

PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	200.00m	ELEVATION	252.00m	
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 14°34'24"; E 121°26'13.2"	INCLINATION	Vertical	DRILL RIG	LY 44
CASING DEPTH	96.00m	DATE		DRILLED	Palma		

Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery — (%) R Q D [%]	Rock Classification	G.W.L N-Value	SPT-Test					WPT-Test (Lugcon Value)				
									N-Value									
									0	10	20	30	40	50				
61				Alternation of conglomerate and shale	Below 67.50m, core becomes more hard than above section, because observed slightly slaking not extremely in shale layers. Bedding planes dipping 55°.	(100%)	CM									Lu'=4.5 (Pc=7.0)		
62						(100%)												
63						(100%)												
64						(100%)												
65						(100%)												
66						(100%)												
67						(100%)												
68						(100%)												
69						(100%)												
70						(100%)												
71						(100%)												
72						(100%)												
73						(100%)												
74	178.20	73.80		Conglomerate	73.80-80.70m Gray firm conglomerate, with rubbles of 0.5-5cm in diameter. Partly thin layers of fine to coarse grained sandstone and shale with bedding planes of 60° in dip.	(100%)										Lu'=7.0 (Pc=4.8)		
75						(100%)												
76						(100%)												
77						(100%)												
78						(100%)												
81	171.30	80.70		Sand Stone	80.70-90.0m Gray sandstone, medium to very coarse grained, very firm and massive, with bedding planes of 60° in dip.	(100%)	CH									Lu'=4.8 (Pc=4.8)		
82						(100%)												
83						(100%)												
84						(100%)												
85						(100%)												
86						(100%)												
87						(100%)												
88						(100%)												
89				(100%)												Lu'=3.6 (Pc=5.5)		
90	162.00	90.00		(100%)														

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CASING DEPTH	96.00m	DATE		DRILLED	Palma		

Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery — (%) R Q D [%]	Rock Classification	G.W.L N-Value	SPT-Test					WPT-Test (Lugcon Value)					
									N-Value										
						0 50 100			0	10	20	30	40	50					
91			Conglomerate	Conglomerate	90.00-109.10m Gray firm conglomerate, with rubbles of 0.5-4cm in diameter. A few calcite veins noted dipping 50-60°.	(100%) (100%)	CH								Lu'=4.2 (Pc=9.3)				
92		(100%) (100%)																	
93		(100%) (100%)																	
94		(100%) (100%)																	
95		(100%) (100%)																	
96		(100%) (100%)																	
97		(100%) (100%)																	
98		(100%) (100%)																	
99		(100%) (100%)																	
100		(100%) (100%)																	
101		(100%) (100%)																	
102		(100%) (100%)																	
103		(100%) (100%)																	
104		(100%) (100%)																	
105		(100%) (100%)																	
106		(100%) (100%)																	
107		(100%) (100%)																	
108		(100%) (100%)																	
109	142.90	109.10																	
110			Shale	Shale	109.10-170.60m Gray hard shale, partly greenish or reddish. A few calcite veins noted dipping 30°and60°. In 109.60-129.60m, noted bedding planes of 60°in dip with cracks parallel.	(100%) (100%)	CM								Lu'=5.3 (Pc=5.0)				
111		(100%) (100%)																	
112		(100%) (100%)																	
113		(100%) (100%)																	
114		(100%) (100%)																	
115		(100%) (100%)																	
116		(100%) (100%)																	
117		(100%) (100%)																	
118		(100%) (100%)																	
119		(100%) (100%)																	
120																			

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CASING DEPTH	96.00m	DATE		DRILLED	Palma		

Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery — (%) R Q D [%]	Rock Classification	G.W.L	SPT-Test					WPT-Test (Lugcon Value)				
									N-Value									
									0	10	20	30	40	50				
121				Shale		(100) 100												
122							(100) 100											Lu'=7.4 (Pc=9.8)
123							(100) 100											
124							(100) 100											
125							(100) 100											
126							(100) 100											
127						In 125.50-129.30m, alternation with fine to medium grained sandstone layers of 20-60cm in thickness.	(100) 100											Lu'=6.6
128							(100) 100											
129							(100) 100											
130							(100) 100											
131						In 129.60-170.60m, noted bedding planes of 45-55° in dip with some cracks parallel.	(100) 100											Lu'=4.0 (Pc=5.0)
132							(100) 100											
133							(100) 100											
134							(100) 100											
135							(100) 100											
136						(100) 100											Lu'=3.3 (Pc=6.0)	
137						(100) 100												
138						(100) 100												
139					Slightly cracky and fragile in 137.30-138.40m and 140.00-141.90m.	(100) 100												
140						(100) 100												
141						(100) 100												
142						(100) 100											Lu'=11.0	
143					In 141.90-146.50m, alternation with medium grained sandstone layers of 10-70cm in thickness.	(100) 100												
144						(100) 100												
145						(100) 100												
146						(100) 100												
147						(100) 100											Lu'=4.7 (Pc=9.4)	
148						(100) 100												
149						(100) 100												
150						(100) 100												

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CASING DEPTH	96.00m	DATE		DRILLED	Palma		

Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery — (%) R Q D [%]	Rock Classification	G.W.L. N-Value	SPT-Test					WPT-Test (Lugcon Value)					
									N-Value										
									0	10	20	30	40	50					
150				Shale	Calcareous red shale noted in 155.00-169.30m.	(100)											Lu=3.7 (Pc=8.0)		
151								(100)											
152								(100)											
153								(100)											
154								(100)											
155								(100)											
156								(100)											
157								(100)											Lu=7.1
158								(100)											
159								(100)											
160				Shale	Below 162.80m, calcite veins and pools rich.	(100)													
161								(100)											
162								(100)											Lu=6.1
163								(100)											
164								(100)											
165								(100)											
166								(100)											
167								(100)											
168								(100)											Lu=4.5 (Pc=5.1)
169								(100)											
170				Limestone	170.60-177.90m Dark white limestone. In 170.60m, brownish surface of crack observed.	(100)													
171	81.40	170.60						(100)											
172								(100)											
173								(100)											
174								(100)											
175								(100)											
176								(100)											
177								(100)											
178	74.10	177.90						(100)											
179						Calcareous Shale	177.90-200.00m Gray to light gray shale, hard and calcareous, with bedding planes of 45° in dip. It looks fragile along thin foliated layers of dark gray shale, caused by release of in-situ stress during drilling operation.	(100)											
180								(100)											

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CASING DEPTH	96.00m	DATE		DRILLED	Palma		

Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery — (%) R Q D [%]	Rock Classification	G.W.L	SPT-Test					WPT-Test (Lu-gcon Value)			
									N-Value								
									0	10	20	30	40	50			
-181				Calcareous Shale	In 181.00-182.00m, low core recovery with fragments in which surface extremely brownish. Possibly fault zone.	(60)	CM									Lu'=10.2	
-182						(65)	D										
-183						(70)											
-184						(60)	CM										
-185						(65)											
-186						(62)	CL										
-187						(50)											
-188						(60)											
-189						(55)											
-190						(56)											
-191				(60)													
-192				(57)													
-193				(56)	CM												
-194				(62)													
-195				(70)													
-196				(55)													
-197				(50)													
-198				(60)													
-199				(57)													
				(60)													

PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	150.00m	ELEVATION	220.00m		
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,380 ; E 529,970		INCLINATION	Vertical	DRILL RIG	LY 44
CASING DEPTH	24.00m	DATE		DRILLED	Palma			

Scale (a)	Elevation (b)	Depth (c)	Column Section	Type of Rock or Soil	Description	Core Recovery — (%) R Q D — [%]	Rock Classification	G.W.L.	SPT-Test					WPT-Test (Lugcon Value)
									N-Value					
						0 50 100			0 10 20 30 40 50					
1				Clay - Sandy Clay	0.00-30.00m Reddish brown clay to sandy clay with high plasticity. Extremely weathered zone.									
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25						In 23.50-24.80m and 28.40-29.40m, noted boulders of comparatively soft tuff breccia.								
26														
27														
28														
29														
30	190.00	30.00												

PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	150.00m	ELEVATION	220.00m
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,380 ; E 529,970		INCLINATION	Vertical
CASING DEPTH	24.00m	DATE		DRILLED	Palma	

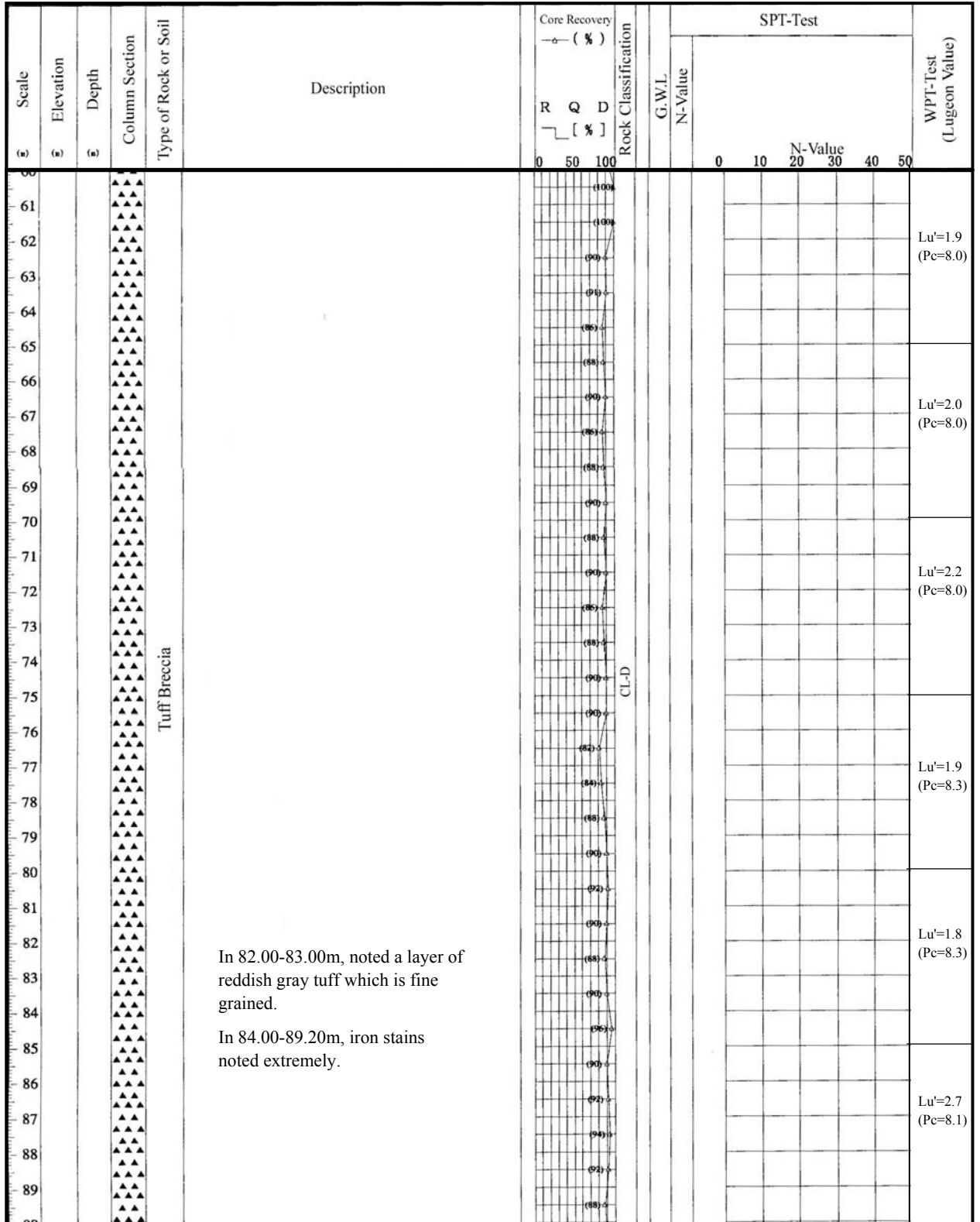
Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery ← (%)			Rock Classification	G.W.L N-Value	SPT-Test					WPT-Test (Lugeon Value)		
						R	Q	D			N-Value							
						0	50	100			0	10	20	30	40	50		
30			▲▲▲▲▲	Tuff Breccia	30.00-132.00m													
31			▲▲▲▲▲		Gray or light brown tuff breccia													
32			▲▲▲▲▲		with mainly rubbles of fresh to													
33			▲▲▲▲▲		weathered andesite, which is													
34			▲▲▲▲▲		1-5cm in average diameter, and													
35			▲▲▲▲▲		including same boulders of 20-60cm													
36			▲▲▲▲▲		in diameter.													
37			▲▲▲▲▲		In 30.00-91.00m, mixed of massive													Lu=5.6
38			▲▲▲▲▲		core, fragments and soil. Iron stains													
39			▲▲▲▲▲		generally noted on surface of cracks.													
40			▲▲▲▲▲		Especially below parts are soil rich:													
41			▲▲▲▲▲		42.00-48.00m													
42			▲▲▲▲▲		51.40-53.00m													
43			▲▲▲▲▲		65.00-65.60m													
44			▲▲▲▲▲		82.00-83.00m													
45			▲▲▲▲▲		88.80-89.20m													
46			▲▲▲▲▲															
47			▲▲▲▲▲															Lu=7.2
48			▲▲▲▲▲															
49			▲▲▲▲▲															
50			▲▲▲▲▲															
51			▲▲▲▲▲															
52			▲▲▲▲▲														Lu'=2.5 (Pc=6.3)	
53			▲▲▲▲▲															
54			▲▲▲▲▲															
55			▲▲▲▲▲															
56			▲▲▲▲▲															
57			▲▲▲▲▲														Lu'=2.5 (Pc=6.2)	
58			▲▲▲▲▲															
59			▲▲▲▲▲															
60			▲▲▲▲▲															

DRILL LOG

HOLE NO. TD-4

SHEET NO. 3 OF 5

PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	150.00m	ELEVATION	220.00m
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,380 ; E 529,970		INCLINATION	Vertical
CASING DEPTH	24.00m	DATE		DRILLED	Palma	

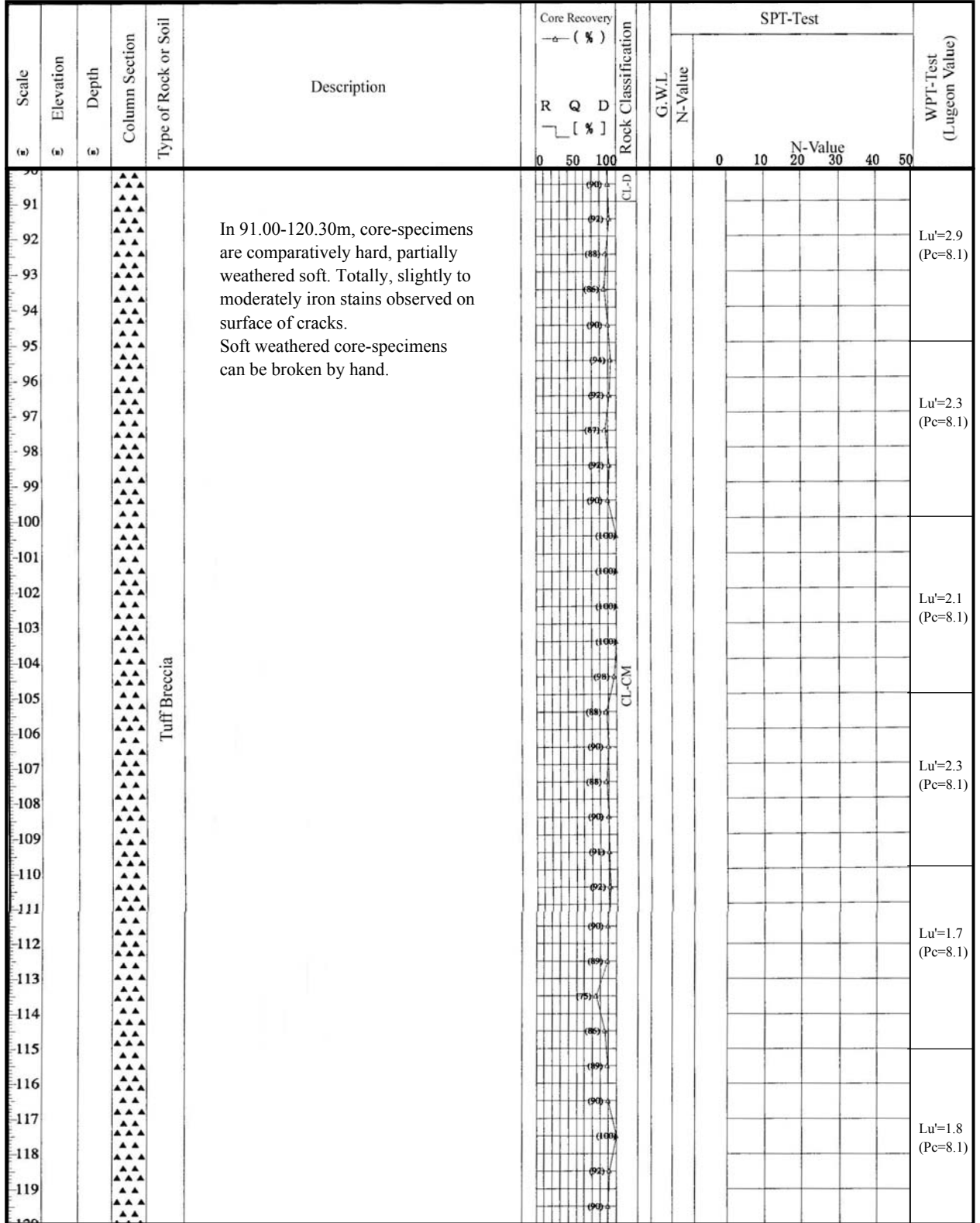


DRILL LOG

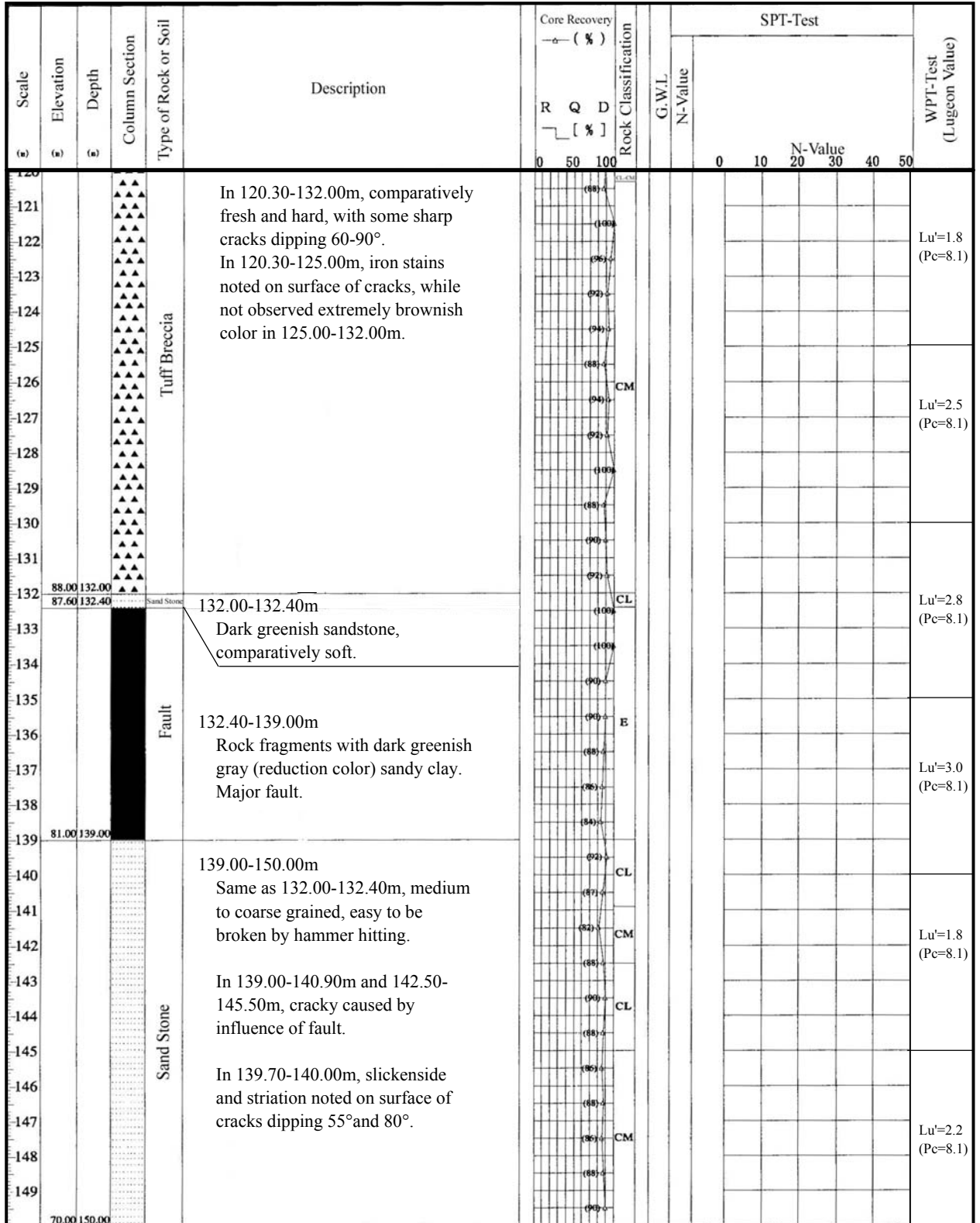
HOLE NO. TD-4

SHEET NO. 4 OF 5

PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	150.00m	ELEVATION	220.00m	
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,380 ; E 529,970	INCLINATION	Vertical	DRILL RIG	LY 44
CASING DEPTH	24.00m	DATE		DRILLED	Palma		



PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	150.00m	ELEVATION	220.00m	
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,380 ; E 529,970	INCLINATION	Vertical	DRILL RIG	LY 44
CASING DEPTH	24.00m	DATE		DRILLED	Palma		



PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	70.00m	ELEVATION	158.00m	
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,530 ; E 527,380	INCLINATION	Vertical	DRILL RIG	LY 24
CASING DEPTH	None	DATE		DRILLED	Palma		

Scale	Elevation	Depth	Column Section	Type of Rock or Soil	Description	Core Recovery — (%) R Q D [%]	Rock Classification	G.W.L.	SPT-Test					WPT-Test (Lugcon Value)				
									N-Value									
(a)	(b)	(c)				0	50	100	0	10	20	30	40	50				
1				Shale	0.00-12.00m Gray to greenish gray sandy shale, firm, with bedding planes of 5-10° in dip.	[80]	CL											
2						[84]												
3						[88]												
4						[90]												
5						[90]												
6						[100]												
7						[100]												Lu'=1.8
8						[100]												
9						[100]												
10						[100]												
11						[100]												
12	146.00	12.00				[100]												
13				Sand Stone	12.00-15.00m Gray firm sandstone, very coarse to medium grained, with graded bedding of 8° in dip. Surface of sharp vertical crack shows brownish color.	[100]	CM											
14						[80]												
15						[84]												
16						[90]												
17						[90]												
18						[84]												
19				Shale	15.00-18.50m Low core recovery, although same as 12.00-15.00m.	[92]	D											
20						[90]												
21						[100]												
22						[88]												
23						[90]												
24						[100]												
25				Shale	18.50-25.70m Gray, reddish gray or greenish gray sandy shale, banded, firm but cracky. Surface of sharp vertical crack indicates brownish color.	[100]	CL											
26	132.30	25.70				[94]												
27	131.50	26.50				[100]												
26				Fault	25.70-26.50m	Brown soft soil. Possibly fault.												
27				Sand Stone	26.50-46.50m Gray sandstone, fine to medium grained, banded and firm.	[94]	D											
28						[100]												
29						[75]												
30						[92]												
30																		

PROJECT	Study on Water Resources Development for Metro Manila		DEPTH	70.00m	ELEVATION	158.00m	
SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,530 ; E 527,380	INCLINATION	Vertical	DRILL RIG	LY 24
CASING DEPTH	None	DATE		DRILLED	Palma		

Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery ← (%) R Q D [%]	Rock Classification	SPT-Test				WPT-Test (Lu _{geon} Value)			
								G.W.L	N-Value	N-Value					
									0	10	20	30	40	50	
31				Sand Stone	In 31.60m, brownish surface of sharp crack dipping 85°.	100	CM	36.00							Lu'=1.2 (Pc=8.9)
32						100									
33						100									
34						100									
35						100									
36						100									
37						100									
38						100									
39						100									
40						100									
41				Shale	In 42.30-46.50m, some cracks dipping 60-80° with slightly brownish surface.	100	CL-CM							Lu'=0.9 (Pc=5.9)	
42						100									
43						100									
44						100									
45						100									
46						100									
47	111.50	46.50				100									
48						100									
49						100									
50	108.00	50.00				100									
51	106.50	51.50		Sand Stone	50.00-51.50m Gray sandstone, fine to coarse graded, slightly greenish.	100							Lu'=1.0 (Pc=8.1)		
52						100									
53				Conglomerate	51.50-55.20m Gray conglomerate including granules. Below 53.70m, no brownish surface of cracks.	100	CM						Lu'=1.2 (Pc=8.6)		
54						100									
55	102.80	55.20				100									
56						100									
57				Alternation of shale and sandstone		100							Lu'=1.2 (Pc=8.6)		
58						100									
59						100									
60						100									

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SITE	Transfer Tunnel No.1 Route	COORDINATE	N 1,612,530 ; E 527,380		INCLINATION	Vertical
CASING DEPTH	None	DATE		DRILLED	Palma	

Scale (m)	Elevation (m)	Depth (m)	Column Section	Type of Rock or Soil	Description	Core Recovery ← (%) R Q D [%] 0 50 100	Rock Classification	G.W.L N-Value	SPT-Test					WPT-Test (Luqcon Value)	
									N-Value 0 10 20 30 40 50						
60															
61				Alternation of shale and sandstone	55.20-70.00m Alternation of sandy shale and sandstone, shale rich (65%) and 50-100cm cycled. Shale is gray, greenish gray or reddish gray, and banded with bedding planes of 10° in dip. Sandstone is fine to coarse grained, and gray. In 60.30-70.00m, comparatively crackly.									Lu'=1.0 (Pc=8.7)	
62															
63															
64															
65															
66															
67															
68															
69															
	55.00	70.00													