


**T-14P1 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.**

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ऋषिकेश (उत्तराखण्ड) / Rishikesh (Uttarakhand)

REVISION

			Geologist	
0	16.04.21	First Issue	Sidar Tekes	<i>dmh</i>
Rev.	Date	Issue, Modification	Prepared	

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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 "T14P1 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 T14 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.

This document has been prepared by Italferr and Lombardi JV. under the responsibility of the Site Team.

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-14 P1 Main and Escape Tunnel Portal Geological Site Assessment" and presents an Executive Summary.

The Tunnel-14 is under the package-8 and is part of New Rail Link Project between Rishikesh to Karanprayag from chainage 110.310km to 117.365km (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 T14 is located near the NH58 and near the Tilani. The portal area is covered with slope wash material/debris 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.

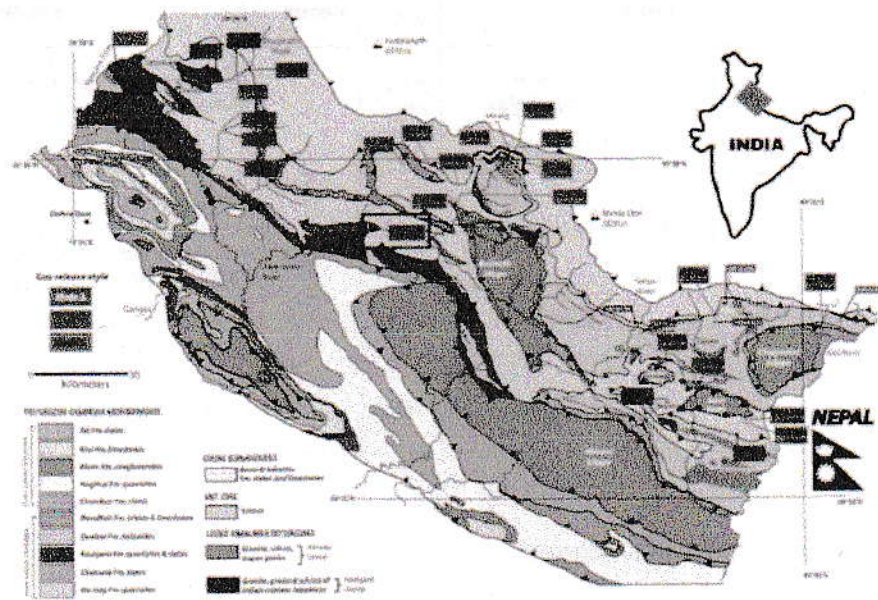


Figure 1 Geological overview [35]: Map view with the area of Package 8 marked with a red rectangle

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:

Table 1 Stratigraphic sequence in the project area of Package 8

Domain	Group	Formation	Code	Age	Description
Quaternary			<i>Q₂Fa</i>	Recent	Boulder, Cobble, Pebble, Gravel, Sand, Silt and Clay.
Inner Lesser Himalaya	Garhwal	Epidiorite Amphibolite and Metavolcanics	<i>βPt_{2e}</i> <i>βPt_{2g}</i> <i>βPt_{2gn}</i>	Meso-Proterozoic	Lenses of Epidiorite, Amphibolite and Metavolcanics
		Berinag	<i>Pt_{2gb}</i>		Sericitic & Chloritic Quartzite, dark grey to brown Phyllite occasionally Chloritic, Graphitic and Carbonaceous, Quartz Schist and Chloritic Schist
		Nagnithank	<i>Pt_{2gn}</i>		Quartzite with subordinate purple Phyllite and basic Metavolcanics
		Pithoragarh	<i>Pt_{2gp}</i>		Dolomitic Limestone, Phyllite, carbonaceous Slate and Quartzite

4 GEOLOGICAL ASSESSMENT

Tunnel-14 is located right after the Tilni bridge having non-consolidated, recent fluvial deposits (sand, gravels and pebbles) an overburden below 50 mtr. The area falls under Pithoragarh and Berinag rock formations of Garhwal group. In this formation the main rock type is Quartzite Phyllite and carbonaceous Slate. The tunnel portal starts with Phyllite and carbonaceous Slate. The start of tunnel is in low overburden and after some distance it will be increased. The minimum and maximum overburden is 18.89 and 68.37.

Bore Hole No.133 is in this section and the total length of bore hole is 50m in which the groundwater level was measured, SPT tests were performed and samples were analyzed in the laboratory. The maximum core recovery is 70% and the water table is around 32.5mtrs level.



Figure 2 General View of the T-14 start point

The alternative Escape Tunnel Portal of Tunnel 14 (Portal 1) is proposed at near the NH58 road, Right bank of Nala. As topography of the Escape Portal, existing slope is moderately steep. The portal area is covered with slope wash/debris. The material consists of Phyllite boulder and gravels mixed with silty soil and clay particles. The material is low-cohesive due to fines where clay particles are less. River borne/Alluvial deposits material is also present below the slope wash/debris material.

During site supervision works additional borehole T14P1-BH01, T14P1-BH02 and T14P1BH03 has been drilled on the alternative portal location to check the geological conditions. T14P1-BH1 executed up to depth 15.00 meter and bed rock encountered at the depth of 9.00 meter. The bed rock is Darkish grey fine to medium grained, very weak to weak, slightly weathered to fresh, coated with Feo, Pyhllite Rock. Low grade metamorphic rock of Garhwal Group. Depends on the borehole data, stratigraphic projection can be made as follows;

- Slope Wash/Debris Material.
- Alluvial Deposites
- Phyllite

Figure 3 represents the topographical feature of the hill slope of Tunnel 14- P1 Portal.



Figure 3 General View of the T-14 P1 (Escape Portal)



Figure 4 Outcrops near the Portal, slope wash/debris material



Figure 5 Outcrops near the Portal, Bed rock-Phyllite outcrops

During site investigations Geological maps and sections are prepared too. These are given as an attachment.

5 GEOTECHNICAL ASSESSMENT

The rock mass outcrop is observed at road level EL.706. The rock mass is slightly weathered, weak to medium strong, fine to medium grained, stained in nature.

The orientation and other empirical properties of the major discontinuities have been determined and presented at the Table 2. This outcrop photo given in Figure 3 and the coordinates are 310450;3353904.

Table 2 Dominant Discontinuities and Discontinuities properties

Joint Set	Dip Amount, (°)	Dip direction, (°)	Spacing, cm	Persistence (m)	Roughness	Aperture, mm	Filling
J1	25°	040°	<60mm	1-5 m	Smooth to slightly rough	0.1-1 mm	Usually stained, soft filling <5mm

J2	55°	070°	06-20 cm	1-3m	Slightly rough	0.1-1 mm	Rarely Iron stained, soft filling <5mm
J3	75°	180°	06-60 cm	1-3 m	Slightly rough	0.1-1 mm	Crushed filling

The Empirical Rock Mass Rating (RMR) and Geological Strength Index (GSI) of the Phyllite is shown in the Table 3.

Table 3 RMR and GSI Values of Phyllite

Rock Group	RMR	GSI
Phyllite	30-35	35-40

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 133/134/135 and this survey data can be evaluate for new portal design too. It is same Phyllite rocks that observed near the new escape tunnel portal area outcrops and borehole T14P1-BH1.

As an attachment geological map of this area given.

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.

However; water table has been determined during the borehole drilling T14P1-BH1 it was measured 9.0mm depth with the elavation. On the other hand, seasonal changes on the water table levels shouldn't be underestimate during the long-term slope stability analysis.

Theoretically, changes at the hydrostatic levels and saturation of the low-cohesive slope wash/debris material during the monsoon season can be increase the driving force, would be cause of long-term slope stability problems.

There is one nala near the portal area this area should be taken in consideration while portal design.

8 SUMMARY AND CONCLUSION

The present report is addressing "T14P1 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 starting construction works early too.

APPENDIX I

**Geological Outcrop Data, Borehole log,
Core Photos.**

Outcrop Survey Form			Date:	10/4/2021
Project:		RVNL Package-08		
Coordinates:	E	N	Outcrop No:	T14-OC1
	310450	3353904	Weather:	Sunny
Location:	New Proposal T14 Escape Tunnel near road NH58		Logged by:	S.TEKES
Lithology:	Phyllite		Formation:	Garhwal Group
Colour:	Weathering:	Grain Size:	Strength:	
Darkish Gray	Slightly Weathered to fresh	Fine to medium	Weak to medium strong	



Joint Set	Dip Amount (°)	Dip direction, (°)	Spacing cm	Persistence (m)	Roughness	Aperture (mm)	Filling
J1	25°	040°	<60mm	1-5 m	Smooth to slightly rough	0.1-1 mm	Usually stained, soft filling <5mm
J2	55°	070°	06-20 cm	1-3m	Slightly rough	0.1-1 mm	Rarely Iron stained, soft filling <5mm
J3	75°	180°	06-20 cm	1-3 m	Slightly rough	0.1-1 mm	Crushed filling

BOREHOLE LOG

Project Name		PACKAGE-08		BH No		T14P1-BH01			
Project Location		Escape Tunnel Portal		Sheet		1 of 1			
Coordinates (Sistem/System		N	3353844	Ground Elevation (m)	725	Start Date		17/03/2021	
		E	310436			Finish Date		20/03/2011	
YAS Der. / GW depth (m)		Derinlik / Depth (m)		Tarih / Date		Açıklama / Remaks		Drill Method	Rotary
9.00								Drill Rig	D-500
								BH Depth (m)	15.00 m

BH Depth m	Sample No	Sample Depth m	Hole Diameter & Casing	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	Fracture Interecep/Run	Weathering Strength	Description	Symbol			
				Insitu Tests									%	%	%
				15	30	45									
1	CR-1	1.00					30	-							
	CR-2	1.50					30	-							
2	CR-3						33	-			Darkish grey color, fine to medium grained Phyllite cobble and boulder size brown color silty sand. (Slope wash) 4.60-4.85m washed material only taken Spt results given refusal 6.30-7.00m washed material only taken 7.20-8.50 Crushed Phyllite rock fragments 8.50 Rounded to subrounded, white to grey coarse gravel and cobble size rock fragments. (Alluvial terrace) 9.00 Darkish grey color, fine to medium grained, fresh-slightly weathered, very weak to weak Phyllite/Slate, coated with FeO Joint set 1:50-55 surface staining with brown color, planar, slightly rough. Joint set 1:70-75 surface staining with brown color, planar, slightly rough. 11.60-11.70 Crushed zone 13.50-13.60 Crushed zone 15.00				
3	CR-4	3.00					37	-							
4	CR-5	4.50					30	-							
5	CR-6	5.00					35	-							
6	CR-7	6.00					30	-							
7	CR-8	7.00					40	-							
	CR-9	7.20													
8	CR-10						63	-							
	CR-11	8.40													
	CR-12	8.50													
9	CR-13	9.00					20	-							
	CR-14	9.50					40	-							
	CR-15	9.75					20	-							
10	CR-16	10.25					70	-							
	CR-17	11.00					60	-							
11	CR-18														
	CR-19	12.50					83	-							
12	CR-20														
	CR-21	14.00					100	9							
13	CR-22														
	CR-23														
14	CR-24														
	CR-25														
15	CR-26														
	CR-27														
	CR-28														
	CR-29														
	CR-30														
	CR-31														
	CR-32														
	CR-33														
	CR-34														
	CR-35														
	CR-36														
	CR-37														
	CR-38														
	CR-39														
	CR-40														
	CR-41														
	CR-42														
	CR-43														
	CR-44														
	CR-45														
	CR-46														
	CR-47														
	CR-48														
	CR-49														
	CR-50														

ZEMİN - KAYA DEĞERLENDİRMESİ / SOIL - ROCK EVALUATION

KAYA KALİTESİ / RQD		KIRIKLILIK (adet/m) FRACTURES (nos./m)	BASINÇLI SU TESTİ / WATER PRESSURE TEST	SPT-YOĞUNLUK / SPT-DENSITY
0 - 25 %	Çok Zayıf / Very Poor	<1 Masif / Massive	1 lugoon : Geçirimsiz / Impervious	N : 0 - 4 Çok Gevşek / Very Loose
25 - 50 %	Zayıf / Poor	1 - 3 Az kırıklı / Slightly fractured	1-5 lugoon : Az geçirimli / Semi-pervious	N : 5 - 10 Gevşek / Loose
50 - 75 %	Orta / Fair	4 - 10 Kırıklı / Fractured	5-25 lugoon : Geçirimli Pervious	N : 11 - 30 Orta Sıkı / M. Dense
75 - 90 %	İyi / Good	11 - 50 Çok kırıklı / Highly fractured	> 25 Lugoon : Çok geçirimli / Highly pervious	N : 31 - 50 Sıkı / Dense
90 - 100 %	Çok İyi / Excellent	>50 Parçalanmış / Crushed		N : > 50 Çok Sıkı / Very Dense
WEATHERING		STRENGTH	KISALTMALAR / ABBREVIATIONS	NOTLAR / REMARKS
W1	Fresh	R0 Extremely Weak	RS Very Strong	UD : Şelbi Tüp / Shelby Tube
W2	Slightly Weathered	R1 Very Weak	RE Extremely	CR : Karot Num. / Core Sample
W3	Mod. Weathered	R2 Weak	STRONG	WPT : Paket Den. / Packer Test
W4	Highly Weathered	R3 Medium Strong		PT : Geçirgenlik D/ Permeability T.
W5	Completely Weathered	R4 Strong		S : Sediman / Sediment
W6	Residual Soil			

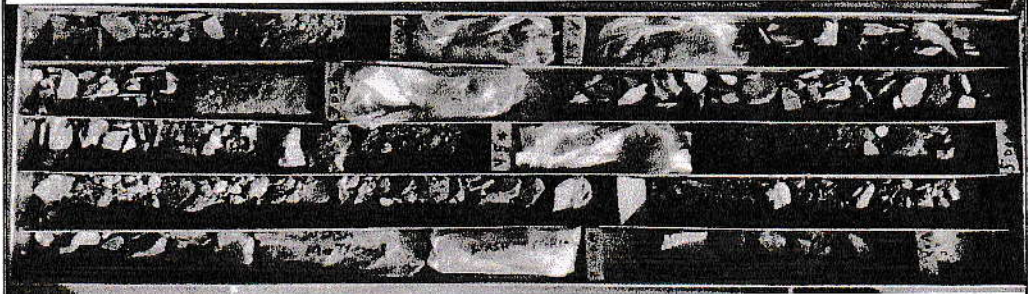
Sondör/Driller:

Logu Yapan/Logged by:

Kontrol/Checked by:

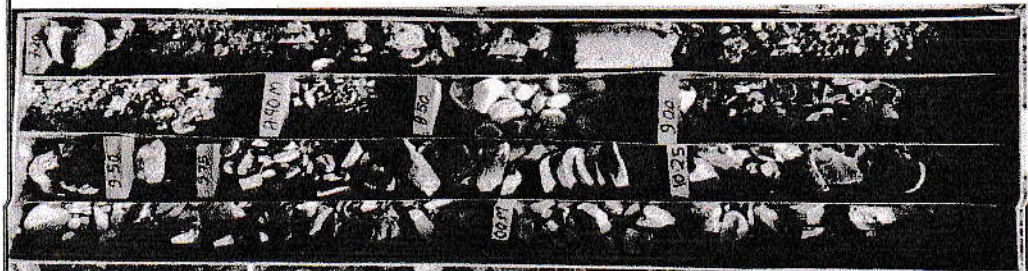
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH1
Sandık No / Box No : 1 / 3
Derinlik / Depth : 0.00 m. - 7.20 m.



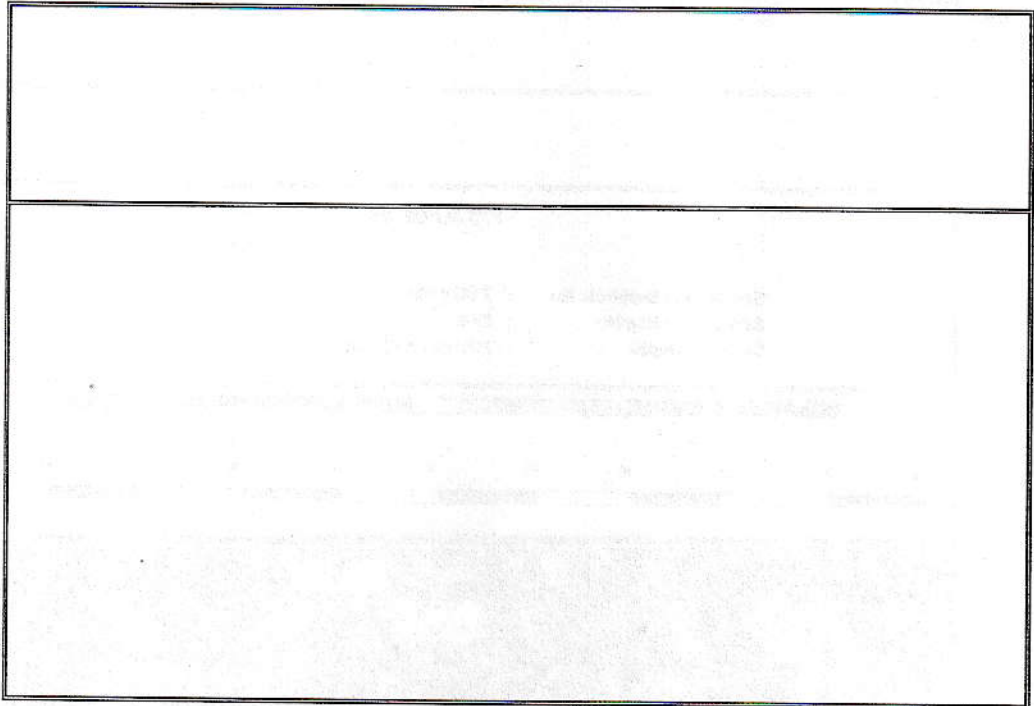
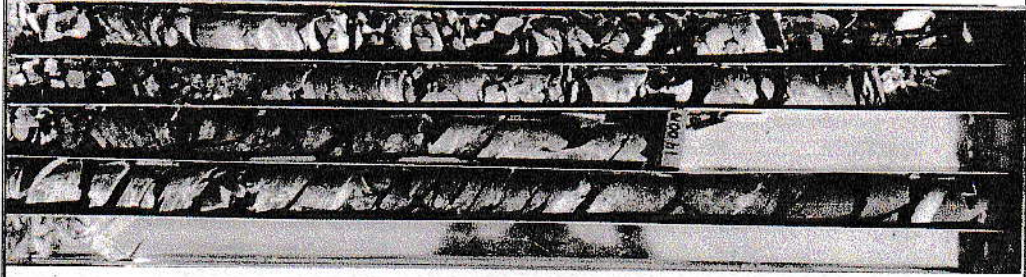
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH1
Sandık No / Box No : 2 / 3
Derinlik / Depth : 7.20 m. - 11.50 m.



PACKAGE-08

Sondaj No / Borehole No : T14P1-BH1
Sandık No / Box No : 3 / 3
Derinlik / Depth : 11.50 m. - 15.00 m.



BOREHOLE LOG

Project Name		PACKAGE-08		Borehole No		T14P1-BH2					
Project Location		T14P1 Main Tunnel		Sheet		1 of 3					
Coordinates (Sistem/System		N 3353758		Ground Elevation (m) 742		Start Date		26/03/2021			
		E 310350				Finish Date		13/04/2011			
YAS Der. / GW depth (m)		Derinlik / Depth (m)		Tarih / Date		Açıklama / Remarks		Drill Method		Rotary	
								Drill Rig		D-500	
								BH Depth (m)		49.00 m	

BH Depth m	Sample No	Sample Depth m	Hole Diameter & Casing	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	Fracture Intercept/Run	Weathering	Strength	Description	Symbol
				# of Blows									
				15	30	45							
1		0.50					40	-				Overburden Consist of Medium to Fine grained, whitish, greenish, purple color, boulder, cobbles and gravel of Quartzite & Metavolcanics with mixture of brown color silty sand wash out during drilling.	
2		1.50					35	-					
3		2.00					60	-					
4		3.50					37	-					
5		4.00					34	-					
6		5.00					35	-					
7		5.50					30	-					
8		7.00					23	-					
9		8.00					20	-					
10		9.50					40	-					
11		10.00					50	-					
12		11.00					30	-					
13		11.50					30	-					
14		12.00					20	-					
15		12.50					24	-					
		14.00					40	-					
		14.50					40	-					
		15.00					40	-					

SOIL - ROCK EVALUATION

KAYA KALİTESİ / RQD		KIRIKLILIK (adet/m) / FRACTURES (nos./m)		BASINÇLI SU TESTİ / WATER PRESSURE TEST		SPT-YOĞUNLUK / SPT-DENSITY	
0 - 25 %	Çok Zayıf / Very Poor	< 1	Masif / Massive	1 lugoon	: Geçirimsiz / Impervious	N: 0 - 4	Çok Gevşek / Very Loose
25 - 50 %	Zayıf / Poor	1 - 3	Az kırıklı / Slightly fractured	1-5 lugoon	: Az geçirimli / Semi-pervious	N: 5 - 10	Gevşek / Loose
50 - 75 %	Orta / Fair	4 - 10	Kırıklı / Fractured	5-25 lugoon	: Geçirimli Pervious	N: 11 - 30	Orta Sıkı / M. Dense
75 - 90 %	İyi / Good	11 - 50	Çok kırıklı / Highly fractured	> 25 Lugoon	: Çok geçirimli / Highly pervious	N: 31 - 50	Sıkı / Dense
90 - 100 %	Çok İyi / Excellent	> 50	Parçalanmış / Crushed			N: > 50	Çok Sıkı / Very Dense
WEATHERING		STRENGTH		KISALTMALAR / ABBREVIATIONS		NOTLAR / REMARKS	
W1	Fresh	R0	Extremely Weak	R5	Very Strong	UD	: Şebhi Tüp / Shelby Tube
W2	Slightly Weathered	R1	Very Weak	R6	Extremely	CR	: Karot Num. / Core Sample
W3	Mod. Weathered	R2	Weak		Strong	WPT	: Packer Den. / Packer Test
W4	Highly Weathered	R3	Medium Strong			PT	: Geçirgenlik D./ Permeability T.
W5	Completely Weathered	R4	Strong			S	: Sediman / Sediment
W6	Residual Soil						

Checked by:

Driller:

Logged by:

BOREHOLE LOG

Project Name		PACKAGE-08		Borehole No	T14P1-BH2
Project Location		T14P1 Main Tunnel		Sheet	2 of 3
Coordinates (System	N	3353758		Ground Elevation (m)	742
	E	310350			
				Finish Date	13/04/2011

BH Depth m	Sample No	Sample Depth m	Hole Diameter & Casing	Insitu Tests	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	SCR (%)	Fracture Intercept/Run	Weathering	Strength	Description	Symbol	
					# of Blows											
					15	30	45									
15.00																
16		15.50					40	-						Overburden Consist of Medium to Fine grained, whitish, greenish, purple color, boulder, cobbles and gravel of Quartzite & Metavolcanics with mixture of brown color silty sand wash out during drilling.		
17		17.00					37	-								
18		17.50					40	-								
19		19.00					50	-								
20		20.00					30	-								
21		21.50					27	-								
22		23.00					70	-								
23		24.50					60	-								
24		26.00					27	-								
25		27.50					25	-								
26		28.00					40	-								
27		29.00					55	-								
28		30.00					30	-								
29		30.50					16	-								
30		31.50					40	-								
31		32.50					23	-								
32		34.00					13	-								
33																
34																

34.00 (End of hole)

Driller: _____ Logged by: _____ Checked by: _____

BOREHOLE LOG

Project Name		PACKAGE-08		Borehole No	T14P1-BH2	
Project Location		T14P1 Main Tunnel		Sheet	3 of 3	
Coordinates (System)	N	3353758	Ground Elevation (m)	742	Start Date	26/03/2021
	E	310350			Finish Date	13/04/2021

BH Depth m	Sample No	Sample Depth m	Hole Diameter & Casing	Insitu Tests	Laboratory Tests	TCR (%)	RQD (%)	SCR (%)	Fracture Intercept/Run	Weathering	Strength	Description	Profil Symbol
						%	%	%					
35		34.00				13	-					Overburden Consist of Medium to Fine grained, whitish, greenish, purple color, boulder, cobbles and gravel of Quartzite & Metavolcanics with mixture of brown color silty sand wash out during drilling.	
36		36.00				30	-						
37		37.00				14	-						
38		37.50				70	-						
39		38.50				30	-						
40		40.00				12	-						
41		40.50				10	-						
42		41.00				20	-						
43		41.50				07	-						
44		42.50				50	-						
45		43.00				24	-					Darkish grey color, fine to medium grained, slightly to mod. weathered, very weak to weak, Phyllite/Slate, coated with FeO	
46		43.50				40	-						
47		44.00				30	-						
48		44.60				25	-						
49		45.60				30	-						
50		46.60				45	-						
51		47.60				20	-						
52		48.60				63	-						
53		49.00											

REMARKS:

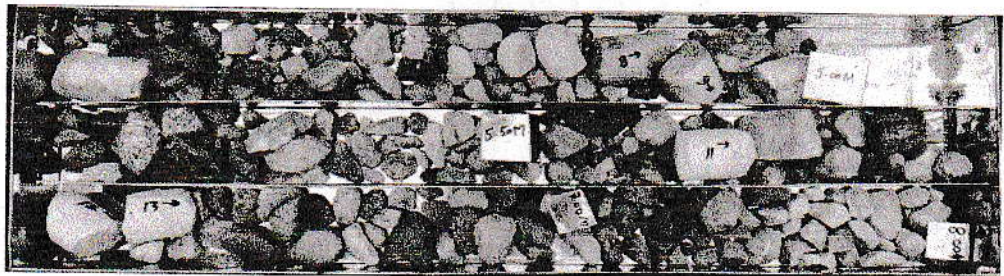
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 1 / 9
Derinlik / Depth : 0.00 m. - 4.00 m.



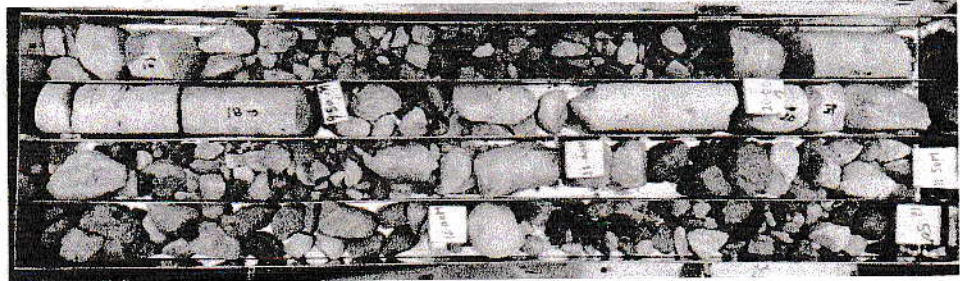
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 2 / 9
Derinlik / Depth : 4.00 m. - 8.00



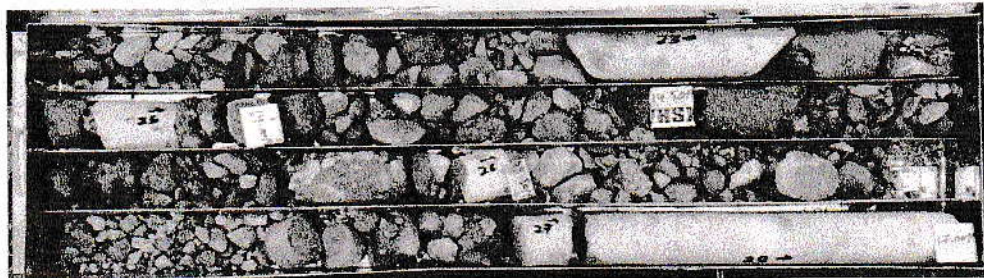
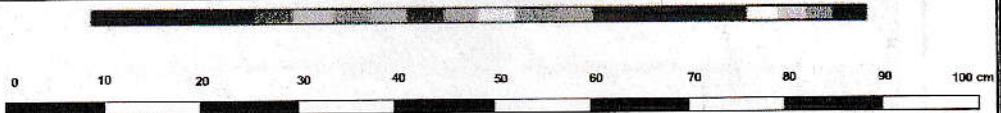
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 3 / 9
Derinlik / Depth : 8.00 m. - 12.50 m.



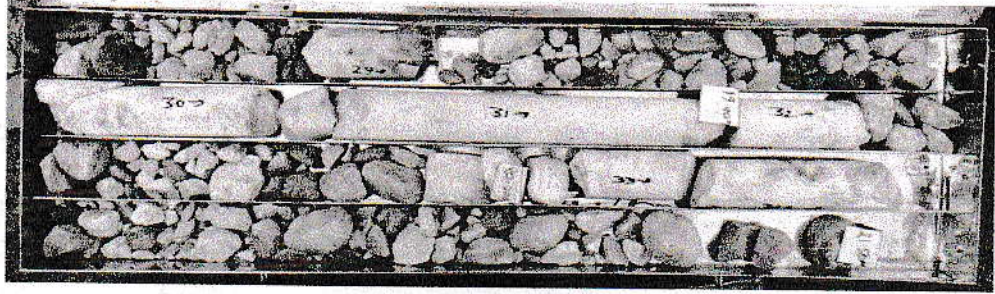
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 4 / 9
Derinlik / Depth : 12.50 m. - 17.00



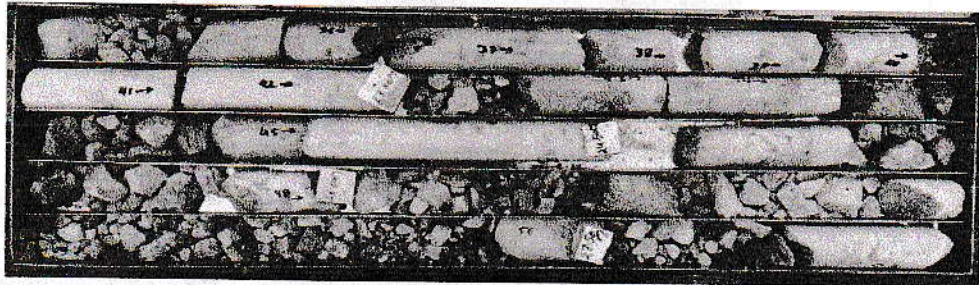
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 5 / 9
Derinlik / Depth : 17.00 m. - 21.50 m.



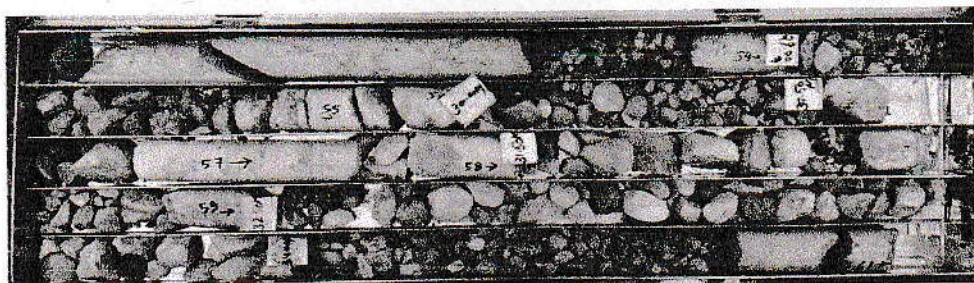
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 6 / 9
Derinlik / Depth : 21.50 m. - 28.00



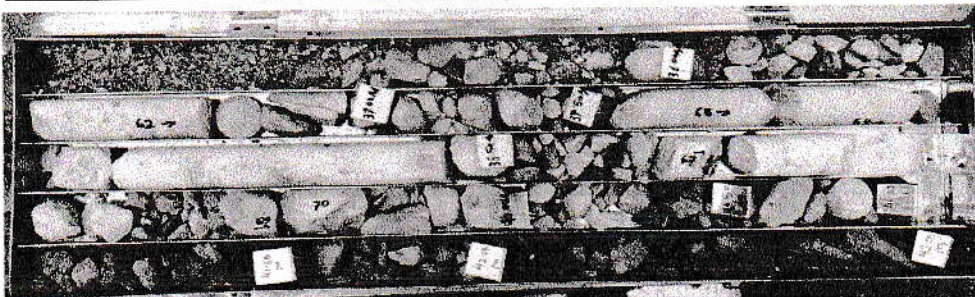
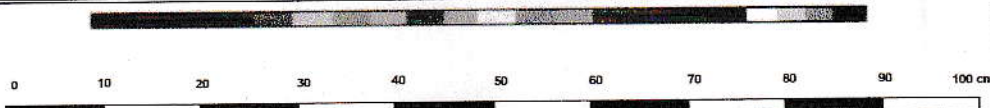
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 7 / 9
Derinlik / Depth : 28.00 m. - 35.00 m.



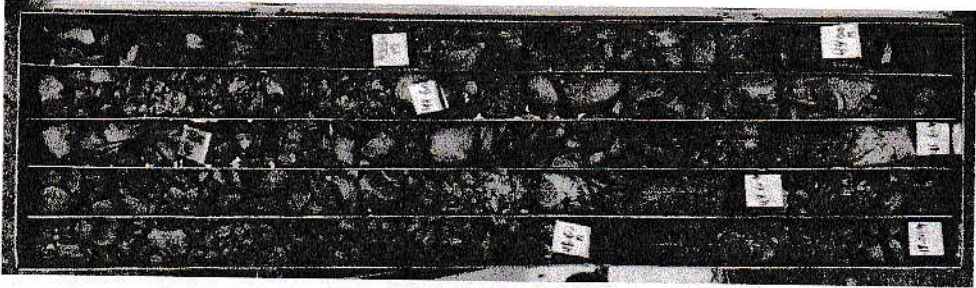
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 8 / 9
Derinlik / Depth : 35.00 m. - 43.00 m.



PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No : 9 / 9
Derinlik / Depth : 43.00 m. - 49.00 m.



PACKAGE-08

Sondaj No / Borehole No : T14P1-BH02
Sandık No / Box No :
Derinlik / Depth :



BOREHOLE LOG

Project Name		PACKAGE-08		Borehole No	T14P1-BH3	
Project Location		T14P1 Main Tunnel		Sheet	1 of 4	
Coordinates (Sistem/System	N	3353729	Ground Elevation (m)	763	Start Date	26/04/2021
	E	310384			Finish Date	16/05/2011
YAS Der. / GW depth (m)	Derinlik / Depth (m)	Tarih / Date	Açıklama / Remaks		Drill Method	Rotary
					Drill Rig	D-500
					BH Depth (m)	63.00 m

BH Depth m	Sample No	Sample Depth m	Hole Diameter&Casing	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	Fracture Intercept/Run	Weathering Strength	Description	Symbol
				# of Blows								
				15	30	45	%	%	%			
1		1.50					50	-			Overburden Consist of Medium to Fine grained, whitish, greenish, purple color, boulder, cobbles and gravel of Quartzite & Metavolcanics with mixture of brown color silty sand wash out during drilling.	
2							33	-				
3		3.00					30	-				
4		4.00					50	-				
5		5.00					35	-				
6		6.00					40	-				
7		7.00					20	-				
8		8.50					30	-				
9		9.00					20	-				
10		10.00					35	-				
11		10.50					30	-				
12		11.50					20	-				
13		12.00					24	-				
14		12.50					50	-				
15		13.00					30	-				
		13.50					30	-				
		14.50					15	-				
		15.00					18	-				

SOIL - ROCK EVALUATION

KAYA KALİTESİ / RQD		KIRIKLILIK (adet/m) / FRACTURES (nos./m)		BASINÇLI SU TESTİ / WATER PRESSURE TEST		SPT-YOĞUNLUK / SPT-DENSITY	
0 - 25 %	Çok Zayıf / Very Poor	< 1	Masif / Massive	1 lugoon	: Geçirimsiz / Impervious	N : 0 - 4	Çok Gevşek / Very Loose
25 - 50 %	Zayıf / Poor	1 - 3	Az kırıklı / Slightly fractured	1-5 lugoon	: Az geçirimli / Semi-pervious	N : 5 - 10	Gevşek / Loose
50 - 75 %	Orta / Fair	4 - 10	Kırıklı / Fractured	5-25 lugoon	: Geçirimli / Pervious	N : 11 - 30	Orta Sıkı / M. Dense
75 - 90 %	İyi / Good	11 - 50	Çok kırıklı / Highly fractured	> 25 lugoon	: Çok geçirimli / Highly pervious	N : 31 - 50	Sıkı / Dense
90 - 100 %	Çok İyi / Excellent	> 50	Parçalanmış / Crushed			N : > 50	Çok Sıkı / Very Dense
WEATHERING		STRENGTH		KISALTMALAR / ABBREVIATIONS		NOTLAR / REMARKS	
W1	Fresh	R0	Extremely Weak	Rs	Very Strong	UD	: Şelbi Tüp / Shelby Tube
W2	Slightly Weathered	R1	Very Weak	R6	Extremely Strong	CR	: Karot Num. / Core Sample
W3	Mod. Weathered	R2	Weak			WPT	: Paker Den. / Packer Test
W4	Highly Weathered	R3	Medium Strong			PT	: Geçirgenlik D / Permeability T.
W5	Completely Weathered	R4	Strong			S	: Sediman / Sediment
W6	Residual Soil						

Driller:

Logged by:

Checked by:

BOREHOLE LOG

Project Name		PACKAGE-08		Borehole No	T14P1-BH3	
Project Location		T14P1 Main Tunnel		Sheet	2 of 4	
Coordinates (System	N	3353729		Ground Elevation (m)	763	
	E	310384				Start Date
					Finish Date	16/05/2011

BH Depth m	Sample No	Sample Depth m	Hole Diameter&Casing	Insitu Tests	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	SCR (%)	Fracture Intercept/Run	Weathering	Strength	Description	Symbol
					# of Blows										
					15	30	45								
15.00															
16		15.50					18	-							
17		16.50					32	-							
18		17.50					43	-							
19		18.50					43	-							
20		19.50					30	-							
21		20.50					20	-							
22		21.50					10	-							
23		22.50					32	-							
24		23.50					45	-							
25		25.00					43	-							
26		26.00					35	-							
27		27.00					55	-							
28		28.00					25	-							
29		29.00					35	-							
30		30.00					18	-							
31		31.00					52	-							
32		31.50					28	-							
33		32.50					52	-							
34		33.50					55	-							
		34.00					72	-							

Overburden Consist of Medium to Fine grained, whitish, greenish, purple color, boulder, cobbles and gravel of Quartzite & Metavolcanics with mixture of brown color silty sand wash out during drilling.

Driller: _____ Logged by: _____ Checked by: _____

BOREHOLE LOG

Project Name		PACKAGE-08		Borehole No	T14P1-BH3
Project Location		T14P1 Main Tunnel		Sheet	3 of 4
Coordinates (System	N	3353729		Ground Elevation (m)	763
	E	310384			
				Start Date	26/04/2021
				Finish Date	16/05/2021

BH Depth m	Sample No	Sample Depth m	Hole Diameter&Casing	Insitu Tests	Laboratory Tests	TCR (%)	RQD (%)	SCR (%)	Fracture Intercept/Run	Weathering	Strength	Description	Profile Symbol
						%	%	%					
34.00		34.00				72	-					Overburden Consist of Medium to Fine grained, whitish, greenish, purple color, boulder, cobbles and gravel of Quartzite & Metavolcanics with mixture of brown color silty sand wash out during drilling.	
34.50		34.50				45	-				See previous page		
35.00		35.50				60	-						
36.00		36.50				20	-						
37.00		37.00				25	-						
38.00		38.00				36	-						
39.00		39.00				30	-						
40.00		40.00				16	-						
40.50		40.50				45	-						
41.00		41.50				13	-						
42.00		42.00				20	-						
43.00		43.00				20	-						
44.00		44.50				10	-						
45.00		45.00				80	-						
46.00		46.00				20	-						
47.00		47.50				20	-						
48.00		48.00				70	-						
49.00		49.00				60	-						
49.50		49.50				15	-						
50.00		50.00				25	-						
51.00		51.00				47	-						
52.00		52.00											
53.00		53.00											

REMARKS:

BOREHOLE LOG

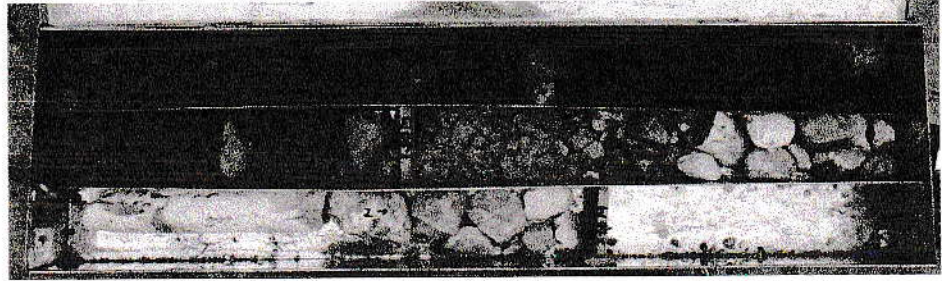
Project Name		PACKAGE-08		Borehole No	T14P1-BH3
Project Location		T14P1 Main Tunnel		Sheet	4 of 4
Coordinates (System)	N	3353729		Ground Elevation (m)	763
	E	310384			
				Start Date	26/04/2021
				Finish Date	16/05/2011

BH Depth m	Sample No	Sample Depth m	Hole Diameter & Casing	In situ Tests	Laboraturar Deneyleri Laboratory Tests	TCR (%) %	RQD (%) %	SCR (%) %						Description	Symbol
54		53.00				33	22							See previous page	
55		54.50				10	-							Darkish grey color, fine to medium grained, slightly to mod. weathered, very weak to weak, Phyllite/Slate, coated with FeO	
56		56.00				30	-								
57		57.00				40	-								
58		57.50				16	-								
58		58.00				16	-								
59		58.50				25	-								
60		59.50				40	15								
61		60.50				83	56								
62		62.00				60	-								
63		63.00													63.00
64															
65															
66															
67															
68															
69															
70															
71															
72															

REMARKS:

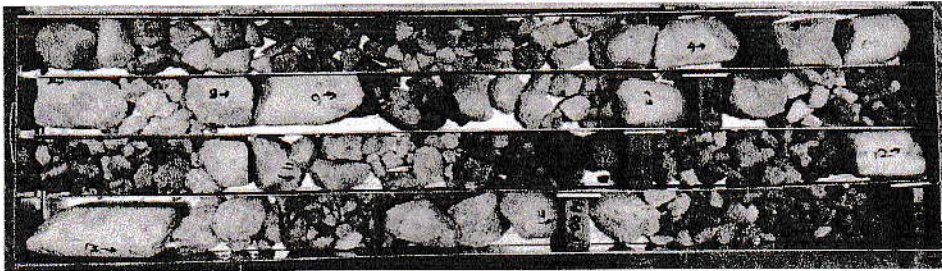
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 1 / 12
Derinlik / Depth : 0.00 m. - 3.00 m.



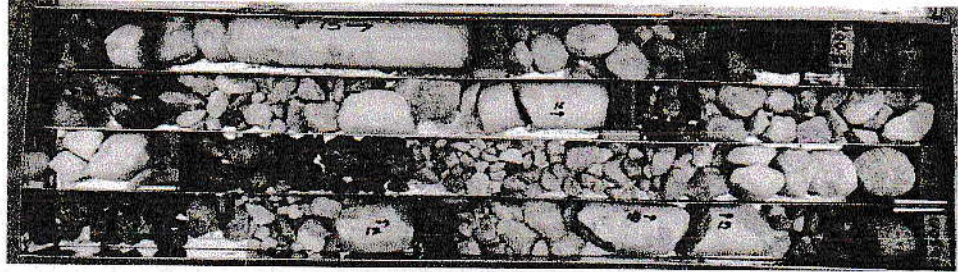
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 2 / 12
Derinlik / Depth : 3.00 m. - 7.50



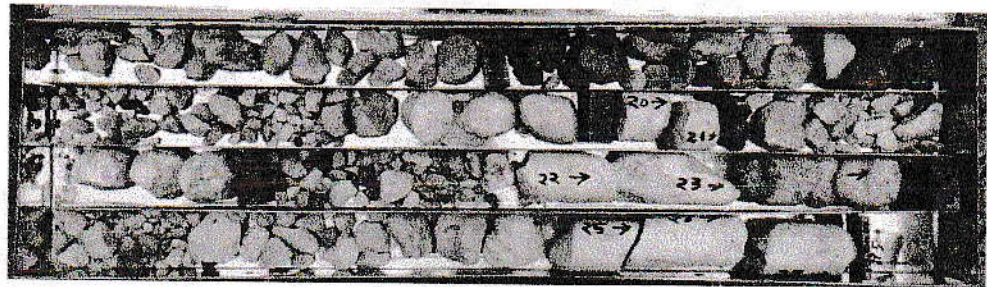
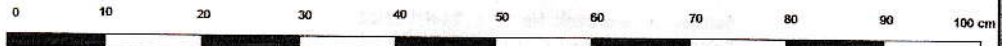
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 3 / 12
Derinlik / Depth : 7.50 m. - 12.50 m.



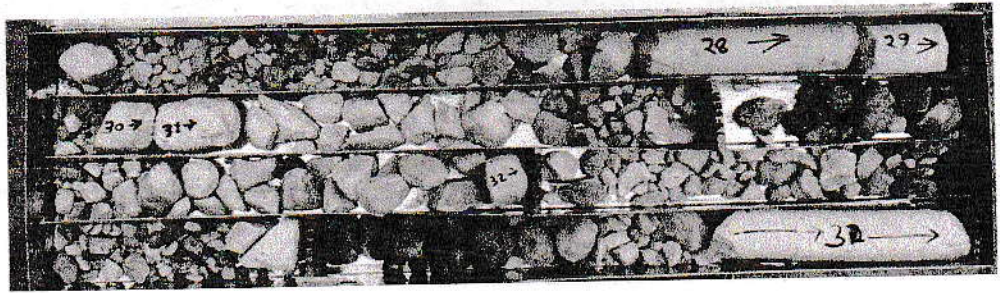
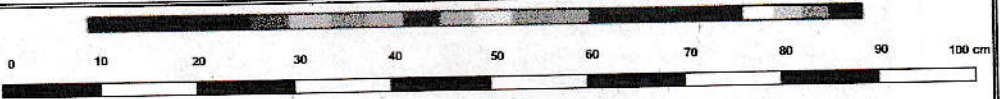
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 4 / 12
Derinlik / Depth : 12.50 m. - 17.50



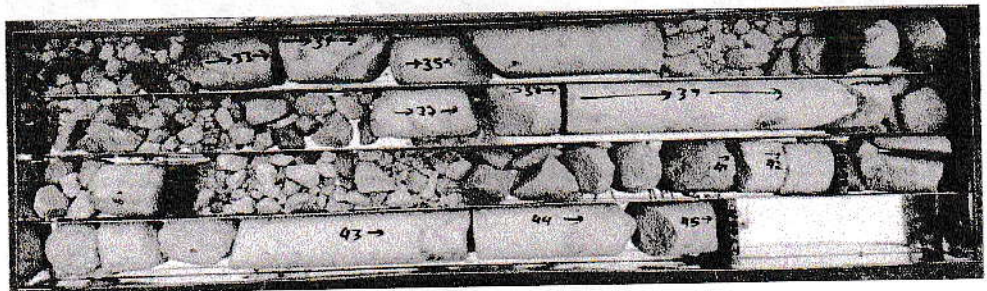
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 5 / 12
Derinlik / Depth : 17.50 m. - 22.50 m.



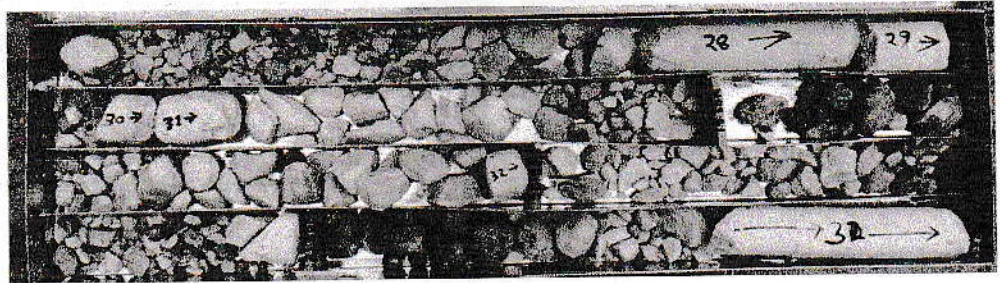
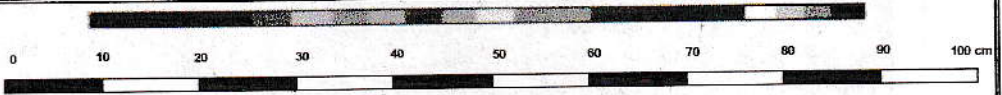
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 6 / 12
Derinlik / Depth : 22.50 m. - 27.00



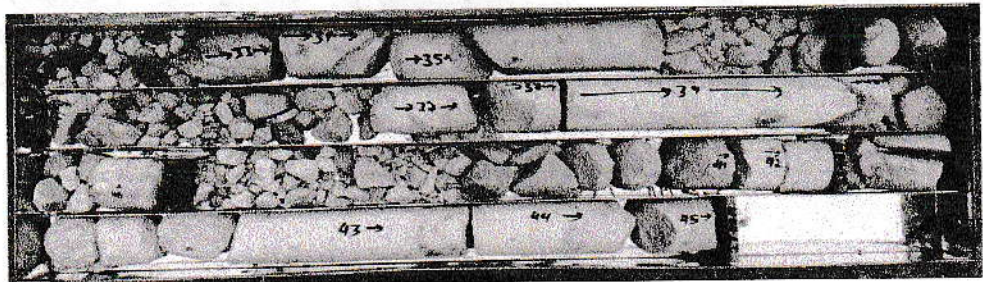
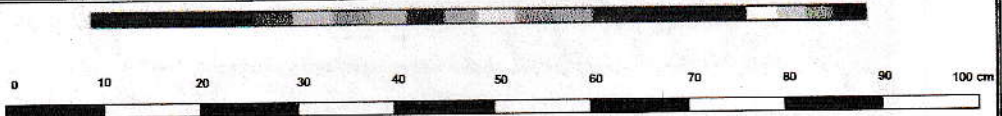
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 5 / 12
Derinlik / Depth : 17.50 m. - 22.50 m.



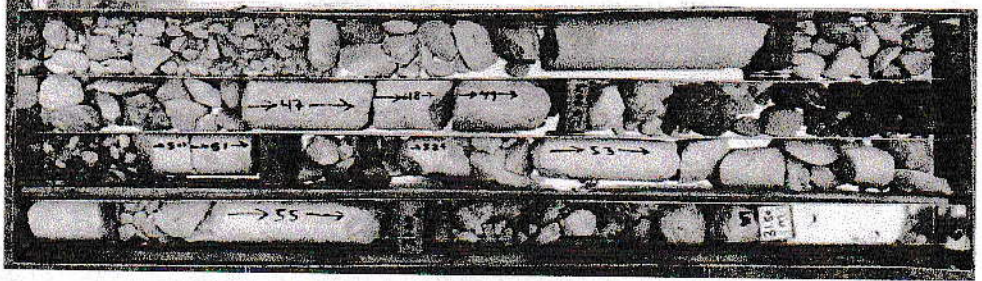
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 6 / 12
Derinlik / Depth : 22.50 m. - 27.00



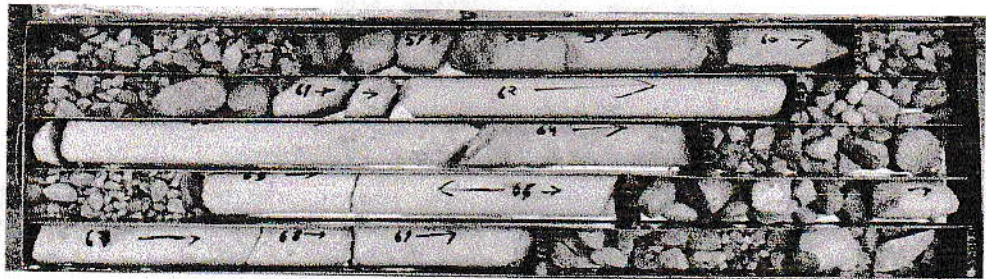
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 7 / 12
Derinlik / Depth : 27.00 m. - 31.50 m.



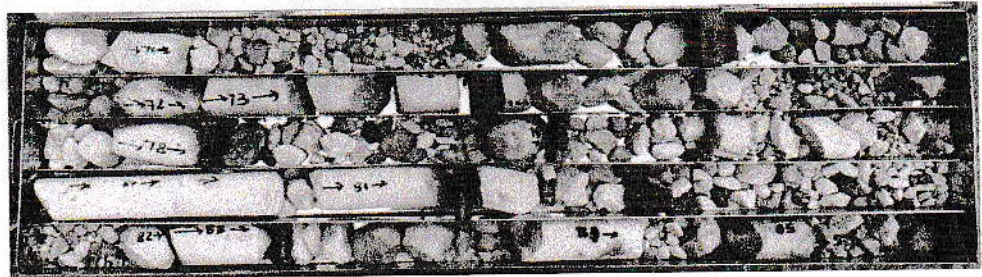
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 8 / 12
Derinlik / Depth : 31.50 m. - 37.00



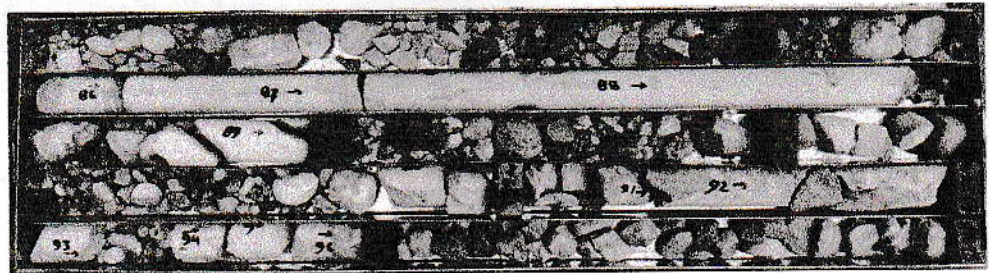
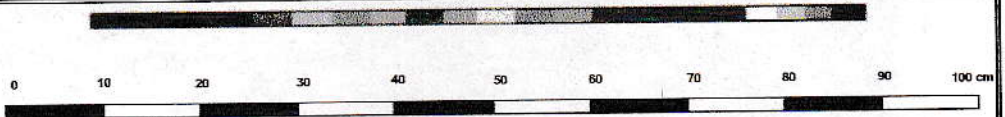
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 9 / 12
Derinlik / Depth : 37.00 m. - 44.50 m.



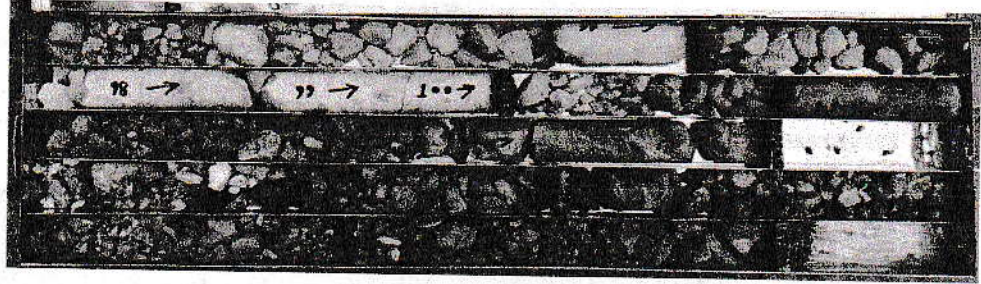
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 10 / 12
Derinlik / Depth : 44.50 m. - 51.00 m.



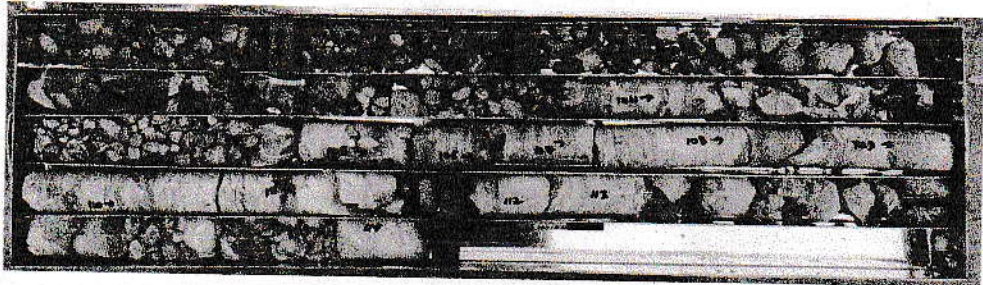
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 11 / 12
Derinlik / Depth : 51.00 m. - 57.50 m.



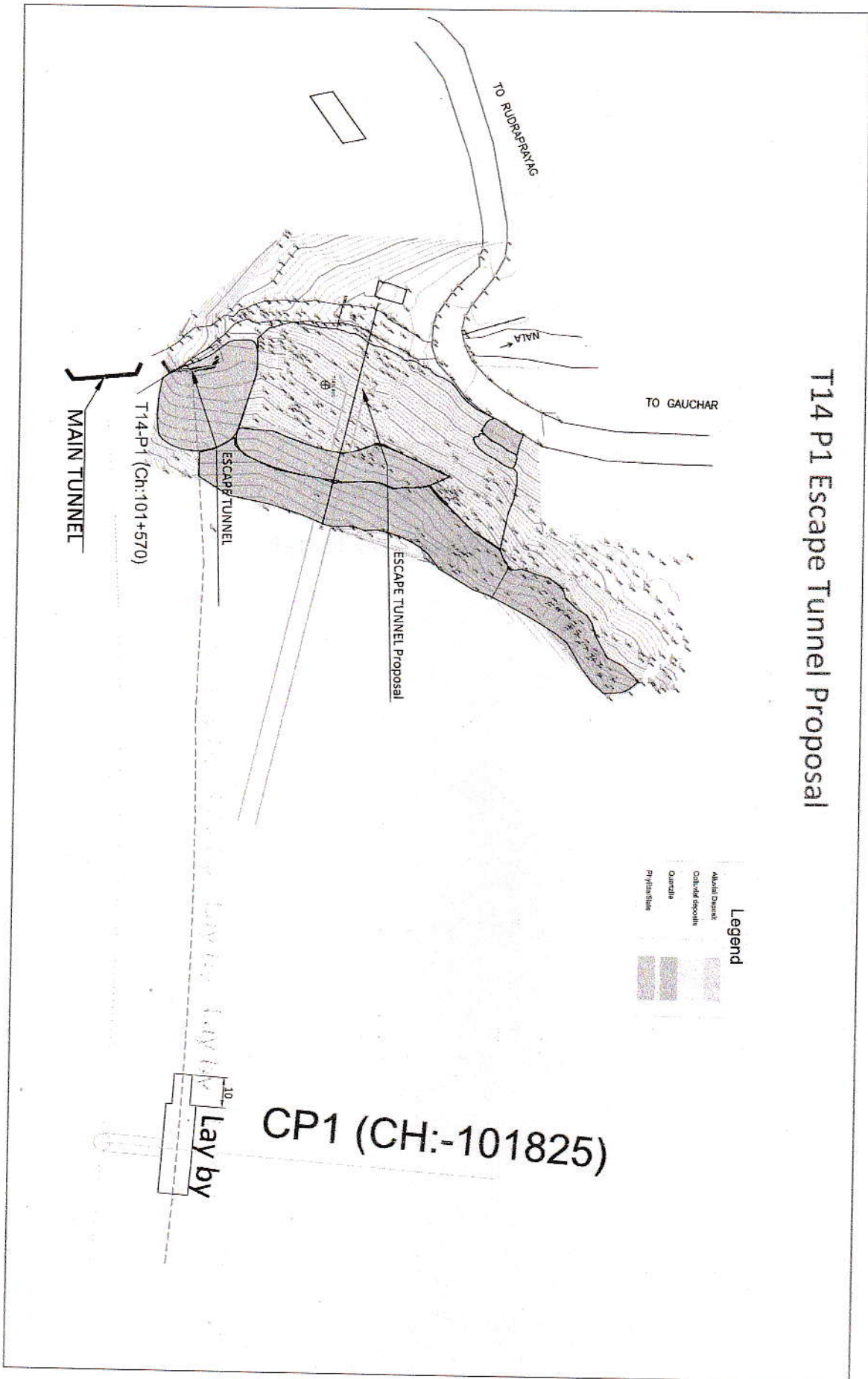
PACKAGE-08

Sondaj No / Borehole No : T14P1-BH03
Sandık No / Box No : 12 / 12
Derinlik / Depth : 57.50 m. - 63.00 m.

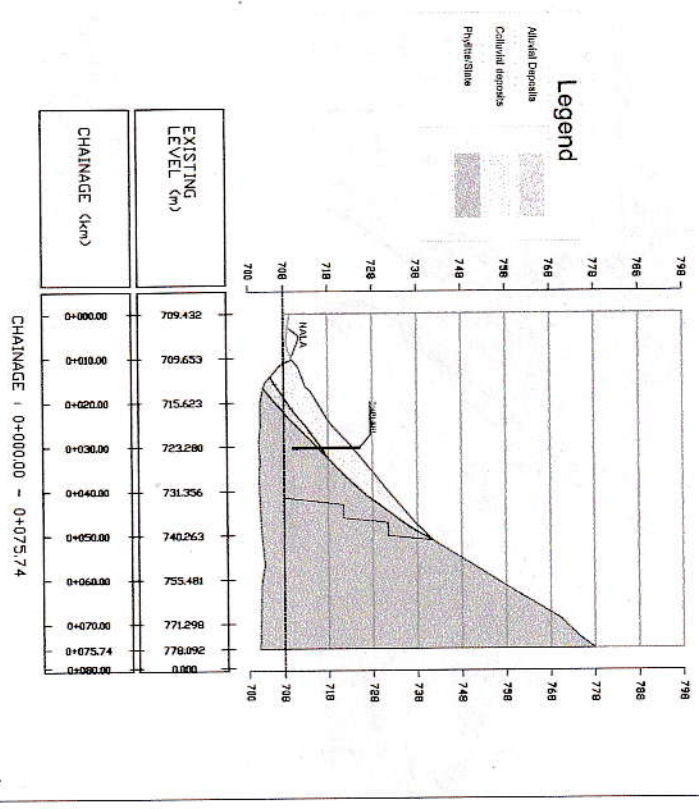


APPENDIX II
Geological Map and Profile.

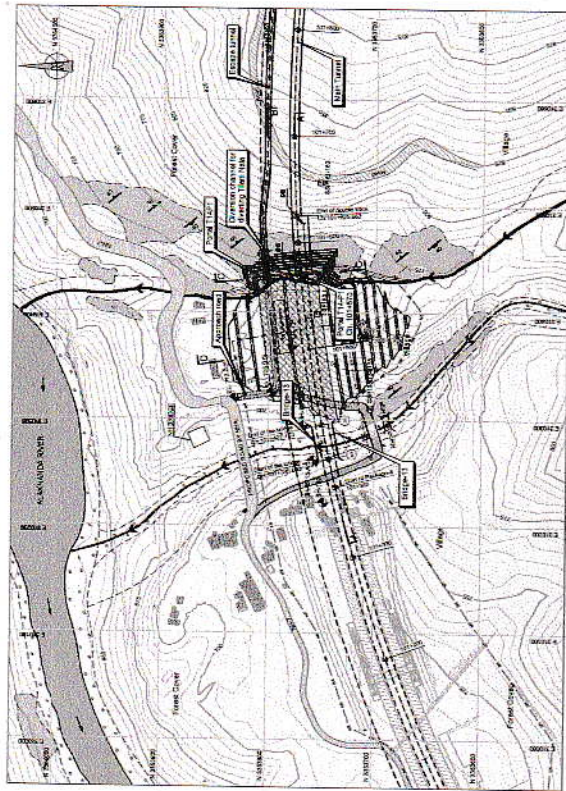
T14 P1 Escape Tunnel Proposal



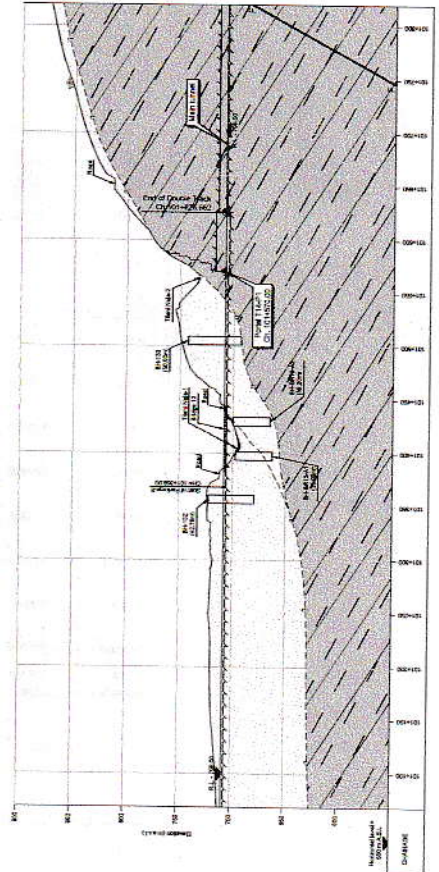
A-A' Geological Section



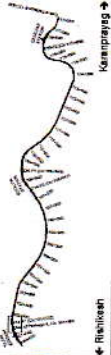
GEOLOGICAL PLAN - TUNNEL 14 AREA OF PORTAL 1
(1:250)



GEOLOGICAL PROFILE (MAIN TUNNEL)
SECTION AA-A
(1:2000)



KEY PLAN



NOTE:

- All dimensions are given in meters unless otherwise specified.
- All heights in the drawings are given in meters unless otherwise specified.
- All elevations are given in meters unless otherwise specified.
- All bearings are given in degrees, minutes and seconds unless otherwise specified.
- All bearings are given in degrees, minutes and seconds unless otherwise specified.

LEGEND

Symbol	Description
[Symbol]	Proposed Tunnel
[Symbol]	Proposed Road
[Symbol]	Proposed Drainage
[Symbol]	Proposed Structure
[Symbol]	Proposed Foundation
[Symbol]	Proposed Retaining Wall
[Symbol]	Proposed Slope
[Symbol]	Proposed Embankment
[Symbol]	Proposed Cut
[Symbol]	Proposed Bridge
[Symbol]	Proposed Pier
[Symbol]	Proposed Abutment
[Symbol]	Proposed Spillway
[Symbol]	Proposed Dam
[Symbol]	Proposed Dam Foundation
[Symbol]	Proposed Dam Structure
[Symbol]	Proposed Dam Foundation
[Symbol]	Proposed Dam Structure

BOREHOLE DETAILS

Borehole No.	Depth (m)	Groundwater Level (m)	Date
BH-01	10.00	7.50	01/01/2000
BH-02	12.00	9.50	01/01/2000
BH-03	15.00	12.50	01/01/2000
BH-04	18.00	15.50	01/01/2000
BH-05	20.00	17.50	01/01/2000

GOOD FOR CONSTRUCTION

APPROVED FOR CONSTRUCTION
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR DESIGN
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR TENDERS
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR CONTRACT
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR AS-BUILT
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR RECORD
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR ARCHIVE
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR LIBRARY
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR PUBLICATION
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR EXHIBITION
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR DESTRUCTION
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR [Blank]
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR [Blank]
DATE: 01/01/2000
BY: [Signature]

APPROVED FOR [Blank]
DATE: 01/01/2000
BY: [Signature]

ITALFERR
CONSTRUCTION CONSULTING S.p.A.

Lombardi
CONSTRUCTION CONSULTING S.p.A.

At Risk
At Risk (At Risk)

8

SHARAD KUMAR AND PARTNERS ARCHITECTS CONSULTANTS
FISHKILL, NASSAU PARADISE, PARADISE 1
Lombardi Engineering Limited - (Incorporated in India)

GEOLOGICAL DRAWINGS
TUNNEL 14 AREA OF PORTAL 1

NO.	REV.	DATE	BY	CHKD.	APPD.
1	1	01/01/2000	[Signature]	[Signature]	[Signature]
2	1	01/01/2000	[Signature]	[Signature]	[Signature]
3	1	01/01/2000	[Signature]	[Signature]	[Signature]
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5	1	01/01/2000	[Signature]	[Signature]	[Signature]
6	1	01/01/2000	[Signature]	[Signature]	[Signature]
7	1	01/01/2000	[Signature]	[Signature]	[Signature]
8	1	01/01/2000	[Signature]	[Signature]	[Signature]
9	1	01/01/2000	[Signature]	[Signature]	[Signature]
10	1	01/01/2000	[Signature]	[Signature]	[Signature]

SCALE: 1:250
DATE: 01/01/2000
BY: [Signature]