## T-15P1 Alternative Main and Escape Tunnel Portal Geological Site Assessment

Construction of Tunnels, Bridges, Yards and Formation Works from Chainage 101+310 to 117+365 (FLS) Under Package-8 in Connection with New BG Line between Rishikesh and Karnaprayag (125km) in the State of Uttarakhand, India.

र. के. शर्मा/A. K. SHARMA

े विकास निगम लि0/ Rail Vikas Nigam Ltd. त तरकार का उपक्रम/ A Govt. of India Enterprises अधिकेश (उत्तराखण्ड) 249201/ Rishikesh (UK) 249201

## T-15P1 Alternative Main and Escape Tunnel Portal Geological Site Assessment

Construction of Tunnels, Bridges, Yards and Formation Works from Chainage 101+310 to 117+365 (FLS) Under Package-8 in Connection with New BG Line between Rishikesh and Karnaprayag (125km) in the State of Uttarakhand, India.

# REVISION

			Geologist	
0	27.04.21	First Issue	Sidar Tekes	diml
Rev.	Date	Issue, Modification	Prepared	

# INDEX

1	INTRODUCTION	3
1.1	Abbreviations	3
1.2	Purpose of the Report	3
1.3	Report Structure	3
2	EXECUTIVE SUMMARY	4
3	PROJECT GEOLOGY	4
3.1	Overview	4
3.2	Stratigraphy	5
4	GEOLOGICAL ASSESMENT	6
5	GEOTECHNICAL ASSESSMENT	9
6	PREVIOUS INVESTIGATIONS	10
7	HYDROGEOLOGICAL ASSESSMENT	10
8	SUMMARY AND CONCLUSION	11

#### FIGURES

Figure 1 Geological overview [35]: Map view with the area of Package 8 marked with a re	d
rectangle 5	
Figure 2 General View of the T-15 P1 (Main tunnel Portal)	7
Figure 3 General View of the T-15 P1 (Escape Portal)	7
Figure 4 General View of the T-15 P1 New Site Geological Investigations.	8
Figure 5 Outcrop-01 above the Main Tunnel Portal,	8
Figure 6 Outcrop-02 above the Escape Tunnel Portal	9
Figure 7 Quartzite photo from Borehole T15P1-BH1.	9

### TABLES

Table 1 Stratigraphic sequence in the project area of Package 8	6
Table 2 Dominant Discontinuities and Discontinuities properties Outcrop-01	10
Table 3 Dominant Discontinuities and Discontinuities properties-Outcrop-02	10
Table 4 RMR and GSI Values of Quartzite	10

#### APPENDIXES

I-Geological Outcrop Data, Borehole log and Core Photos.

II-Geological Map and Profile.

#### **1 INTRODUCTION**

Italferr and Lombardi JV " have been assigned as a Consultant by M/s. Rail Vikas Nigam Limited (RVNL) is a Public Sector Enterprise created by Ministry of Railways, Government of India, for consultancy services for "Detailed design & Project Management consultancy for construction of tunnels, bridges & formation works from chainage 101+310 to 117+365 under Package-8 in connection with new single line broad gauge rail link between Rishikesh and Karanprayag (125km) in state of Uttarakhand, India".

#### 1.1 Abbreviations

BH	Borehole
C/L	Centre Line
EL	Elevation
JV	Joint Venture
RVNL	Rail Vikas Nigam Limited
SSP	Surface Survey Mapping

#### **1.2 Purpose of the Report**

This report aims to describe the "T15P1 Alternative Main and Escape Tunnel Geological Site Assessment" due diligence performed based on the route analysis which are performed at the pre-design and design stages of the project, previous Geological, Geotechnical, Hydrogeological and Geophysical studies, Additional Geological-Geotechnical Site Investigations during Site Supervision stage, and conclusions of the assessment and presents an Executive Summary.

Along the field studies previous to start the excavation in the T15 P1 for the Main and the Escape tunnel a new alternative for the location of the Escape Tunnel's Portal has been study and found beneficial in terms of excavation time, earth movement and future maintenance requirements.

#### 1.3 Report Structure

This Report contains following items:

- Site Investigations and Observations
- Site specific Geological Assessment

- Site specific Geotechnical Assessment
- Site specific Hydrogeological Assessment

#### **2 EXECUTIVE SUMMARY**

The present report is addressing "T-15 P1 Main and Escape Tunnel Portal Geological Site Assessment " and presents an Executive Summary.

The Tunnel-15 is under the package-8 and is part of New Rail Link Project between Rishikesh to Karanprayag from chainage 108.950km to 115.958km (RVNL/RKSH-KNPG/TUNNEL /PKG-8). For the main reason of that report is the shifting Escape tunnel portal to the alternative location for this purpose additional surveying and geological investigations has been carry out to confirm the suitability of the new portal location. The alternative inlet portal of T15 is located around 20-25m inside to the tunnel with same alignment. The portal area is covered with thin slope wash/alluvial terrace material. Single track escape tunnel will be constructed after completion of the construction of the Inlet Portal structure.

#### **3 PROJECT GEOLOGY**

#### 3.1 Overview

The project area consists of high hills and mountains with narrow valleys, deep gorges i. e. having very high topographic gradients. The parts in the N, E and NE are the Tethyan Himalayans with snow cover throughout the year. The main river in the area is the Alaknanda River, which originates from the Satopanth-Bhagat Kharak group of glaciers. The major tributaries of the river Alaknanda are Dhauliganga, Patalganga, Nandakini, Mandakini and Pindar. The riverbed material mostly consists of pebbles, cobbles, boulders etc. in a sandy matrix resting over rocky floor. Fluvial terraces consisting of boulders, cobbles, pebbles admixed with sandy clay and thick sand horizons are preserved on the riverbanks. The Quaternary sediments are deposited in the form of fluvial terraces of river-borne material, glacial deposits and terminal moraines. The bedrock in the project area belongs to the Garhwal Grp., part of the Inner Lesser Himalaya. Figure 1 shows a geological sketch of the Indian Lesser Himalaya. Package 8 is in the area of the interference of Lesser and Higher Himalaya and lies in a tectonic foredeep. Within the Lesser Himalayan sequence, the phyllitic rocks of the Jaunsar Grp. are overridden by the rocks of the Garhwal Grp. along the North Almora Thrust (NAT), locally known as the Srinagar Thrust.



Figure 1 Geological overview [35]: Map view with the area of Package 8 marked with a red rectangle

#### 3.2 Stratigraphy

Geologically the area of Package 8 is part of the Inner Lesser Himalaya. The area consists of thick Quaternary cover and the rocks of the Garhwal Grp., which is of Meso-Proterozoic age. It forms a major part of the Lesser Himalaya and is represented by a thick sequence of sediments which show a low-grade metamorphism, i. e. consisting of quartzite with mafic metavolcanics and carbonate rocks.

The Garhwal Grp. is limited in the N by the Main Central Thrust and in the S by the Main Boundary Fault. The lithologies in the Garhwal Grp. are mainly quartzite, phyllite, carbonaceous slate, limestone and Epidiorite-Amphibolite-Metavolcanics. It is internally subdivided into the following rock units:

Domain	Group	Formation	Code	Age	Description	
Quaternary		Q2Fa	Recent	Boulder, Cobble, Pebble, Gravel, Sand, Silt and Clay.		
ya		Epidorite Amphibolite and Metavolcanics	βPt2e βPt2g βPt2gn		Lenses of Epidiorite, Amphibolite and Metavolcanics	
Inner Lesser Himalay	Garhwal	Berinag	Pt2gb	Meso-Proterc	Sericitic & Chloritic Quartzite, dark grey to brown Phyllite occasionally Chloritic, Graphitic and Carbonaceous, Quartz Schist and Chloritic Schist	
		Nagnithank	Pt2gn	ozoic	Quartzite with subordinate purple Phyllite and basic Metavolcanics	
		Pithograrh	Pt2gp		Dolomitic Limestone, Phyllite, carbonaceous Slate and Quartzite	

Table i enalgiapine cequence in the project and of i achage c	Table 1	Stratigraphic	sequence	in the proje	ect area of	Package 8
---	---------	---------------	----------	--------------	-------------	-----------

#### 4 GEOLOGICAL ASSESMENT

The alternative Escape Tunnel Portal of Tunnel 15 (Portal 1) is proposed at same tunnel alignment but around 20-25m inside to the tunnel. As topography of the Escape Portal, it is mostly flat area. The portal area is covered with slope wash/Alluvial terrace deposits. The material consists of boulder and cobbles of Quartzite&Metabasics with pebbles of subrounded fracments mixture of brown color silty sand and soil.

During site supervision works additional borehole T15P1-BH01 has been drilled on the alternative escape portal location to check the geological conditions and rock depth. T15P1-BH1 executed up to depth 20.00 meter and bed rock encountered at the depth of 2.00 meter. The bed rock up to 6.50m underlaying the alluvial terrace part is slightly weathered. The bed rock up to 6.50m is Whitish color, medium grained, medium strong, slightly weathered to fresh, caoted with Feo, after 6.50m-20.00m fresh, strong, joint surfaces stained Quartzite Rock.Low grade metamorphic rock of Garhwal Group. Depends on the borehole data, stratigraphic projection can be made as follows;

- Slope Wash/Alluvial terrace
- Quartzite

Figure 2,3,4 represents the topographical feature of Tunnel 15- P1 Portal.



Figure 2 General View of the T-15 P1 (Main tunnel Portal)



Figure 3 General View of the T-15 P1 (Escape Portal)



Figure 4 General View of the T-15 P1 New Site Geological Investigations.



Figure 5 Outcrop-01 above the Main Tunnel Portal,



Figure 6 Outcrop-02 above the Escape Tunnel Portal



Figure 7 Quartzite photo from Borehole T15P1-BH1.

During site investigations Geological maps,outcrop survey maps and borehole logs are prepared .These are given as an appendix.

#### **5 GEOTECHNICAL ASSESSMENT**

The rock outcrops are observed at two different locations. The rock mass is fresh to slightly weathered, strong rock, medium grained, stained in nature.

The orientation and other empirical properties of the major discontinuities have been determined and presented at the Table 1 outcrop-01 above Main tunnel and Table 2 outcrop-02 above escape tunnel area. This outcrop details given as an attachment with outcrop survey map.

Joint Set	Dip Amount (º)	Dip direction (°)	Spacing cm	Persistence (m)	Roughness	Aperture (mm)	Filling
J1	70	310	60-200mm	3-10m	Slightly rough	0.1-1 mm	surface stained
J2	50	035	60-500mm	3-10m	Slightly rough	0.1-1 mm	surface stained
J3	60	200	200-600mm	3-8m	Slightly rough	0.1-1 mm	surface stained
J4	28	030	60-200mm	3-10m	Slightly rough	0.1-1 mm	surface stained

Table 2 Dominant Discontinuities and Discontinuities properties Outcrop-01

Table 3 Dominant Discontinuities and Discontinuities properties-Outcrop-02

Joint Set	Dip Amount (°)	Dip direction (°)	Spacing cm	Persistence (m)	Roughness	Aperture (mm)	Filling
J1	47	015	60-200mm	1-3-10m	Slightly rough	0.1-1 mm	surface stained
J2	60	090	200-800mm	1-3m	Slightly rough	0.1-1 mm	surface stained
J3	62	178	20-400mm	1-3m	Slightly rough	0.1-1 mm	surface stained,soft filling >5mm
J4	77	325	60-200mm	1-3m	Slightly rough	0.1-1 mm	surface stained

The Empirical Rock Mass Rating (RMR) and Geological Strength Index (GSI) of the Quartzite is shown in the Table 2.

	Table 4 RMR	and	GSI	Values	of	Quartzite
--	-------------	-----	-----	--------	----	-----------

Rock Group	RMR	GSI
Quartzite	60	65

#### 6 PREVIOUS INVESTIGATIONS

In the Final Design stage GBR and GDR reports prepared by DDC teams.

That reports including outcrops geological surface survey mapping data around the new escape tunnel area which named as; SSP 267 and 268 and this survey data can be evaluate for new portal design too. It is similar Quartzite rocks that observed near the new escape tunnel portal area outcrops and borehole T15P1-BH1.

#### 7 HYDROGEOLOGICAL ASSESSMENT

Since the report prepared at the dry season, there is not any surface water observed at the portal site during the Geological Site Investigations.

Water table has not been determined during the borehole drilling T15P1-BH1. On the other hand, seasonal changes on the water table levels shouldn't be underestimate during the long-term slope stability analysis.

#### 8 SUMMARY AND CONCLUSION

The present report is addressing "T15P1 Alternative Main and Escape Tunnel Geological Site Assessment" structure.

After reviewing all the information, it has been concluded by Site Geology Team this location is giving advantages for Portal excavation works.

In new location its observed that portal excavation is going to be done in Quartzite rock.

APPENDIX I Geological Outcrop Data, Borehole log, Core Photos.

Outcrop Survey Form						C	Date:		21.04.2021		
Project:		PK	-08				C	Outcrop No:		T150C-	·01
Coordinat	es:	Е			Ν		۷	Veather:		Sunny	
		31	7221		335340	4	L	ogged by:		S.TEKES	5
Location		T1	5 Portal Area	(Ab	ove to M	IT)					
Lithology:		Qu	iartzite				F	ormation:		Garhwa	al Group
Colour:	Weathering: Grain Size: Strength:		Strength:								
Yellowish w	vhite	Fre	esh to slightly	'	Mediur	n	ν	/ery strong	strong		
Joint Set	Dip Amount	: <b>(°)</b>	Dip direction (°)	Spa cm	acing	Persistence (m)		Roughness	Apo (mr	erture n)	Filling
J1	70		310	60	-200mm	3-10m		Slightly rough	0.	1-1 mm	surface stained
J2	50		035	60	-500mm	3-10m		Slightly rough	0.	1-1 mm	surface stained
J3	60		200	200	0-600mm	3-8m		Slightly rough	0.	1-1 mm	surface stained
J4	28		030	60	-200mm	3-10m		Slightly rough	0.	1-1 mm	surface stained



	0	utcı	rop Survey	For	m		C	Date:		21.04.2	021
Project:		PK	-08				C	Dutcrop No:		T150C-	02
Coordinat	es:	Е			Ν		V	Veather:		Sunny	
		31	7219		335344	0	L	.ogged by:		S.TEKES	5
Location		T1.	5 Portal Area	(clo	se to ET)						
Lithology:		Qu	artzite				F	ormation:		Garhwa	al Group
Colour:		We	eathering:		Grain S	Size:	S	Strength:			
Yellowish v	vhite	Fre	esh to slightly	,	Mediun	n	V	/ery strong			
Joint Set	Dip Amount	: <b>(°)</b>	Dip direction (°)	Spa cm	acing	Persistence (m)		Roughness	Apo (mr	erture n)	Filling
J1	47		015	60	-200mm	1-3-10m		Slightly rough	0.	1-1 mm	surface stained
J2	60		090	200	)-800mm	1-3m		Slightly rough	0.	1-1 mm	surface stained
J3	62		178	20	-400mm	1-3m		Slightly rough	0.	1-1 mm	surface stained,soft filling >5mm
J4	77		325	60	-200mm	1-3m		Slightly rough	0.	1-1 mm	surface stained



								BC	DRE	EHO	OL	EL	OG						
Project	t Nam	ne			P	ACF	KAG	E-08			<u> </u>			Borehole No		T15I	P1-BH1		
Project	t Loca	ation			Т	' <b>15P</b> 1	1 Ne	w Es	cape	Tu	nnel	Port	al	Sheet		1 0	of 1		
Coord	inates	3		1	V	33	35345	5.72		C		<b>F1</b> 4		Start Date		14/0	4/2021		
(Sister	m/Sys	stem .		.) 1	Ξ	3.	17173	.66		(m)	) )	Elevan	763	Finish Date		22/0	4/2011		
YAS	Der. /	GW	depth (m)	Deri	nlik / I	Depth	(m)	Tarih	/ Date	;		Açıl	dama / Remaks	Drill Method		Rota	ary		
	1	Dry												Drill Rig		D-5	00		
														BH Depth (m)		20.0	00 m		
BH Depth	Sample No	B Sample Depth	Hole Diameter&Casing	insitu Tests	(SPT # of Blo 5 30	ation Test () ws 45	<sub>δ</sub> TCR (%)	» RQD (%)	%	Fracture Intercept/Run	Weathering	Strength		Description			Symbol		
- 1		1.00 1.50 2.50					20 50 55	- - 11					Overburden Consi cobbles of Quartzit fracments mixture	st of Medium to Fin e&Metabasics with of brown color silty drilling. 2.00	e grained, boulder a pebbles of subroun / sand wash out dur	and ded ing			
3		2.30 3.00 3.50 4.10 5.00					90 80 97 78 87	0 28 53 0					Whitish color,me medium strong, Vertical-subvertical	dium grained,fresl Quartzite,slightly r stained joints,surfaces staine	n-slightly weathere ough,joint surfaces d.	d, S			
6 7 8		6.50 7.50 7.75					95 80 96	80 0 64					0.00-0.0011 010310	6.50 -					
9 10 11 12		9.15 10.40 11.60 12.08 12.68					92 92 94 87	80 48 63 67					Whitish co rock,Quartzite	h color,medium grained,fresh,strong tzite,slightly rough,joint surfaces stained					
- 13		13.23 13.93 14.88					95 79 89	78 39 77					Joint set 1;50-55° s Joint set 1;70-75° si	urface staining,slight spacing urface staining,slight	y rough,moderately y rough,wide spacing				
- 15-		KA	YA KALİTE	Sİ / RQE	)		KIR	SOIL iklilik	- ROC (adet/m)	/FRAC	VALU TURES	JATIO (nos./m)	N BASINÇLI SU TESTİ / V	VATER PRESSURE TEST	SPT-YOĞUNLUK	/ SPT-DI	ENSITY		
	0 - 2 25 - 5 50 - 7 75 - 9 90 - 1 W1 1 W2 1 W3 1 W4 1 W5 0 W6	5 % 0 0 % 2 5 % 0 0 % 00 % WF Fresh Slightly Mod. W Highly V Complet Residue	Cok Zayıf / Zayıf / Orta / İyi / Çok İyi / EATHERING Weathered eathered weathered tely Weatheret LSoil	Very P Poor Fair Good Excelle	oor nt		<pre></pre>	1 3 10 50 >50 P Extrem Very W Weak Medius Strong	Masi Az kırık Çok kırı çok kırı çok kırı çok kırı arçalann STRI ely Weał /eak m Strong	f / M h / S kh / J kh / mş / G ENGTH c R5 R6 Stron	Massive lightly f Fracture Highly Crushed Very St Extremo g	fractured d fractured rong ely	1 lugeon       : Geçirimisi         1-5 lugeon       : Az geçiri         5-25 lugeon       : Geçirimli         > 25 Lugeon       : Cok geçi         WD       : Şelbi Tüp         / CR       : Karot Num. /         WPT       : Paker Den. /         PT       : Geçirgenlik D./ P         S       : Sediman	z / Impervious nli / Semi-pervious Pervious imli / Highly pervious / ABBREVIATIONS Shelby Tube Core Sample Packer Test ermeability T. Sediment	N:0 - 4 Cok Gevşi N:5 - 10 Gevşek N:11 - 30 Orta Sıkı N: 31 - 50 Sıkı N: > 50 Çok Sıkı NOTLAR / REMA	ARKS	Very Loose Loose M. Dense Dense Very Dense		

										BC	RE	EHC	DLE	LOG			
Proje İsr	mi	/ Pr	oject l	Name		PA	ACK	AG	E-08						Borehole No	T15	P1-BH1
Proje Ye	eri	/ Pro	oject L	ocatio	on	T1	5P1	Nev	v Esc	cape	Tun	nel	Porta	1	Sheet	1	of 2
Koordin	atlar	/ Co	ordinat	tes	Ν		33	53455	5.72		Kot Groi	und E	Elevatio	n 763	Start Date	14/	04/2021
(Sistem/	'Syste	em		)	Е		31	7173.	66		(m)			/03	Finish Date	22/	04/2011
BH Depth	Sample No	Sample Depth	ole Diameter&Casing	İnsitu Tests	Standar	rd Penetra (SPT of Blow	tion Test ) vs	TCR (%)	RQD (%)	SCR (%)	acture Intercept/Run	Weathering	Strength		Description		Symbol
m		m 15.00	Η		15	30	45	%	%	%	E —						
		15.73						100	80								
								97	90					W/bitish color	r medium arained fresh strong		
17		16.67 17.10						93	81					rock,Quartzite,sl	ightly rough, joint surfaces stained		
18								99	92								
19		18.35						94	89					Joint set 1;50-55° su	urface staining,slightly rough,moderately spacing		
20		19.25 20.00						100	84					Joint set 1;70-75° su	rrface staining,slightly rough,wide spacing	9	
	ľ	20.00													20.00		
_ 21																	
_ 22																	
_ 23																	
_ 24																	
_ 25																	
_26																	
_ 27																	
_ 28																	
_ 29																	
_ 30																	
31																	
32																	
_ 33																	
<u> </u>	[.	34.00															
Driller:								Logg	ed by:						Checked by:		













Project Project Coordi	Nam Loca	e															
Project Coordi	Loca					PA	CKA	GE	-08						Borehole No	T1	5P1-BH2
Coordi		tion				T15	5P1-E	BH0	2 N	lain	Tur	nnel	Porta	l	Sheet		1 of 1
(d) .	nates				N		335.	3428	}		Gr	ound	Elevati	20 762	Start Date	0	1/07/2021
Sisten	ı/Sys	tem		)	E		317	139			(m)	)	Lievau	/62	Finish Date	0	6/07/2011
YAS E	Der. /	GW d	lepth (m)	De	rinlik	k / Dep	pth (m	i) Ta	arih /	/ Date			Açık	lama / Remaks	Drill Method	R	otary
	Ľ	Dry													Drill Rig	D	-500
															BH Depth (m)	1	8.10 m
BH Depth	Sample No	B Sample Depth	Hole Diameter&Casing	Insitu Tests	Standard   (S # of	Penetration <sup>7</sup> SPT) f Blows <u>30</u>	Test (%) UCK (%) 45 %	6	» RQD (%)	%	Fracture Intercept/Run	Weathering	Strength		Description		Symbol
1		1.50							-						Hand excavation To	p Soil.	
3 -		3.00 4.00					4	1	-					Overburden Con cobbles of Quartzi fracments mixtur	2.80 sist of Medium to Fir ite&Metabasics with e of brown color silt	ne grained, boulder and pebbles of subrounder y sand wash out during	l d
-		4.50					2	8	-						drilling.		
5 -		5.00						6	- 24						4.80		
6		5.50					7	5	19					Whitish color,m medium strong	edium grained,fres g,Quartzite,slightly i	h-slightly weathered, rough,joint surfaces	
7		6.50 7.30					8	1	31						Stanley		
8							8	8	29								
0		8.50 9.00					8	6	68								
10		10.40					9	0	32					Joint set 1;75-80	℃ surface staining,slig spacing	htly rough,close to mod.	
11		11.60					8	8	32						11.50		
12							8	3	42						Quartz bar 	nd	
13 14		12.80 14.20					10	01	42					Greenish color,r medium strong,	nedium grained,fre: Sandstone-Quartzi surfaces staine	sh-slightly weathered, te,slightly rough,joint d	
15	_						8	8	38						15.00		
0 2: 50 7: 90	- 25 5 - 50 0 - 75 5 - 90 0 - 10	KA 5 % ( 0 % Z 5 % ( 0 % 1 00 % (	YA KALİTI Çok Zayıf Zayıf / Orta / İyi / Çok İyi /	SI / RC / Very Poor Fair Good Excel	2D Poor		к 1 1	SC IRIKL < 1 - 3 4 - 10 1 - 50 >50	DIL - LILIK ( ) ) 0 Pa	- ROC (adet/m) Masi Az kırık Kırıl Çok kırı arçalanm	CK E /FRAC f / 1 h / S kh / 1 kh / 1 hh / 1 hh / 1	VALU TURES Massive lightly f Fracture Highly Crushed	JATIO (nos./m) fractured ad fractured	N BASINÇLI SU TESTÎ / Î lugeon : Geçirim 1-5 lugeon : Az geçi 5-25 lugeon : Geçirim > 25 Lugeon : Çok geq	WATER PRESSURE TEST siz / Impervious rimii / Semi-pervious li Pervious șirimli / Highly pervious	SPT-YOĞUNLUK / SP           N:0 - 4         Çok Gevşek           N:5 - 10         Gevşek           N:11 - 30         Orta Sıkı           N:31 - 50         Sıkı           N: > 50         Çok Sıkı	T-DENSITY / Very Loose / Loose / M. Dense / Dense / Very Dense
W W W W	/1 F /2 S /3 N /4 H /5 C	WE fresh flightly ' fod. We flighly W	ATHERING Weathered eathered Veathered ely Weathered		I I I I I I I I	R0 E: R1 V R2 V R3 N R4 S	xtreme 'ery Wo Veak Mediun Strong	STRE ely Weak eak n Strong	ENGTH R5 R6 Stron	I Very St Extrem g	rong ely	KISALTMALAF       UD : Şelbi Tüp //       CR : Karot Num. /       WPT : Paker Den. /       PT : Geçirgenlik D./       S : Sediman /	R / ABBREVIATIONS Shelby Tube Core Sample / Packer Test Permeability T. Sediment	NOTLAR / REMARKS	5		

									BC	RE	ЕНС	DLE	LOG			
Proje İsmi	/ I	Project 1	Name		PA	ACK	KAG	E-08						Borehole No	T15	P1-BH1
Proje Yeri	/ P	roject L	ocatio	n	<b>T</b> 1	15P1	-BH	02 N	Iain	Tun	nel	Porta	1	Sheet	1	of 2
Koordinat	lar / Co	oordina	tes	N		3.	35342	8		Kot	und E	lovotic		Start Date	01	/07/2021
(Sistem/Sy	stem .		)	Е		3	17139	)		(m)		levan	762	Finish Date	06	/07/2011
BH Depth Sample No	Sample Depth	ا ole Diameter&Casing	İnsitu Tests	Standar	rd Penetra (SPT of Blow	tion Test	TCR (%)	RQD (%)	SCR (%)	racture Intercept/Run	Weathering	Strength		Description		Symbol
m	m	<u> </u>		15	30	45	%	%	%	년 						
16	16.00						94 85	41					Whitish color,me medium strong	edium grained,fresh-slightly we ,Quartzite,slightly rough,joint s stained	eathered, urfaces	
_ 17	- 10.00						95	26					Joint set 1;40-45° surf	ace staining,slightly rough,60-200r	nm spacing	
	18.10													(End of hole)		
_ 19																
_ 20																
_ 21																
_ 22																
_ 23																
_ 24																
_ 25																
_ 26																
_ 27																
_ 28																
_ 29																
_ 30																
_ 31																
_ 32																
_ 33																
_ 34	34.00															
Driller:							Logg	ed by:						Checked by:		









Project Project Coordi	Nam Loca	e															
Project Coordi	Loca					PA	CKA	GE	-08						Borehole No	T1	5P1-BH2
Coordi		tion				T15	5P1-E	BH0	2 N	lain	Tur	nnel	Porta	l	Sheet		1 of 1
(d) .	nates				N		335.	3428	}		Gr	ound	Elevati	20 762	Start Date	0	1/07/2021
Sisten	ı/Sys	tem		)	E		317	139			(m)	)	Lievau	/62	Finish Date	0	6/07/2011
YAS E	Der. /	GW d	lepth (m)	De	rinlik	k / Dep	pth (m	i) Ta	arih /	/ Date			Açık	lama / Remaks	Drill Method	R	otary
	Ľ	Dry													Drill Rig	D	-500
															BH Depth (m)	1	8.10 m
BH Depth	Sample No	B Sample Depth	Hole Diameter&Casing	Insitu Tests	Standard   (S # of	Penetration <sup>7</sup> SPT) f Blows <u>30</u>	Test (%) UCK (%) 45 %	6	» RQD (%)	%	Fracture Intercept/Run	Weathering	Strength		Description		Symbol
1		1.50							-						Hand excavation To	p Soil.	
3 -		3.00 4.00					4	1	-					Overburden Con cobbles of Quartzi fracments mixtur	2.80 sist of Medium to Fir ite&Metabasics with e of brown color silt	ne grained, boulder and pebbles of subrounder y sand wash out during	l d
-		4.50					2	8	-						drilling.		
5 -		5.00						6	- 24						4.80		
6		5.50					7	5	19					Whitish color,m medium strong	edium grained,fres g,Quartzite,slightly i	h-slightly weathered, rough,joint surfaces	
7		6.50 7.30					8	1	31						Stanley		
8							8	8	29								
0		8.50 9.00					8	6	68								
10		10.40					9	0	32					Joint set 1;75-80	℃ surface staining,slig spacing	htly rough,close to mod.	
11		11.60					8	8	32						11.50		
12							8	3	42						Quartz bar 	nd	
13 14		12.80 14.20					10	01	42					Greenish color,r medium strong,	nedium grained,fre: Sandstone-Quartzi surfaces staine	sh-slightly weathered, te,slightly rough,joint d	
15	_						8	8	38						15.00		
0 2: 50 7: 90	- 25 5 - 50 0 - 75 5 - 90 0 - 10	KA 5 % ( 0 % Z 5 % ( 0 % 1 00 % (	YA KALİTI Çok Zayıf Zayıf / Orta / İyi / Çok İyi /	SI / RC / Very Poor Fair Good Excel	2D Poor		к 1 1	SC IRIKL < 1 - 3 4 - 10 1 - 50 >50	DIL - LILIK ( ) ) 0 Pa	- ROC (adet/m) Masi Az kırık Kırıl Çok kırı arçalanm	CK E /FRAC f / 1 h / S kh / 1 kh / 1 hh / 1 hh / 1	VALU TURES Massive lightly f Fracture Highly Crushed	JATIO (nos./m) fractured ad fractured	N BASINÇLI SU TESTÎ / Î lugeon : Geçirim 1-5 lugeon : Az geçi 5-25 lugeon : Geçirim > 25 Lugeon : Çok geq	WATER PRESSURE TEST siz / Impervious rimii / Semi-pervious li Pervious șirimli / Highly pervious	SPT-YOĞUNLUK / SP           N:0 - 4         Çok Gevşek           N:5 - 10         Gevşek           N:11 - 30         Orta Sıkı           N:31 - 50         Sıkı           N: > 50         Çok Sıkı	T-DENSITY / Very Loose / Loose / M. Dense / Dense / Very Dense
W W W W	/1 F /2 S /3 N /4 H /5 C	WE fresh flightly ' fod. We flighly W	ATHERING Weathered eathered Veathered ely Weathered		I I I I I I I I	R0 E: R1 V R2 V R3 N R4 S	xtreme 'ery Wo Veak Mediun Strong	STRE ely Weak eak n Strong	ENGTH R5 R6 Stron	I Very St Extrem g	rong ely	KISALTMALAF       UD : Şelbi Tüp //       CR : Karot Num. /       WPT : Paker Den. /       PT : Geçirgenlik D./       S : Sediman /	R / ABBREVIATIONS Shelby Tube Core Sample / Packer Test Permeability T. Sediment	NOTLAR / REMARKS	5		

									BC	RE	HC	DLE	LOG			
Proje İsmi	/ I	Project 1	Name		PA	ACK	KAG	E-08						Borehole No	T15	P1-BH1
Proje Yeri	/ P	roject L	ocatio	n	<b>T</b> 1	15P1	-BH	02 N	Iain	Tun	nel	Porta	1	Sheet	1	of 2
Koordinat	lar / Co	oordina	tes	N		3.	35342	8		Kot	und E	lovotic		Start Date	01	/07/2021
(Sistem/Sy	stem .		)	Е		3	17139	)		(m)		levan	762	Finish Date	06	/07/2011
BH Depth Sample No	Sample Depth	ا ole Diameter&Casing	İnsitu Tests	Standar	rd Penetra (SPT of Blow	tion Test	TCR (%)	RQD (%)	SCR (%)	racture Intercept/Run	Weathering	Strength		Description		Symbol
m	m	<u> </u>		15	30	45	%	%	%	년 						
16	16.00						94 85	41					Whitish color,me medium strong	edium grained,fresh-slightly we ,Quartzite,slightly rough,joint s stained	eathered, urfaces	
_ 17	- 10.00						95	26					Joint set 1;40-45° surf	ace staining,slightly rough,60-200r	nm spacing	
	18.10													(End of hole)		
_ 19																
_ 20																
_ 21																
_ 22																
_ 23																
_ 24																
_ 25																
_ 26																
_ 27																
_ 28																
_ 29																
_ 30																
_ 31																
_ 32																
_ 33																
_ 34	34.00															
Driller:							Logg	ed by:						Checked by:		









# APPENDIX II

Alignment Plan, Geological Map and Profile.



 
 Polnt
 Easting

 P1
 317151.217

 P2
 317151.217

 P2
 317151.217

 P3
 317151.217

 P4
 317150.210

 P5
 317149.651

 P4
 317150.210

 P5
 317149.651

 P6
 317169.228

 P6
 317169.228

 P7
 317152.540

 P8
 317169.204

 P1
 317153.041

 P11
 317154.001

 P14
 317154.001

 P14
 317154.241

 P15
 317154.241

 P16
 317154.241

 P17
 317154.245

 P18
 317154.245

 P19
 317154.245

 P14
 317154.245

 P14
 317154.245

 P14
 317154.245

 P14
 317152.241

 P20
 317152.241

 P23
 317152.812

 P24
 317152.813

 P24
 317128.363

</tabula> P47 P44 P43 P40 P39 P38 P37 P35 P36 P34 P33 P30 P29 P28 P25 P26 P27 P46 P42 P32 317122.663 317148.25 317116.26 
 COORDINATES

 '9
 Northing
 Elevation

 2473
 355440-333
 743.00

 2689
 355440-2335
 743.00

 2681
 355440-2335
 743.00

 2681
 355440-2345
 743.00

 2681
 355440-2345
 743.00

 2681
 355440-2345
 743.00

 2681
 355346-2483
 743.00

 2683
 355346-2483
 743.00

 2640
 3553407\_416
 755.00

 3644
 3553407\_413
 755.00

 3644
 3553405\_413
 755.00

 3644
 3553405\_413
 755.00

 3644
 3553405\_413
 755.00

 3644
 3553405\_413
 755.00

 3644
 3553405\_413
 755.00

 3647
 755.00
 3553405\_4547
 755.00

 3647
 3553405\_4547
 755.00

 365405\_451
 755.00
 3553405\_4547
 755.00

 3653405\_4547
 755.00
 3553405\_4547
 755.00

 3353484 934 3353483 005 3353480 3353479 3353473 3353475 3353392 3353476.2 3353468. 33534 335339 335341 33533 3353477. 3353-3353395 3353390. 3353406 3353395. 33534 3353396 3353396. 3353 33534 3353: 33534 3353474 3353 3353416 33533 7765,00 7765,00 7765,00 7765,00 7755,00 7775,00 7775,00 7775,00 7765,00 785,00 Desci

PLAN VIEW (1:400)

5						Ţ		DET		PROJ	CLIER	REV 0	≻			TRANS															
F JV-P8	Project									ECT	7	DRAWN	VKS			VISSION STATU	Deputy T Georgi							Brldge-14 (A2	Portal T15-P1	Faciliti	(loosened Berinag Fo Nagnithan	Alluvial de	Existing ROV	Existing roa	rootpaut
с П	Author Phase											GT	GT			\$	eam Leader os Tziallas									8	rock blocks) ormation (Pt k Formation	posit Muvial deno	/ Pillar line	d/NH/	
CW	System	1		Ţ			۲ ۲					APPROVED	뭐					. –			ſ°			108+	108+	Chair	2) [2gb) - (Pt₂gn)	ei e			
3 DW	Doc.ty	pe		JNNEL-1	PLAN	CIVIL						30.06.2020 DATE	01.10.2020			APPROVAL RET	Team Lea Davic	Signature o	AGM/Pro Vikas E	GOOD	4			265.06	950.00	age	7			2	
001 A	Rev.	Revision	1	5, PORTAL-	I VIEW	WORKS						Final	Final De			URN STATUS:	ider (Design) de Fabbri	f DDC officers	SAVIAL OILICEIS Ojects/RKSH Bahuguna	) FOR C	20	1:400		316538.012	Easting 317151.225	1 Coordinate					
Scale	Dimension: A1 (8	Date 30.06.20		-							N,	Design (Hrst)st	esign (Second				Aut			ONSTR		(A1)		3353152.211	Northing 3353424.083						
		20	2									(uoissimar	Submission)	Ż	>		horized Signate Surjit Singh		CPM/RKSH Imansu Badon	UCTION	4										
	-	N. OF SN	:								-	STAT.					ory		_		ШÓ З										

All dimensions are given in meter     All dimensions are given in meter     The elevation levels are given as meter above sea level [m a.s.l]     The elevation levels are given as meter above sea level [m a.s.l]     Calinages and levels of contractor is responsible for providing his own survey     Calinages and levels of contractor survey approximate     All anomal positions of portul. (bridges and station location as the responsibility of the Contractor     Fixer location only for likewistion     Darawing is based on survey dated 28.08.2019     This drawing may be revised during the final design stage     This drawing may be revised during the final design stage     Main Turnel     Ecorpe Turnel     Contour		
All dimensions are given in meter     All dimensions are given in meter     All dimensions are given as meter above sea level [m a.s.l]     The devation levels are given as meter above sea level [m a.s.l]     All topography only for fluateduio & the contractor is responsible for providing his own survey     Chalmages and levels of corrected bodients are genorimate     All anougle positions of portal. Independent on contractor is responsible for providing his own survey     Chalmages and levels of corrected bodients are genorimate     Drawing is based on survey dated 20.08.2019     Drawing be based on survey dated 20.08.2019     This drawing may be revised during the fleat design stage     Eacope Turnel     Eacope Turnel     Contractor	)	Contour
All dimensions are given in meter     All dimensions are given in meter     The elevation levels are given as meter above sea level [m a.s.l]     The elevation levels are given as meter above sea level [m a.s.l]     All topography only for fluctuations & the contractor is responsible for providing his own survey     Chalmages and levels of bornhule locations are approximate     All anotal positions of point. Independent and station location is the responsibility of the Contractor     Fourier costing only for illustration     Drawing he based on survey dated 20.03.019     This drawing may be revised during the fluid design stage     Main Turnel		Escape Tunnel
Al dimensions are given in meter     Al dimensions are given is meter above sea level [m a.s.l]     The elevation levels are given as meter above sea level [m a.s.l]     All topography only for illustration & the contractor is responsible for providing his own survey     Chainages and levels of contractive contracts are approximate     All anatual positions of portul, totigges and station location as the responsibility of the Contractor     River location only for illustration     Drawing is based on survey dated 28.08.2019     This drawing may be revised during the final design stage		Main Tunnel
<ul> <li>All dimensions are given in meter</li> <li>All interceptions are given as meter above sea level [in a.s.l]</li> <li>The elevation levels are given as meter above sea level [in a.s.l]</li> <li>All topography only for illustration &amp; the contractor is responsible for providing his own survey</li> <li>Chainages and levels of borotic boardions are approximate</li> <li>All actual positions of portal: tridges and station location is the responsibility of the Contractor</li> <li>Fibrer location only for illustration</li> <li>Drawing the action survey to a station 22.00.2019</li> <li>This drawing may be revised during the final design stage</li> </ul>	-egend	_
All dimensions are given in meter     All dimensions are given in meter     Multicoparahy only for illustration & the contractor is responsible for providing its own survey     Charlanges and levels of toeroids locations are aproximate     All actual positions of portal, bridges and station location is exponsibility of the Contractor     Kerre location only willustration     This drawing may be revised during the final design stage		
All dimensions are given in meter     All dimensions are given in meter     All concerning only or illustrations are sponsately and the source of the s	based on survey dated 28.08.2019 ig may be revised during the final design stage	<ul> <li>Drawing is t</li> <li>This drawin</li> </ul>
Al dimensions are given in meter     Ald meters are given as meter above sea level [m a.s.]     The elevation levels are given as meter above sea level [m a.s.]     Chainages and levels of theoretic bicarloss are approximate     Chainages and levels of theoretic bicarloss are approximate     All actual positions of portal, bridges and station location is the responsibility of the Contrador     All actual positions of portal, bridges and station location is the responsibility of the Contrador	on only for illustration	<ul> <li>River location</li> </ul>
All dimensions are given in meter     All offensions are given in meter above sea level [in a.s.l]     The devation levels are given as meter above sea level [in a.s.l]     All poography only for illustration & the commator is responsible for providing his own survey     Chainages and levels of cobracted locations are approximate     Chainages and levels of cobracted locations are approximate	ositions of portal, bridges and station location is the responsibility of the Contractor	<ul> <li>All actual po</li> </ul>
All dimensions are given in meter     All dimensions are given as meter above sea level [m a.s.]     The devation levels are given as meter above sea level [m a.s.]     All topography only for illustration 8 the contractor is responsible for providing his own survey	and levels of borehole locations are approximate	<ul> <li>Chalnages.</li> </ul>
All dimensions are given in meter     The elevation levels are given as meter above sea level [m a.s.l]	phy only for illustration & the contractor is responsible for providing his own survey	<ul> <li>All topograp</li> </ul>
All dimensions are given in meter	on levels are given as meter above sea level [m a.s.]	<ul> <li>The elevation</li> </ul>
	ons are given in meter	<ul> <li>All dimensic</li> </ul>

Contour Footpath





Image: construction of the construction of	[-]		DOC							DETA			PROJE	CLIEN REV	0	⊳	TRANS								
1.250 (AT)         COOD FOR CONSTRUCTION         Signature of RNUL officers         Compression of RNUL officers         Signature of RNUL officers         Signature of Do officers         Signature of Do officers         Signature of Do officers         Signature of Do officers         Signature of Do officers         Signature of Do officers         Control Conferes         Signature of Do officers         Signature of Do officers         Signature of Do officers         Control Conferes         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature of Do officer         Signature officer Referer	F_JV-P8	Project	UMENT C				<u>×</u>	2		LED DESIGN (			Ö	T. DRAWN	SW	MS	MISSION STATI	Deputy Georg							
Image: Priority of Prio	-	Author		LONG						CONSULTANT				CHECKE	GŢ	GT	ŝ	ieam Leac ios Tziallas							
1.25 $1.25$ $1.25$ $1.25$ $1.25$ $1.25$ Signature of FWNL officers         CPMR/KSH Vision of EVNL officers         Signature of DDC officers         Team Leader (Design) Davie Fabler       Authorized Signatory Davie Fabler       Authorized Signatory Signature of DDC officers       Authorized Signatory Signature of DDC officers       Authorized Signatory Signature of DDC officers       Authorized Signatory Signatory       Authorized Signatory       Authorized Signatory       Signatory       Authorized Signatory       Signatory <thsignatory< th="">       Signatory</thsignatory<>	" Ç	System	-	TUDI		EXC/		GRUIPO			RISHIKE			D APP				s ter							
Source of RVNL officers       12.5       25         AdM(Projects)/RKSH Vikes Bahuguna       Himmsu Badoni Himmsu Badoni Vikes Bahuguna       Himmsu Badoni Himmsu Badoni Himmsu Badoni Vikes Bahuguna       Himmsu Badoni Himmsu Badoni Himmsu Badoni Nutriced Signatory Davide Fabbri	/ P3	Area		VAL S	TUT	AVATI		IT.		omba	SH - KA			ROVED	GT	Ŗ					0	0	ຼີ		
12.50 (A1)       12.50 (A1)         12.5       25         12.5       25         12.5       25         12.5       25         12.5       25         12.5       25         12.5       25         12.5       25         12.5       25         12.5       125         12.5       125         12.5       125         12.5       11         12.5       11         12.5       11         12.5       11         12.5       11         12.5       11         12.5       11         12.5       12.5         12.5       12.5         12.5       12.5         12.5       12.5         12.5       12.5         13.5       12.5         14.5       12.5         15.5       12.5         15.5       12.5         15.5       12.5         15.5       12.5         15.5       12.5         15.5       12.5         15.5       12.5         15.5       12.5	DW	Doc.typ	e	ECTIC	NEL-	ON AN	CIVII	ALFE ELLO STATO		rdi Enc	RANPR/			DATE	30.06.20	01.10.20	APPROVAL	Team L Da	Signature	AGM(F	impotitio	ö	5		
12.25 (A1)         12.5 Interventional problem intervention of the problem intervention o	001	Sub-doo type	:	N AL	15, P(	ND SL	- WOF	RR		lineer	WAG RA	1		_	120	20	RETURN ST	eader (L vide Fab	of DDC	rojects) s Bahug	of D/N	D T	l.		
All     25 m       ONSTRUCTION     25 m       CPMRKSH     Himansu Badoni       Himansu Badoni     January       Sign (Second Submission)     suph Singh       Repark     Repark       Repore	Þ	Rev. Rev.	FILE NAME	ONG ES	ORTAL-1	OPE SU	SKS	6		ina Limit	VIL LINK - P	2	(A Gove		Final D	Final De	ATUS:	Design) bri	officers	INA Inters	officere	DR CC	12.5	1-250 /	
25 m TRUCTION CPM/RKSH Himansu Badoni Himansu Badoni Raref Submission) Marker Surft Submission) Marker Margen Limited Trindue Enverprison Trindue E	30ale: 1:250	Dimensio	LOHTE_JV-F	CAPE	-	JPPOF		5		led - It	ONSULTAN		ra Pato 1 Vikas 1 Vikas	2	Design (F	sign (Se			┢			SNC	51 <u>[</u>	Δ1)	
25 m Standard Str. N. of 1 Standard Str. N.		n: A1 (841x55	8-UF-GE-P3-DV	TUNN		Ϋ́		dute	al.	alferr S	88 Q		स बिगम S Nigam ति एव पार of India En	EMARK	irst Submi	cond Subr		Authori: Su		CP Hima		TRU			
		4 	4001 A kest S	μ				ard	La la	p.A JV			ितिमिदेव Limitec दशिता terprise)		ssion)	nission)		zed Signa rjit Singh		M/RKSH nsu Bado					
		ω	n. N. of					least	•				de la	SI				tory		2.		Z	⊒ m		

# Notes:

- All dimensions are given in meter The elevation necks are given as meter above sea level [m\_aAi] All topography for Illustration only & contractor is responsible for providing the own survey All actual positions of portal, bridges and satisfon location is the responsibility of the contractor All actual positions of portal, bridges and satisfon location is the responsibility of the contractor All actual positions of portal, bridges and satisfon location is the responsibility of the contractor All actual positions of portal, bridges and satisfon location is the responsibility of the contractor Drawing Is based on survey dated 28.08,2019

Reference drawing: . LOHTE\_WARAU-ECWARDW001 . LOHTE\_WARAU-ECWARDW002 . LOHTE\_WARAU-ECWARDW002

Excavation line	Terrace Alluvium	Slope wash	Berinag Fm.	Leg	
				end	

T15P1	Rd.L.	R.L.	Fm.	Ę	MT	NSL	Abbre
Tunnel 15 Portal 1	Road Level	Rall Level	Formation	Escape Tunnel	Main Tunnel	Natural Surface Line	viations:

Rock-soll Interface