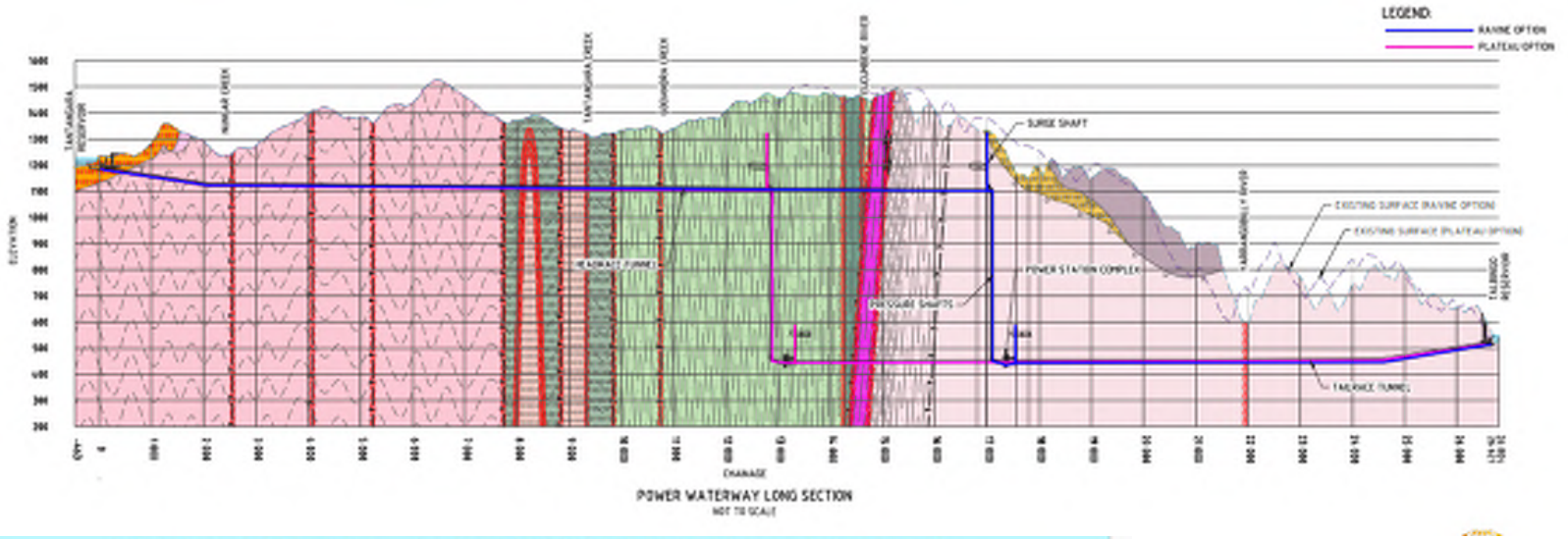
Low confinement

Tantangara lón er í um 1230 m y.s., með núverandi geymslurými 0,3 GL (255Mm^3) og yfirborðsflatarmál 22 km^2.

- Inntak virkar í báðar áttir
- Aðrennslisgöng 17km, 9.9m í þvermál-TBM.
- Fallpípugöng 1,6 km hallandi fallpípugöng (TBM) í 25 gráður sem tengist sundurgreininni í virkjunarsamstæðunni, sem nær sex hverfla/dælueiningar (TBM)
- Stöðvarhússhvelfingar (PSC) D&B með 6 Francis vélum með uppsett heildarafl 2000 MW, >700m head.
- 420m3/s í framleiðslu
- 350m3/s í dælingu
- Vélasalur og spennasalur tengdir með 6 tengigöngum (IPC).
- D&B göng umlykja hvelfingar
- Frárennsisgöng 7 km, 9,9 m í þvermál
- Talbingo lón er í um 550 m y.s., með geymslurými um 0,10 GL (920Mm^3) og yfirborðsflatarmál um 19 km^2

Landsvirkjun



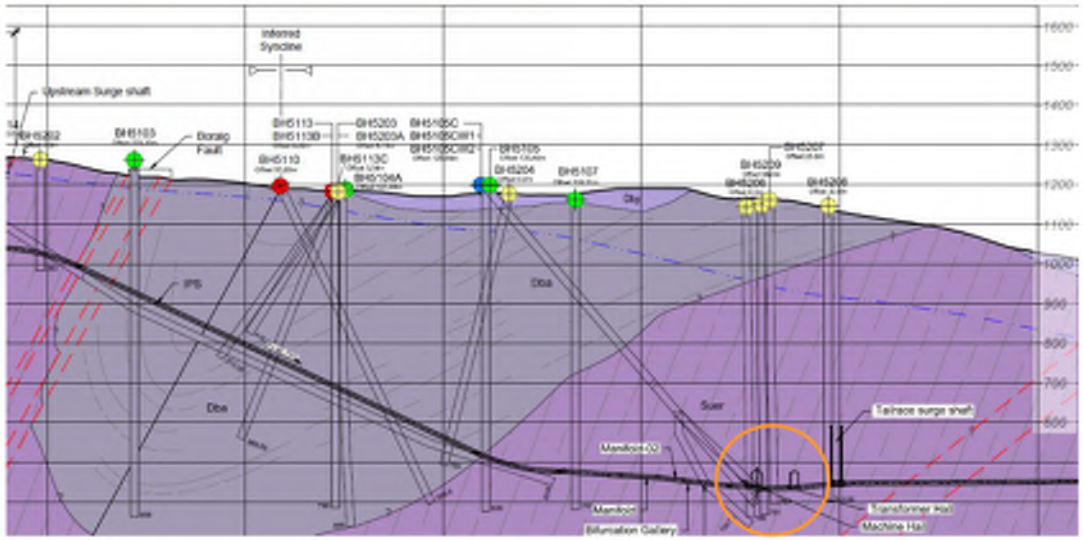


POWER WATERWAY LONG SECTION

NOT TO SCALE

Landsvirkjun

GEOLOGICAL & GEOTECHNICAL MODEL



The PSC will be excavated at depths between 600 and 720m below ground surface in the Ravine Beds Sedimentary Rock Formation. According to the logs on cores in the vicinity of the PHC indicate about 80% of the rocks are interbedded siltstone / sandstone with 70 to 85% being siltstone.

Snowy 2.0 framkvæmdaverk

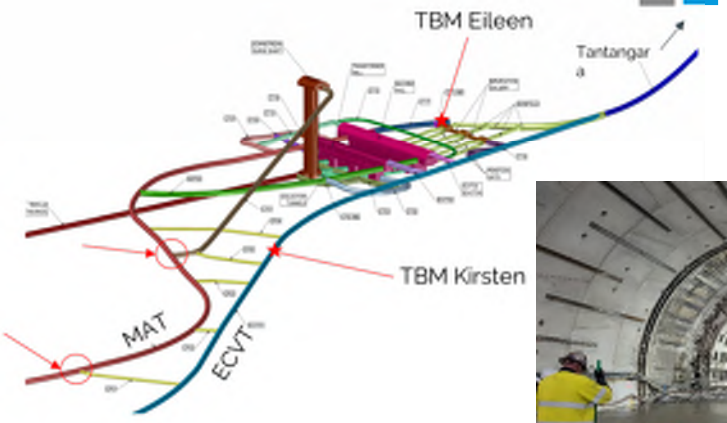
Landsvirkjun

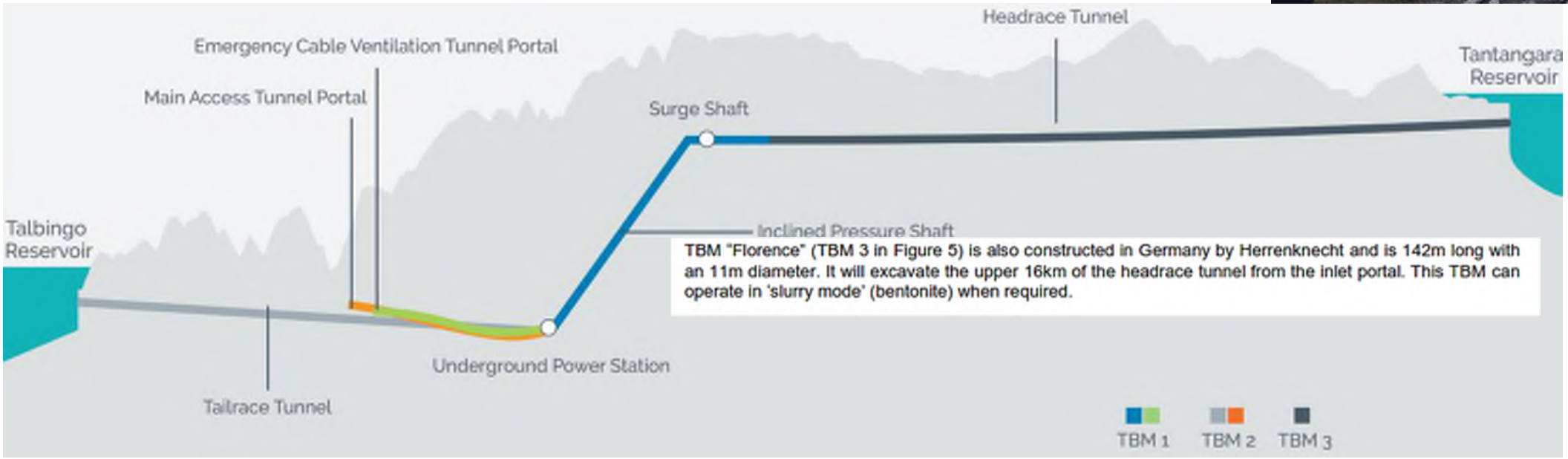
- Eigandi er Snowy Hydro Limited
- Verktaki er Future Generation, sem er samsteypa Salini Impregilo, Clough og Lane Construction. Voith er undirverktaki FGJV
- EPC samningur (Engineering, Procurement and Construction)
- Verkkaupi sér um sjálfstætt eftirlit og ráðgjafa sem fylgjast með verkinu(LVP, SMEC og fl.)
- Verktími áætlaður um 7-8 ár

TBM "Kirsten" (TBM 1 in Figure 5) is a hard rock shield machine and is constructed by Herrenknecht AG. It has been specially designed to excavate the inclined pressure shaft at a 25 degree incline with all equipment within the TBM pivoting from horizontal to inclined such that work spaces and key platforms remain horizontal. It is approximately 11m in diameter and 205m long. Kirsten will excavate the Emergency, Ventilation and Cable Tunnel from the surface down to the power station complex. From there, it will excavate the inclined pressure shaft, linking the headrace tunnel (the upper waterway tunnel) to the power station.

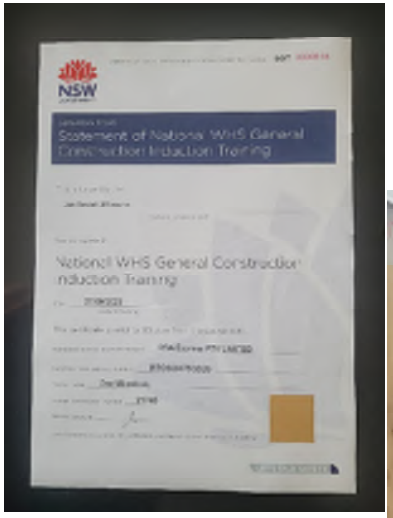
TBM "Lady Eileen Hudson" (TBM 2 in Figure 5) will excavate the Main Access Tunnel from the surface in down to the power station complex. From there, it will be dismantled underground and reassembled at the Talbingo Porta (outlet). This machine is constructed in China by CREG. It is also a hard rock shield in diameter and 137m long. This was the first TBM to be launched on the project and is the only machine that will excavate two separate tunnels.

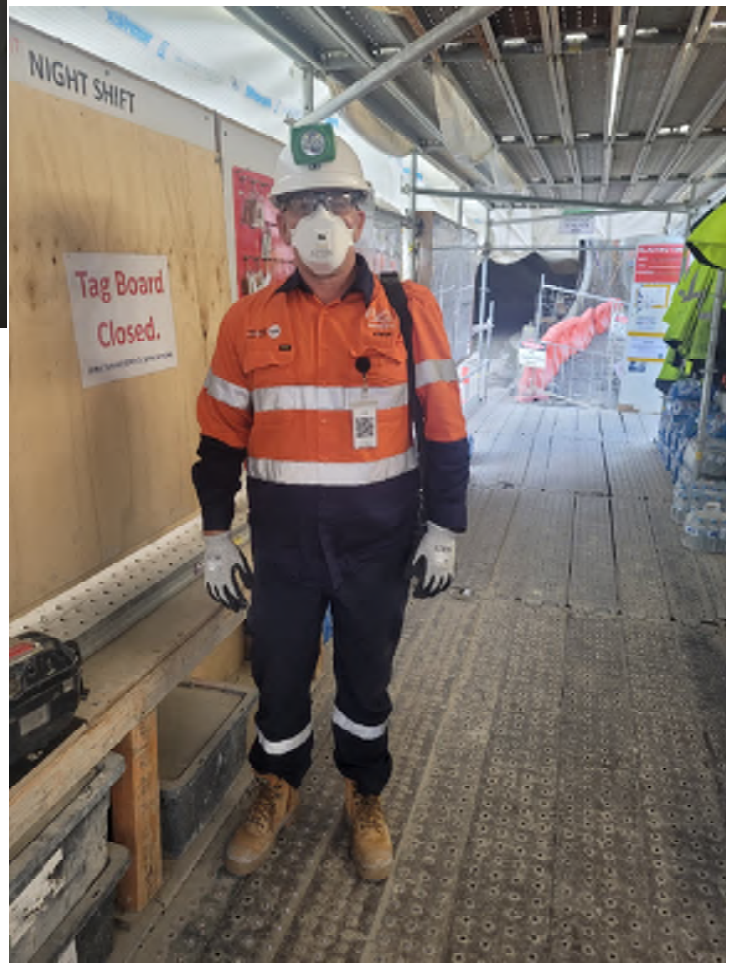
Landsvirkjun





TBM "Florence" (TBM 3 in Figure 5) is also constructed in Germany by Herrenknecht and is 142m long with an 11m diameter. It will excavate the upper 16km of the headrace tunnel from the inlet portal. This TBM can operate in 'slurry mode' (bentonite) when required.

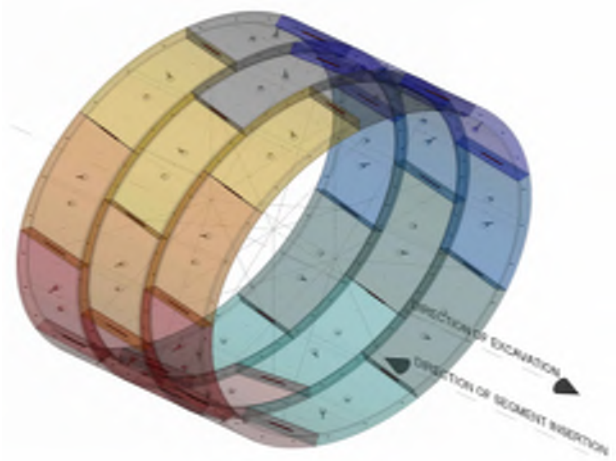




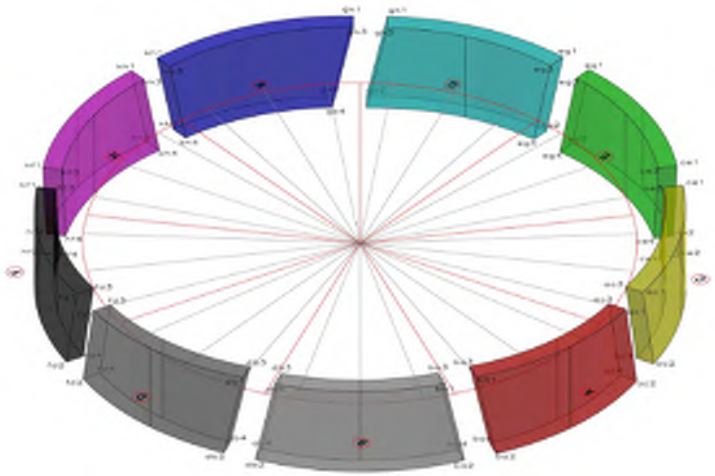
Landsvirkjun

Steypueiningar eru framleiddar hjá verktaka í COOMA og flutt á lagersvæði allan sólarhringinn-

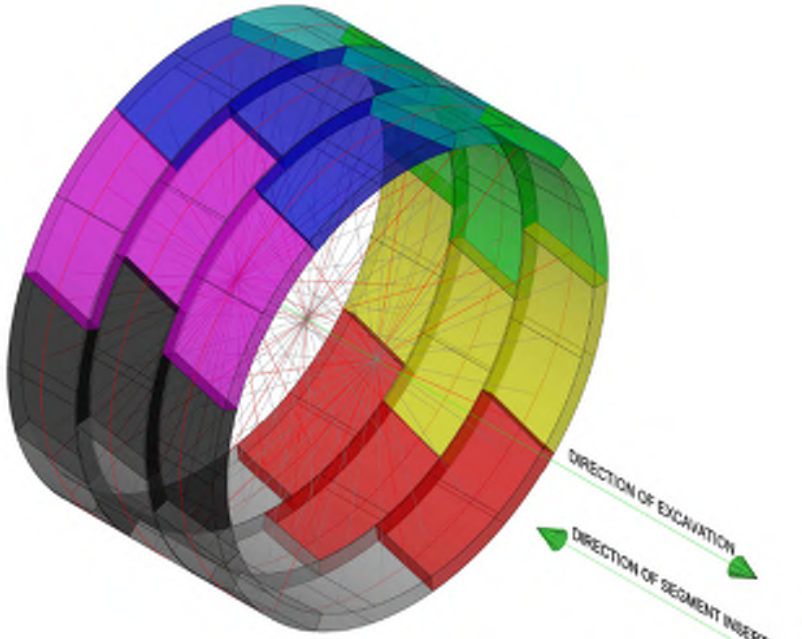
Alls verða framleidd 130.500 stk í 14.500 hringi. Hvert stykki 6.5 tonn- 60 tonn í flutningi



Landsvirkjun



3D KEY SEGMENT INSERTION
SCALE 1:50



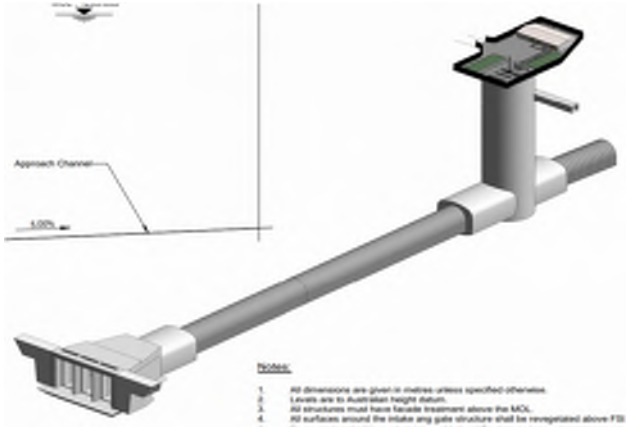
NOTES

1. SEGMENTAL LINING THICKNESS AND REINFORCEMENT MUST BE CONSIDERED INDICATIVE AND THEY CAN BE MODIFIED WITH THE UPDATING OF THE GEOLOGICAL-HYDROGEOLOGICAL DATA DURING THE DETAILED DESIGN.
2. SEGMENTAL LINING SHOWN IN PRESENT DRAWING IS REFERRED TO :
   - HRTD HEADRACE TUNNEL
   - IPS INCLINED PRESSURE SHAFT

DIRECTION OF EXCAVATION

DIRECTION OF SEGMENT INSERTION

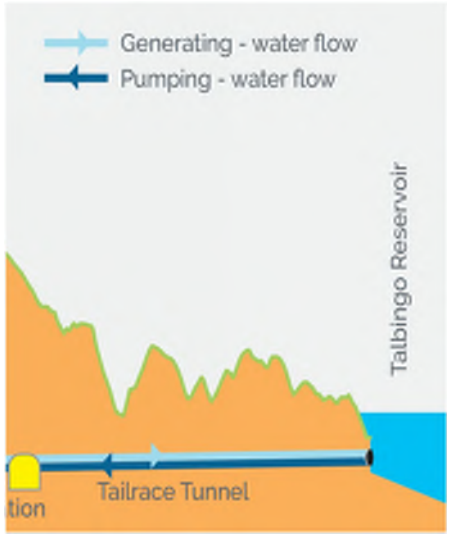
Inntak úr Tantangara lóni



Landsvirkjun

Öryggismerkingar og umferðarstýring á vinnusvæði

Talbingo-vatn-frárennslislón



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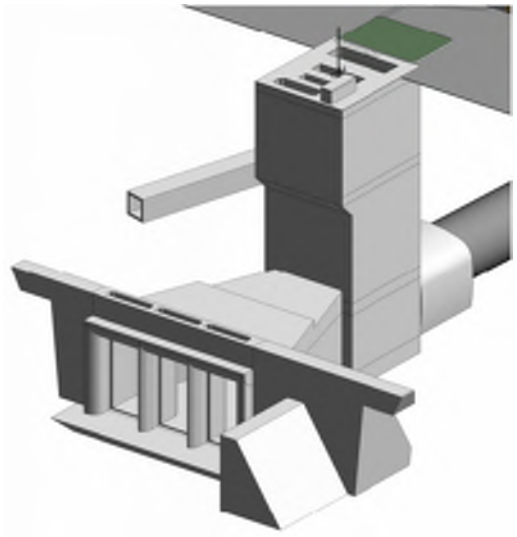


Upstream Surge shaft

Date: 29/09/2023

Current Bench- B25

Exc. Level - 1229.7 AHD

Exc. Depth - 51.2 m

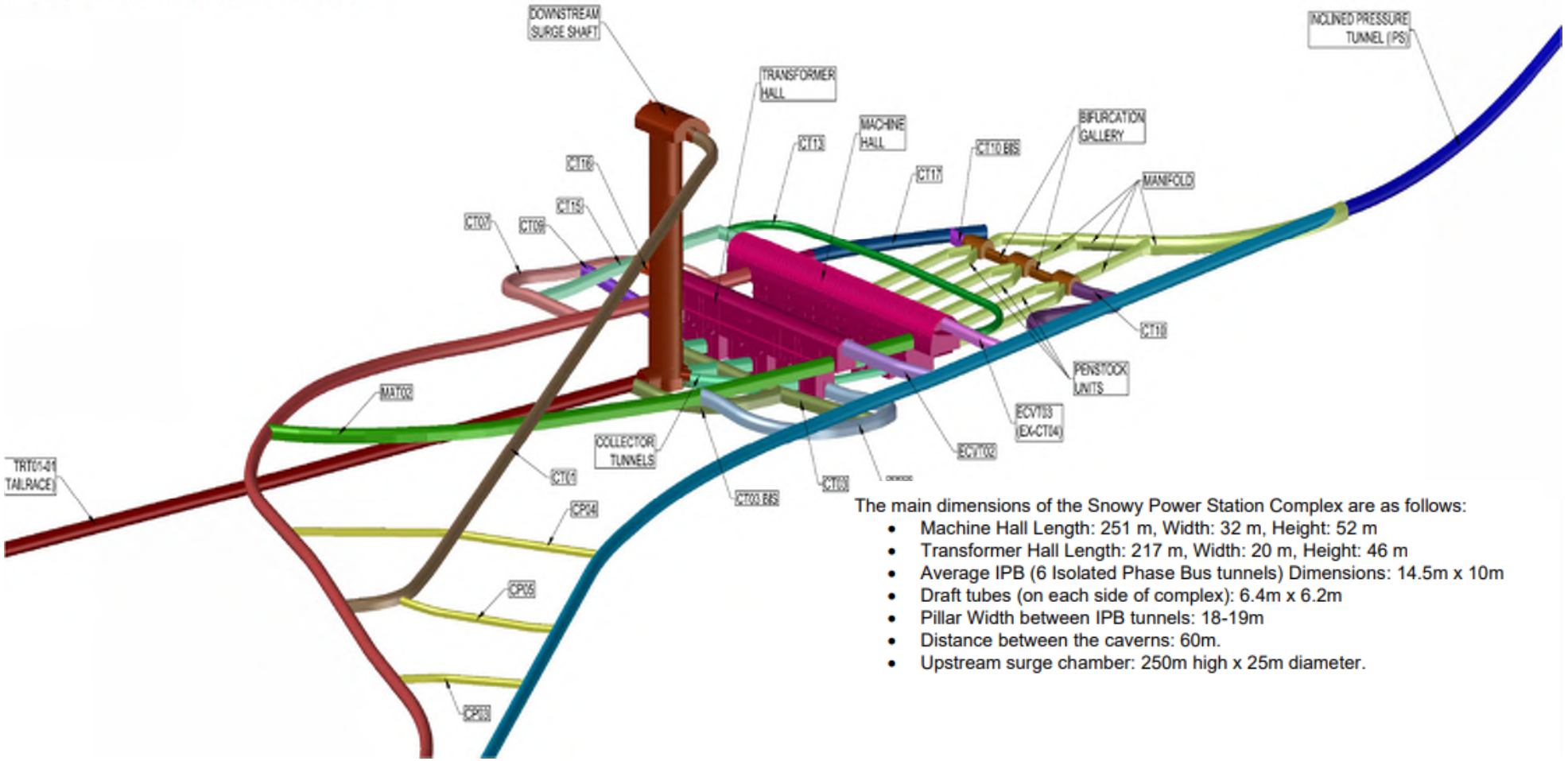
Exc. Diameter - 27.1 m

Thick support - 150mm

Landsvirkjun

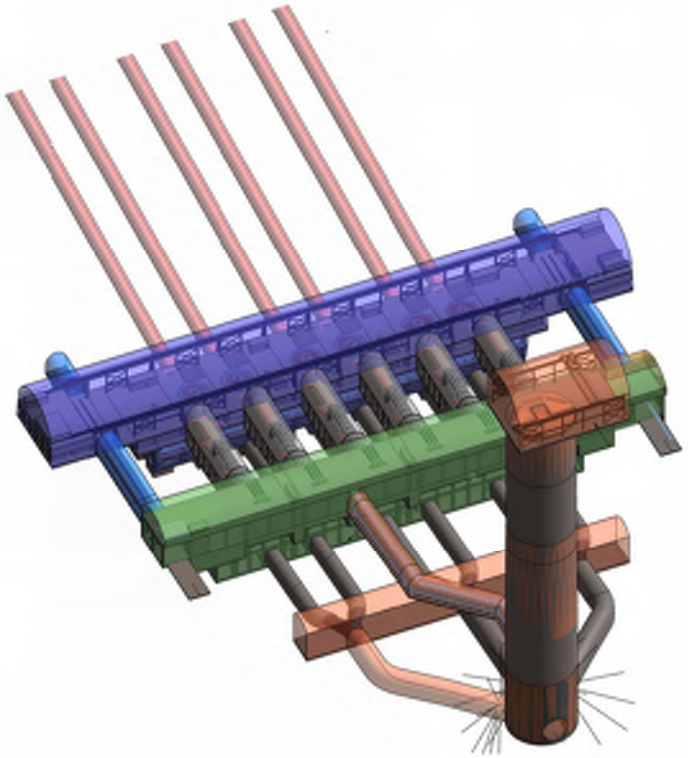
- 2000 MW uppsett afl
- 6 Francisvélar (tvívirkar)
- 420 m3/s í framleiðslu og 350 m3/s í dælingu
- Fallhæð 680 m
- Framleiða toppafl inn á kerfið

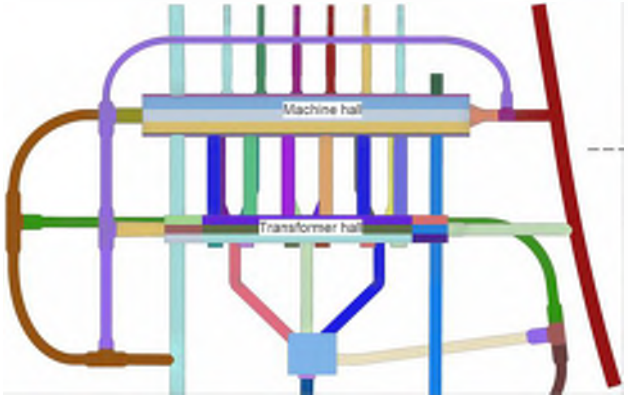
Landsvirkjun



The main dimensions of the Snowy Power Station Complex are as follows:

- Machine Hall Length: 251 m, Width: 32 m, Height: 52 m
- Transformer Hall Length: 217 m, Width: 20 m, Height: 46 m
- Average IPB (6 Isolated Phase Bus tunnels) Dimensions: 14.5m x 10m
- Draft tubes (on each side of complex): 6.4m x 6.2m
- Pillar Width between IPB tunnels: 18-19m
- Distance between the caverns: 60m.
- Upstream surge chamber: 250m high x 25m diameter.





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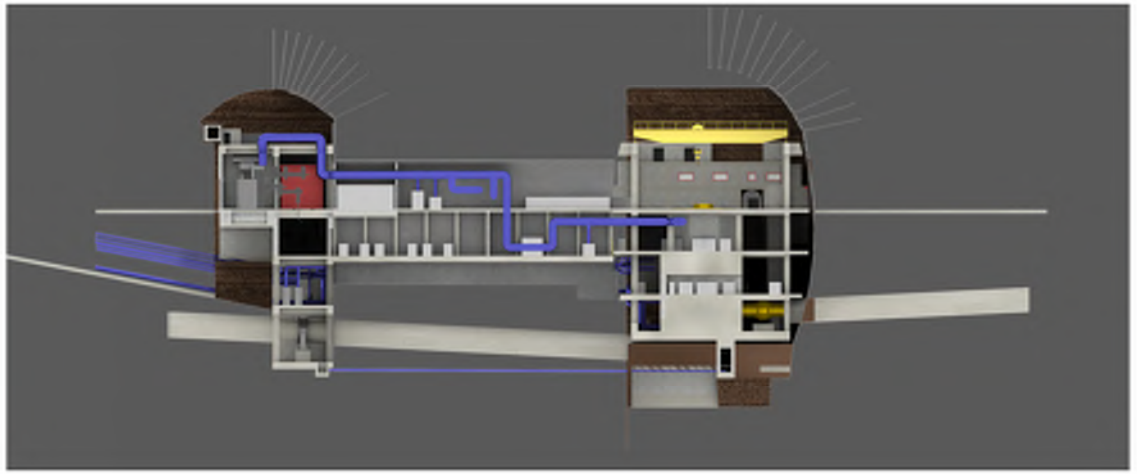


The following joint sets are retained for the PSC complex area. The bedding joints are by far the most conspicuous set of discontinuities.

Table 1: Joint Sets Characteristics

Joint sets	Dip direction	Dip	Comments
Bedding joint	75° ± 15°	35° ± 10°	Pre-sheared joint every 10 m (T3 & T4)
Major tectonic joint	125° ± 25°	75° ± 15°	Pre-sheared joint every 20 m (T3 & T4)
Random tectonic joints	185° ± 15°	55° ± 15°	Pre-sheared joint every 50 m (T3 & T4)
Random tectonic joints	255° ± 15°	55° ± 15°	Pre-sheared joint every 50 m (T3 & T4)
Random tectonic joints	315° ± 15°	55° ± 15°	Pre-sheared joint every 50 m (T3 & T4)

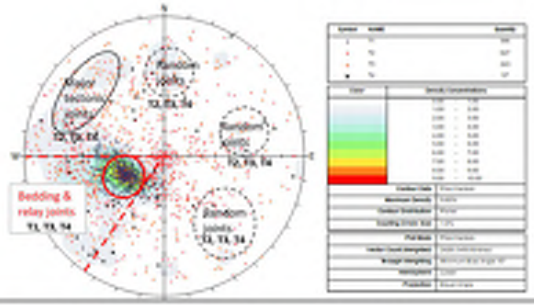


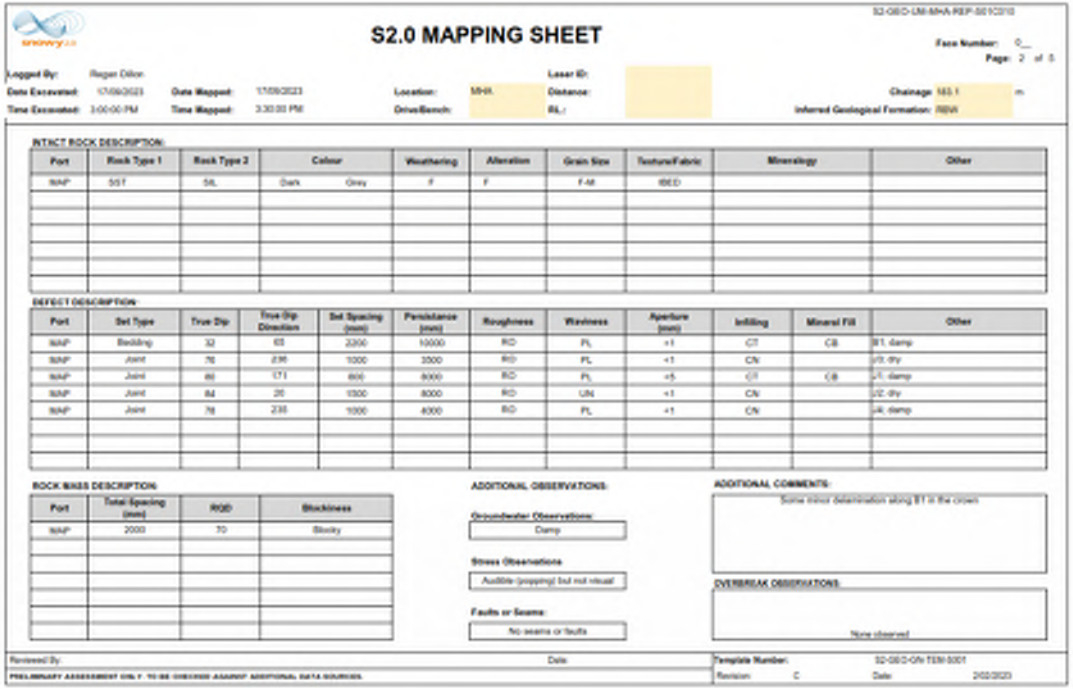
Fig. 2: Dip-directions of the bedding planes and the 2-3 joint sets expected. Orientation of the cavern is the dotted red line.

Fig. 3: MH-face at ~0:167. Joints, minor tectonic faulting and bedding planes with minor deformations are visible. The tripods devices are photographing and laser scanning the exposed surface of the cutting. The contractor's geologist (and sometimes the SHL's technical team) are mapping the geology and rating the stability.

The PSC will be excavated at depths between 600 and 720m below ground surface in the Ravine Beds Sedimentary Rock Formation. According to the logs on cores in the vicinity of the MHC, of the summary statistics in the relevant depth interval indicate that about 80% of the rocks are interbedded siltstone / sandstone with 70 to 85% being siltstone.

Landsvirkjun

BIM-Modelling



S2.0 MAPPING SHEET

Logged By: Roger Chlon
Date Excavated: 17/08/2023 Date Mapped: 17/08/2023
Time Excavated: 3:00:00 PM Time Mapped: 3:30:00 PM
Location: MH Laser ID:
Drive/Bench: Distance:
Chainage: 163.1 m
Inferred Geological Formation: RBM

INTACT ROCK DESCRIPTION

Port	Rock Type 1	Rock Type 2	Colour		Weathering	Alteration	Grain Size	Texture/Fabric	Mineralogy	Other
MAP	SST	SIL	Dark	Grey	F	F	F-M	BED		

DEFECT DESCRIPTION

Port	Set Type	True Dip	True Dip Direction	Set Spacing (mm)	Persistance (mm)	Roughness	Waviness	Aperture (mm)	Infilling	Mineral Fill	Other
MAP	Bedding	32	65	2200	10000	RO	PL	<1	CT	CB	B1, damp
MAP	Joint	76	236	1000	3500	RO	PL	<1	CN		J3, dry
MAP	Joint	80	171	800	8000	RO	PL	<5	CT	CB	J1, damp
MAP	Joint	84	20	1500	8000	RO	UN	<1	CN		J2, dry
MAP	Joint	78	238	1000	4000	RO	PL	<1	CN		J4, damp

ROCK MASS DESCRIPTION

Port	Total Spacing (mm)	RQD	Blockiness
MAP	2000	70	Blocky

ADDITIONAL OBSERVATIONS

Groundwater Observations: Damp

Stress Observations: Audible (popping) but not visual

Faults or Seams: No seams or faults

ADDITIONAL COMMENTS

Some minor deformation along B1 in the crown

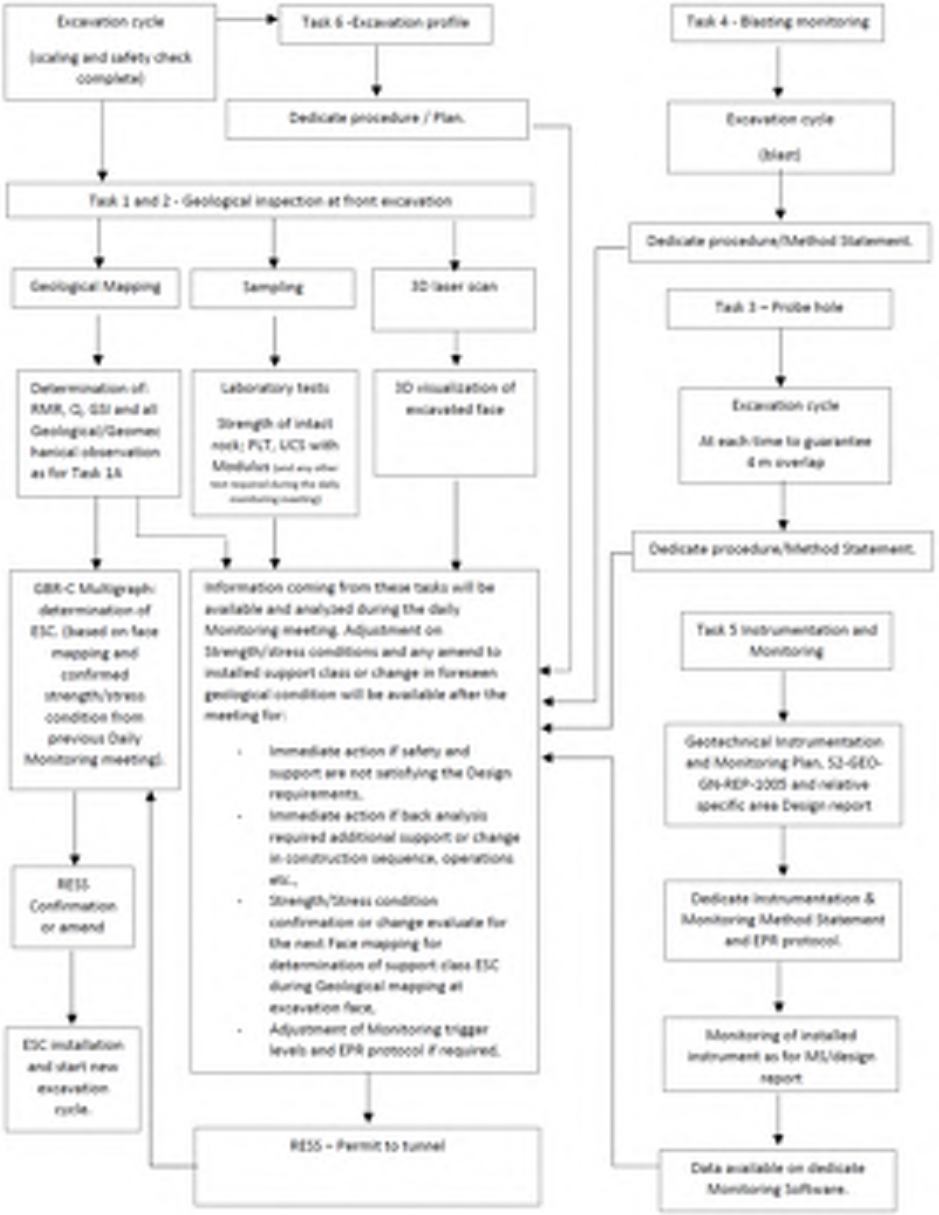
OVERBREAK OBSERVATIONS

None observed

Reviewed By: Date:

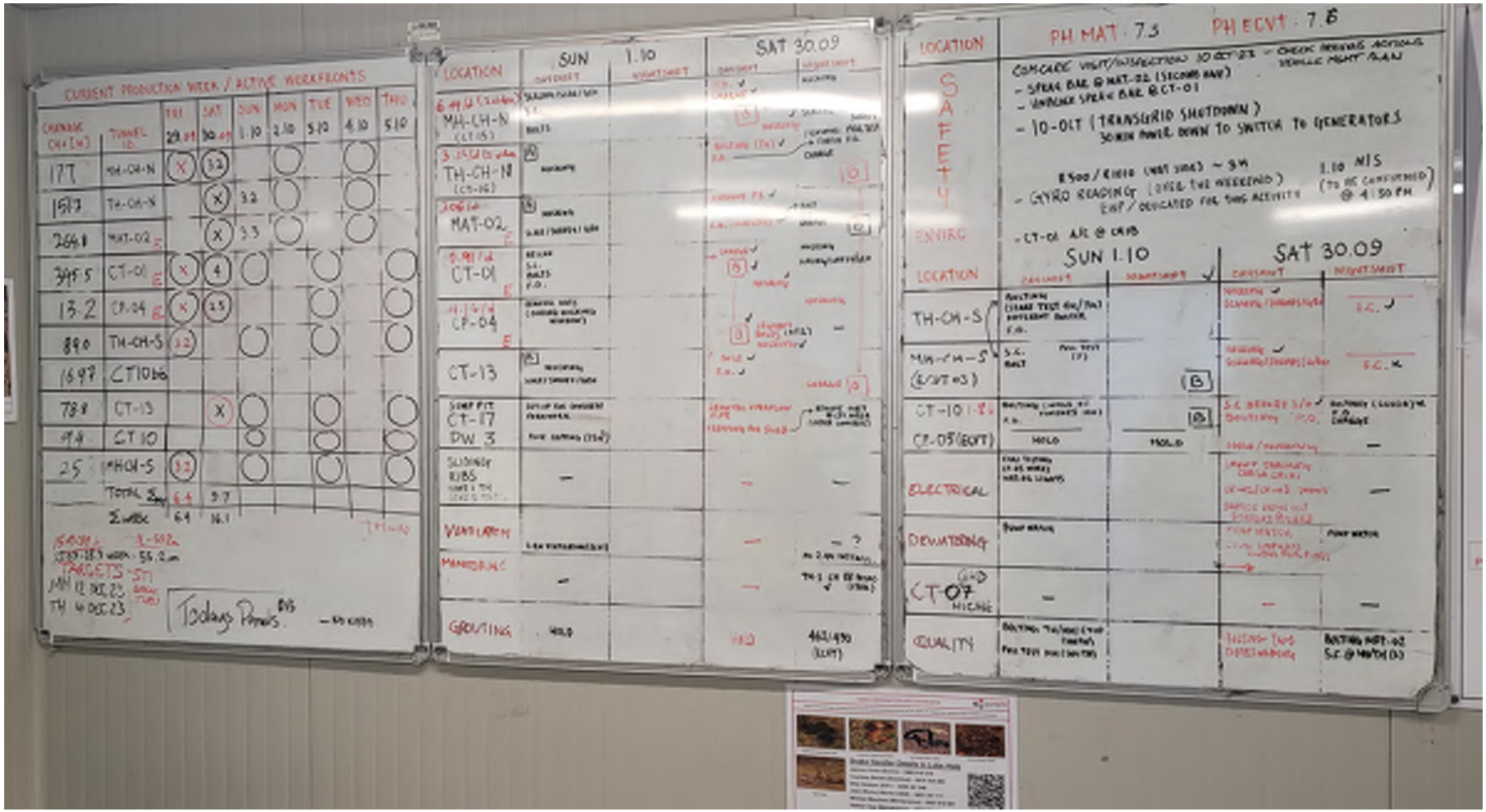
PRELIMINARY ASSESSMENT ONLY - TO BE CHECKED AGAINST ADDITIONAL DATA SOURCES

Template Number: S2-GEO-CRI-TEM-0001
Revision: C Date: 2/02/2023



Landsvirkjun

Vaktaskiptafundur hjá verktaka



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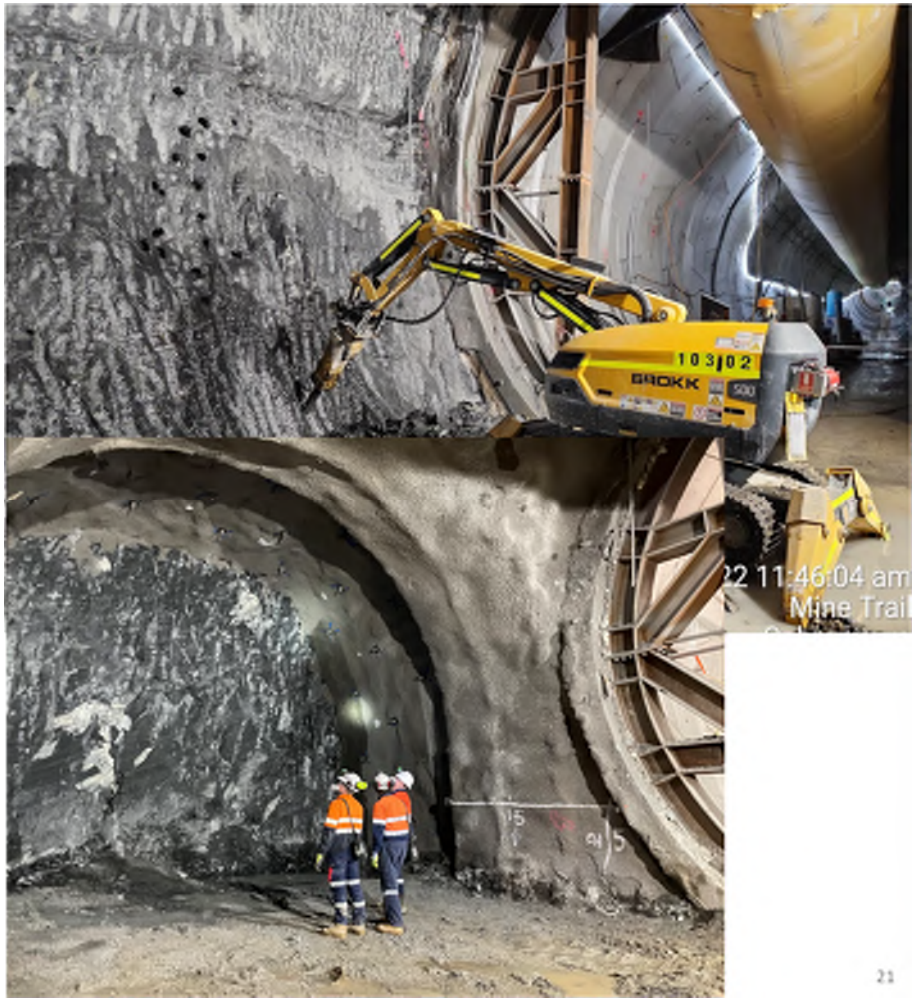


Landsvirkjun

Hjólaskófla sérútbúin sér um boltun, er með magasin og setur út staðsetningu á CT-bergboltum og herðir

Tveggja arma jumbo sér um að bora fyrir sprengihleðlum og grautun

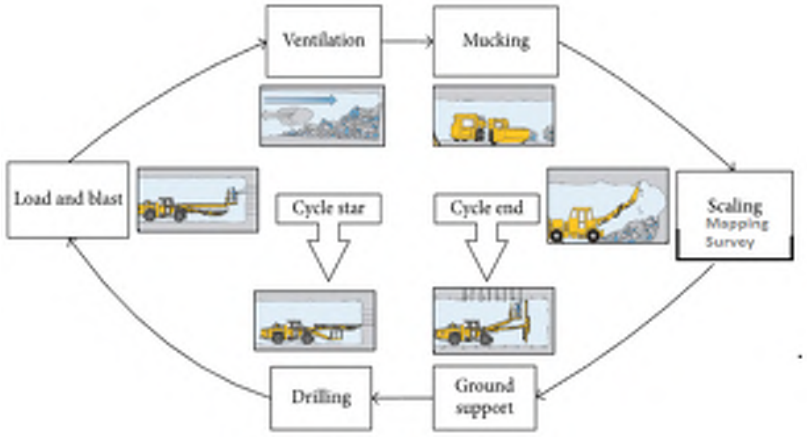


Figure 18: General Drill & blast excavation cycle

Direct shear tests are executed to estimate the in-situ shearing property of either existing discontinuities or a fracture surface in the rock mass which is formed while testing. Due to scale effects, no simple laboratory tests exist to provide equivalent results. Consequently, in-situ shear tests allow testing of large test blocks and provide the most reliable results for stability estimation of large underground excavations.

Landsvirkjun

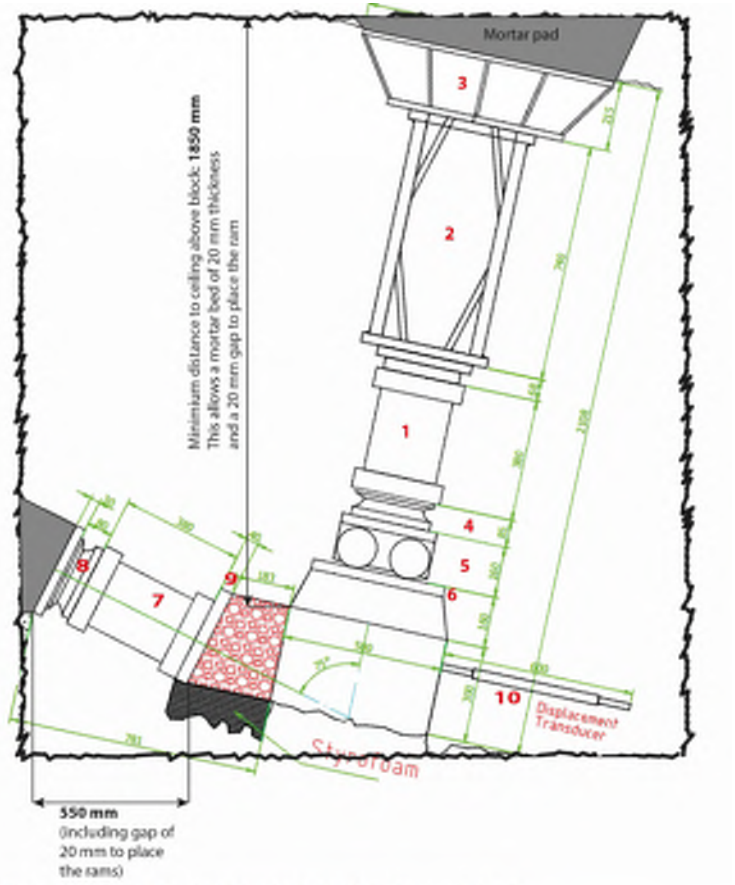


Figure 8 - Equipment used for the direct shear test with dimensions in mm.

Figure 5 - The plate load apparatus assembled for a long-term test in an underground rock laboratory in Switzerland. The metal frame to hold the displacement transducers measuring the plate movement can be recognized on both sides of the tunnel.

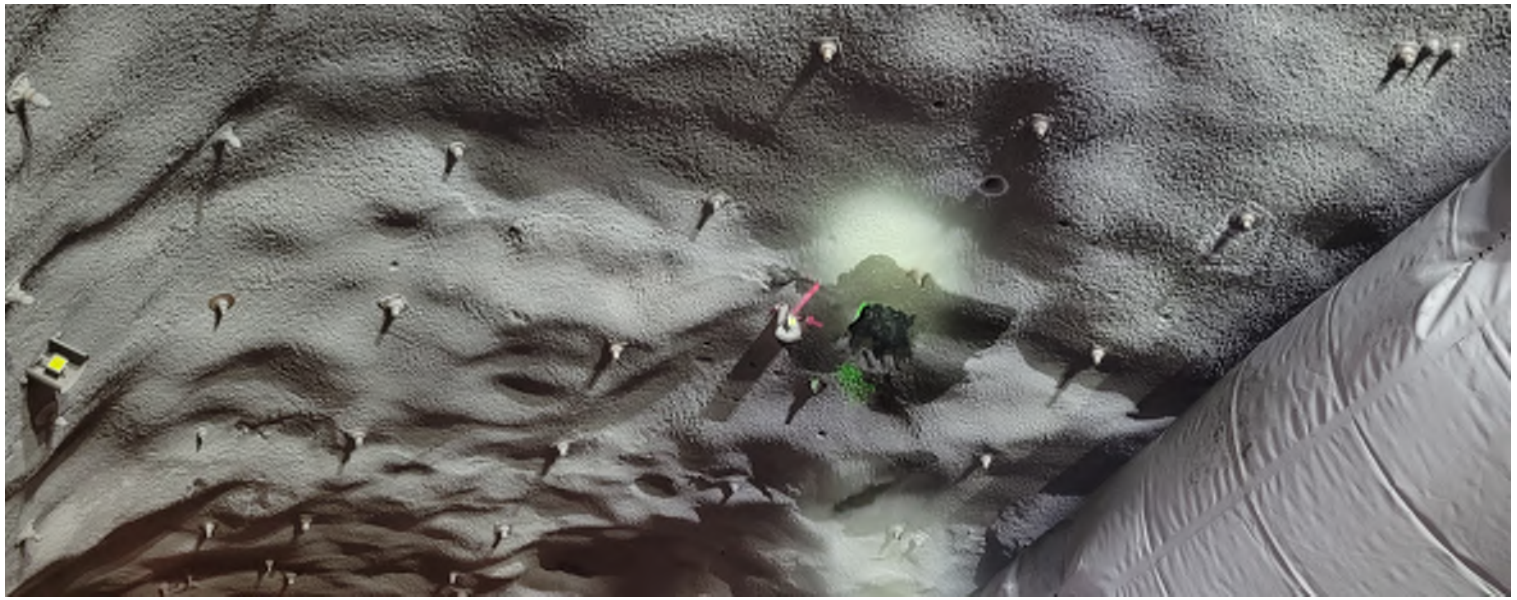
Plate load tests are executed to estimate the large-scale deformation properties of the rock mass including deformation modulus, modulus of elasticity and modulus of reloading. This is achieved by applying several load cycles onto a rock face and monitoring the displacement at the surface and deformation in the rock mass.

Landsvirkjun

Landsvirkjun

Pull-out test failure evaluation

1. Was the diameter of the borehole as requested in the Specification. Optimised drill-hole diameter for CT-bolt is 54mm, according to the Question raised as per discrepancy reports?
2. Improper flushing of the borehole is always a risk for failure during pull-out testing.
3. Bolt grout properly injected into the CT-bolt is a risk.
4. Deviation from the direction of the borehole and direction of push-in pressure of the rock bolt is a risk, as long CT- bolt sleeves can easily be damaged during improper installation.
5. Had the bolt grout gained sufficient strength prior to pull-out testing?
6. Was the FGJV´s inspector present during the installation of the rock-bolts, as requested?
7. How accurate is the discrepancy report?



EXCAVATION SEQUENCE: CROWN

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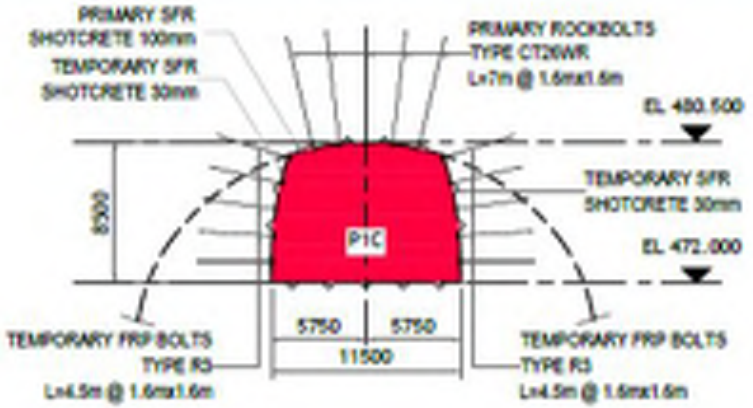
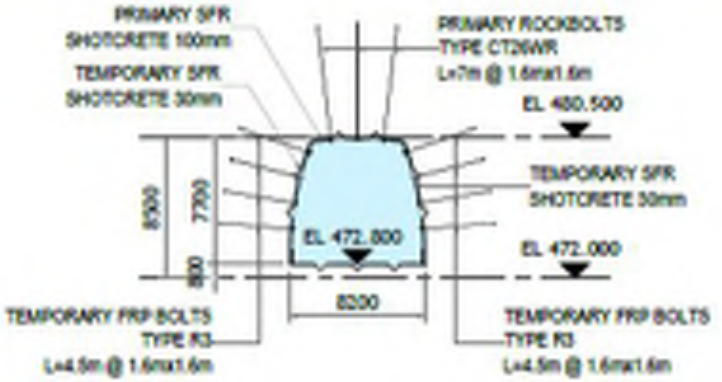
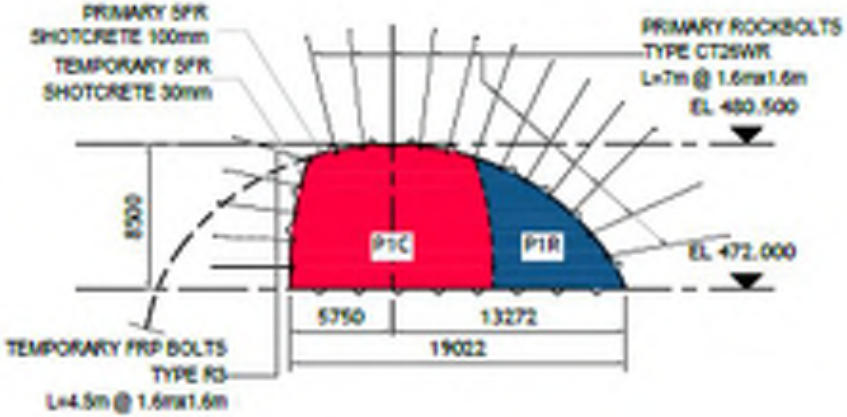
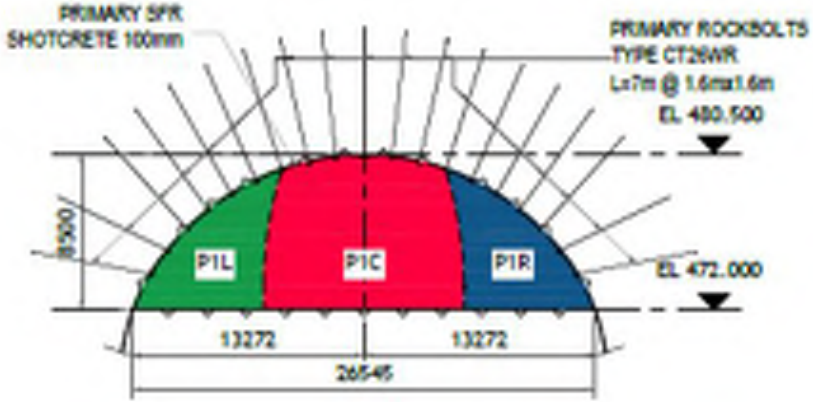
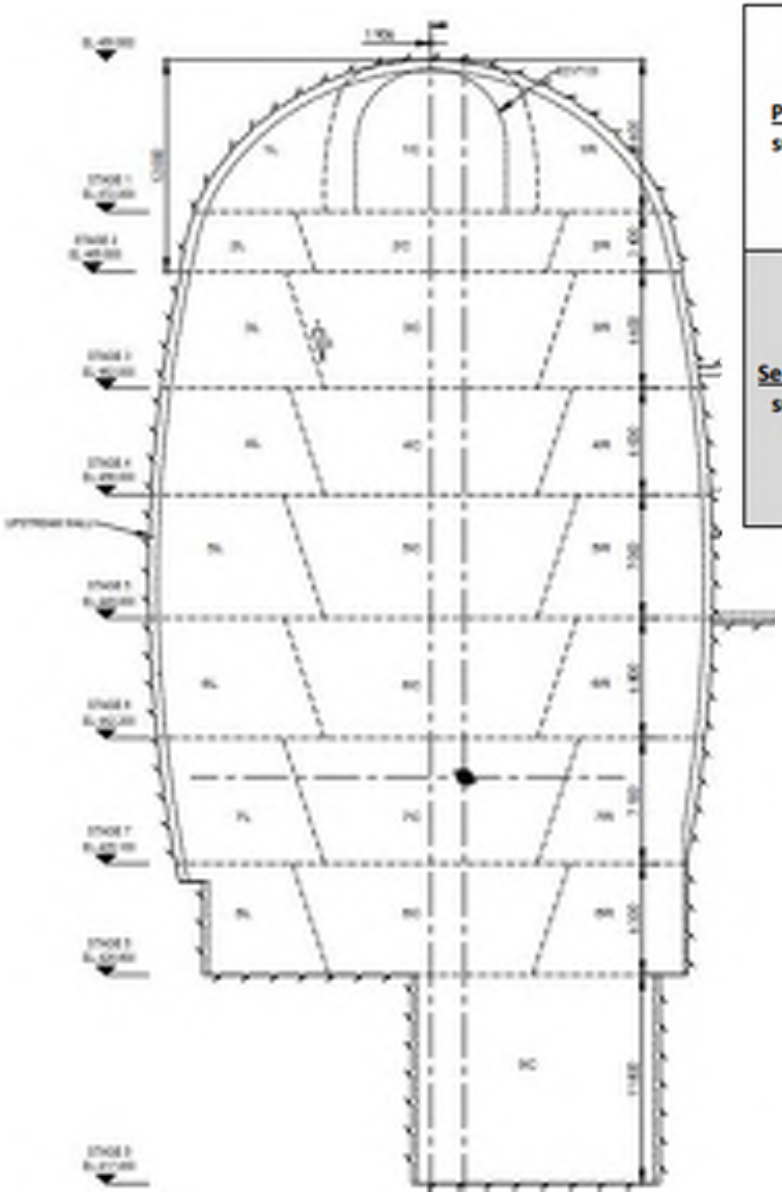


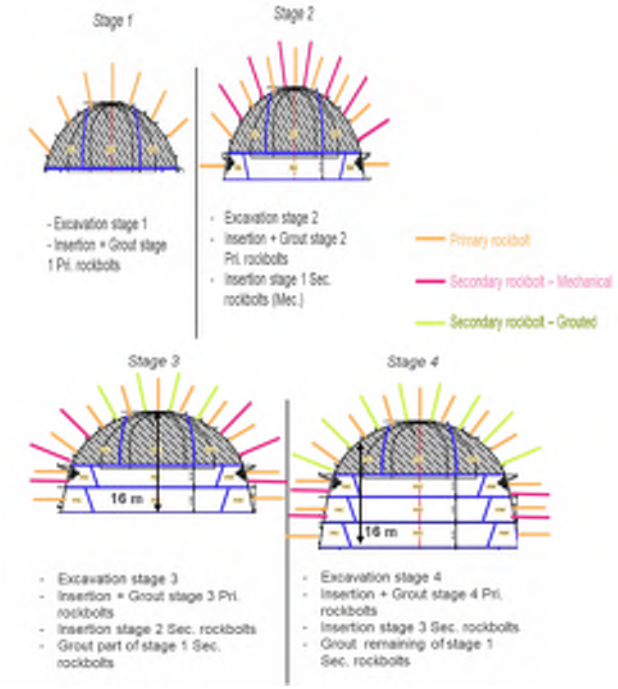








		Crown	Side walls
Primary support	Fiber Reinforced Shotcrete (SFR40)	10 cm (1 layer)	10 cm (1 layer)
		Wire mesh if necessary	Wire mesh if necessary
	Rock-bolt type CT26WR	ϕ26.5mm-L=7m stage 1 ϕ26.5mm-L=7m stage 2	Crown & side wall included in crown
		1.6m x 1.6m 1st stage 1.6m x 1.6m 2nd stage	
Secondary support	Fiber Reinforced Shotcrete (SFR40)	20 cm (2 layers)	20 cm (2 layers)
		1 layer of wire mesh	1 layer of wire mesh
	Rock-bolt type CT26WR	ϕ26.5mm-L=8m stage 1 ϕ26.5mm-L=11.8m stage 2	Crown & side wall included in crown
		1.6m x 1.6m 1st stage 1.5m x 1.6m 2nd stage	



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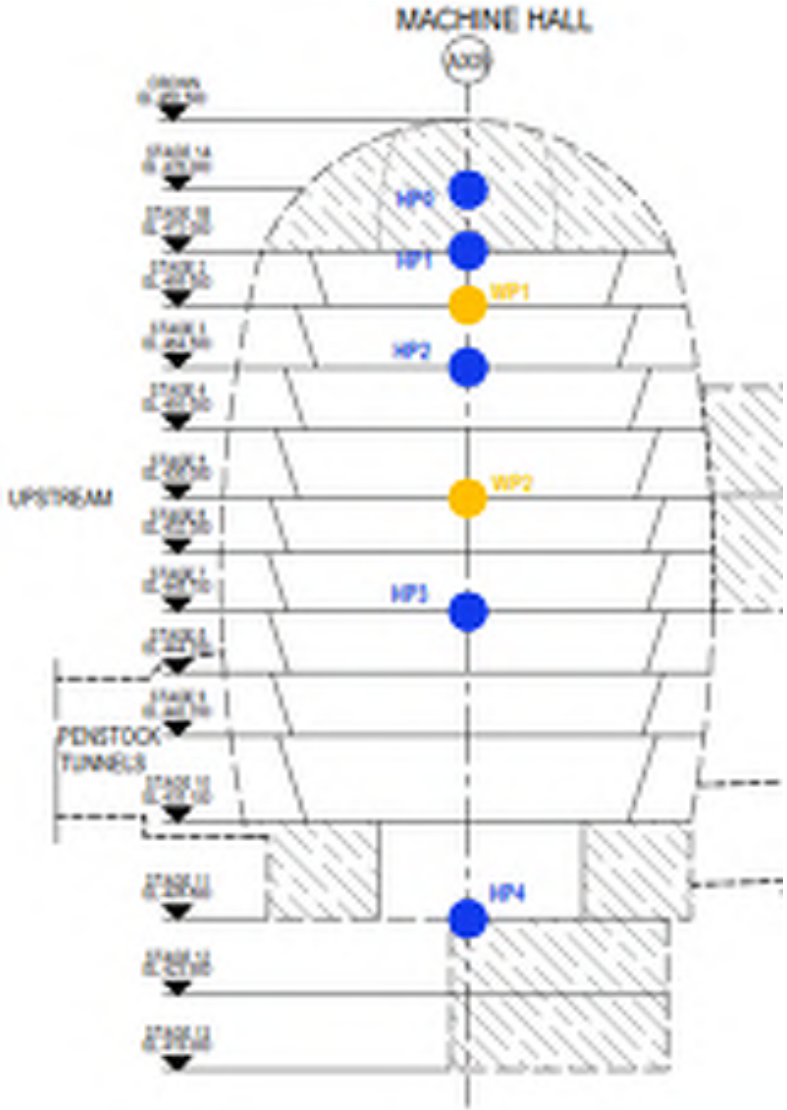


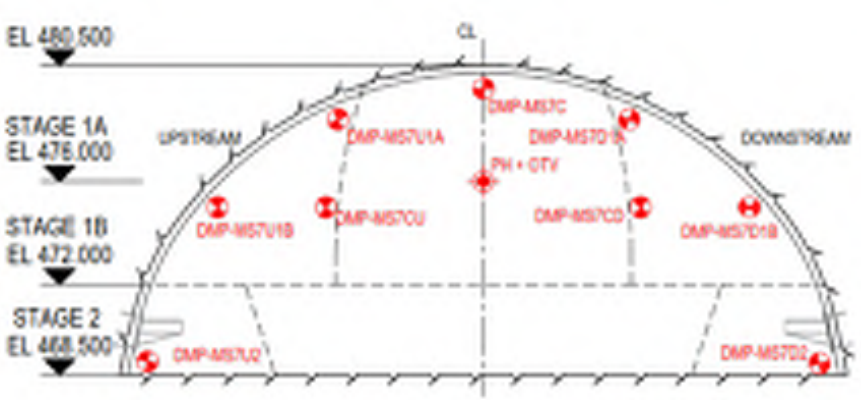
Hold Points

- Jarðfræðileg stæðni
- Skýrslugerð lokið
- Færslur innan marka
- Öll gögn fyrirliggjandi
- In-situ mælingum lokið
- In-situ shear-load test
- In-situ plate-load test
- Hönnun staðfest

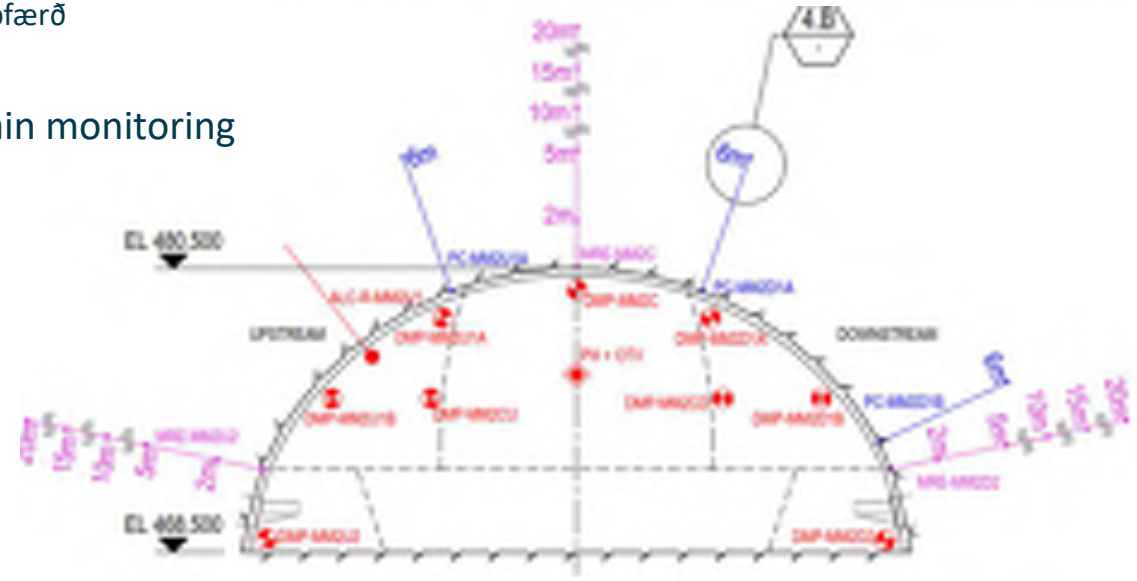
Witness points

- Jarðfræðileg stæðni
- Skýrslugerð lokið
- Færslur innan marka
- Öll gögn fyrirliggjandi
- Líkan uppfærð

Standard monitoring



Main monitoring



MONITORING INSTRUMENTS	
DMP	DISPLACEMENT MONITORING POINT (OPTICAL TARGET FOR 3 D DISPLACEMENT MONITORING)
DMP-C	DISPLACEMENT MONTORING POINT FOR CORBELS (OPTICAL TARGET FOR 3D DISPLACEMENT MONITORING)
ALC-R	ANCHOR LOAD CELL ON SECONDARY ROCKBOLTS
ALC-S	ANCHOR LOAD CELL ON MULTI STRAND
MRE	MULTIPLE ROD EXTENSOMETER (WITH MEASURING POINTS AT 2,5,10,15,20m)
MRE -A	ADDITIONAL ROD EXTENSENMETERS IF REQUIERED (SEE NOTE 7).
PC	PIEZOMETRIC PORE PRESSURE CELL
OTV	OPTICAL BOREHOLE SCANNING (SEE NOTE 18)

- **Displacement Monitoring Points (DMP):** Their main objective is the measurement of the displacement and convergences of the tunnels and caverns and eventually the deflections of structures.
- **Displacement Monitoring Points for Corbels (DMP-C):** Same concept as DMP presented above, for corbels of the temporary beam cranes.
- **Multiple Rod Extensometers (MRE):** Measurements of the rock mass movements at depth. Each extensometer will be equipped with several points of measure.
- **Piezometric Cells (PC):** Measurements the pore-pressure of the rock-mass around the excavation.
- **Anchor Load Cells on secondary Rock-bolts (ALC-R):** The load cells (ALC-R) will measure the axial loads acting in the secondary rockbolts.
- **Anchor Load Cells on multi-Strand anchors (ALC-S):** The load cells (ALC-S) will measure the loads of the multi-strand anchors supporting the corbels of the temporary beam crane.

ATTENTION THRESHOLDS FOR MH CROWN	ALERT LEVEL (3)	ACTION LEVEL (4)	ALARM LEVEL (5)
STAGE 1 - STAGE 1 CROWN & SIDEWALLS - ABSOLUTE DISPLACEMENTS - UPON COMPLETION OF STAGE 1 EXCAVATION - UPON COMPLETION OF STAGE 2 EXCAVATION	 1.5 cm 2.5 cm	 2 cm 3 cm	 2.5 cm 3.5 cm
STAGE 2 -STAGE 2 CROWN & SIDEWALLS - ABSOLUTE DISPLACEMENTS - UPON COMPLETION OF STAGE 2 EXCAVATION	1.5 cm	2 cm	2.5 cm
SHEAR DISPLACEMENTS AT JOINTS (6) OR ROCKBOLTS - DURABILITY (7)	15 mm	20mm/18mm (*)	25 mm
SHEAR DISPLACEMENTS AT JOINTS (6) OR ROCKBOLTS - INTEGRITY (8)	25 mm	35 mm	40 mm
WATER PRESSURE (9)	1.5 m	2.5 m	4 m

(*) 20mm FOR ROCKBOLTS TYPE CT26WR
18mm FOR ROCKBOLTS TYPE CT-BOLT M24

04

04

Instruments [1]	Excavation of the Crown
Displacement Monitoring Point - Optical target (DMP)	Once a day (<30 m from the excavation front) [2] Twice a week (>30 m from the excavation front) [2] Once per week (two months following the completion of excavation) [3]
Anchor Load cells (ALC)	Twice a week [2] Once a week [3]
Multi Rod Extensometer (MRE)	Twice a week [2] Once a week [3]
Piezometric Cells (PC)	Twice a week [2] Once a week [3]

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The SHL´s site technical independent review and interpretation of all received documents of the excavation cycle.

Description of QC activity	Checking Activity to be performed	Resp Dept.	Controlling FGJV Documents	Employer Requirements/Clause, Applicable Standards/Sections.	Acceptance Criteria (extracted / gathered from ERs, Standards etc.)
Geological Mapping	Review of geological mapping in Daily Monitoring Meeting.	CON TEC	S2-GEO-GN-REP-1005 S2-FGJV-TEC-REP-2004 – Section 4 Task 1A	Volume 3.06 Construction Requirements – Cl 3.06.12.2	ER 3.06.12.2(b)(ii), ER 3.06.12.2(i) Face mapping is managed as per S2-GEO-GN-REP-1005 Rev. E and S2-FGJV-TEC-REP-2004. Mapping is undertaken safely prior to any application of tunnel support. As per SHL requirement, mapping record will be submitted via Aconex.
Geotechnical Monitoring	Review of geotechnical monitoring data.	CON	S2-GEO-GN-REP-1005 – Clause 7.2.2 S2-CIV-PX-GEN-REP-0004	N/A	Geotechnical monitoring to be carried out as follows: Instruments / Monitoring Frequency Displacement Monitoring Point – Optical Target (DMP): - Daily (<30m from the excavation front) [1] - Twice a week (>30m from the excavation front) [2] - Once per week (two months following completion of excavation) [3] Anchor Load Cells (ALC): - Twice a week [1] - Once a week [3] Multi Rod Extensometer (MRE): - Twice a week [1] - Once a week [3] Piezometric Cells (PC): - Twice a week [1] - Once a week [3] (1) During excavation and for one month following the completion of the excavation. (2) Up to construction of the internal concrete structure.
Retolling strategy	Identification of geological discontinuities in Drainage and Extensometer Holes	CON TEC	S2-CIV-PX-GEN-REP-0004	ER R4.2 Design life	Identification of Joint prone to potentially to significant joint shear displacements. This is done by identification of the pre-sheared geological discontinuities

Færslumælingar og viðbragðsáætlun

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Trigger Levels	Condition	Action Plans
Alert Level (Alert Value)	Movement is occurring, but system behaviour still below the design value	- Monitoring team review the readings to ascertain the reading is reliable and not related to errors. - If the event is not caused by erroneous reading, monitoring team should advise the design and construction teams. - Continue work as normal operation.
Action Level (Design Value)	Movement is occurring, and system reaching design value.	- Monitoring team immediately review the readings to ascertain the reading is reliable and not related to errors. - If the event is not caused by erroneous reading, monitoring team advise the design and construction teams. - Monitoring frequency will be increased - Deformation to be reviewed to confirm that the performance is as anticipated.
Alarm Level (Alarm Value)	Movement is occurring, and system reaching tolerance level	- Monitoring team to advise immediately the design and construction teams. Construction team to immediately cease all construction work. Construction team to remove of surcharge load, such as operational crane, that may cause further deformation to the structure. Subject to the situation (actual different between measured value vs. alarm level value), install additional support without delay and take specific additional safety measures. - Monitoring team to review the readings. Monitoring frequency to be increased as required. - No further excavation shall be allowed until further notice. - Deformation to be analysed so that it is understood why it goes beyond the alarm level and, as may be the case: • Define remedial measures (e.g. review ground support, install additional support, review construction/excavation methodology, extent monitoring system…) and carry out such remedial works • Modify values related to the attention thresholds, subject to detailed analysis and justification - Work may only proceed if remedial measures and any other actions implemented have been deemed successful

	Excavation phases										
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	Stage 10	End of excavation
Alert - Stage 1	15	25	30	40	50	55	65	70	70	80	90
Alert - Stage 2		15	30	40	50	65	70	80	90	95	105
Alert - Stage 3			15	30	40	50	65	70	80	90	95
Alert - Stage 4				15	30	40	50	65	70	80	90
Alert - Stage 5					15	30	40	50	65	75	90
Alert - Stage 6						15	30	40	50	65	70
Alert - Stage 7							15	30	40	50	65
Alert - Stage 8								15	30	45	55
Alert - Stage 9									15	30	50
Alert - Stage 10										15	35
Alert - Stage 11											15
Action - Stage 1	20	30	40	50	60	70	80	85	90	100	110
Action - Stage 2		20	40	50	65	80	90	100	110	120	130
Action - Stage 3			20	40	50	65	80	90	100	110	120
Action - Stage 4				20	40	50	65	80	90	100	110
Action - Stage 5					20	40	50	65	80	95	110
Action - Stage 6						20	40	50	65	80	90
Action - Stage 7							20	40	50	65	80
Action - Stage 8								20	40	55	70
Action - Stage 9									20	40	60
Action - Stage 10										20	45
Action - Stage 11											20
Alarm - Stage 1	25	35	50	60	70	85	95	100	110	120	130
Alarm - Stage 2		25	50	60	80	95	110	120	130	145	155
Alarm - Stage 3			25	50	60	80	95	110	120	130	145
Alarm - Stage 4				25	50	60	80	95	110	120	130
Alarm - Stage 5					25	50	60	80	95	115	130
Alarm - Stage 6						25	50	60	80	95	110
Alarm - Stage 7							25	50	60	80	95
Alarm - Stage 8								25	50	65	85
Alarm - Stage 9									25	50	70
Alarm - Stage 10										25	55
Alarm - Stage 11											25

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The SHL´s site technical independent review and interpretation of all received documents of the excavation cycle.

SHL og FGJV sameiginlegir tæknifundir

- Everyday 05:20: Prestart Meeting for specific work area (e.g., MAT). Attended by at least one SHL Engineer/Surveillance Officer – no meeting minutes.
- Everyday 07:30: SimOps meeting with all people responsible for different work fronts. Schedule for that day and all works are being documented and discussed. Attended by one SHL Engineer/SO – no meeting minutes.
- Every day 11:00: Geotechnical Monitoring Meeting: Results from instrument readings and mappings in the tunnel are being presented by FG. Discussions and comments. Advance copy for headings provided. Designer present, open discussion. No minutes.
- Every day 16:00: PTT (Permit to Tunnelling) meeting. PTTs being presented and handed out for signing by all parties. Similar pour clearance in concrete works.
- Drill & Blast Meeting – Every Tuesday 08:30-09:50: All matters and problems regarding D&B are being discussed with FG/DJV/SHL present. Meeting minutes taken by FG and sent in advance via Aconex. Technical issues/safety issues regarding blasting and drilling can be discussed.
- Weekly TBM meeting, every Thursday 1p.m. Attended by TBM crews/DJV/SHL. One SHL engineer usually present. Meeting minutes taken by FG and sent in advance via Aconex filing system.

SHL-innri fundir tæknimanna og stjórnenda

- Every day at 12:30: Daily site catchup meeting, all sites presenting what is happening now. All SHL personnel present. No minutes, just briefings.
- Every Wednesday 09:00: Internal Handover meeting between two crews by SHL. Handover Excel Table read on the meeting.
- Every second Wednesday 10:00: Bi-weekly internal SHL meeting presenting project progress. Managers, Engineers, Surveillance officers among others required as may apply.

Table 8: Cycle time for Stage 1 Central part excavation, 3.2m excavation stage

LOCATION	Stage 1 Central part excavation, 3.2m each excavation cycle			
Cross section area	Nearly 100m2	3 boom Jumbo		01
Advance	3.2m+0.1=3.3m			
No. of holes		150 nos' Approx.		
Cycle time			minutes	
Drilling	495m		160 minutes	
Charging & blasting			120 minutes	Twin hose charging unit emulsion with EWP/2 units
Defuming			60 minutes	
Scaling if required			35 minutes	Hydraulic breaker or similar
Mucking	330 cum	25 trips (8 no dump trucks)	210 minutes	30T Dump trucks Roback RA30 or similar
Scaling & Geological mapping			40 minutes	
Survey			30 minutes	
Shotcrete (Primary)	13 m3		145 minutes total (30min setup, 75 min spray, 40min wash	Shotcrete SPM 500 Wetkret
Primary Rock bolts including R4 CT bolts in crown & R3 FRP bolts on sides	CT26WR:5+6 no, 7m long FRP: 5+6 no, 4.5m long	Boltec or 3 boom jumbos: drilling, installation & grouting	220 minutes (15 min setup & 190 min & 15 min removal	1.5 MPa early strength should achieve to personnel work under supported ground
Sub-total			1020 minutes	
Contingency	18~20%		200 minutes	
Total Cycle time			1220 min (20.5 hrs.)	
Progress (m)/day			3.2m/day	

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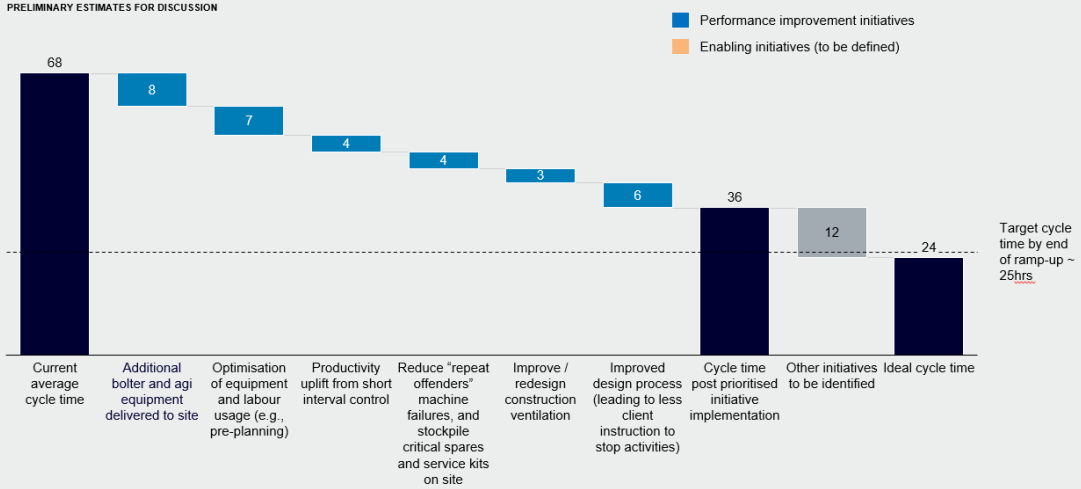
6 TARGETED INITIATIVES CAN HELP TO REDUCE MACHINE HALL AND TRANSFORMER HALL CYCLE TIMES TO <24 HOURS

Initiative impacts on current cycle times, hrs

PRELIMINARY ESTIMATES FOR DISCUSSION



- Verktaki var 11 daga á eftir áætlun eftir mánaðarvinnu – Nákvæm greining vikulega skipulögð
- Halda sig á krítiskum verkþáttum-útgreftri hvelfinga, mikil og tafsöm vinna sem tefur útgröft við að vera að vinna á mörgum stöðum
- Tilfærslur tækja tafsöm-jumbo og bolter geta unnið samhliða, skoða að nota 3ja arma jumbo og bolta samhliða borun og sprengivinnu
- Lengingar salva-almennt of stuttir
- Tafsamt að skipta um vaktir-vaktir hittast á skrifstofu og fundur haldinn og staðan tekin
- Verkstjórn ábótavant að því er virtist

FGJV Weekly report mid september 2023 Excavation and support cycle-review				
	As-built	**Planned**	**Contractor´s clarification and respond**	**JSU add. Comments**
	hrs	**hrs**		
Face drilling	4,1	2,5	Increase number of equipment	Optimise the workfronts when applicable-evaluate rockbolting and drilling for blasting simulteniously
Evacuation	1,5	1	Increase number of transportation vehicles, better organisation	Improve by better organisation
Charging and blasting	1,4	2	OK (subcontractor)	Ok-make sure that information between work-groups are ok-saves time
Vent-out	2	1,8	Organise and improve ventilation.	Install movable blowers if possible during venting of blast fumes
Mucking out	7,5	5	Increase dumper fleet, consider crusher or conveyer belt.	Increase dumpers up-to as sufficient for effective and organised mucking-out progress
Scaling	2,6	1,5	Review work performance	Decrease irsk of possible underbreaks and review performance-Limit start-up time
Surveying	0,9	1	Ok	
Shotcreting	5	2,5	Increase mixers and organise work performance	Appears reasonable estimated time for active work, not included is start-up and finishing of shotcrete work-Estimated length of the perimeter (walls and crown) of the topheading is 25m and volume taken into account 30% roughness and 10% rebound is 15m3, net productivity of shotcrete apply is 7m3/hrs, thus net time is 1.6 hrs, cleaning and mobilisation/demobilisation is 1 hr. Be organised and ready for shotcrete testing when applicable. Order shotcrete when washing is starting and applicable.
Mapping	0,6	1	Ok	Ok
Rockbolting and grouting	12,3	4,5	Increase equipment	Improve organising and limit stand-still and start-up time
Exc. cycle	37,9	22,8		According to Equivalent time method, round 3.5m long round of 100m2 should be around 20 hrs net, brutto 25hrs.

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Working cycle optimisation

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2024-06-14-Lobs Hole - Caverns - Machine Hall (looking north)

Lobs Hole - Caverns - Transformer Hall: Corbel Installation Ongoing

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2024-06-14-staða útgraftrar
MH-22%
TH 32%

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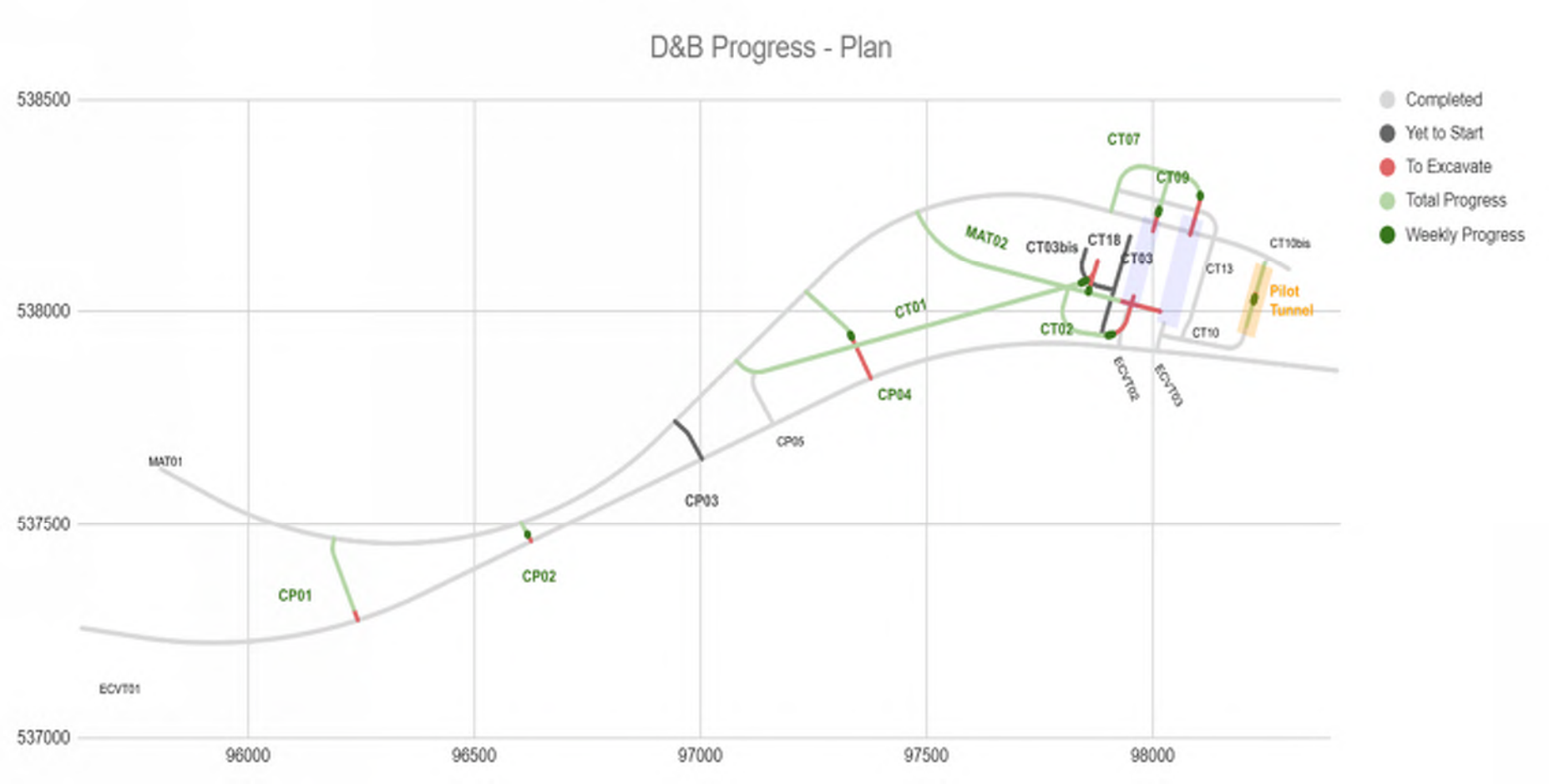

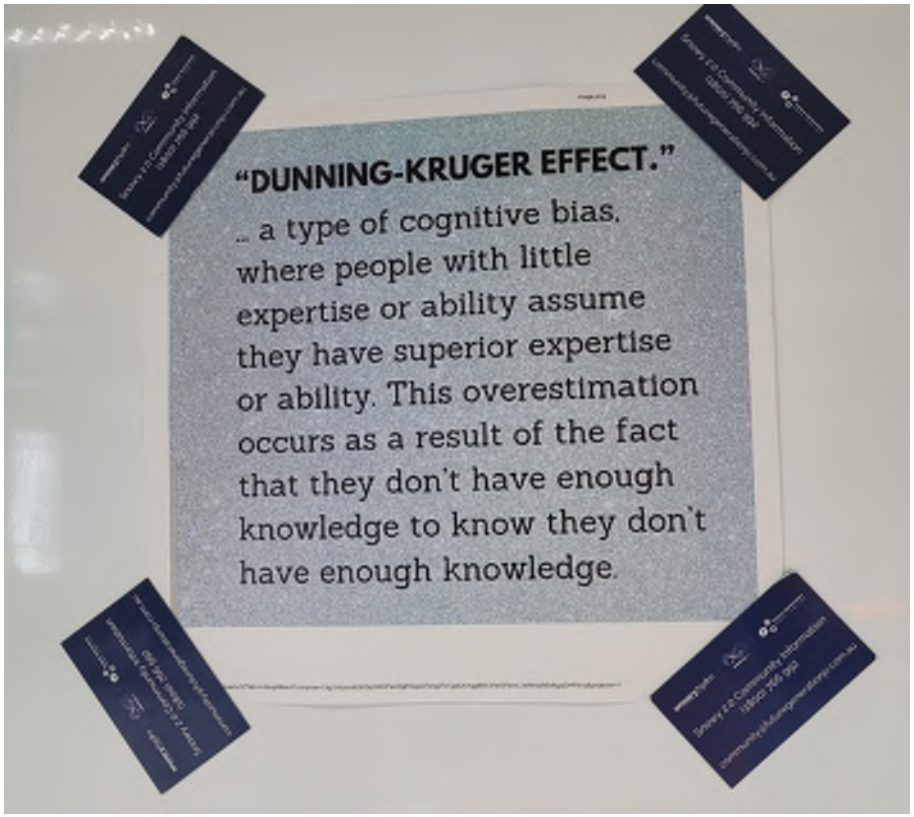

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Skrifstofa SHL á verkstað

"Dunning-Kruger effect"

…tegund vitsmunalegrar hlutdrægni, þar sem fólk með litla sérfræðiþekkingu eða getu gerir ráð fyrir að þeir hafi yfirburða sérþekkingu eða getu. Þetta ofmat á sér stað vegna þess að þeir hafa ekki næga þekkingu til að vita að þeir hafa ekki næga þekkingu

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https://drive.google.com/file/d/1brxIpKNt8N5_VIKI9UAOooAvLGgHXHzk/view?pli=1

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Takk fyrir!