



4. APPENDIXES



4.1 LOGGING OF BOREHOLES



BASIS FOR THE CORE DRILLING GEOTECHNICAL DESCRIPTION

The attached figure shows the geotechnical data collected from the drilled boreholes. A brief description of the different parameters used to characterize the core is given below:

1. Boring number
2. Project name
3. Site and coordinate
4. Depth and inclination of borehole
5. Elevation
6. Drill rig
7. Drilled
8. Logged
9. Date
10. Depth
11. Elevation
12. Formation name
13. Soil and rock type
14. Profile, Graphic No 1
15. Core drilling geotechnical description
The soil samples characterization has followed in based on the visual-manual description (ASTM-2488) the main criterion are summarized in table No 1 the rock core characterization was carried out according to the International Society of Rock Mechanics (Basic Geotechnical Description of Rock Masses). Table No 2, 3, 4.
16. Soil consistency or rock grade (Bieniawsky)
17. Result of the laboratory test
18. Graphical illustration of core recovery
19. Graphical illustration of R.Q.D. rock factor
20. N_{30} and Lugeon permeability test graphic representation


DRILL LOG

HOLE N° ①

SHEET N° OF

PROJECT		THE DETAILED DESIGN ON TRANSBASH CHONE - PORTOVIJAO BASIN ②				DEPTH	ELEVATION		⑤									
SITE		COORDINATES ③		③		INCLINATION	DRILL RIG		⑥									
AVERAGE CORE RECOVERY		DATE		③		DRILLED	LOGGED		⑧									
DATE	DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	CORE RECOVERY		R.O.D. %	SPT (N50) LUCEON TEST					DEPTH	
									%	cm		10	20	30	40	50		
⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲	⑲	⑳						
1																		
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HOLE N°

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CRITERION FOR SOIL DESCRIPTION

<p>COARSE GRAINED SOILS</p> <p>More than half of material is larger than No. 200 sieve size</p>	<p>GRAVELS</p> <p>More than half of coarse traction is larger than No. 4 sieve size</p>	<p>CLEAN GRAVELS</p>		GW	Well graded gravels sand mixtures little or no fines
		<p>FINES >5%</p>		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		<p>GRAVELS WITH FINES</p>		GM	Silty gravels, poorly graded gravel-sand-silt mixtures
		<p>FINES >12%</p>		GC	Clayey gravels, poorly graded gravel-sand-clay mixture
	<p>SANDS</p> <p>More than half of coarse traction in smaller than No. 4 sieve size</p>	<p>CLEAN SANDS</p>		SW	Well graded sands, gravelly sands, little or no fines
		<p>FINES <5%</p>		SP	Poorly graded sands, gravelly sands, little or no fines
		<p>SANDS WITH FINES</p> <p>>12%</p>		SM	Silty sands, poorly graded sand silt mixtures
				SC	Clayey sands, poorly graded sand-clay-mixtures
<p>FINE GRAINED SOILS</p> <p>More than half materials is smaller than No. 200 sieve size</p>	<p>SILTS AND CLAYS</p> <p>Liquid limit less than 50</p>		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silty and organic silt-clays of low plasticity	
	<p>SILTS AND CLAYS</p> <p>Liquid limit greater than 50</p>		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays or high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity	
			PT	Peat and other highly organic soils	
<p>HIGHLY ORGANIC SOILS</p>					

PLASTICITY CHART

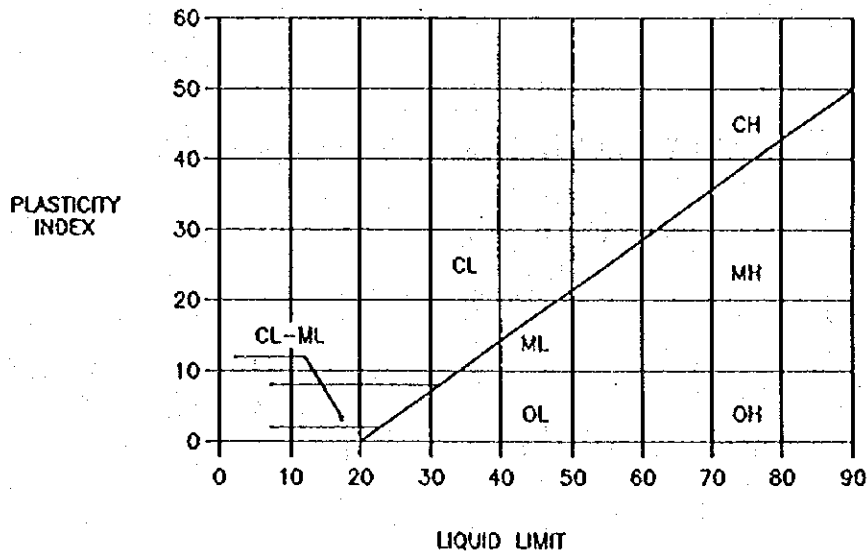


TABLE Nº 1

DESCRIPTION FOR PARTICLE SIZE CONTENT

3/4"		No.4	No.10	No.40	No.200	200	SIEVE NUMBER ASTM
GRAVEL		SAND			FINES		
COARSE	FINE	COARSE	MEDIUM	FINE	SILTS	CLAYS	
100	20.0	4.7	2.0	0.5	0.74	0.002	SIEVE SIZE

<u>RATE</u>	<u>DESCRIPTION TERM</u>
5 - 10	TRACES
10 - 20	SOME
20 - 35	LARGE AMOUNT OF
35 - 50	CLAYEY, SILTY, ETC.

DESCRIPTION OF COMPRESSIBILITY TERMS FOR A GRANULAR SOIL

<u>N</u>	<u>DESCRIPTION TERM</u>
0 TO 4	VERY LOOSE
5 TO 10	LOOSE
11 TO 30	COMPACT DENSE
31 TO 50	DENSE
>50	VERY DENSE

DESCRIPTION OF CONSISTENCY TERMS FOR A COHESIVE SOIL

<u>q_v (kPa)</u>	<u>N₃₀</u>	<u>DESCRIPTION TERM</u>	
<25	<2	VERY SOFT	
25 TO 50	2 to 4	SOFT	
50 TO 100	4 to 8	FIRM	
100 TO 200	8 to 10	STIFF	
200 TO 400	15 to 30	VERY STIFF	
>400	>30	HARD	

1 kg/cm² = 100 k Pa
q_v = UNIAXIAL COMPRESSION STRENGTH



TABLE NO 2

ROCK'S WEATHERING

W1 Sound Rock

- a) Without visible meteorization
- b) The joints are slightly oxidated

W2 Slightly Weathered Rock

Weathering penetrates slightly into the rock thru main joints

W-3 Very Weathered Rock

- a) Weathering follows thru all the rock's body, but the rock is strong enough not to be broken by hand.
- b) Less than half of the rock's body is desintegrated and/or decomposed into soil. Some parts of the rock's body is healthy rock or slightly decolorized, as a whole, or as contiguous blocks.

W4 Highly Weathered Rock

- a) Weathering thru the whole rock's body. The rock can be easily desintegrated by hand.
- b) More than half of the rock's body is desintegrated and/or decomposed into soil. The rock's body could have healthy blocks or slightly decolorized blocks.

W5 Completely Weathered Rock

All the rock's body is desintegrated or decomposed into soil, being possible to recognize its original structure and rock type.



TABLE NO 3

VISUAL RESISTANCE GRADES OF ROCK'S MATRIZ

S1 Very Stiff Rock

- Hard to break ($q_u > 2000 \text{ kg/cm}^2$)
- Very crisp sound when hit by hammer's head
- $q_u > 2000 \text{ kg/cm}^2$

S2 Stiff Rock

- Scratchable and breakable with hammer's head
- Crisp sound when hit by hammer's head
- $600 < q_u < 2000 \text{ kg/cm}^2$

S3 Medium Rock

- Easy to scratch with hammer's head
- Uncrisp sound when hit by hammer's head
- $200 < q_u < 600 \text{ kg/cm}^2$

S4 Soft Rock

- Easily to scratch with hammer
- Impossible to break by hand in blocks greater than 10 cm^2
- $60 < q_u < 200 \text{ kg/cm}^2$

S5 Very soft Rock

- Hammer's head corner hit leaves a mark on the rock
- Breakable by hand
- $20 < q_u < 60 \text{ kg/cm}^2$

Transition between rock and soil: $4 < q_u < 20 \text{ kg/cm}^2$



TABLE NO 4

STRATA THICKNESS ACCORDING TO B.G.D.'S SPECIFICATIONS

INTERVALS cm	SYMBOL	DESCRIPTION
> 200	F 1	Very thick
60 - 200	F 2	Thick
20 - 60	F 3	Medium
6 - 20	F 4	Thin
< 6	F 5	Very thin

Table 5 : The Rock Mass Rating System (after Bieniawski, 1979).

A. CLASSIFICATION PARAMETERS AND THEIR RATINGS

Parameter		Ranges of Values							
1	Strength of intact rock material	Point load strength index (MPa)	>10	6-10	2-6	1-2	For this low range uniaxial compressive test is preferred		
	Uniaxial compressive strength (MPa)	>250	100-250	50-100	25-50	5-25	1-5	<1	
	Rating	15	12	7	4	2	1	0	
2	Drill core quality RQD (%)	90-100	75-90	50-75	25-50				
	Rating	20	17	13	9	3			
3	Spacing of discontinuities	2 m	0.6-2 m	200-500 mm	60-200 mm	<60 mm			
	Rating	20	15	10	8	5			
4	Condition of discontinuities	Very rough surfaces Not continuous No separation Unweathered wall rock	Slightly rough surfaces Separation < 1 mm Slightly weathered walls	Slightly rough surfaces Separation < 1 mm Highly weathered walls	Stepped surfaces or Gouges < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge > 5 mm thick or Separation > 5 mm Continuous			
		Rating	30	25	20	10	0		
5	Groundwater	Inflow per 10 m tunnel length (L/min)	None	<10	10-25	25-125	>125		
		Joint water pressure Ratio Major principal stress	0	<0.1	0.1-0.2	0.2-0.5	>0.5		
	General conditions	Completely dry	Damp	Wet	Dripping	Flowing			
		Rating	15	10	7	4	0		

B. RATING ADJUSTMENT FOR DISCONTINUITY ORIENTATIONS

Strike and Dip Orientations of Discontinuities		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable
Ratings	Tunnels and mines	0	-2	-5	-10	-12
	Foundations	0	-2	-7	-15	-25
	Slopes	0	-5	-25	-50	-60

C. ROCK MASS CLASSES DETERMINED FROM TOTAL RATINGS

Rating	100-81	80-61	60-41	40-21	<20
Class no.	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock

D. MEANING OF ROCK MASS CLASSES

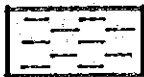
Class no.	I	II	III	IV	V
Average stand-up time	20 yr for 15 m span	1 yr for 10 m span	1 wk for 5 m span	10 h for 2.5 m span	30 min for 1 m span
Cohesion of the rock mass (kPa)	>400	300-400	200-300	100-200	<100
Friction angle of the rock mass (deg)	>45	35-45	25-35	15-25	<15

*After Bieniawski (1979).

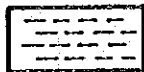
SYMBOLIC FOR EACH TYPE OF SOIL OR ROCK

GRAPHIC Nº 1

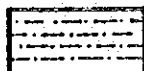
SOILS



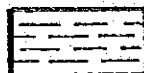
VEGETAL SOIL, ORGANIC SILT OR CLAY



SILT



SANDY SILT OR SILTY SAND

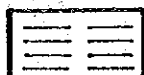


PLASTIC CLAYS

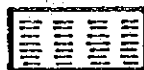


FINE GRAINED SAND WITH A SMALL CONTENT OF FINES

ROCKS



MUDSTONE



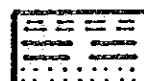
SILTSTONE



FINE GRAINED SANDSTONE



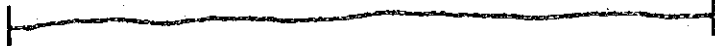








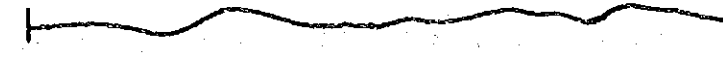
MEDIUM TO COARSE GRAINED SANDSTONE

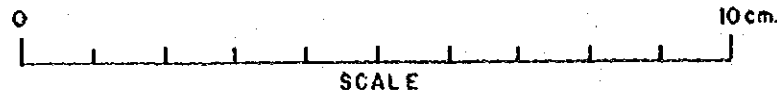


ALTERNATING LAYERS OF SILTSTONE, MUDSTONE AND SANDSTONE

TYPE PROFILE TO DETERMINE THE JOINT ROUGHNESS COEFFICIENT
 (AFTER N. BARTON AND V. CHOUBEY)

GRAPHIC Nº 2

GROUP		J. R. C.
1		0 - 2
2		2 - 4
3		4 - 6
4		6 - 8
5		8 - 10
6		10 - 12
7		12 - 14
8		14 - 16
9		16 - 18
10		18 - 20



SCALE

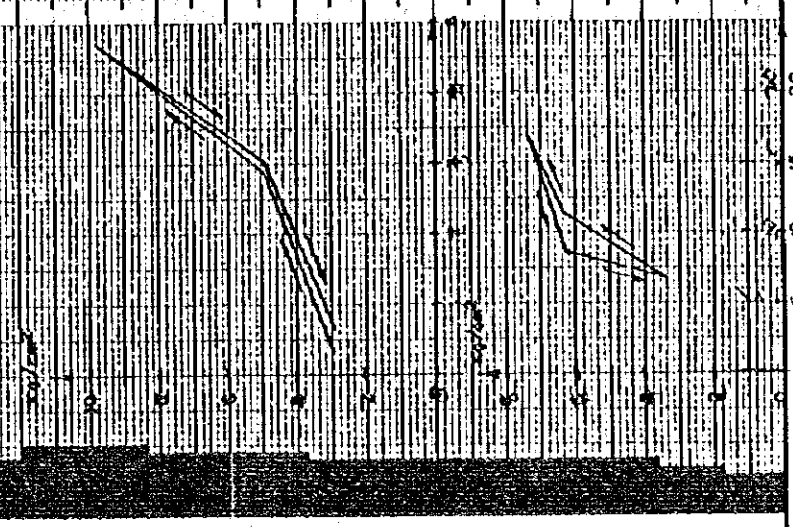
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DRILL LOG HOLE N° DP-93-1 SHEET N° 1 OF 1

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIJEJO BASIN		DEPTH	30.00	ELEVATION	83.01 msnm						
SITE		COORDINATES		INCLINATION	VERT	DRILL RIG	ACKER H. BILLY						
AVERAGE CORE RECOVERY		EST. MULATOS 100%		DRILLED	A. QUIROZ	LOGGED	R. BURGOS						
DATE	DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	TEST	RECOVERY	R.Q.D. %	SPT (N30)	LUCEON TEST
26/11/93	1	83.01	COLLUVIUM	Colluvium	Blackish silty clay with weathered debris		SHTF						
	2	81.71		Mudstone	Withish Mudstone								
	3				Grayish brown silty fine grained sandstone, slightly weathered								
	4				Dark gray color with oxidated levels								
	5				Massive but triable								
	6				levels of fine grained sandstone alternating with Mudstone								
	7				Dark gray silty fine grained sandstone, some soft								
	8				Gray silty fine grained sandstone Bedding = horizontal								
	9				some soft								
27/11/93	10	73.31			Greenish gray fine and medium grained sandstone								
	11				Massive								
	12				microconglomeratic								
	13				Light gray fine grained sandstone soft rock								
	14	68.51			siliceous level								
	15				brown Mudstone, tufaceous Bedding - horizontal								
	16	67.01			Moderately cemented								
28/11/93	17	65.90			Dark gray fine and medium grained sandstone, some soft								
	18	64.51			Brown massive, moderately cemented								
	19				Greenish gray silty fine grained sandstone								
	20				Bedding - horizontal								
	21	21.30											
	22	21.80											
	23	59.81											
29/11/93	24				dark gray fine and medium grained sandstone, some soft bedding - horizontal								
	25	72.75											
	26												
	27												
	28	54.81											
	29				medium and coarse grained sandstone, soft rock (conglomeratic)								
30/11/93	30	53.31			Conglomerat, soft rock								

PLAGIOCLASE > 30%
 SMECTITE / ILLITE < 10%
 HORNBLLENDE QUARTZ < 1%
 Gs = 2.758 gr/cm3
 Sm = 1.787 gr/cm3
 Qu = 48.91 Kg/cm2
 E = 12.320 Kg/cm2
 D = 0.11
 Id2 = 85.9%
 SPl = 0.00 Kg/cm2



Microsuelos Cia. Ltda.

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DRILL LOG

HOLE N° DP-93-2

SHEET N° 1 OF 1

HOLE N° DP-93-2

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASIN				DEPTH		ELEVATION		84.85m a.s.m	
SITE		EST. CANALES		COORDINATES		DATE		FROM 28/11/93 TO 7/12/93		VERT.	
AVERAGE CORE RECOVERY		87%		87%		DRILLED		A. QUIROZ		LOGGED	
R. BILLY		ACKER H. BILLY		R. BURGOS		LOGGED		A. QUIROZ		R. BURGOS	
DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	INCUNATION	DRILLED	LOGGED	DEPTH
1	84.45		Sand		sand and gravel						0
2	82.10		Sandstone		coarse grained sandstone, conglomeratic	IV					10
3					Greenish gray silty fine grained sandstone	III					20
4					Gray fine grained sandstone						30
5					Bedding - horizontal						40
6					dark brown medium and coarse grained sandstone						50
7	78.15		medium and coarse grained sandstone		Bedding - horizontal	II					
8	77.25		Mudstone		Massive, soft/compact						
9					Greenish gray Mudstone, with some breach	II					
10					Greenish gray silty fine and medium grained sandstone						
11					Bluish gray medium grained sandstone, some soft						
12	72.85		fine and medium grained sandstone		Bedding - horizontal						
13					coarse grained conglomeratic in coarse grained sandstone	II					
14	70.70		Conglomerat								
15					Gray Mudstone, Tufaceous						
16					greenish gray, silty fine and medium grained sandstone						
17					medium and coarse grained	H					
18			fine and medium grained sandstone								
19					gray color						
20					conglomeratic						
21					fine and medium grained						
22	62.55										
23					Greenish gray Mudstone, with some sandstone	II					
24	23.35				Bedding - horizontal						
25	23.75		Mudstone		gray color tufaceous						
26											
27	58.45		fine grained sandstone		greenish gray fine and medium grained sandstone	II					
28	56.70				medium and coarse grained conglomeratic						
29			Mudstone		Greenish gray Mudstone, with some sandy parts						
30	54.85				gray color, tufaceous						

PLAGIOCLASE, SMECTITE / ILLITE > 30%
 QUARTZ < 10%
 HORNBLLENDE, CHLORITE, PYRITE > 1%
 Gs = 2704 gr/cm3
 Km = 1824 gr/cm3
 Qu = 10328 Kg/cm2
 E = 12600 Kg/cm2
 Spi = 6.47 Kg/cm2
 Id2 = 0.1
 Gb = 6.47 Kg/cm2



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DRILL LOG

HOLE N° DP-93-3

SHEET N° 1 OF 1

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASIN				DEPTH		ELEVATION	
SITE		COORDINATES		DATE		INCLINATION		VERT.	
AVERAGE CORE RECOVERY		CONCUILLO		FROM 19/11/93 TO 23/11/93		DRILLED		A. QUIROZ	
100%		100%				LOGGED		R. BURCOS	
DEPTH	ELEVATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	CORE RECOVERY	R.O.D.	SPT (N50) LUCEON TEST
DATE		FORMATION					%	%	
1	89.67	Weathered Mudstone		brown Mudstone with siliceous conglomeratic debris(breach)	N				
2	88.47	sandstone		brown fine grained sandstone, with joints					
3	86.67			brown medium grained coarse grained	H				
4		Mudstone		brown Mudstone with conglomeratic debris(breach)					
5	85.07			Dark brown					
6				Greenish gray fine grained sandstone with traces of shell, silty	H				
7		fine grained sandstone		conglomeratic level					
8				brown color					
9									
10	79.47								
11				Dark brown medium and coarse grained sandstone, some soft					
12		sandstone		medium grained	N H				
13									
14	75.12			sandy and conglomeratic greenish Mudstone	H				
15		Mudstone							
16	74.07			Greenish gray silty fine grained sandstone					
17				dark brown color					
18		fine grained sandstone		breach-level	H				
19				Greenish gray color					
20									
21	69.17			Greenish gray Mudstone with breach debris					
22	66.07	Mudstone			H				
23		Mudstone		Greenish gray Mudstone with traces of shell, some sandy					
24									
25		sandstone		Greenish gray fine and medium grained sandstone with traces of shell, muddy					
26									
27				microconglomeratic					
28	51.77	Mudstone		Coarse, massive					
29	50.87	Mudstone		Greenish gray Mudstone					
30	59.67	fine grained sandstone		Greenish gray muddy fine grained sandstone					
				microconglomeratic					

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HOLE N° DP-93-3

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DRILL LOG

HOLE N° SR-93-1

SHEET N° 1 OF 2

HOLE N° SR-93-1

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTO VIEJO BASIN				PROBIDAD	ELEVATION	ELEVATION	
SITE		ESTACION DE BOMBEO		COORDINATES		INCLINACION	55.00	DRILL RIG	ACKER H. BILLY
AVERAGE CORE RECOVERY		100%		DATE		POBUCADO	VERT.	LOGGED	F. VASCOINEZ
FORMATION		COLLUVIUM		FROM 9/12/93		TO 17/12/93		SPT (NOO) LUCEON TEST	
DEPTH	ELEVATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	CORE RECOVERY	DEPTH	
DATE							%	cm	
9/12/93	95.93	Colluvium		stiff blackish clayey silt with organic material	DURO				0
9/12/93	94.43			Greenish gray fine grained sandstone, moderately cemented	IV				
10/12/93	88.93	fine grained sandstone		yellowish green fine and medium grained sandstone with shells, stiff rock and oxidated joints weathered	III				
10/12/93	85.43	coarse grained sandstone		Bluish gray medium and coarse grained sandstone, moderately cemented	II				
11/12/93	81.93	medium and fine grained sandstone		Dark brown coarse grained conglomeratic soft rock	IV				
11/12/93	76.63	medium and coarse grained sandstone		Gray medium grained sandstone stiff, with conglomeratic levels	II				
11/12/93	73.93	fine grained sandstone		Granish brown fine grained microconglomeratic	II				
12/12/93	70.83	fine and medium grained sandstone		Gray medium and coarse grained sandstone, moderately cemented with microconglomeratic levels	III				
12/12/93		fine grained sandstone		Dark brown, some soft fine and medium grained	II				
12/12/93		fine and medium grained sandstone		Light gray silty and fine grained sandstone, stiff rock	II				
12/12/93		fine and medium grained sandstone		coarse grained level, Greenish	II				
12/12/93		fine and medium grained sandstone		yellowish green fine and medium grained sandstone	III				
12/12/93		fine and medium grained sandstone		microconglomeratic levels	III				
12/12/93		fine and medium grained sandstone		Light gray fine grained levels of Mudstone	II				

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DRILL LOG

HOLE N° SR-93-1

SHEET N° 2 OF 2

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIJEJO BASIN				DEPTH		ELEVATION	
SITE		COORDINATES		DATE		INCLINATION		VERT.	
ESTACION DE BOMBEO		FROM 9/12/93 TO 17/12/93		ORILLED		A. QUIROZ		ACKER: H. BILLY	
AVERAGE CORE RECOVERY		100%		ROCK TEST		CORE RECOVERY		LOGGED	
FFORMATION		ROCK TYPE		COLUMN SECTION		DESCRIPTION		ROCK GRADE	
ELEVATION		ROCK TYPE		COLUMN SECTION		DESCRIPTION		ROCK GRADE	
DEPTH		ROCK TYPE		COLUMN SECTION		DESCRIPTION		ROCK GRADE	
DATE		ROCK TYPE		COLUMN SECTION		DESCRIPTION		ROCK GRADE	
31	12/12/93		fine and medium grained sandstone		Homogeneous and massive Sub-vertical joint at 31.4 ~ 32.3m	H			
32			medium grained sandstone		the levels of Mudstone disappear Bluish grey color, a rock some soft	H			
33						H			
34		62.03				H			
35						H			
36						H			
37	13/12/93					H			
38		57.83				H			
39						H			
40						H			
41						H			
42	14/12/93					H			
43		52.33				H			
44						H			
45		50.93				H			
46						H			
47	15/12/93					H			
48		48.34				H			
49		48.92				H			
50		46.73				H			
51	16/12/93					H			
52						H			
53	17/12/93					H			
54						H			
55		40.93				H			
				level with shells		END OF BORE HOLE 55.00m			

PLAGIOCLASE > 30%
SMECTITE / ILLITE 10-30%
HORNBLENDE, QUARTZ AND PIRITE < 1%

Gs = 2726 gr/cm3
Bm = 2006 gr/cm3
Fu = 9200 Kg/cm2
E = 37500 Kg/cm2
U = 0.24
GIP = 1838 Kg/cm2
SPL = 0.26 Kg/cm2
ID2 = 77.10 %

HOLE N° SR-93-1



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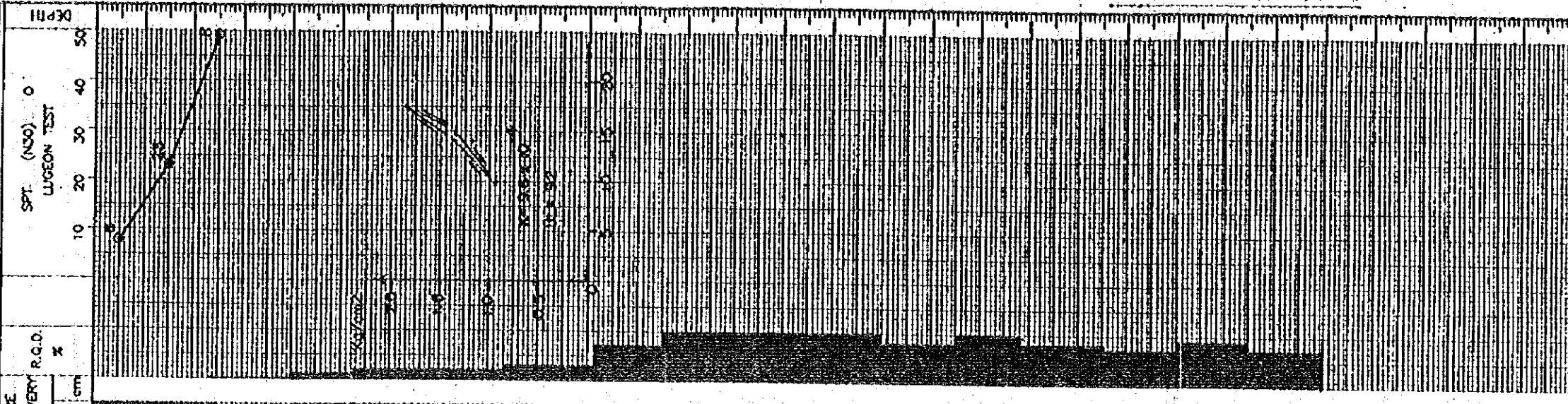
DRILL LOG

HOLE Nº SR-93-2

SHEET Nº 1 OF 1

HOLE Nº SR-93-2

PROJECT		THE DETAILED DESIGN ON TRANSASIN CHONE - PORTO VIEJO BASIN				DEPTH		ELEVATION	
SITE		COORDINATES		DATE		INCLINATION		VERT.	
SUBESTACION		DATE		FROM 17/12/93		DRILLED		A. QUIROZ	
AVERAGE CORE RECOVERY		99%		TO 20/12/93		LOGGED		F. V.	
DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	LOGGED	DEPTH
1	107.06	COLLUVIUM	Colluvium		blockish vegetal soil				0
2	104.76				weathered debris in grayish brown silty clay				5
3	103.06		Mudstone		Yellowish brown very weathered Mudstone	M	Spi = 008 Kg/cm2 Id2 = 95.20 %		10
4					Greenish yellow very weathered siltstone with sandy layers	M			15
5	99.76		Sandstone		Including granules	H			20
6	98.16		fine grained Sandstone		Weathered light brown fine grained sandstone	H			25
7			fine to medium grained sandstone		Greenish yellow medium grained sandstone, soft rock	M	E = 56000 Kg/cm2 C = 0.19 Gp = 29.64 Kg/cm2		30
8	95.31				Brown-stained on horizontal bedding planes				35
9					Greenish gray fine grained sandstone with medium and coarse grained levels, stiff rock with cross-beddings				40
10			fine grained sandstone		with some of shell	H	Gs = 2657 g/cm3 Um = 2071 g/cm3 Pu = 129.50 Kg/cm2		45
11					Below 17.5m				50
12					Dark gray, sandy Mudstone				55
13	88.26		fine grained sandstone		Yellowish green fine grained sandstone, with oxidated joints	M			60
14	88.16								65
15	88.84								70
16	85.76		medium to coarse sandstone		Bluish grey, compact medium and coarse grained sandstone, with conglomeratic levels	M			75
17					rock some soft, in parts				80
18	82.06								85
19									90
20									95
21									100
22									105
23									110
24									115
25									120
					END OF BORE HOLE 25.00m				125



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DRILL LOG

HOLE N°SR-93-3 : SHEET N°1 OF 1

HOLE N° SR-93-3

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIJO BASIN				DEPTH		ELEVATION		130.00m	
SITE		CANAL DULCE		COORDINATES		INCLINATION		DRILL RC		ACKER ACE	
AVERAGE CORE RECOVERY		99%		DATE		DRILLED		LOGGED		R. BURGOS	
DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	DEPTH	SPT (NOO)	DEPTH	LOGGED
DATE								10	0	30	R. BURGOS
18/12/93	130.00	COLLUVIUM	Colluvium	△-△-△	yellowish brown silty clay with weathered rock debris	STIFF	Spl = 1.75 Kg/cm2 Idr = 79.10 %	10	0	30	R. BURGOS
18/12/93	127.00		Completely Weathered Mudstone	▨	Completely weathered yellowish brown Mudstone	II		20	0	40	R. BURGOS
20/12/93	123.80		Weathered Mudstone	▨	weathered greenish gray Mudstone with traces of shells Core samples are fragmental or distorted clayey material	III		30	0	50	R. BURGOS
21/12/93	121.20			▨	Greenish gray Mudstone with traces of shell and levels of siltstone, some sandstone Bedding - horizontal			40	0		R. BURGOS
4/01/94				▨	Massive and compact			50	0		R. BURGOS
5/01/94				▨	Gray in lower zone stiff			60	0		R. BURGOS
5/01/94				▨	some of shells traces of shells			70	0		R. BURGOS
5/01/94				▨	some of shells			80	0		R. BURGOS
5/01/94				▨	with numerous shells			90	0		R. BURGOS
5/01/94				▨	some of shells the sandy character disappear			100	0		R. BURGOS
6/01/94				▨	with sandy character			110	0		R. BURGOS
6/01/94				▨	with numerous shells			120	0		R. BURGOS
6/01/94				▨	siliceous level			130	0		R. BURGOS
6/01/94				▨	some of shells			140	0		R. BURGOS
6/01/94				▨	with numerous shells			150	0		R. BURGOS
7/01	100.00			▨	some of shells, dark gray color.			160	0		R. BURGOS

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DRILL LOG

HOLE N°SR-93-4

SHEET N°1 OF 2

HOLE N°SR-93-4

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASING				DEPTH	40.00	ELEVATION	135.00mstrm		
SITE		COORDINATES		DATE		INCLINATION	VERT.	DRILL R.C.	ACKER TEREDO		
AVERAGE CORE RECOVERY		100%		FROM 29/11/93 TO 7/12/93		DRILLED	F. LINDAO	LOGGED	R. BURGOS		
DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	CORE RECOVERY %	R.Q.D. %	SPT (N50) LUCEON TEST	DEPTH
1	135.00	COLLUVIUM	Colluvium	▽▽ ▽▽ ▽▽	weathered Mudstone fragments brown silty matrix	STIFF					0
2	133.50		Completely weathered Mudstone		Very weathered yellowish brown Mudstone residual clay	II					10
3											20
4											30
5											40
6											50
7											60
8	126.70		Mudstone		Greenish gray Mudstone, sound rock with traces of shell and levels of siltstone Bedding - horizontal	H					70
9											80
10											90
11											100
12											110
13											120
14	121.20										130
15											140
16											150
17											160
18											170
19											180
20											190
21	113.80										200
22											210
23											220
24											230
25											240
26											250
27											260
28											270
29											280
30											290

Gs = 2786 g/cm³
 Bm = 2038 g/cm³
 D = 0.18
 E = 12.895 Kg/cm²
 Spi = 0.54 Kg/cm²
 Id₂ = 86.20 %
 Gb = 14.49 Kg/cm²
 9u = 63.72 Kg/cm²

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DRILL LOG

HOLE N°SR-93-4

SHEET N° 2 OF 2

HOLE N° SR-93-4

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASING				DEPTH		ELEVATION		1:35.00msnm	
SITE		COORDINATES		DATE		INCLINATION		VERT.		DRILL RIG	
AVERAGE CORE RECOVERY		P. HONDA PATA DE PALARO		100%		DRILLED		F. LINDAO		LOGGED	
DATE		FORMATION		ROCK TYPE		COLUMN SECTION		DESCRIPTION		ROCK GRADE	
DEPTH		ELEVATION		ROCK TYPE		COLUMN SECTION		DESCRIPTION		ROCK GRADE	
DATE		FORMATION		ROCK TYPE		COLUMN SECTION		DESCRIPTION		ROCK GRADE	
31	4/12/93							Massive, moderately cemented			
32	4/12/93			Sandy Mudstone				32.3 ~ 32.5 soft			
33		33.00									
34		33.50									
35											
36	6/12/93	100.20									
37	6/12/93		ONZOL	fine grained sandstone				Greenish gray, silty fine grained sandstone, with traces of shell Bedding - horizontal, compact			
38	7/12/93										
39	7/12/93										
40		95.00									
END OF BORE HOLE 40.00m											

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DRILL LOG HOLE N°SR-93-5 SHEET N° 1 OF 1

HOLE: N° SR-93-5

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASIN		DEPTH	25.00	ELEVATION	119.07msnm												
SITE		COORDINATES		INCLINATION	VERT.	DRILL RIG	ACKER H. BILLY												
AVERAGE CORE RECOVERY		TANQUE DE CARGA		DRILLED	A. QUIROZ	LOGGED	R. BURGOOS												
DATE	DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	DATE	DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	DATE	
3/01/94	2	119.07	COLLUVIUM	Colluvium	blackish vegetal soil	blackish vegetal soil			3/01/94	2	119.07	COLLUVIUM	Colluvium	blackish vegetal soil	blackish vegetal soil				3/01/94
4/01/94	3				yellowish brown clayey silt with plant roots	yellowish brown clayey silt with plant roots			4/01/94	3					numerous rock fragments				4/01/94
4/01/94	4			Completely weathered Mudstone	Brown residual soil with shells and rock debris	Brown residual soil with shells and rock debris			4/01/94	4									4/01/94
5/01/94	7	112.87		fine grained sandstone	Greenish gray fine grained sandstone with shells, stiff	Greenish gray fine grained sandstone with shells, stiff	H	Spl = 0.10 Kg/cm2 I ₂ = 83.9 % GIp = 21.07 Kg/cm2	5/01/94	7	112.87								5/01/94
5/01/94	8	111.27		Mudstone	Light brown Mudstone with levels of shells	Light brown Mudstone with levels of shells	H		5/01/94	8	111.27								5/01/94
5/01/94	9			Mudstone	Dark gray color	Dark gray color	H		5/01/94	9									5/01/94
6/01/94	10			Muddy fine grained sandstone	Dark gray fine grained with shells and levels of Mudstone	Dark gray fine grained with shells and levels of Mudstone	H		6/01/94	10									6/01/94
6/01/94	11				Moderately cemented	Moderately cemented			6/01/94	11									6/01/94
6/01/94	12				shell presence is increased	shell presence is increased			6/01/94	12									6/01/94
6/01/94	13								6/01/94	13									6/01/94
6/01/94	14								6/01/94	14									6/01/94
6/01/94	15	104.22		Siltstone	Dark gray siltstone with levels of sandstone, with shells	Dark gray siltstone with levels of sandstone, with shells	H	Gs = 2733 gr/cm3 Gm = 2040 gr/cm3 Gp = 134.59 Kg/cm2	6/01/94	15	104.22								6/01/94
7/01/94	16				Moderately cemented	Moderately cemented			7/01/94	16									7/01/94
7/01/94	17	101.24		Muddy fine grained sandstone	Greenish gray fine grained sandstone with some of shell, stiff	Greenish gray fine grained sandstone with some of shell, stiff	H		7/01/94	17	101.24								7/01/94
7/01/94	18								7/01/94	18									7/01/94
7/01/94	19								7/01/94	19									7/01/94
8/01/94	20	99.22		fine and medium grain sandstone	Dark gray fine and medium grained sandstone	Dark gray fine and medium grained sandstone	H		8/01/94	20	99.22								8/01/94
8/01/94	21				Moderately cemented to 22.85m	Moderately cemented to 22.85m			8/01/94	21									8/01/94
8/01/94	22				yellowish green color, compact	yellowish green color, compact			8/01/94	22									8/01/94
8/01/94	23				medium grained, some soft	medium grained, some soft			8/01/94	23									8/01/94
8/01/94	24								8/01/94	24									8/01/94
8/01/94	25	94.37							8/01/94	25	94.37								8/01/94
						END OF BORE HOLE 25.00M													

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DRILL LOG

HOLE N° MG-93-1 SHEET N° 1 OF 2

DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	INCLINATION	DEPTH	ELEVATION	DRILL RIG	LOGGED
PROJECT: THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIJO BASIN SITE: P. HONDA - EST. GUAJABE COORDINATES: FROM 21/11/93 TO 27/11/93 DATE: 21/11/93 AVERAGE CORE RECOVERY: 100%												
1	117.420	COLUVIUM	Coluvium	V-V-V D D D D D D D	vegetal soil Weathered and oxidated clastic of brown silty fine grained sandstone in sandy silt matrix				0	117.420	ACKER TEREDO	R. BURGOS
2	114.42		Completely weathered fine grained sandstone		Weathered yellowish brown silty fine grained sandstone Bedding - horizontal Intensively weathered and disintegrated	K	SPI = 0.39 Kg/cm ² Id ₂ = 68.40 %		10	35.00	F. LINDAO	
3			Completely weathered Mudstone		Completely weathered yellowish brown Mudstone in clayey silt matrix Decomposed into residual soil sandy character the sandy character disappear Drilled without water circulation	K	E = 77.30 Kg/cm ² D = 0.22 SPT = 10.70 Kg/cm ²		20			
4			Highly weathered Mudstone		Highly weathered greenish gray Mudstone, with trace of shells oxidated levels	M	E = 2608 gr/cm ³ Dm = 2062 gr/cm ³ D = 0.22 SPT = 37.59 Kg/cm ²		30			
5			Mudstone		Sound greenish gray Mudstone Bedding - horizontal sandy character and traces of shells the sandy character disappear Bedding - horizontal, compact	H M	PLAGIOCLASE > 30 % SMECTITE / ILLITE 10-30 % QUARTZ < 10 % HORNBLENDE, CHLORITE AND PYRITE < 1 %		40			
6			fine grained sandstone		gray sound muddy sandstone, compact	H M			50			
7			Mudstone		Greenish gray Mudstone with traces of shells, some sandy Bedding - horizontal Moderately cemented	H						

HOLE N° MG-93-1

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DRILL LOG HOLE N° MG-93-1 SHEET N° 2 OF 2

HOLE N° MG-93-1

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASIN				DEPTH	ELEVATION	ELEVATION
SITE		COORDINATES		DATE	DRILLED	VERT.	DRILL RIG	LOGGED
AVERAGE CORE RECOVERY		P. HONDA - EST. GUAJABE		FROM 27/11/93 TO 27/11/93	F. LINDAO	F. LINDAO	ACKER TEREDO	R. BURGOS
DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	DEPTH
DATE								SPT (N30) 0 LUCEON TEST
31	87.32	ONZOLT	Muddy, fine grained sandstone		Greenish gray Muddy fine grained sandstone Bedding - horizontal, compact	III		0
32								
33					Massive			
34								
35	82.42				END OF BORE HOLE 35.00m			

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DRILL LOG

HOLE N° MG-93-2 SHEET N° 1 OF 2

HOLE N° MG- 93-2

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTO VIEJO BASIN				DEPTH	ELEVATION	128.10msnm				
SITE		COORDINATES		DATE	FROM	TO	DRILLED	VERT	45.00	DRILL RIG	ACKER TEREDO	
AVERAGE CORE RECOVERY		MANCHA GRANDE		94%		16/12/93		F. LINDAO		LOGGED		R. BURCOS
DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	CORE RECOVERY	R.O.D.	SPT (N30)	LUGEON TEST	
DATE								%	CM			
1	128.10	COLLUVIUM	Colluvium	VI	vegetal soil	STIFF						
2	Yellowish gray clayey silt with some fine grained sand and numerous weathered rock debris											
3	block of weathered fine grained sandstone											
4												
5	Weathered yellowish gray debris of sandstone and siltstone											
6	122.50	MUDSTONE	Completely Weathered Mudstone	VII	Weathered brown silty fine grained sandstone, residual decomposed into soil. Drilled without water	IV						
7												
8	120.30				Grayish brown weathered shale with sandy levels							
9					sandy levels disappear							
10					Decomposed and disintegrated into residual soil							
11					very weathered and oxidated							
12												
13												
14												
15												
16					Drilled without water circulation							
17												
18	110.30	SANDSTONE	Highly Weathered fine grained Sandstone	VIII	Weathered Yellowish brown silty fine grained sandstone. Drilling cores are mostly fragmental	IV						
19					Weathered							
20					Soft, core samples are crushed at places							
21												
22												
23												
24												
25												
26		Muddy										
27	100.60	MUDSTONE	Weathered Mudstone	IX	Core samples are broken into fragments or short cores	IV						
28					Yellowish brown Mudstone, weathered, with oxidated joints							
29												
30												

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DRILL LOG HOLE N° MG-93-2 SHEET N° 2 OF 2

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASIN		DEPTH	45.00	ELEVATION	128.10msnm	DRILL RIG	ACKER TEREDO
SITE		COORDINATES		INCLINATION	VERT			LOGGED	R. BURGOS
AVERAGE CORE RECOVERY		DATE		DRILLED	F. LINDAO				
94%		FROM 16/12/93 TO 9/01/94							
DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	CORE RECOVERY	SPT (N50) LUCEON TEST
31	98.00		Mudstone		Greenish gray Mudstone with yellowish oxidated levels			98.75%	
32					Compact				
33					Core samples are broken				
34	94.40								
35					Greenish sound gray Mudstone with traces of shells and sandy levels				
36	36.52		Mudstone		Sound				
37	37.00				intensively laminated along horizontal				
38					Bedding				
39									
40									
41									
42									
43									
44									
45	83.10								
END OF BORE HOLE 45.00m									

PLAGIOCLASE, SMECTITE/ILLITE > 30%
 QUARTZ < 10%
 HORNBLENDE, CHLORITE, PYRITE AND MICA < 1%
 Gs = 2661 g/cm³
 Sm = 2068 g/cm³
 U = 0.21
 E = 6100 Kg/cm²
 GIB = 12.39 Kg/cm²
 SpI = 0.16 Kg/cm²
 Id2 = 12.6%
 Id3 = 80.29 Kg/cm²

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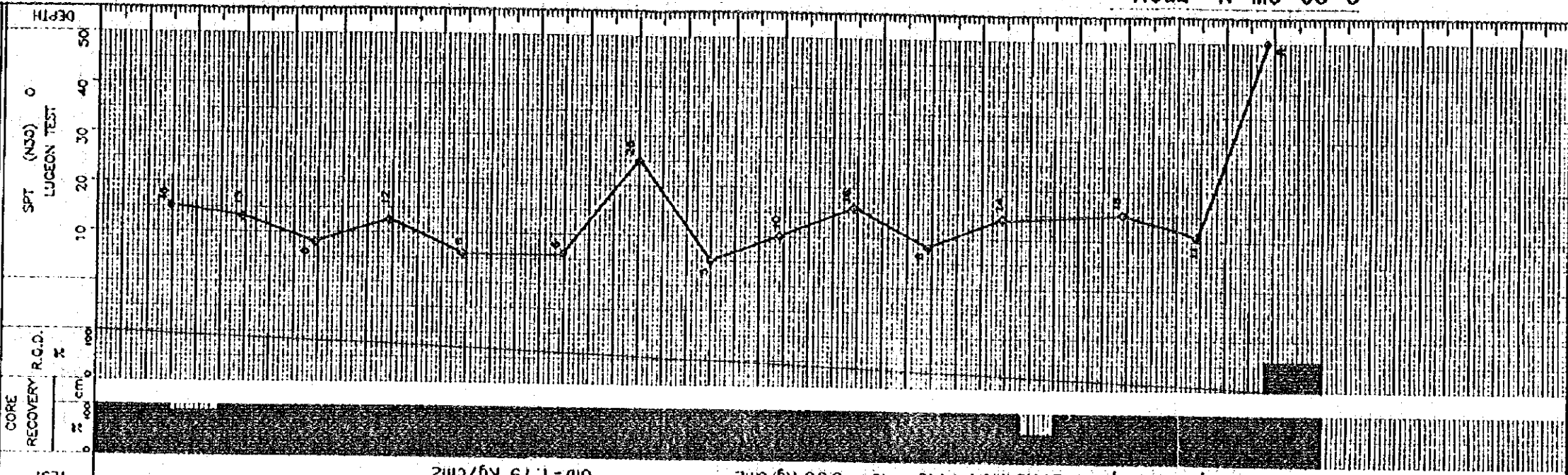
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DRILL LOG

HOLE N° MG-93-3 SHEET N°1 OF 1

HOLE N° MG-93-3

PROJECT		THE DETAILED DESIGN ON TRANSBASIN CHONE - PORTOVIEJO BASIN		DEPTH	25.00	ELEVATION	97.75msnm					
SITE		MANCHA GRANDE		INCLINATION	VERT	DRILL RIG	ACKER TEREDO					
AVERAGE CORE RECOVERY		99%		DRILLED	F. UNDAO	LOGGED	R. BURGOS					
DATE	DEPTH	ELEVATION	FORMATION	ROCK TYPE	COLUMN SECTION	DESCRIPTION	ROCK GRADE	ROCK TEST	TEST	DEPTH	SPT (N30) 0	LUCEON TEST
10/12/93	1	97.75	ALUVIAL	Silt		Grayish brown sandy silt with some of weathered rock debris	STIFF	Spi = 0.22 Kg/cm2		0		
	2					Numerous debris and gravels						
	3					Grayish brown fine grained silty sand						
	4					Clayey levels						
	5					level of debris						
	6					some debris						
	7					Gray containing rock fragments	STIFF					
	8					Greenish gray sandy silt						
	9	8.50 8.80				block of volcanic rock						
	10					Grayish brown silty fine grained sand	SOFT	E = 1900 Kg/cm2	D = 0.20			
	11					dark gray sandy soft silt						
	12					Greenish gray silty fine grained sand with some of gravel blocks	STIFF	Gs = 2735 gr/cm3	Rm = 2000 gr/cm3			
	13					Greenish gray sandy soft silt	SOFT					
	14					Brown silty fine sand with debris and gravel						
	15					Greenish gray silty sand with some gravels	STIFF					
	16					Grayish brown silty fine grained sand with weathered rock debris and gravel						
	17											
	18											
	19	78.85				Weathered blocks and rock fragments						
	20					Weathered debris of siltstone and fine grained sandstone in yellowish brown silty sand matrix						
	21											
	22					Greenish gray color						
	23					Drilled without water circulation						
	24	73.95				Greenish gray silty fine grained sandstone, some soft						
	25	24.20 24.52 72.75										
						END OF BORE HOLE 25.00m						



PLAGIOCLASE, SMECTITE / ILLITE > 30%
 QUARTZ < 10%
 HORNBLENDE, CHLORITE, PYRITE AND MICA < 1%
 Gs = 2735 gr/cm3
 Rm = 2000 gr/cm3
 Qu = 5.55 Kg/cm2
 D = 0.20
 Gb = 1.79 Kg/cm2
 Spi = 0.22 Kg/cm2
 Idz = 0.4 %

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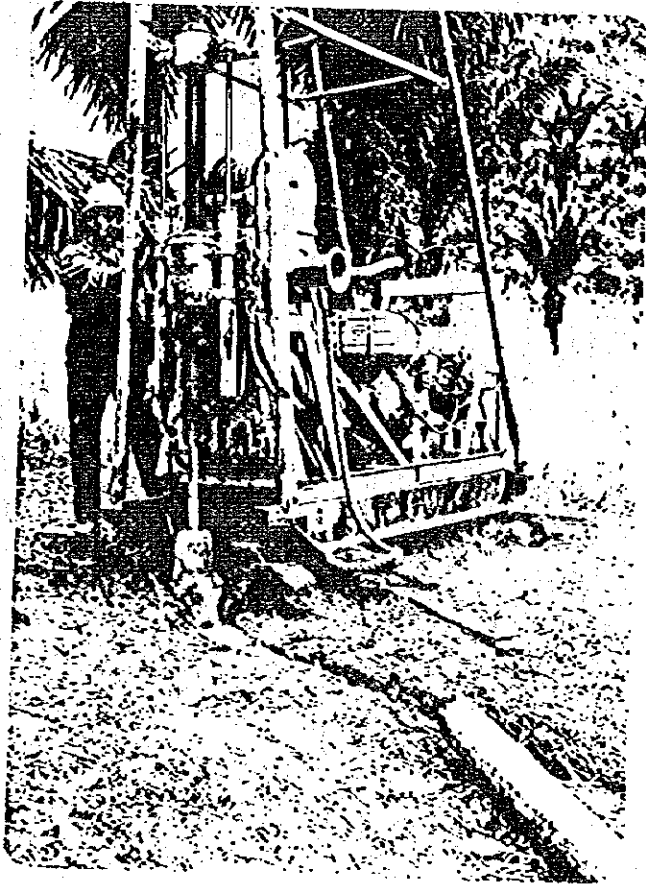


4.2 PHOTOGRAPHIC DOCUMENTATION



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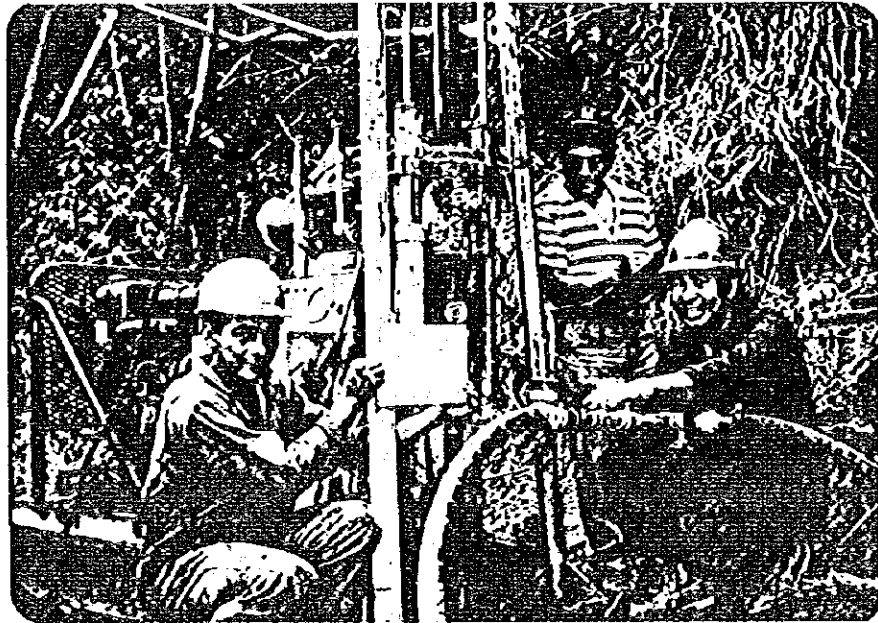
ACKER TEREDO DRILLING MACHINE



)

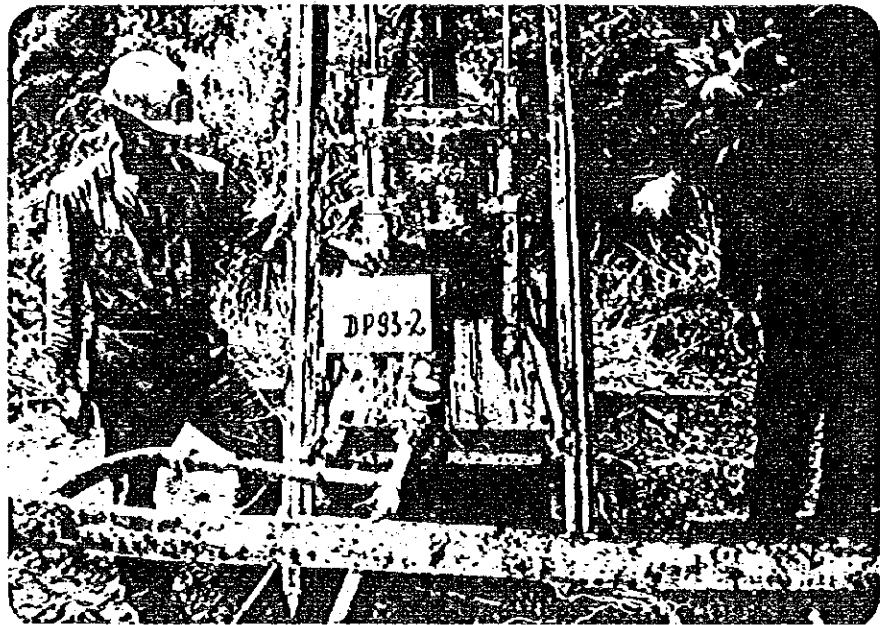


ACKER HILL BILLY DRILLING MACHINE





ACKER ACE DRILLING MACHINE



LUGEON TEST



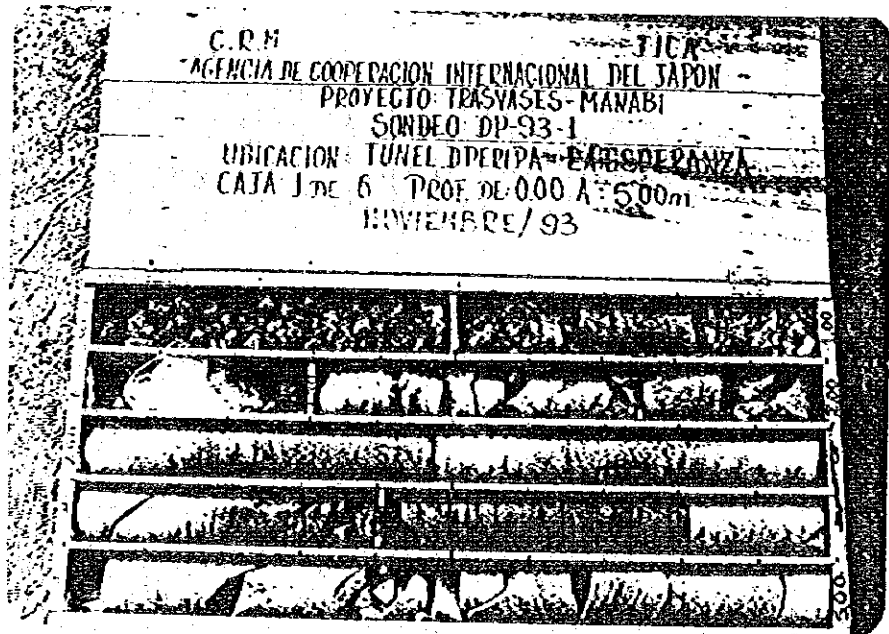


DP-93-1 BORING

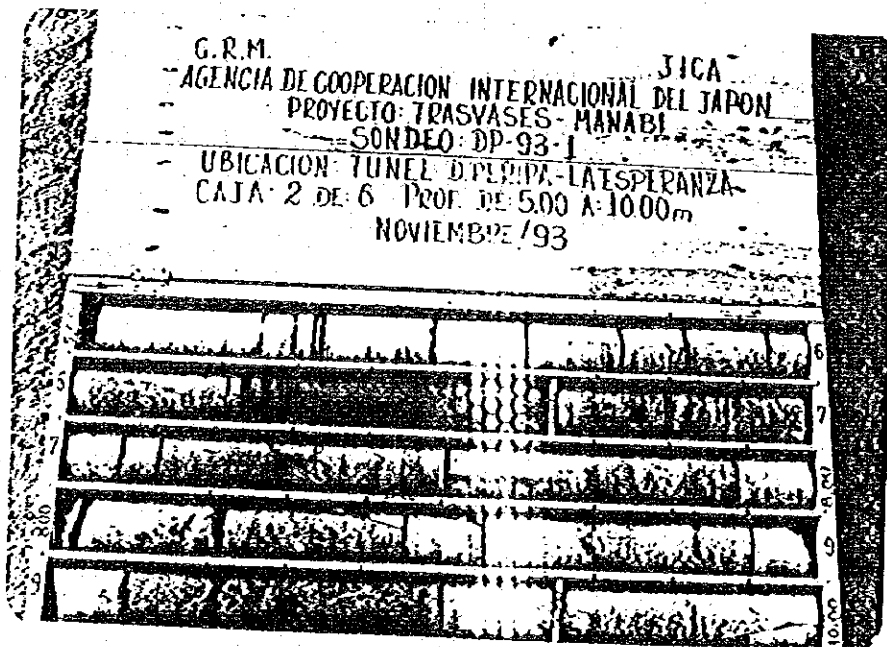
SITE: MULATOS
WORK: DAULE PERIPA TO LA ESPERANZA TUNNEL
DEPTH: 30 m.



BORING: DP-93-1
SITE: MULATOS
BOX NO: 1 OF 6
DEPTH: FROM 0.00 TO 5.00 m.

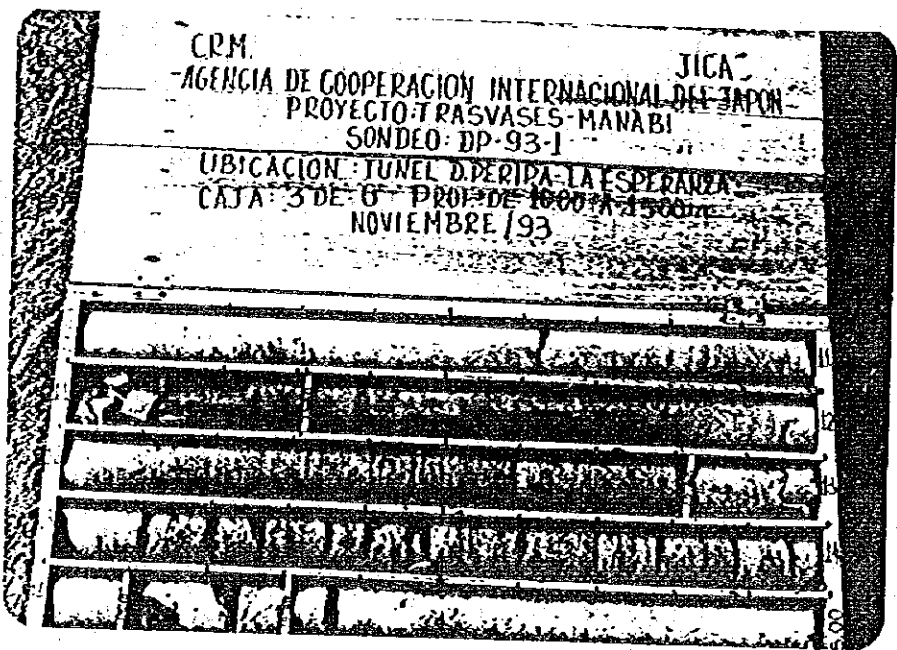


BORING: DP-93-1
SITE: MULATOS
BOX NO: 2 OF 6
DEPTH: FROM 5.00 TO 10.00 m.

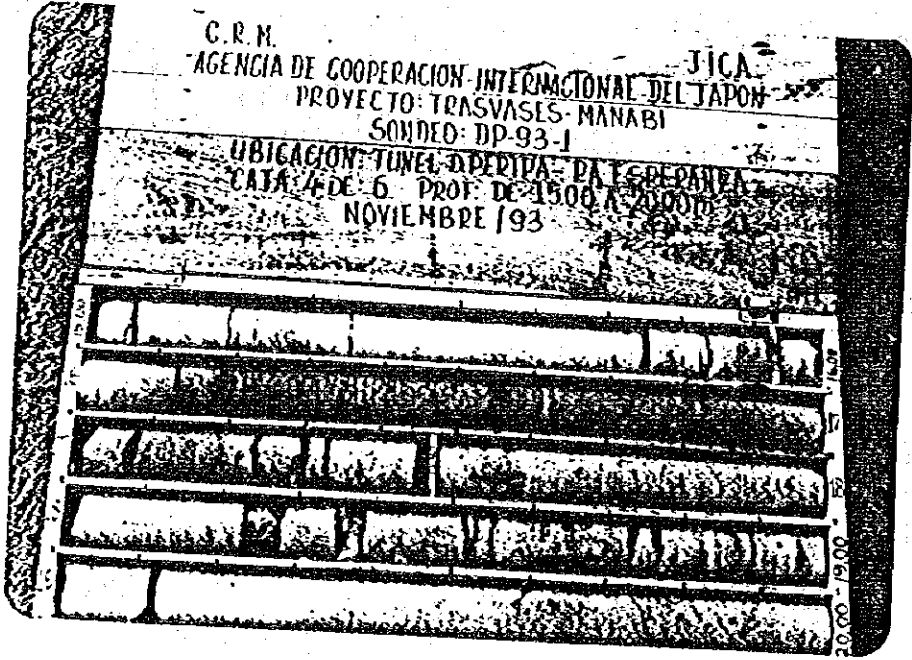




BORING: DP-93-1
SITE: MULATOS
BOX NO: 3 OF 6
DEPTH: FROM 10.00 TO 15.00 m.

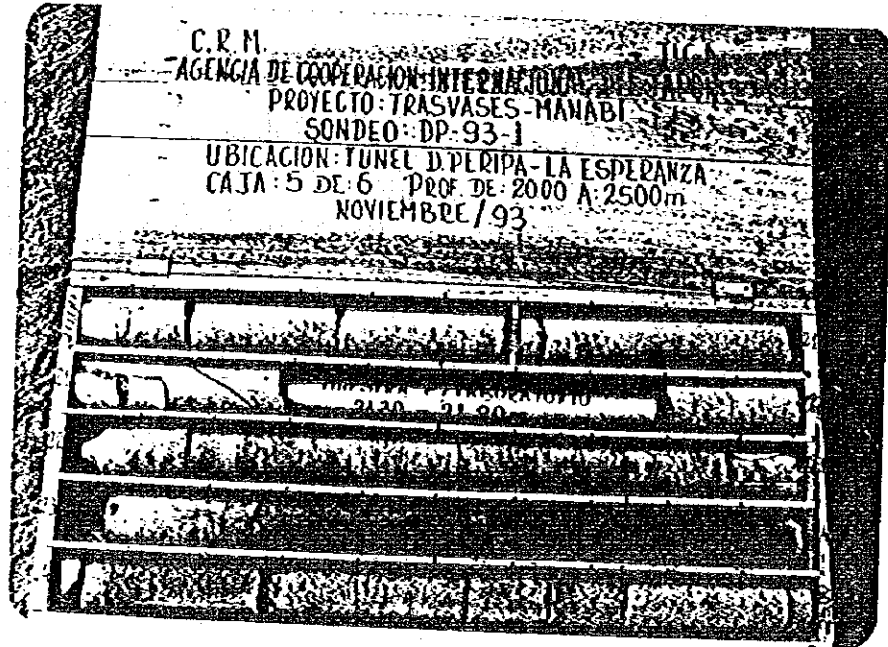


BORING: DP-93-1
SITE: MULATOS
BOX NO: 4 OF 6
DEPTH: FROM 15.00 TO 20.00 m.

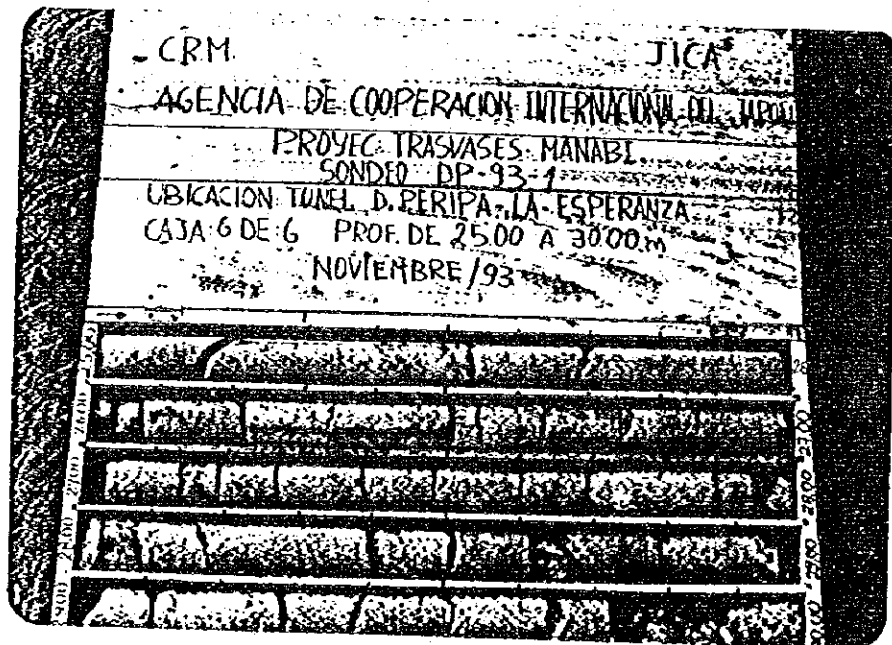




BORING: DP-93-1
SITE: MULATOS
BOX Nº: 5 OF 6
DEPTH: FROM 20.00 TO 25.00 m.



BORING: DP-93-1
SITE: MULATOS
BOX Nº: 6 OF 6
DEPTH: FROM 25.00 TO 30.00 m.



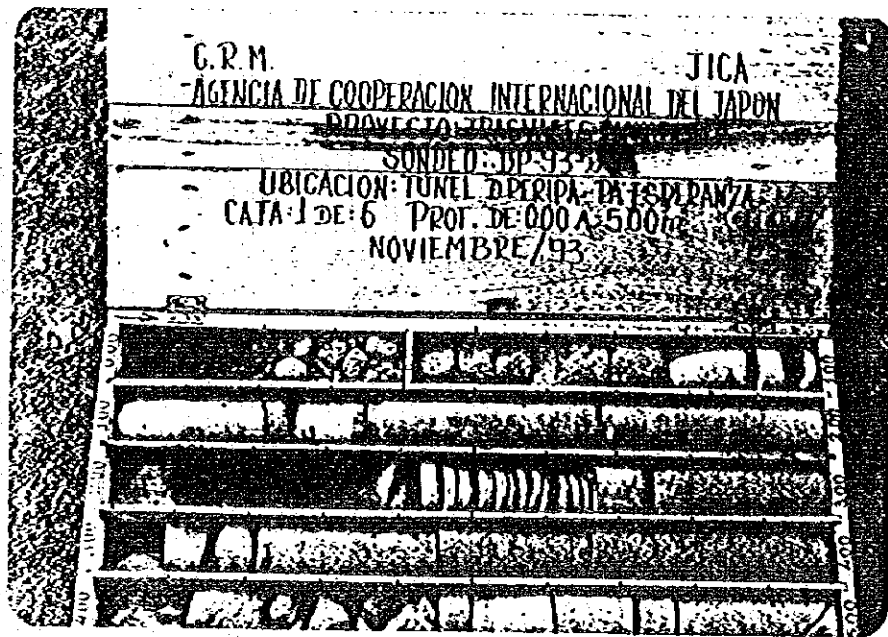


DP-93-2 BORING

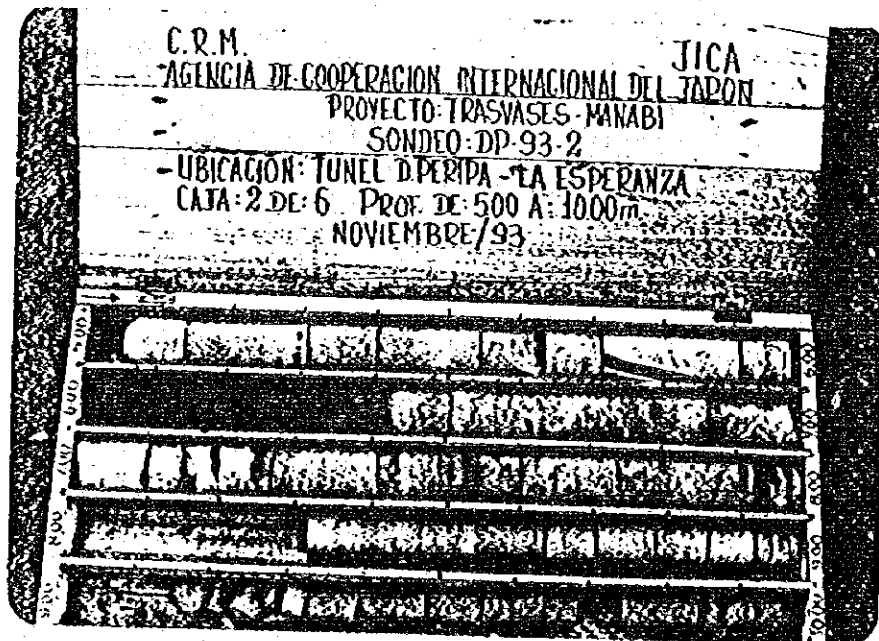
SITE: CAÑALES
WORK: DAULE PERIPA TO LA ESPERANZA TUNNEL
DEPTH: 30 m.



BORING: DP-93-2
SITE: CANALES
BOX Nº: 1 OF 6
DEPTH: FROM 0.00 TO 5.00 m.

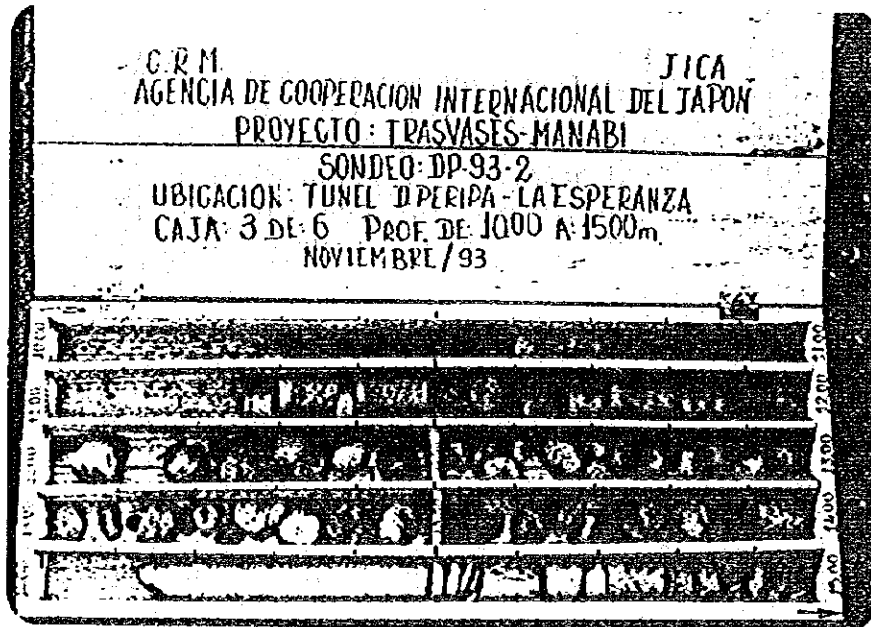


BORING: DP-93-2
SITE: CANALES
BOX Nº: 2 OF 6
DEPTH: FROM 5.00 TO 10.00 m.

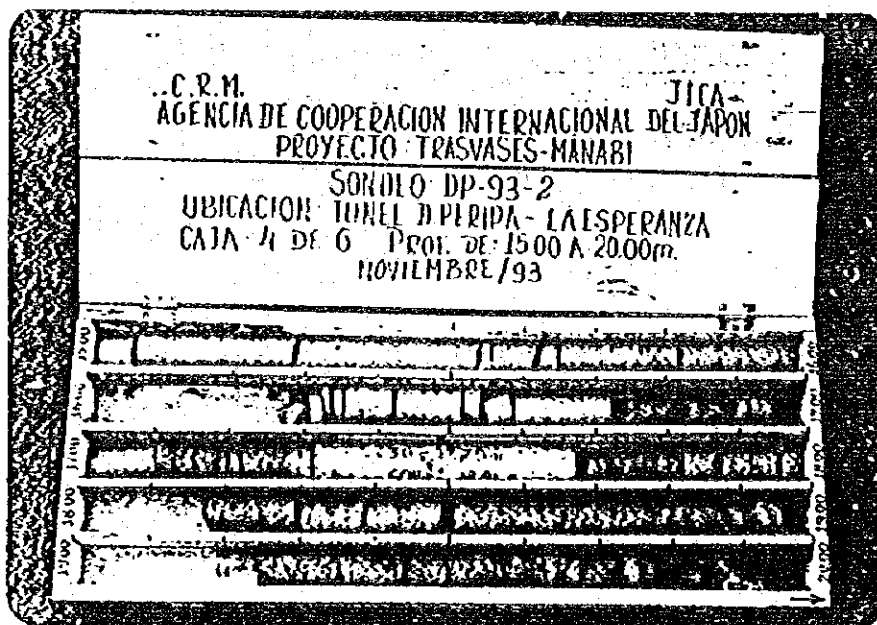




BORING: DP-93-2
SITE: CAÑALES
BOX Nº: 3 OF 6
DEPTH: FROM 10.00 TO 15.00 m.

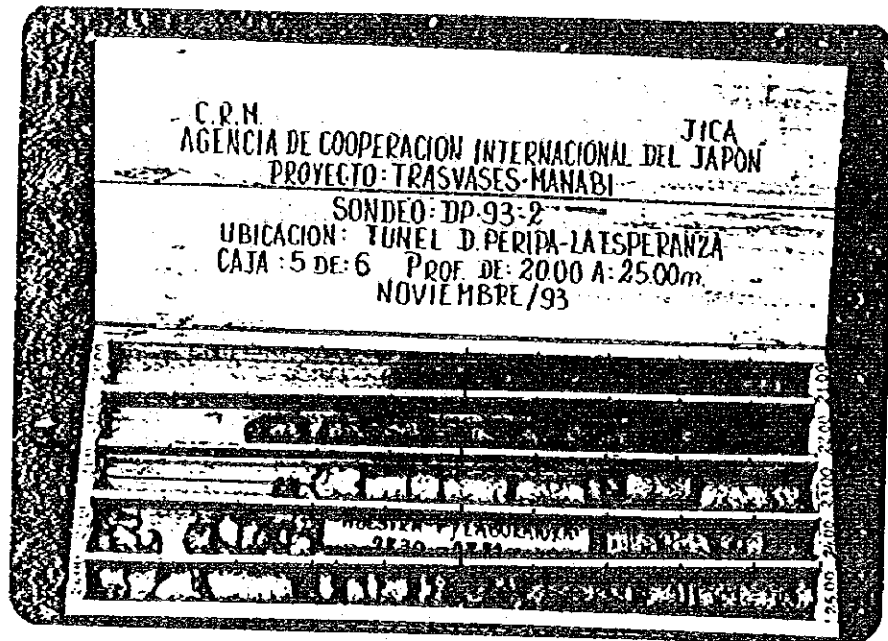


BORING: DP-93-2
SITE: CAÑALES
BOX Nº: 4 OF 6
DEPTH: FROM 15.00 TO 20.00 m.





BORING: DP-93-2
SITE: CAÑALES
BOX NO: 5 OF 6
DEPTH: FROM 20.00 TO 25.00 m.



BORING: DP-93-2
SITE: CAÑALES
BOX NO: 6 OF 6
DEPTH: FROM 25.00 TO 30.00 m.

