PN AE'L-777

94372

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

MISSION TO PAKISTAN

CATHODIC PROTECTION OF ALL BURIED PIPELINES ON THE 600 MW GUDDU COMBINED CYCLE PROJECT

REQUISITION NO 391-0473-3-40480

REPORT ON
C-SCAN,
PEARSON AND
PIPE TO SOIL
POTENTIAL SURVEYS

PAKISTAN ENGINEERING SERVICES (PVT) LIMITED.
Consulting Engineers
Karachi - Pakistan

BEST AVAILABLE DOCUMENT

PROJECT
FOR

CATHODIC PROTECTION OF YARD
PIPING OF GUDDU COMBINED CYCLE
POWER PLANT AND SURVEY OF
20" MARRI-GUDDU GAS LINE

REF: REQUISITION NO. 391-0473-340480

REPORT: COVERS 20" MARRI-GUDDU GASLINE SURVEY AND ANALYSIS

BEST AVAILABLE DOCUMENT

CONTENTS

20" MARRI GUDDU PIPELINE CORROSION SURVEY

1. INTRODUCTION

2. BASIC PURPOSE DEFINED

3. SYSTEM DEFINED

4. METHODOLOGY

5. PIPE TO SOIL POTENTIALS

6. CONDUCTANCE OF COATING

7. COATING CONDTITION

   A) Pearson Survey
   B) C-Scan Survey

8. CASING INSULATION SURVEY

9. INSULATING FLANGES CHECK

10. TRANSFORMER RECTIFIER OUTPUT AND GROUND BED RESISTANCE.

11. COATING PEEL TESTS

12. RECOMMENDATIONS

13. POTENTIAL SURVEY ANNEXURE A

14. PEARSON SURVEY ANNEXURE B

15. C-SCAN SURVEY ANNEXURE C

16. C-SCAN GRAPHICAL PRESENTATION PLOTS

BEST AVAILABLE DOCUMENT

1. INTRODUCTION

Scope of work required following site tests to be conducted on 20" Marri-Guddu gas pipeline:

1. Measure current densities.

2. Perform conductance survey of existing pipeline coating.

3. Make Pipe to Soil Potential survey on existing pipeline installation.

4. Take measurement of induced A/C voltages.

5. Check insulation levels of pipeline insulated flanges and joints

6. Pearson and C-Scan survey.

2. BASIC PURPOSE:

The purpose of all the above tests were basically to assess the condition of Cathodic Protection system as well the condition of coating protection. In depth investigations and detail tests were conducted on the entire length of the pipeline. Review of the test results will enable accurate assessment of the external pipeline corrosion possibilities and actions to reduce the rate of corrosion.

3. SYSTEM DEFINED

The 20 inch Marri-Guddu Steel pipeline conforming AP1 5L specification coated with two wraps of inner 3 ply polyethylene butyl-polyethlene coating and two layers of outer wrap of two ply Polyethylene Butyl coating. This system of coating ensures inter-layer bonding adhesion as well as gives better cohesion as four layers gives additional pressure on the bottom layers. The pipeline is protected against corrosion by Cathodic Protection using impressed current system. A total of five transformer rectifiers have been used so as to reduce the drain point potential.

Insulating flanges have been installed at either end of the pipeline, that is, at Guddu end before the gas regulators and at Marri-end dehydration plant. No insulating flanges were found at any other location along the route.

BEST AVAILABLE DOCUMENT

4. METHODOLOGY

A: Check of pipe to soil potential and current drain of rectifier to asertain the conductance of coating and condition of ground beds.

B: Casing and insulating flanges were checked to ascertain their insulation condition.

C: Pearson was done to ascertain coating faults.

D: C-Scan was done to counter check Pearson results and to have reference data for future.

E: Coating peel tests was done to get a physicl assessment.

As the as-built drawings did not have any scale physical reference points were used to identify and fix location of faults.

5. PIPE TO SOIL POTENTIAL

Pipe to soil potentials are given in Annexure A.

The minimum potential rquired to protect the pipeline against corrosion is -0.85V with Cu-Cu sulphate half cell as reference. Keeping this in view the whole pipeline was under protection. It is preferred to keep the potential as close to -0.85V as possible and preferably betwwen 0.90 to 1.0. Too high a potential can result in disbonding of coating. As can be seen the potentials are very high and these should be brought in the range of -0.90 to -1.0 volts. With five rectifiers available this will be no problem.

In view of the test of insulating flanges which showed leakage at both ends it was decided to conduct fresh tests by shutting off all the five transformer rectifiers. As expected the pipeline retained potentials between -0.70 to -0.88 which is partial protection with nearly two third of the pipeline having potentials of -0.80 volts which is very close to full protection. This means that over all cathodic protection is being achieved wherever the current is reaching the pipe.

No induced voltage was found along the pipeline.

Salient points:

(a) Drain point potentials are high and can be reduced.

(b) The line across the barrage should have insulating flanges. These can be at valve assemblies.

BEST AVAILABLE DOCUMENT

(c) The insulation of pipeline on barrage is doubtful. After the installation of insulating flanges this can be monitored. However, since both sides of the barrage the pipeline is under full protection the situation is not very serious.

(d) The fact that even after shutting down all five transformer rectifiers on Marri-Guddu line the line still shows potentials means current is coming in from both ends. The insulating flanges at either end need to be rectified so that they provide proper insulation and the ability of corrosion engineer to control potential level within reasonable limits.

6. CONDUCTANCE OF COATING:

Presently one transformer rectifier was not giving the output. The balance four were giving output of 1,7,4,4 amperes or a total of 16 amperes. It is possible that at this level of out put the transformers at either ends are feeding the other structures. The reason being that the potential at both end goes down with transformers of Marri line energised. The current requirement is therefore in the range of 10 amperes. The surface area of the pipeline is 1.08 million square feet which gives density of protection at 0.01 mA/sq. feet. This is a requirement of a polyethylene coated or polyethylene extruded pipeline which shows that high dielectric strength of the polyethyline and the amalgamation of the two layers of three ply butyl rubber are quite effective.

7. COATING CONDITION

The coating condition-deterioration depends on following factors:

a) Original specifications of coating mterials and application requirements.

b) Quality control on cleaning of pipe during construction.

c) Proper storage and handling of coating material prior to its application.

d) Quality of coating material such as primer, tape etc.

e) Damage to coating during lowering of pipe in trench.

f) Damage of coating due to installation of trench weight.

BEST AVAILABLE DOCUMENT

Pearson survey and C-Scan survey are instruments which are used to carry out check without excavation of the pipeline and without damaging the coating.

The survey report are extremely helpful in locating coating damages, disbonding or other faults. All these faults are picked up by the operator electronically. In case of C-Scan the fault pick up is quantified in form of attenuation and current values whereas in case of Pearson the operator has to assess the sound signals and record his evaluation. Pearson has been in use for more than 25 years whereas C-Scan is an instrument which has been recently introduced.

(A) PEARSON SURVEY

The survey analysis is given in Annexure B attached herewith. During the Pearson survey we had the technician of WAPDA with our team all the time. In this way he was able to physically mark on the ground the potential fault areas. However, the fault areas are also identified in the discription. Since the pipeline is going through open area the possibility of interference with other structures is remote. As also damage by other agencies. So whatever faults are there are either of coating material, or inadequate application of primer or tape or damage to coating at time of lowering in trench or installation of trench weight. In some instances the line was exposed which will result in faster ageing due to effect of exposure to sun and wide variation in temperature besides external damage. As can be noted the earth cover over the line is not sufficient in many places as the line has not been laid deep enough. From Marri-gas field end the trench weight are exposed, indicating that no packing has been placed between trench weight and pipeline. This would resultt in damage to coating at time of installation. Furthermore more damage will occur due to soil movements resulting in pipe and trench weight differential movements. So all trench weight locations are suspect.

(B) C-SCAN

This survey has the good feature of quantifying and recording the ampere loss and attenuation which can be rechecked by anyone say after two years to see the difference. If there is no difference this would mean the situation is stable.

BEST AVAILABLE DOCUMENT

The survey has been carried out from T.P. 1 to 144 meter beyond the T.P. 58 (from Mari Gas Field towards Guddu). It was not possible to continue beyond this limit, due to the interference problem caused by the high tension transmission lines in the vicinity of pipeline route. We have plotted the data in graphical form to ease in the understanding. The graphical form can be used to physically investigate the actual condition by excavation.

There is a need to briefly describe the result and their actual signifcance. The C-Scan instrument displays the value of mB per meter to indicate the conditon of the coating. The mB reading is recorded against drop in current values. The ideal values for a very good quality coating for a 20 inch pipeline has been given as 0.2 to 0.4 mB/M when new. This is only the reference and for each line the standard value should be established when it is newly construcrted. Since figures of newly constructed lines are not available for this line the current C-Scan survey will form the baseline for future comparison.

In our case following parameter would be more appropriate: Standard between 0.2 to 0.5 mB. Acceptable between 0.5 to 4.0 mB. Beyond the value of 4 mB detail investigation should be done. It is likely that beyond 4 mB range there is some damage either during construction or later while installing trench weights. Seperate note will be given under recommendation for rectification of fautls.

Here it maybe pointed out polyethylene coating of two ply and three ply system with four layer gives extremely tough long lasting protection. Polyethylene coating has very high dielectric resistance and extremely low water absorptions. All these factors provide a very good safety margin and long term reliability of the coating.

One aspect which needs to be noted is that coating adhesion to pipe is of critical importance. If the coating is disbonded due to numerous factors of material and construction quality control the effectiveness of the coating is substantially reduced. This disbonding of coating also results in higher reading of mB in C-Scan survey. However disbonding of coating would be on longer sections giving uniformaly higher figures of mB and so the evaluation is limited to consider this as deterioation of coating. Another factor of higher readings would be insufficient overlap resulting in less number of layers and therefore reduced compression on lower layer or higher chances of disbondment.

The C-Scan and Pearson survey results as attached should be kept as important reference for effective control of the corrosion mitigation programme of this very important pipeline.

BEST AVAILABLE DOCUMENT

8. CASING INSULATION:

Pipe is usually encased in casing pipe of bigger diameter at road, railway or other crossings in order to protect the main carrier pipe. In this case 24 inch pipe casing has been used.

The pipe casing is to be insulated from the carrier pipe by seperators so that the carrier pipe is not shorted with casing pipe which is bare unprotected pipe.

If a carrier pipe is shorted with casing pipe it results in obnormal current drainage from the carrier pipe to casing pipe. A dip can occur at shorted point resulting in potential drop below protected levels. Besides the current input has to be increased resulting in requirements of high potentials at drain points as well as in distant locations to meet this "unplanned" drain on the C.P system. This short is generally due to poor construction practice. Following casing are shorted as can be seen from potentials taken from breather vents which are welded to casing.

a) National Highway, crossing no. MG-008, drawing no. MG/XING/008 by Petrocon: -1.25v

b) Kanju Dharki Road, crossing no. MG-003, drawing no. MG/XING/003 by Petrocon: -1.25v

c) Reti Road, crossing no. MG-007, drawing no. MG/XING/007 by Petrocon: -0.94v

Three others have potentials which are suspect.

d) Machka Road, crossing no. MG-011, drawing no. MG/XING/011 by Petrocon: -0.54v

e) Railway crossing, crossing no. MG-004, drawing no. MG/XING/004 by Petrocon: -0.54v

f) Dharki/Sankhe Road, crossing no. MG-002 drawing no. MG/XING/002 by Petrocon: -0.70v

To rectify this short is not simple matter because the cause of short is difficult to ascertain. There could be water in the casing, the ends could be touching if proper insulators were not used, or there could be some unwanted metallic debris between carrier pipe and casing. Rectification should be tried by:

a) Exposing the end seals and checking for clearance between carrier pipe and casing.

b) Checking for water or other debris.

BEST AVAILABLE DOCUMENT

c) If the potential presists then the casing would also need to be protected for which cathodic system for each shorted casing would need to be investigated, special test performed and design implemented.

9. INSULATING FLANGES

As far as we could ascertain from site investigatings and available drawings there are only two insulating flanges installed at either end of this pipeline. There should be a minimum of six flanges which include two at either end of Guddu Barrage. Insulating flanges are ideal places where current flows can be easily monitored for control purpose. Not to have insulating flanges for such long lengths is poor cathodic protection practice. To minimize drain point potential as well as maximum potential it should be possible to restrict each rectifier to a controlled section. This is achieved by installing insulating flanges. Recomended locations are:

a) Upstream of valve assembly near Guddu.

b) Upstream of valve assembly near Sahar Wah before C.P. station No.3.

c) Near C.P station 2.

d) Down stream of valve assembly near Narly Wah.

The insulating flanges are generally installed, at valve assemblies as this is considered convenient. If no valve assembly is available then a pit would need to be constructed to maintain and monitor the flange assembly. The existing insulating flanges are shorted. These need to be rectified to enable proper control of C.P. system. From our visual observation it is unlikely that the shorts can be rectified without cutting out the flanges and reallignig them so that the holes of flanges are matched.

10. TRANSFORMER RECTIFIERS

Each Transformer Rectifier Station was checked and following results noted:

A: C.P. station No.1
Output 4 Amps. at 2 volts giving a ground bed resistance of 0.5 ohm which is OK.

BEST AVAILABLE DOCUMENT

B: C.P. station Np.2
Output 4 Amps at 1.5 volts giving ground bed resistance of 0.38 ohms which is OK.

C: C.P. station No.3
This station was off as it was not givign the out. Our investigation has indicated that T.R. is OK and the likely fault is in the positive cable between 5 to 20 meters from the T.R.

D: C.P. station No.4
Output of 1.0 Amps at 5 vots giving a ground bed resistance of 5 ohms which is high and this should be improved by watering.

E: C.P. station No.5
Output of 7 Amps at 6 volts giving ground bed resistance of 0.8 ohm which is O.K.

As the current requirement is small at present due to pipeline being practially new there is excess capacity available. It is possible to operate the T.R. at very low level or even shutting off some transformer rectifier altogether. As advised earlier the drain point potentials would need to be balanced to achieve optimum levels of potential all along the line. This job of optimization can become much simpler after installation of insulating flanges.

11. COATING PEEL TESTS:

C-Scan and Pearson surveys help in locating faults and to assess the deterioration of coating. Peel test, which is a destructive test is also very useful in assessing the condtion of coating integrity. In short time of about 1 to 2 years all good quality coating system like the 3 ply/2 ply polyethylene cold applied tape system nothing should really go wrong.

Peel tests cannot be taken at frequent intervals as this will unnecessiarly create faults which will need very careful repair.

Consequently we decided to make just one test. The test was done by cutting a strip of tape on three side of width 20 mm and length about 7 cm. The moment the cuts were made the tape lifted up and exposed the surface rusting below the tape. This meant that there was no bond. This could be due to many reasons. Quality of primer, low primer application, quality of cleaning etc. As there was no bond it was decided to take another test where we can hopefully get a reading.

BEST AVAILABLE DOCUMENT

The first test was conducted between Haji Khan Leghari Bridge and culvert about 3 meters from culvert. The next site was choosen toward Guddu about 200 meter after C.P. station No.1. At this point the peel test was repeated which gave much better results than the previous test. At this test there was visible bond between pipe and tape. The bond test machine was used to assess

the value of the Bond and it gave reading of 3.2 N/20 mm. This mean a reading of 1.6 N/10 mm. The values which are considered achievable and given in manufacturers literature of such tapes is 15 N/10 mm which gives the level of bonding strength. So by and large the bonding of tape to pipe is below standard.

Lack of bonding needs very careful evaluation. The various points are given as below:

a) Low bonding strenght but bond is present with tape through primer.

b) No bond but the tape is in touch with the pipe with some pressure.

c) No bond, and the tape is not touching the pipe.

d) No bond and the tape is damaged allowing moisture to travel along the pipe below the tape by capillary action.

Under various conditions the adverse effects will be different. Where the peel test showed no bond there was visible rusting of pipe which means that even though the cathodic potentials were well above the minimum values and even though the tape was not damaged at point of test, rusting has taken place. We shall cover in our recomendations what further investigation is required so as to monitor the pipline condition on regular basis.

12. RECOMENDATIONS:

The above noted report is comprehensive enough for experienced pipeline engineers with knowledge of cathodic protection to take planned corrective actions. However we summarize our recomendations below:

A: Trench weights packing to be checked by first lifting say 5 to 10 weights. If no packing is found then all trench weights would need to be located and lifted and packing placed.

BEST AVAILABLE DOCUMENT

NB: Unless very tight quality inspection is used at time of lifting of trench weight and placing of right type of packing material it would be better to leave the weights in their place.

B: Peel tests to be done at each kilometer interval. Before peel tests are done proper repair materials like moulding tape primer (good quality) and outer wrap tape to be available and repairs should be done immediately after

peel test is checked and recorded. At point of taking peel test wall thickness of pipe can be checked using ultrasonic method. Peel tests and wall thickness tests to be conducted by experts in this field. This will give a over all picture of coating condition.

C: The existing insulating flanges at either end to be rectified and shorts eliminated.

D: Additional insulating flanges to be installed.

E: Casing shorts to be cleared. If casing shorts cannot be cleared than C.P. 'hot spot' protection arrangement to be properly designed alongwith other preventive measure.

F: After isolating the barrage section current drainage check to be done and if abnormal than isolation procedure to be innitiated.

G: Action to be taken immediately to reduce current input to minimum levels by balancing the outputs of the five transformer rectifiers. This can be done even befpre other steps are taken.

H: Where the C-Scan has given very high mB reading these sections to be excavated to check for coating damages. However extremely tight inspection procedures must be adopted because excavation can cause <u>much more damage</u> than the original damage which is to be located. A shovel can easily damage the coating during excavaion. All damaged areas need to be repaired. Proper repair procedures have to be made and implementation closely watched.

I: SPECIAL NOTE

Pipeline engineering is a specialized field. All aspects of its maintenance, repairs, monitoring require special care and application of porper procedure. The pipeline is supposed to last 40 years without any problem if properly designed constructed and maintained. Unless experienced

BEST AVAILABLE DOCUMENT

pipeline engineers are involved in this work the likelyhood of the situation getting worse rather than better is higher. In case such experts are not presently available in WAPDA then outside help should be taken. It would be much cheaper and economical in short term as well as in long term. We feel that all important aspects have been covered in our proposal. We are ofcourse available to assist in anyway possible.

BEST AVAILABLE DOCUMENT

Annexure 1

PIPE TO SOIL POTENTIAL SURVEY FOR
20 DIA MARI GUDDU GAS PIPELINE, WAPDA
GUDDU

T/R INSPECTION - FORMAT: ON

LOCATION OF T/R UNIT: C.P.St. no. 5 at Power Station (between T.P. 62 and T.P. 63)

TYPE: Ground Bed LOCATION: 200M East of T/R Room

NO. OF ANODES: 11 Nos. SIZE: 5'X 3"

T/R D.C. OUTPUT: 07 Amps / 06 volts

CIRCUIT RESISTANCE: 0.85 Ohm

PS/P AT DRAIN POINT: 2.15 volts

REMARKS:

S.NO.	TEST POINT NO.	PS/P READING IN VOLTS T/R ON	T/R OFF	REMARKS
1.	063	0.90	0.82	Ins-Flang is bypassed at manifold (T.P.S).
2.	062	1.10	0.80	Located near boundary wall of Thermal Power Station located at Valve assembly no. 5
3.	061	-	-	Major portion lies on Barrage.
4.	060	0.90	0.80	Located at V.assy No.4
5.	059	0.85	0.80	
6.	058	0.90	0.80	
7.	057	0.35	0.30	Cable seems to be detached
8.	056	1.10	0.80	
9.	055	1.2	0.80	
10.	054	1.35	0.80	
11.	053	1.5	0.80	Broken (Test point)

BEST AVAILABLE DOCUMENT

14

T/R INSPECTION - FORMAT: ON

LOCATION OF T/R UNIT: C.P.St. no.4 at WAPDA Grid Station 11 kv.

TYPE: Ground Bed LOCATION: App. 200M West of T/R Room

NO. OF ANODES: 11 nos. SIZE: 5'X 3"

T/R D.C. OUTPUT: 01 Amps / 05 volts

CIRCUIT RESISTANCE: 5 Ohms

PS/P AT DRAIN POINT: T.P. 52 1.45 volts

REMARKS:

S.NO.	TEST POINT NO.	PS/P READING IN VOLTS T/R ON	T/R OFF	REMARKS
12.	52	1.45	0.80	Drain point of C.R.St No.4
13.	51	1.10	-do-	
14.	50	1.00	-do-	
15.	49	1.00	-do-	
16.	48	0.98	-do-	
17.	47	0.98	-do-	
18.	46	1.10	-do-	Located at Road crossing of Mureed Shakh
19.	45	1.10	-do-	
20.	44	1.20	-do-	
21.	43	1.20	-do-	
22.	42	1.20	-do-	

BEST AVAILABLE DOCUMENT

T/R INSPECTION - FORMAT: OFF

LOCATION OF T/R UNIT: C.P.St. no. 3 located near T.P. 39

TYPE: Ground Bed LOCATION: 200M Just behind of T/R Room

NO. OF ANODES: 11 nos. SIZE: 5'X 3"

T/R D.C. OUTPUT: OFF

CIRCUIT RESISTANCE: Nil

PS/P AT DRAIN POINT: 1.25 (T.P. 39)

REMARKS: Positive cable was checked and found broken at about 5-20M away from T/R room towards groundbed.

S.NO.	TEST POINT NO.	PS/P READING IN VOLTS T/R ON	T/R OFF	REMARKS
23.	41	1.34	0.80	
24.	40	1.34	0.80	Valve Assembly no.3 Located between T.P 40 and T.P 39
25.	39	1.25	0.70	Drain point of C.P.St.no. 3
26.	38	1.35	0.70	
27.	37	1.35	0.70	
28.	36	1.35	0.70	
29.	35	1.40	0.70	
30.	34	1.40	0.70	
31.	33	1.40	0.70	
32.	32	1.40	0.70	
33.	31	1.40	0.70	

BEST AVAILABLE DOCUMENT

T/R INSPECTION - FORMAT: ON

LOCATION OF T/R UNIT: C.P.St. no. 2 located near T.P. 28

TYPE: Ground Bed LOCATION: 200M north of T/R Room.

NO. OF ANODES: 11 NOS. SIZE: 5' X 3"

T/R D.C. OUTPUT: 04 Amps / 1.5 volts

CIRCUIT RESISTANCE: 0.37 Ohm

PS/P AT DRAIN POINT: At T.P. 28 1.45 volts

REMARKS:

S.NO.	TEST POINT NO.	PS/P READING IN VOLTS T/R ON	T/R OFF	REMARKS
34.	30	1.40	0.72	
35.	29	1.40	0.72	Casing of Road crossing is short (PS/P-0.74 T/R-OFF)
36.	28	1.45	0.74	Drain point (C.P.St.no.2)
37.	27	1.35	0.74	
38.	26	1.30	0.74	
39.	25	1.25	0.74	
40.	24	1.20	0.74	
41.	23	1.25	0.74	
42.	22			T.P. is missing
43.	21	1.20	0.74	
44.	20	1.05	0.34	Lead seems to be broken

BEST AVAILABLE DOCUMENT

T/R INSPECTION - FORMAT: ON

LOCATION OF T/R UNIT: C.P.St. no. 1 located at km 10

TYPE: Ground Bed LOCATION: North of T/R room

NO. OF ANODES: 11 nos. SIZE: 5'X 3"

T/R D.C. OUTPUT: 04 Amps / 02 volts

CIRCUIT RESISTANCE: 0.5 Ohm

PS/P AT DRAIN POINT: 1.4 volt at T.P. 10

REMARKS:

S.NO.	TEST POINT NO.	PS/P READING IN VOLTS T/R ON	T/R OFF	REMARKS
45.	19	1.10	0.76	
46.	18	1.15	0.78	
47.	17	1.10	0.78	
48.	16	1.10	0.80	
49.	15	1.05	0.80	
50.	14	1.05	0.80	Railway crossing V.Assy no. 1 to 2 lies between T.P 14 & T.P 15
51.	13	1.25	0.80	
52.	12	1.25	0.80	
53.	11	1.35	0.80	
54.	10	1.40	0.80	Casing of Road crossing bypass 1.25v. Drain point of C.P.St. no.1
55.	09	1.35	0.80	
56.	08	1.35	0.80	
57.	-	-	-	Test points were not installed from T.P.7 to T.P.2. Therefore PS/P could not be measured.
58.	-	-	-	

BEST AVAILABLE DOCUMENT

S.NO.	TEST POINT NO.	PS/P READING IN VOLTS T/R ON	T/R OFF	REMARKS
59.	-	-	-	
60.	-	-	-	
61.	-	-	-	
62.	-	-	-	
63.	01	1.10	0.88	

BEST AVAILABLE DOCUMENT

PEARSON SURVEY

20" DIA MARI TO GUDDU GAS PIPE LINE

S. NO.	TEST POINT NO.	DISTANCE IN METERS	REFERENCE MARK	REMARKS
01	T.P 61 to T.P 62			1) Oscillator connected to TP 61 & moved to T.P 62 15v 0.7 Amp 70 to 80% Sensitivity. 2) T.P 61 is located at V.Assy No.5 3) Travesed was made to upstream 4) Dry, sand loam 5) 4 Nos. Faults are marked.
	-do-	100 M from	T.P 61	
	-do-	350 M "	-do-	
	-do-	490 M "	-do-	
	-do-	600 M "	-do-	
02	T.P 62 to T.P 63	10 M "	T.P 62	1) Up stream - Traversed. 2) 3 Nos faults are marked. 3) Near T.P 63 filling is 10' to 12' approximately. 4) T.P 63 located inside of T.P.S manifold.
	-do-	85 M "	-do-	
	-do-	110 M "	-do-	
03	T.P 61 to T.P 60	11 M "	T.P 61	1) 2 faults are marked. 2) Major protion of this section lies at Main Barrage.
	-do-	27 M "	-do-	
04	T.P 60 to T.P 59	100 M "	T.P 60	1) Oscillator connected at T.P 60 located at V.assy No.4 7.5v 1.4 Amp 30% to 70% sensitivity 2) Line is running on right bank of Gothki Feeder at less cover say (Depth) 16" to 18" from top of pipe to G.level 3) Marshi land. 4) River-weights are also placed on pipe line to protect from floating under every R.weight coating damaged indicated. 5) H.T. line is also runnign just parallel to gas pipe line.
	-do-	450 M "	-do-	

BEST AVAILABLE DOCUMENT

05	T.P 59 to T.P 58			
06	T.P 58 to T.P 57			
07	T.P 57 to T.P 56			
08	T.P 56 tO T.P 55			
09	T.P 55 to T.P 54			1) Over head crossing at Gothki feeder. 2) At both ends of crossing, coating is demaged 3) Supports are insulated
10	T.P 54 tO T.P 53	350 M from	T.P 54	1) Oscillator conncted to T.P 54 7.5 - 1.5Amp 40% to 70% sensitivity 2) 1 fault is marked.
11	T.P 53 to T.P 52	125 M from	T.P 53	1) T.P 53 is broken 2) Traversed was made to Down Stream 3) Formation -sandy & sand dunes 4) 4 Nos faults are marked.
	-do-	75 M "	-do-	
	-do-	500 M "	-do-	
	-do-	610 M "	-do-	
12	T.P 52 to T.P 51			No fault
13	T.R 51 to T.P 50	400 M "	T.P 51	1) 2 faults are marked 2) Sandy - sand dunes. 3) Line is passing through left bank of canal (Gothki feeder)
	-do-	800 M "	-do-	

AVAILABLE DOCUMENT

21

14	T.P 50 to T.P 49	421 M from	T.P 50	1) 6 Nos. faults are marked 2) Depth is less. 3) Sandy formation 4) Traversed to Down stream
	-do-	529 M "	-do-	
	-do-	557 M "	-do-	
	-do-	584 M "	-do-	
	-do-	600 M "	-do-	
	-do-	700 M "	-do-	
15	T.P 49 to T.P 48	150 M "	T.P 49	1) Oscillator connected to T.P 49 7.5v - 1.4Amp 40% to 80% sensitivity 2) 2 faults are marked.
	-do-	285 M "	-do-	
16	T.P 48 to T.P 47	180 M "	T.P 48	1) 2 faults - marked 2) Sandy - sand dunes 3) Traversed to down stream
	-do-	190 M "	-do-	
17	T.P 47 to T.P 46	700 M "	T.P 47	1) 2 faults marked 2) At 2nd mark land is cultivated. Down stream 3) Coating condition is unsatisfactory
	-do-	900 M "	-do-	
18	T.P 46 to T.P 45	28.5 M "	Up stream vent	1) vent of crossing at Murid - Shakh. 2) 2 faults are marked. 3) Compacted and asphalted portion of road crossing
	-do-	37 M "	Down stream vent	
19	T.P 45 to T.P 44			Oscillator shifted to T.P 45 15v - 1.5Amp - 60% to 80% sensitivity. No fault.
20	T.P 44 to T.P 43	550 M "	T.P 44	1) Fault - marked. Sandy + sand loam
21	T.P 43 to T.P 42			No fault

BEST AVAILABLE DOCUMENT

22

22	T.P 42 to T.P 41	475 M from	T.P 42	1) Line is running in between road and left bank of Gothki feeder. 2) Mark is located infront of mile post of main road KM - 12
23	T.P 41 to T.P 40	485 M "	T.P 41	1) Near mile post of main road KM 10th. Fault has been marked
24	T.P 40 to T.P 39	470 M "	T.P 40	1) 2 faults are marked Down stream 1st fault located near KM 10th mile post 2nd one located near over head crossing.
	-do-	710 M "	-do-	
25	T.P 39 to T.P 38			Located at C.P.St. No.3 T.P 39 Oscillator connected to T.P 39 15v - 1.4Amp- 60% to 80% sensitivity.
26	T.P 38 to T.P 37	400 M "	T.P 38	1) Down stream 2) 3 faults are marked 3) Line is running through left bank of canal and right curb of main road.
	-do-	550 M "	-do-	
	-do-	555 M "	-do-	
	-do-	560 M "	-do-	
27	T.P 37 to T.P 36	950 M "	T.P 37	1) Oscillator shifted to T.P 37 60% to 80% sensitivity 2) Fault is marked 50 M from T.P 36
28	T.P 36 to T.P 35	90 M "	T.P 36	1) 2 faults are marked 2) Traversed to down stream Sand loam
	-do-	610 M "	-od-	
29	T.P 35 to T.P 34	150 M "	T.P 35	1) Fault is marked down stream T.P 35 Oscillator shifted at T.P 35 2) 15v - 1.3Amp - 70% to 80% sensitivity

BEST AVAILABLE DOCUMENT

30	T.P 34 to T.P 33	200 M from	T.P 34	1) 2 faults are marked Down stream of T.P 34 2) Sandy loam formation
	-do-	550 M "	-do-	
31	T.P 33 to T.P 32	700 M "	T.P 33	1) Fault is marked down stream 2) Oscillator 7.5v - 1.4Amp 50% to 80% Sensitivity
32	T.P 32 to T.P 31	300 M "	T.P 32	1) Fault is marked Down stream 2) Sand loam
33	T.P 31 to T.P 30	-	-	Oscillator shifted 1.4Amp - 7.5v 60% to 70% sensitivity (No fault)
34	T.P 30 to T.P 29	500 M "	T.P 30	1) Cultivated land 2) Fault is marked
35	T.P 29 to T.P 28	-	-	No fault
36	T.P 28 to T.P 27	300 M "	T.P 28	1) Oscillator shifted to T.P 28 2) Fault is marked 3) Cultivated land
37	T.P 27 TO T.P 26	100 M "	T.P 27	1) 3 faults are marked 2) From T.P 27 200 M to end T.P 26 coating condition is very poor say 80% coating is in bad shape as per signals received on receiver (Earth) cover is less at some places less than 6"
	-do-	780 M "	-do-	Near R.D 39
	-do-	980 M "	-do-	Between R.D. 39 to 40

BEST AVAILABLE DOCUMENT

38	T.P 26 to T.P 25	100 M from	T.P 26	1) Located near R.D 40 TO 41 2) Depth is less 6" to 8" 3) Faults are marked. Other features are as under of this particular section, starts from T.P 27 upto T.P 25.
	-do-	120 M "	-do-	
	-do-	250 M "	-do-	1) Cover is less than specified depth. 2) At some location it was found that coating is teared off (removed) from top of pipe as a result of plough of land by local farmers. 3) Cover is hardly 4" to 6" from top of pipe to natural ground level. 4) This particular section is passing through cultivated land. Needs immediate attention
	-do-	400 M "	-do-	
	-do-	580 M "	-do-	
	-do-	800 M "	-do-	

TRAVERSE DIRECTION
DOWN-STREAM (GUDDU TO MARI)

39	T.P 25 to T.P 24	400 M from	T.P 25	1) 5 Nos faults are marked 2) Cultivated land 3) Oscillator shifted to T.P 24 7.5v - 1.5Amp - 30% to 60% sensitivity
	-do-	500 M "	-do-	
	-do-	600 M "	-do-	
	-do-	780 M "	-do-	
	-do-	850 M "	-do-	
40	T.P 24 to T.P 23	1580 M "	T.P 24	1) 2 faults are marked 2) T.P 22 is missing
	-do-	1900 M "	-do-	
41	T.P 23 to T.P 22	170 M from	T.P 23	1) Oscillator connected to T.P 23 7.5v - 1.5Amp 40% to 60% sensitivity 2) Faults are marked.
	-do-	195 M "	-do-	

BEST AVAILABLE DOCUMENT

42	T.P 21 to T.P)	350 M	"	T.P 20	1) 2 nos faults are marked from T.P 21 to T.P 19
	-do-	700 M	"	-do-	
43	T.P 19 to T.P 18	450 M	"	T.P 19	Faults are marked - lenght of fault is more than 300 M R.D 7 to R.D 8 of Narli wah
	-do-	750 M	"	-do-	
44	T.P 18 to T.P 17	490 M	"	R.D 10 T.P 18	Faults are marked Oscillator - 7.5v - 1.3A 50% to 80% sensitivity
	-do-	600 M	"	-do-	
45	T.P 17 to T.P 16	290 M	"	T.P 17	1) 5 faults are marked 2) Road is under construction 3) R.weights are also placed Pipe coating is damaged at R.weights.
	-do-	600 M	"	-do-	
	-do-	710 M	"	-do-	
	-do-	910 M	"	-do-	
46	T.P 16 to T.P 15	20 M	"	T.P 16	T.P 16 lies betwwen R.D 17 to T.D 18 of Narli Wah Fault is marked
47	T.P 15 to T.P 14	11 M	"	T.P 15	1) Located at V.assy No.2 2) Faults are marked R.D 17 to R.D 18 Oscillator was connected at T.P. 20
	-do-	700 M	"	-do-	
48	T.P 15 to T.P 14	12 M	"	Cage of V.assy No.2	After crossing of Railway tracks. Faults has been marked

BEST AVAILABLE DOCUMENT

49	T.P 14 to T.P 13	100 M	"	T.P 14	5 faults are marked down stream
		190 M	"	-do-	
	-do-	310 M	"	-do-	
	-do-	395 M	"	-do-	
	-do-	700 M	"	-do-	
50	T.P 13 to T.P 12	25 M	"	T.P 13	1) 5 faults are marked down stream 2) Oscillator connected 7.5v - 1.4Amp
	-do-	350 M	"	-do-	
	-do-	380 M	"	-do-	
	-do-	490 M	"	-do-	
	-do-	550 M	"	-do-	
51	T.P 12 to T.P 11	100 M	"	T.P 12	4 faults are marked down stream to T.P 12
	-do-	550 M	"	-do-	
	-do-	750 M	"	-do-	
	-do-	800 M	"	-do-	
52	T.P 11 to T.P, 10	410 M	"	T.P 11	1) 3 faults are marked 2) Cultivated land coating is damaged.
	-do-	650 M	"	-do-	
	-do-	950 M	"	-do-	
53	T.P 10 to T.P 9	122 M	"	T.P 10	4 faults are marked oscillator was attached to T.P 10 (located C.P 1) T/R No.1
	-do-	172 M	"	-do-	
	-do-	78 M	"	2nd fault	
	-do-	50 M	"	R.D 35 of Narli canal	

BEST AVAILABLE DOCUMENT

21

54	T.P 9 to T.P 8	75 M "	R.D 37 of Narli Wah	A big portion shown indications of poor coating.

55 T.P 8 to R.D 50 Oscillator was connected to T.P 8 and traversed to T.P 1 as in this section Test points were not installed from T.P 7 upto T.P 2 T.P 1 is located at (Mari-de-hydration-plant))

Faults:-

30 M from T.P 8
79 M " R.D 40 NARLI CANAL
15 M " 2nd fault
64 M " 3rd fault
100 M " 4th fault located just under H.T.E line (11 KV) cultiyated land
08 M " R.D 45 Down stream
15 M " R.D 48 Down stream
70 M " R.D 49 (Narli canal)
150 M " R.D 49 (Narli canal) (Line is passing through R.B. of canal (Narli Wah)

56 T.P 1 to O.H.Crossing - 4 M from 7th R.weight
5 M from 8th R.weight
3 M from 9th R.W
KM from R.W (10th) at Nalla
4 M from R.weight (12th)

Faults
1) 5 fauls are marked.
2) Oscillator was fixed at T.P 12 traversed was made to up stream
3) At every point where R.ware kept coating is damaged
4) Cover is also less.

56 O.H.Crossing to R.D 500 of Narliwah
1) 167 M from R.D. 53
2) 09 M from R.D 53 towards R.D 52 Up stream
3) 93 M from R.D 52
4) 42 M from R.D 51

BEST AVAILABLE DOCUMENT

28

Annexure C

DYNALOG C-SCAN SURVEY

FROM: T.P.1
TO : T.P.1+820M
ON :
DATE: 19-02-89
SURVEY REFERENCE: 001 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.1 (MARI GAS FIELD)
GENERATOR SETTING: 250 mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	0.56	89.18	SURVEY START POINT 14:41 SUNDAY 19TH FEBRUARY,1989			
01	0.86	70.46	200	00	1.01	00-15M U/S of T.P.1
02	0.56	59.45	105	01	1.36	
03	0.60	53.31	100	02	0.92	(Survey from D/S to U/S)
04	0.47	42.97	100	03	1.79	
05	0.56	47.62	50	03	1.88	
05	0.56	47.62	50	04	-1.75	
06	0.74	35.82	150	05	1.64	
07	0.64	15.59	200	06	3.45	
08	0.51	22.22	100	07	-2.99	
08	0.52	22.22	100	06	3.96	
09	0.54	28.14	50	08	-3.94	
09	0.54	28.14	50	06	4.18	T.P.1+820M

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM: O/H CROSSING OF NURLI WAH+20M
TO : T.P.1+820M
ON :
DATE: 20-02-89
SURVEY REFERENCE: 002 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: O/H CROSSING OF NURLI WAH
GENERATOR SETTING: 215mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	0.75	73.60	SURVEY START POINT 11:18 MONDAY 20TH FEBRUARY			
01	1.13	66.42	100	00	0.87	00-20M D/S of LOC: 00 NURLI WAH O/H CROSS. SURVEY TO D/S.
02	0.92	58.46	200	01	0.55	
03	1.00	13.96	200	02	6.21	
04	0.95	29.69	100	02	5.63	
04	0.95	29.69	100	03	-6.81	
05	1.00	49.67	50	04	-8.84	
05	1.00	49.67	50	02	2.74	
06	0.88	21.61	100	05	6.91	
06	0.88	21.61	50	03	-7.58	
07	0.94	37.58	SURVEY START POINT 12:15 MONDAY 20TH FEBRUARY			
08	0.88	15.93	100	07	7.25	CURRENT INCREASED FROM 215mA TO 516mA AT LOC: 07
09	0.80	9.333	208	07	5.81	
09	0.80	9.333	108	08	4.08	
10	0.74	8.333	111	09	1.50	
11	0.62	7.690	56	10	1.21	T.P.1 + 820M

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM: O/H CROSSING OF NURLI WAH+60m
TO : R.D-50 (NURLI WAH)
DATE: 20/02/89
GENERATOR SETTING: 354mA
SURVEY REFERENCE: 002 (2 of 2)
LOCATION: O/H CROSSING OF NURLI WAH 20" DIA MARI-GUDDU GAS PIPE LINE
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
12	1.24	159.8	SURVEY START POINT 14:15 MONDAY 20TH FEBRUARY			
13	1.60	73.98	30	12	22.3	12 TO 60M U/S OF LOC: 00 NURLIWAH O/H CROSSING SURVEY TO U/S
14	1.04	50.84	50	13	6.48	
15	1.09	47.63	100	14	0.52	
16	1.12	45.63	200	15	0.18	
17	1.12	42.15	160	16	0.43	R.D.54
18	0.94	16.58	300	17	2.69	R.D.53
19	1.07	27.47	200	17	1.85	
19	1.07	27.47	100	18	-4.50	
20	3.57	12.27	200	19	3.48	
21	1.00	10.68	100	20	1.20	
21	1.04	25.94	SURVEY START POINT 15:15 MONDAY 20TH FEBRUARY			
22	1.42	23.69	200	21	0.39	CURRENT INCREASED FROM 354mA TO 849mA AT LOC: 21
23	1.55	19.79	211	22	0.73	R.D.51
24	1.04	20.06	200	23	-0.05	
25	1.24	15.61	100	24	2.10	
26	2.73	8.812	100	25	4.79	R.D.50 TO U/S NURLI WAH

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM : R.D.50
TO : R.D,46
DATE : 21-2-89
SURVEY REFERENCE: 003
LOCATION: T.P.8 20" DIA MARI-GUDDU GAS PIPELINE
GENERATOR SETTING: 756mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRETN (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.20	117.8	SURVEY START POINT 14:08 TUESDAY 21ST FEBRUARY			
01	1.48	59.27	194	00	2.96	18-100M U/S OF R.D.50 SURVEY TO U/S
02	1.09	65.63	100	00	4.84	
02	1.09	65.63	94	01	-0.92	RECALL
03	1.34	60.67	256	02	0.25	
04	1.30	54.12	137	03	0.71	R.D.48
05	1.14	50.05	150	04	0.42	
06	1.73	51.73	150	05	-0.19	R.D.47
07	1.82	51.31	150	06	0.04	
08	1.90	46.60	53	07	1.54	R.D.46 (NURLI WAH)

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM : T.P.8 (R.D.40)
TO : R.D.46 (NURLI WAH)
DATE : 21-02-89
SURVEY REFERENCE: 004 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.8
GENERATOR SETTING: 310mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.33	178.2	SURVEY START POINT 10:33 TUESDAY 21ST FEBRUARY			
01	0.92	96.43	300	00	1.69	00-R.D.40 D/S OF T.P.8 SURVEY TO D/S
02	0.80	82.24	200	01	0.69	
03	1.44	58.65	200	02	1.41	
04	1.34	58.25	14	03	0.40	
05	0.67	53.60	50	04	1.37	
06	2.75	28.25	213	05	2.60	
07	0.60	31.78	110	06	-0.91	
07	0.60	31.78	103	05	4.10	
08	1.80	19.89	50	07	5.05	
09	1.28	17.10	183	08	0.71	R.D.44
10	1.70	10.01	310	09	1.42	R.D.45
11	1.57	10.14	210	09	2.06	
11	1.57	10.14	100	10	-0.10	RECALL
12	1.28	14.25	100	09	1.57	
12	1.28	14.25	110	11	-2.68	RECALL
13	1.55	26.40	SURVEY START POINT 12:30 TUESDAY 21ST FEBRUARY			

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM : T.P.8 (R.D.40)
TO : R.D.46 (NURLI WAH)
DATE : 21-02-89
SURVEY REFERENCE: 004 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.8
GENERATOR SETTING: 310mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF	ATTENUATION (mB/M)	COMMENTS
14	2.13	19.60	153	13	1.16	CURRENT INCREASED FROM 310mA TO 765mA AT LOCATION-14
15	1.84	6.351	150	14	6.52	R.D.46 (NURLI WAH)
16	2.04	8.667	75	15	-3.70	
16	2.04	8.667	75	14	9.24	

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM: C.P. STATION NO.1
TO : R.D.40 (NURLI WAH)
DATE: 20-02-89
SURVEY REFERENCE: 005 20" MARI-GUDDU GAS PIPE LINE
LOCATION: C.P. STATION NO.1
GENERATOR SETTING: 718 mA
SURVEYOR:PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	3.44	170.9	SURVEY START POINT 16:54			MONDAY 20TH FEBRUARY 00-20M D/S OF C.P. STATION NO.1 SURVEY TO D/S
01	1.43	49.06	131	00	8.26	T.P.10
02	1.42	54.34	80	00	12.3	
02	1.42	54.34	51	01	-1.70	
03	1.32	31.79	300	02	1.52	
04	1.06	32.58	153	03	-0.13	
05	1.06	30.60	14	04	3.69	R.D.36
06	0.94	22.48	157	05	1.65	T.P.9
07	1.02	11.21	142	06	-4.25	
08	1.02	14.06	200	07	-0.96	
09	1.00	16.08	108	08	-1.03	R.D.38
10	2.34	16.91	150	09	-0.28	
11	1.00	14.81	155	10	0.74	R.D.39
12	1.24	14.29	150	11	0.20	
13	1.35	13.08	155	12	0.48	R.D.40 OF D/S

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM : T.P.11
TO : C.P. STATION 1
ON :
DATE : 21-02-89
SURVEY REFERENCE : 006 (1 of 2) 20" DIA MAR-GUDDU GAS PIPELINE
LOCATION: T.P.11
GENERATOR SETTING: 206mA
SURVEYORS:PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	
00	0.82	110.5	SURVEY START POINT 16:05 TUESDAY 21ST FEBRUARY			
01	0.78	103.1	153	00	0.39	00-15M D/S OF T.P.11 SURVEY TO D/S
02	1.09	90.05	140	01	0.80	R.D.31
03	0.95	73.81	190	02	0.86	
04	0.60	31.41	200	03	3.53	
05	1.00	40.90	107	03	4.57	
05	1.00	40.90	93	04	-2.46	RECALL
06	1.18	22.29	207	05	2.44	
07	1.12	16.41	150	06	1.70	
08	1.13	13.01	50	07	3.93	
09	1.63	3.292	51	08	23.1	
10	1.30	9.442	31	08	8.76	
10	1.30	9.442	20	09	-45.76	(ROAD CROSSING) C.P. STATION 1

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SYSTEM

FROM: T.P.11
TO : T.P.12
DATE: 21/02/89
SURVEY REF: 006 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.11
GENERATOR SETTING: 206mA
SURVEYORS: PAKISTAN ENGINEERING SERIVCES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
11	1.02	75.70	SURVEY START POINT 17:17 TUESDAY 21ST FEBRUARY			
12	0.80	64.83	54	11	2.48	11-40M U/S OF T.P.11 SURVEY TO U/S
13	0.90	55.99	100	12	1.23	
14	1.05	46.41	110	13	1.45	R.D.29
15	0.79	52.49	150	14	-0.71	
15	0.79	52.49	260	13	0.20	
16	0.95	59.56	153	15	-0.70	R.D.28
17	0.90	81.92	303	16	-0.91	T.P.12

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM : T.P.12
TO : R.D.23
ON :
DATE : 22/02/89
SURVEY REFERENCE: 007 (1 of 3) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.12
GENERATOR SETTING: 300mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	
00	0.77	98.97	SURVEY START POINT 11:40			WEDNESDAY 22ND FEBRUARY 00-15M U/S OF T.P.12 SURVEY TO U/S
01	0.92	99.88	570	00	-0.01	
02	0.78	31.68	300	01	3.32	
03	0.87	96.21	50	01	0.63	
03	0.87	96.21	250	02	-3.98	RECALLED
04	1.09	89.49	125	03	0.48	
04	1.09	89.49	125	02	0.74	
05	1.05	90.77	145	03	0.34	
05	1.05	90.77	105	02	-8.71	RECALLED
06	0.78	59.91	59	05	5.59	
07	0.82	31.51	50	06	11.0	T.P.13
08	1.43	22.70	100	07	2.76	
09	2.60	6.576	191	08	5.62	R.D.23
10	1.03	18.96	93	09	-9.89	
10	1.03	18.96	98	08	1.59	

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM: T.P.14
TO : R.D.23
DATE: 22/02/89
SURVEY REFERENCE: 007 (2 of 3) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.14
GENERATOR SETTING: 300mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	
11	0.77	118.7	SURVEY START POINT 13:48 WEDNESDAY 22ND FEBRUARY			
12	0.95	99.13	120	11	1.27	11-15M D/S OF T.P.14 SURVEY TO D/S
13	0.83	91.94	89	12	0.73	
14	1.06	58.42	192	13	2.02	
15	1.23	53.14	160	14	0.49	R.D.23

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM: T.P.14
TO : R.D.16+200M
DATE: 22/02/89
SURVEY REFERENCE: 007 (3 of 3) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.14
GENERATOR SETTING: 300mA
SURVEYORS: PAKISTAN ENGINEERING SERIVCES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
16	1.06	120.7	SURVEY START POINT 14:14			WEDNESDAY 22ND FEBRUARY 16-40M U/S OF T.P.14
17	0.70	105.3	150	16	0.77	SURVEY TO U/S
18	1.02	82.24	125	17	1.70	
19	0.80	30.28	317	18	2.68	R.D.19
20	1.88	33.00	111	19	-0.65	
21	0.59	38.78	120	20	-1.13	
21	0.59	38.78	86	18	7.59	
22	0.84	24.29	261	20	0.95	
23	0.78	21.06	157	22	0.78	R.D.18
24	0.65	16.59	100	23	1.99	T.P.15
25	1.15	16.46	205	24	0.03	R.D.17
26	1.25	14.17	150	25	0.84	
27	0.94	14.33	155	26	-0.06	R.D.16
28	1.14	5.779	200	27	3.76	R.D.16+200M
29	2.07	11.18	100	28	-5.49	
29	2.07	11.18	100	27	2.15	RECALL

BEST AVAILABLE DOCUMENT

DYNALOG C-SCAN SURVEY

FROM : T.P.17
TO : R.D.16+200M
ON :
DATE : 22/02/89
SURVEY REFERENCE: 008 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.17
GENERATOR SETTING: 404mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.24	149.2	SURVEY START POINT 16:10 WEDNESDAY 22ND FEBRUARY			00-15M D/S OF T.P.17 SURVEY TO D/S
01	1.25	150.3	214	00	-0.03	
02	0.82	108.0	125	01	2.26	R.D.13
03	1.48	108.2	200	02	-0.000	
04	1,50	86,01	200	03	0.97	
05	1.00	80.24	200	04	0.30	R.D.15
06	1.00	64.05	103	05	1.86	
07	1.05	72.93	53	06	-2.05	R.D.16+200M
07	1.05	72.93	50	05	1.65	RECALL-

BEST AVAILABLE DOCUMENT

41

DYNALOG C-SCAN SURVEY

FROM: T.P.17
TO : T.P.18
DATE: 22/02/89
SURVEY REFERENCE: 008 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.17
GENERATOR SETTING: 404mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
08	1.67	236.2	SURVEY START POINT 16:57 WEDNESDAY 22ND FEBRUARY			08-15M U/S OF T.P.17 SURVEY TO U/S
09	1.73	209.1	244	08	0.41	R.D.11
10	0.68	69.63	200	09	4.55	
11	1.06	67.32	300	09	3.26	R.D.10
12	0.90	56.70	200	11	0.74	
13	1.21	58.02	100	11	1.29	
13	1.21	58.02	100	12	-0.19	RECALL
14	0.75	47.26	200	13	0.88	
15	1.24	46.10	90	14	0.23	T.P.18

BEST AVAILABLE COPY

112

DYNALOG C-SCAN SURVEY

FROM : TP.P.19
TO : T.P.18
ON :
DATE : 21/02/89
SURVEY REFERENCE: 009 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.19
GENERATOR SETTING: 260mA
SURVEYORS;PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	0.75	103.9	SURVEY START POINT 11:13			THURSDAY 23RD FEBRUARY 00-10M D/S OF T.P.19 SURVEY TO D/S
01	0.87	98.50	200	00	0.22	
02	0.63	87.92	200	01	0.48	
03	1.00	49.94	200	02	2.32	
04	0.82	47.69	100	02	5.03	
04	0.82	47.69	100	03	0.38	
05	0.67	52.68	300	04	-0.28	
06	1.14	43.83	74	05	2.05	T.P.18
07	0.90	44.38	27	05	5.35	

BEST AVAILABLE COPY

43

DYNALOG C-SCAN SURVEY

FROM: T.P.19
TO : T.P.21
DATE: 21/02/89
SURVEY REFERENCE: 009 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.19
GENERATOR SETTING: 260mA
SURVEYORS: PAKISTAN ENGINEERING SERIVCES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
08	0.73	122.4	SURVEY START POINT 12:10 THURSDAY 23RD FEBRUARY			08-10M U/S OF T.P.19 SURVEY TO U/S
09	0.93	107.6	200	08	0.55	
10	1.17	50.81	200	09	3.25	
11	0.89	55.35	110	09	4.99	
11	0.89	55.35	90	10	-0.80	
12	0.62	65.08	36	11	-3.70	
13	0.89	52.71	200	12	0.91	
14	0.60	42.08	185	13	1.03	T.P.20
15	0.69	12.77	200	14	5.00	
16	1.09	18.69	100	15	-3.30	
16	1.09	18.69	100	14	6.73	RECALL
17	1.08	31.87	150	15	-5.40	
17	1.08	31.87	50	14	4.68	RECALL
TIME OUT AT 13:20 THURSDAY 23RD FEBRUARY						
18	0.67	31.25	SURVEY START POINT 13:25 THURSDAY 23RD FEBRUARY			
19	0.66	17.98	200	18	2.4	LOC. 18&15 ARE SAME GEN. CURRENT INCREASEI
20	0.86	14.09	200	19	1.00	
21	0.72	12.90	160	20	0.46	
22	1.13	10.21	65	21	3.12	
23	1.30	6.724	56	22	6.41	T.P.21

BEST AVAILABLE COPY

44

DYNALOG C-SCAN SURVEY

FROM : T.P.21
TO : R.D.50 (DHARWAH)
ON :
DATE : 23/02/89
SURVEY REFERENCE: 010 20" DIA MARI-GUDDU GAS PIPELINE
LOCATION: T.P.22
GENERATOR SETTING: 300mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	ID (REF)	ATTENUATION (dB/m)	COMMENTS
00	0.69	37.64	SURVEY START POINT 15:01 THURSDAY 23RD FEBRUARY			
01	0.70	47.69	100	00	0.055	00-T.P.21 OF D/S SURVEY TO D/S
02	1.14	47.97	200	01	0.025	
03	1.09	47.22	200	02	0.068	
04	1.68	52.97	70	03	-1.42	
05	0.99	53.54	217	04	-0.042	
06	1.36	64.42	200	05	0.80	
07	0.80	92.67	200	06	-0.58	R.D.50 OF DHAR WAH

BEST AVAILABLE COPY

DYNALOG C-SCAN SURVEY

FROM : T.P.25
TO : R.D.50 (DHAR WAH)
ON :
DATE : 27/02/89
SURVEY REFERENCE: 011 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.25
GENERATOR SETTING: 446mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	ID (REF)	ATTENUATION (mA/M)	COMMENTS
00	1.13	156.7	SURVEY START POINT 15:21 MONDAY 27TH FEBRUARY			
01	0.98	156.6	129	00	0.000	00-30M D/S OF T.P.25 SURVEY TO D/S
02	0.90	122.2	125	01	1.71	
03	0.78	120.4	100	02	0.12	
04	0.87	124.6	86	03	-0.33	
05	1.06	103.5	137	04	1.11	
06	1.73	85.01	150	05	1.09	
07	0.50	80.15	75	06	0.66	T.P.24
08	0.80	53.47	100	07	3.49	
09	1.16	47.84	120	08	4.63	
10	0.99	31.66	112	09	3.19	R.D.46
11	0.96	32.05	100	10	-0.10	
12	0.77	19.11	100	11	4.45	
13	0.82	18.94	100	12	0.07	R.D.47
14	1.28	18.97	106	13	-0.01	
15	2.09	17.50	175	14	0.38	R.D.48
16	1.06	10.79	148	15	2.82	
17	1.29	12.47	200	16	-0.61	

BEST AVAILABLE COPY

46

DYNALOG C-SCAN SURVEY

FROM : T.P.25
TO : R.D.50 (DHAR WAH)
ON :
DATE : 27/02/89
SURVEY REFERENCE: 011 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.25
GENERATOR SETTING: 446mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (NEF)	ATTENUATION (mB/M)	COMMENTS
18	1.43	12.46	100	17	0.01	
18	1.43	12.46	100	16	-1.20	RECALL
19	0.95	12.37	126	17	0.05	
20	0.99	12.81	135	19	-0.21	R.D.50 (DHAR WAH)

BEST AVAILABLE COPY

DYNALOG C-SCAN SURVEY

FROM : T.P.25
TO : T.P.25 + 255M
ON :
DATE : 27/02/89
SURVEY REFERENCE: 012 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.25
GENERATOR SETTING: 160mA
SURVEYORS:PAKISTAN ENGINEERING SERIVCES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (CLP)	ATTENUATION (mA/M)	COMMENTS
00	1.23	96.56	SURVEY START POINT 17;20 MONDAY 27TH FEBRUARY			
01	1.23	97.05	50	00	-0.08	00-20M U/S OF T.P.25 SURVEY TO U/S
02	0.74	90.65	50	01	1.14	
03	0.92	84.11	50	02	1.26	
04	0.57	86.66	05	03	-0.30	T.P.25 + 255M

BEST AVAILABLE COPY

DYNALOG C-SCAN SURVEY

FROM : T.P.28
TO : T.P.25 + 255M
ON :
DATE : 27/02/89
SURVEY REFERENCE: 013 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.28
GENERATOR SETTING: 449mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (M)	ATTENUATION (mA/M)	COMMENTS
00	1.29	118.5	SURVEY START POINT 13:05 MONDAY 27TH FEBRUARY			00-45M D/S OF T.P.28 SURVEY TO D/S
01	1.06	103.8	200	00	0.57	
02	1.28	107.8	200	01	-0.18	
03	1.57	113.8	240	02	-0.18	T.P.27
04	1.34	101.3	200	03	0.50	
05	1.05	89.20	50	04	2.21	
06	1.20	82.99	50	05	1.21	
07	1.57	73.17	60	06	1.72	
08	1.35	67.29	50	07	1.41	
09	1.30	60.73	100	08	0.87	
10	1.12	57.38	50	09	0.96	
11	1.22	45.33	100	10	1.94	
12	0.82	29.30	100	11	3.78	
13	0.99	18.51	90	12	4.17	
14	0.60	17.72	90	13	0.40	T.P.26
15	0.68	14.96	100	14	1.43	
16	0.60	14.87	106	15	0.04	
17	1.00	12.09	100	16	1.79	

BEST AVAILABLE COPY

DYNALOG C-SCAN SURVEY

FROM : T.P.28
TO : T.P.25 + 255M
ON :
DATE : 27/02/89
SURVEY REFERENCE: 013 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.28
GENERATOR SETTING: 449mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
18	1.20	11.42	126	17	0.38	R.D.41
19	1.22	11.32	56	18	0.15	
20	0.50	8.147	25	19	11.1	
21	1.10	3.360	70	20	10.7	T.P.25 + 255M

BEST AVAILABLE COPY

50

DYNALOG C-SCAN SURVEY

FROM : T.P.28
TO : O/H CROSSING (DHAK WAH)
ON :
DATE : 27/2/89
SURVEY REFERENCE: 014 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.28
GENERATOR SETTING: 250mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	
00	1.23	112.0	SURVEY START POINT 17:56 MONDAY 27TH FEBRUARY			00-20M U/S OF T.P.28 SURVEY TO U/S
01	1.19	74.50	400	00	0.02	
02	1.18	74.32	200	01	0.01	
03	1.05	57.11	217	02	1.05	
04	1.77	13.74	25	03	49.4	(ROAD CROSSING)
05	1.90	8.154	60	04	7.23	T.P.29
06	0.55	6.641	50	05	3.56	
07	1.39	6.889	75	06	-0.43	
08	2.89	6.336	150	07	0.47	
09	2.40	4.755	175	08	1.39	R.D.29
10	0.85	2.310	150	09	4.07	
11	0.95	1.999	167	10	0.72	O/H CROSSING OF DHAR WAH (MARI BUNGALOW)

BEST AVAILABLE COPY

DYNALOG C-SCAN SURVEY

FROM: T.P.31
TO : T.P.30
ON :
DATE: 28/02/89
SURVEY REFERENCE: 015 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.32
GENERATOR SETTING: 208mA
SURVEYORS: PAKISTAN ENIGNEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.15	73.42	SURVEY START POINT 09:46 TUESDAY 28TH FEBRUARY			00-T.P.31 OF D/S SURVEY TO D/S
01	1.10	68.77	200	00	0.27	
02	0.86	79.63	200	01	-0.62	
03	0.82	85.68	200	02	-0.31	
04	0.83	88.06	200	03	-0.11	
05	2.52	83.31	217	04	0.27	T.P.30 (D/H CROSSING

BEST AVAILABLE COPY

52

DYNALOG C-SCAN SURVEY

FROM: T.P.36
TO : T.P.31
ON :
DATE: 27/2/89
SURVEY REFERENCE: 016 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.36
GENERATOR SETTING: 316mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATIO	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (NO)	ATTENUATION (mB/M)	COMMENTS
00	1.03	159.4	SURVEY START POINT 08:45 MONDAY 27TH FEBRUARY			00-20M D/S OF T.P.36 SURVEY TO D/S
01	1.30	112.1	100	00	2.99	
02	0.90	83.56	100	01	2.53	
03	1.05	79.99	100	02	0.37	
04	0.97	76.06	150	03	0.23	
05	0.86	70.44	25	04	3.02	
06	1.38	62.35	200	05	0.50	
07	1.45	51.79	200	06	0.78	T.P.35
08	1.90	51.34	110	07	0.06	
09	1.03	35.18	30	08	10.4	
10	1.28	41.23	200	09	-0.60	
11	1.36	38.36	150	10	0.40	
12	1.23	43.46	250	11	-0.43	KM 5 OF MAIN ROAD
13	0.75	44.88	200	12	-0.14	
14	1.18	49.12	175	13	-0.43	T.P.34
15	1.36	53.56	200	14	-0.37	
16	1.17	54.00	25	15	-0.26	
17	1.32	53.45	10	16	0.09	

BEST AVAILABLE COPY

53

DYNALOG C-SCAN SURVEY

FROM : T.P.36
TO : T.P.31
ON :
DATE : 27/02/89
SURVEY REFERENCE: 016 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.28
GENERATOR SETTING: 316mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
18	0.90	53.36	200	17	0.000	
19	0.64	50.00	100	18	0.54	KM 4 OF MAIN ROAD
20	0.90	32.02	20	19	17.6	
21	1.20	21.08	200	20	1.79	
22	1.37	21.38	140	21	-0.08	T.P.33
23	1.12	17.20	200	22	0.09	
24	1.30	17.11	200	23	0.02	
25	0.79	16.87	215	24	0.05	KM 3 OF MAIN ROAD
26	0.89	17.11	50	25	-0.24	
27	0.70	15.08	20	26	5.19	
28	1.23	11.64	230	27	0.94	T.P.32
29	0.90	10.56	200	28	0.41	
30	1.09	6.304	200	29	2.21	
31	1.18	5.996	100	30	0.42	
32	0.92	5.532	140	31	0.47	KM 2 OF MAIN ROAD
33	1.35	3.956	145	32	1.94	
34	1.64	4.487	70	33	-1.51	T.P.31

BEST AVAILABLE COPY

54

DYNALOG C-SCAN SURVEY

FROM: T.P.36
TO : KM 8 OF MAIN ROAD
ON :
DATE: 27/02/89
SURVEY REFERENCE: 017 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.36 20" DIA MARI-GUDDU GAS PIPELINE
GENERATOR SETTING: 313mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (NTP)	ATTENUATION (mN/M)	COMMENTS
00	0.83	121.9	SURVEY START POINT			11:00 MONDAY 27TH FEBRUARY 00-20M U/S OF T.P.36 SURVEY TO U/S
01	0.89	125.7	35	00	-0.75	
02	1.03	125.5	10	01	0.13	
03	1.37	45.25	200	02	4.43	
04	2.30	99.44	100	03	-7.08	RECALL
04	2.30	99.44	100	02	2.02	RECALL
05	0.80	116.0	50	04	-2.49	
06	1.34	47.21	200	04	3.27	
07	1.03	48.29	100	06	-0.19	
08	0.90	58.03	200	07	-0.78	
09	0.89	57.55	100	08	0.07	
10	1.10	62.31	165	09	-0.41	T.P.37
11	1.20	65.96	200	10	-0.24	
12	1.29	66.77	200	11	-0.05	
13	0.94	19.59	30	12	17.1	
14	0.80	13.85	90	13	3.24	KM 8 OF MAIN ROAD

BEST AVAILABLE COPY

55

DYNALOG C-SCAN SURVEY

FROM: T.P.39
TO : KM 8 OF MILE POST (MAIN ROAD)
ON :
DATE: 27/02/89
SURVEY REFERENCE: 018 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.39
GENERATOR SETTING: 307mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.95	33.77	SURVEY START POINT 18:23			SUNDAY 26TH FEBRUARY 00-30M D/S OF T.P.39 SURVEY TO D/S
01	1.40	28.07	15	00	10.4	
02	1.40	32.18	100	01	-1.17	
03	1.34	37.42	200	02	-0.67	
04	1.09	42.97	200	03	-0.60	
05	1.13	48.68	200	04	-0.54	
06	0.60	50.05	185	05	-0.12	T.P.38
07	1.00	50.08	200	06	0.000	
08	0.80	50.93	200	07	0.07	KM 8 OF MILE POST (MAIN ROAD)

BEST AVAILABLE COPY

56

DYNALOG C-SCAN SURVEY

FROM: T.P.44
TO : T.P.39
ON :
DATE: 26/2/89
SURVEY REFERENCE: 019 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE"
LOCATION: T.P.44
GENERATOR SETTING: 280mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mD/M)	
00	1.53	101.9	SURVEY START POINT 12:13 SUNDAY 26TH FEBRUAR			
						00-20M D/S OF T.P.
						SURVEY TO D/S
01	1.29	89.26	200	00	0.57	
02	0.83	93.73	200	01	-0.20	
03	0.87	108.1	205	02	-0.61	
04	1.07	109.3	90	03	-0.10	T.P.43
05	1.04	124.9	210	04	-0.53	
06	1.29	123.7	20	05	0.39	
07	1.46	129.5	200	06	-0.20	
08	1.29	114.7	200	07	0.50	
09	1.50	95.13	200	08	0.79	
10	1.29	81.76	100	09	1.31	T.P.42
11	1.78	68.82	200	10	0.72	
12	1.43	50.87	200	11	1.31	
13	1.72	36.84	200	12	1.32	
14	1.37	28.70	100	13	2.12	
15	0.90	25.88	100	14	0.89	
16	1.44	18.52	60	15	4.68	T.P.41
17	1.34	23.89	30	16	-7.36	
17	1.34	23.89	30	15	2.26	

BEST AVAILABLE COPY

57

DYNALOG C-SCAN SURVEY

FROM : T.P.44
TO : T.P.39
ON :
DATE : 26/02/89
SURVEY REFERENCE: 019 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.44
GENERATOR SETTING: 280mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
18	0.90	10.27	200	16	2.53	
19	1.29	12.83	200	18	2.51	
20	1.17	14.50	200	19	-0.51	
21	1.99	18.03	200	20	-0.94	
22	1.50	19.67	115	21	-0.67	
23	1.63	21.29	200	22	-0.33	
24	1.16	22.32	188	23	-0.20	
25	1.29	22.92	28	24	-0.78	
26	1.38	23.55	200	25	-0.11	
27	1.25	17.14	200	26	1.33	
28	1.58	12.50	81	27	3.18	T.P.39

BEST AVAILABLE COPY

58

DYNALOG C-SCAN SURVEY

FROM: T.P.44
TO : T.P.46
ON :
DATE: 26/02/89
SURVEY REFERENCE: 020 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.44
GENERATOR SETTING: 283mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.23	175.2	SURVEY START POINT 16:30			SUNDAY 26TH FEBRUARY 00-40M U/S OF T.P.44 SURVEY TO U/S
01	1.43	173.8	200	00	0.03	
02	1.55	108.8	200	01	1.99	
03	1.04	108.3	40	02	0.11	T.P.45
04	2.17	121.3	200	03	-0.48	
05	0.97	125.8	200	04	-0.15	
06	2.00	132.3	200	05	-0.21	
07	1.70	118.8	200	06	0.45	
08	2.96	85.82	40	07	6.86	
09	3.20	47.29	60	08	8.39	T.P.46

BEST AVAILABLE COPY

DYNALOG C-SCAN SURVEY

FROM: T.P.48
TO : T.P.46
ON :
DATE: 25/02/89
SURVEY REFERENCE: 021 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.48
GENERATOR SETTING: 267mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	0.80	104.6	SURVEY START POINT 15:28 SATURDAY 25TH FEBRUARY			00-20M D/S OF T.P.48 SURVEY TO D/S
01	0.57	91.02	200	00	0.58	
02	1.19	73.10	200	01	0.94	
03	0.89	84.41	100	02	-1.24	
03	0.89	84.41	100	01	0.65	
04	1.38	81.56	200	02	-0.47	
05	1.19	93.17	200	04	-0.56	
06	1.00	114.0	200	05	-0.87	
07	0.96	134.7	200	06	-0.72	
08	1.22	150.9	200	07	-0.48	
TIME OUT AT 16:26 SATURDAY 25TH FEBRUARY						
09	1.29	152.2	150	08	-0.04	
10	1.20	139.8	100	09	0.73	
11	1.39	166.0	125	10	-1.15	
12	1.35	168.0	25	11	-0.41	
13	1.32	188.0	225	12	-0.44	
14	1.28	187.0	200	13	0.02	
15	2.14	139.0	120	14	2.12	T.P.46

BEST AVAILABLE COPY

DYNALOG C-SCAN SURVEY

FROM: T.P.54
TO : T.P.48
ON :
DATE: 25/02/89
SURVEY REFERENCE: 022 (1 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.54
GENERATOR SETTING: 208mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.30	86.91	SURVEY START POINT 09:21			SATURDAY 25TH FEBRUARY 00-20M D/S OF T.P.54 SURVEY TO D/S
01	1.45	86.96	200	00	-0.000	
02	1.15	89.39	200	01	-0.11	
03	1.35	83.94	200	02	0.25	
04	1.28	83.34	200	03	0.03	T.P.53
05	0.88	77.68	200	04	0.29	
06	0.88	72.76	300	05	0.18	
07	0.63	71.55	200	06	0.06	
08	0.96	66.52	200	07	0.30	
09	1.08	60.23	120	08	0.68	T.P.52
10	0.80	55.64	150	09	0.45	
11	1.12	49.87	300	10	0.31	
12	1.20	46.58	150	11	0.38	T.P.51
13	1.03	49.82	200	12	-0.29	
14	1.54	50.50	200	13	-0.05	
15	0.92	53.65	200	14	-0.26	
16	1.22	50.44	300	15	0.17	
17	1.36	52.91	200	16	-0.20	

BEST AVAILABLE COPY

61

DYNALOG C-SCAN SURVEY

FROM : T.P.54
TO : T.P.48
ON :
DATE : 25/02/89
SURVEY REFERENCE: 022 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.54
GENERATOR SETTING: 208mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
18	1.00	54.15	200	17	-0.09	
19	0.80	46.44	200	18	0.62	
20	1.00	38.08	200	18	0.83	
21	1.39	38.29	200	20	-0.01	
22	1.52	36.57	200	21	0.18	
23	1.22	30.87	200	22	0.71	
24	1.13	27.15	200	23	0.55	
25	1.02	22.87	200	24	0.72	
26	1.15	19.21	200	25	0.73	
27	0.82	15.87	100	26	1.65	T.P.48

BEST AVAILABLE COPY

62

DYNALOG C-SCAN SURVEY

FROM: T.P.54
TO : T.P.55
ON :
DATE: 28/02/89
SURVEY REFERENCE: 023 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.53
GENERATOR SETTING: 300mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mB/M)	COMMENTS
00	1.43	102.7	SURVEY START POINT 13:59			TUESDAY 28TH FEBRUARY U/S OF T.P.54 SURVEY TO U/S
01	1.38	101.1	50	00	0.25	
02	1.64	100.5	200	01	0.02	
03	0.73	94.94	390	02	0.12	
04	0.83	59.16	50	03	8.21	O/H CROSSING T.P.55

BEST AVAILABLE COPY

DYNALOG C SCAN SURVEY

FROM: T.P.55
TO : 144M SHORT OF TRANSMISSION TOWER
ON :
DATE: 28/02/89
SURVEY REFERENCE: 024 (1 of 2) "20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.56
GENERATOR SETTING: 258mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (RLF)	ATTENUATION (mD/M)	COMMENTS
00	0.72	83,63	SYRVEY START POINT 15:20 TUESDAY 28TH FEBRUARY 00-28M U/S OF T.P.55 SURVEY TO U/S			
01	1.18	83.97	200	00	-0.01	
02	1.36	75.56	200	01	0.45	
03	1.32	74.81	200	02	0.04	
04	1.34	74.98	200	03	-0.000	
05	1.25	78.65	160	04	-0.26	T.P.56
06	1.57	79.91	15	05	-0.88	
07	1.54	85.32	200	06	-0.28	
08	0.86	83.87	200	07	0.07	
09	1.06	89.22	200	08	-0.26	
10	0.94	94.28	200	09	-0.23	T.P.57
11	1.20	90.19	190	10	0.19	
12	0.88	91.36	15	11	-0.73	
13	1.06	76.67	200	12	0.74	
14	0.88	87.13	100	13	-1.11	
14	0.88	87.13	100	12	0.40	
15	1.08	93.27	50	13	-3.32	

BEST AVAILABLE COPY

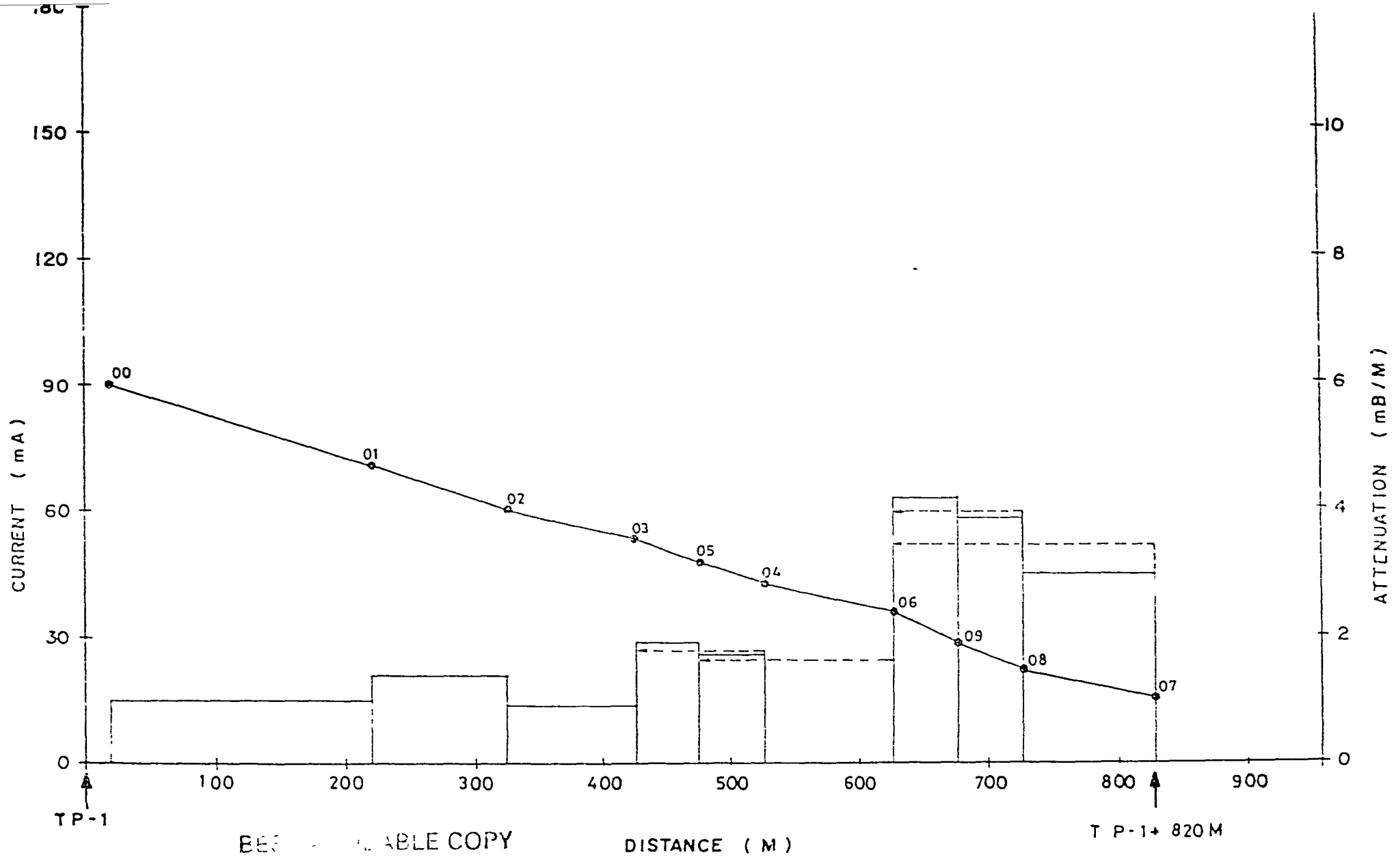
DIGITAL C SCAN SURVEY

FROM : T.P.55
TO : 144M SHORT OF H.T. TRANSMISSION TOWER
ON :
DATE : 28/02/89
SURVEY REFERENCE: 024 (2 of 2) 20" DIA MARI-GUDDU GAS PIPE LINE
LOCATION: T.P.55
GENERATOR SETTING: 258mA
SURVEYORS: PAKISTAN ENGINEERING SERVICES (PVT) LTD.

LOCATION	DEPTH (M)	CURRENT (mA)	DISTANCE (M)	TO (REF)	ATTENUATION (mD/M)	COMMENTS
15	1.08	93.27	50	14	-1.14	
16	0.95	64.38	200	13	0.73	
17	0.93	66.94	200	16	-0.17	
18	0.94	68.53	200	17	-0.10	
19	0.86	68.15	75	18	0.06	T.P.58
20	0.83	68.42	10	19	-0.33	
21	1.44	56.96	150	20	1.05	END: 144M SHORT TRANS. TOWER

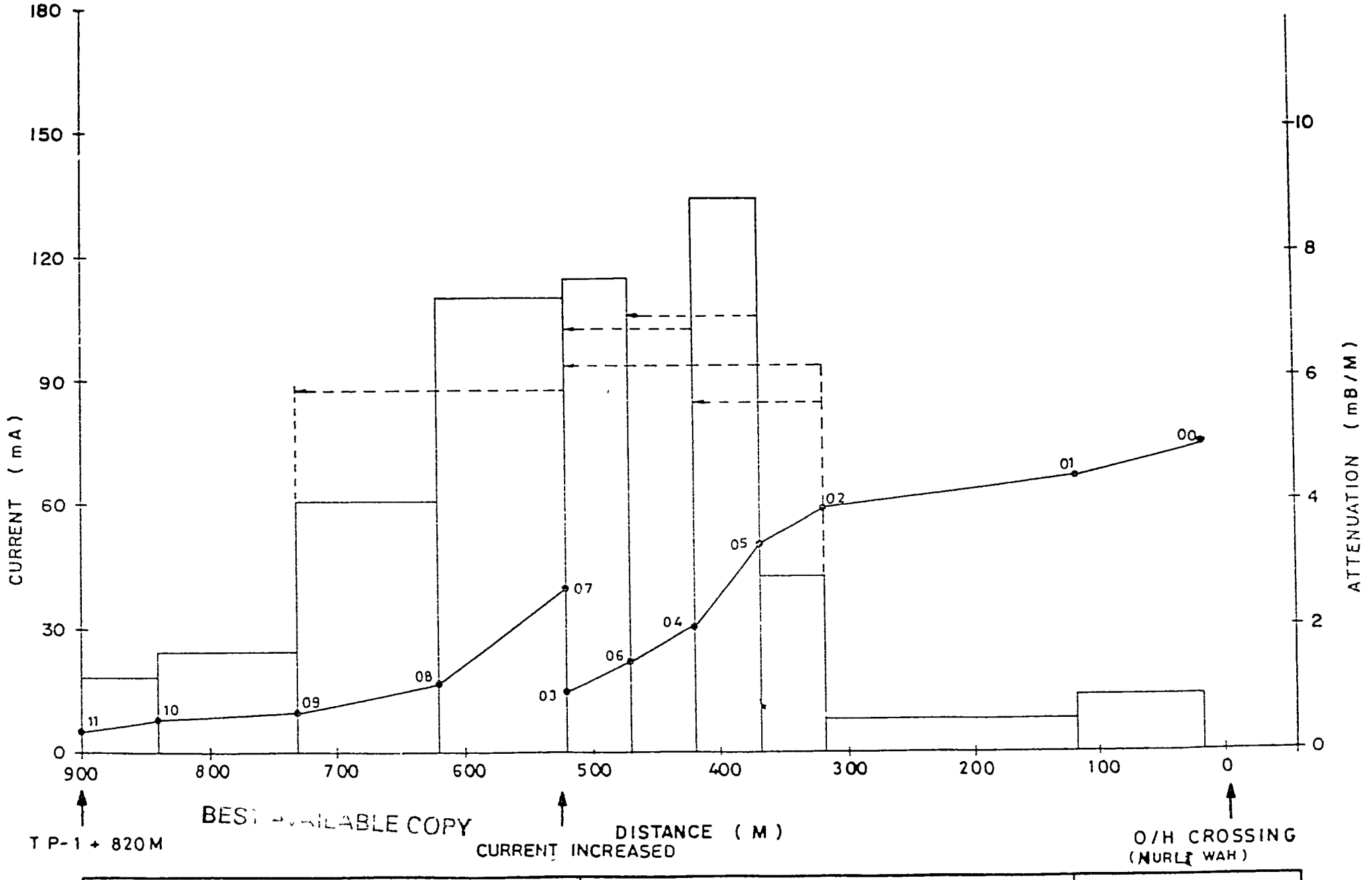
BEST AVAILABLE COPY

65



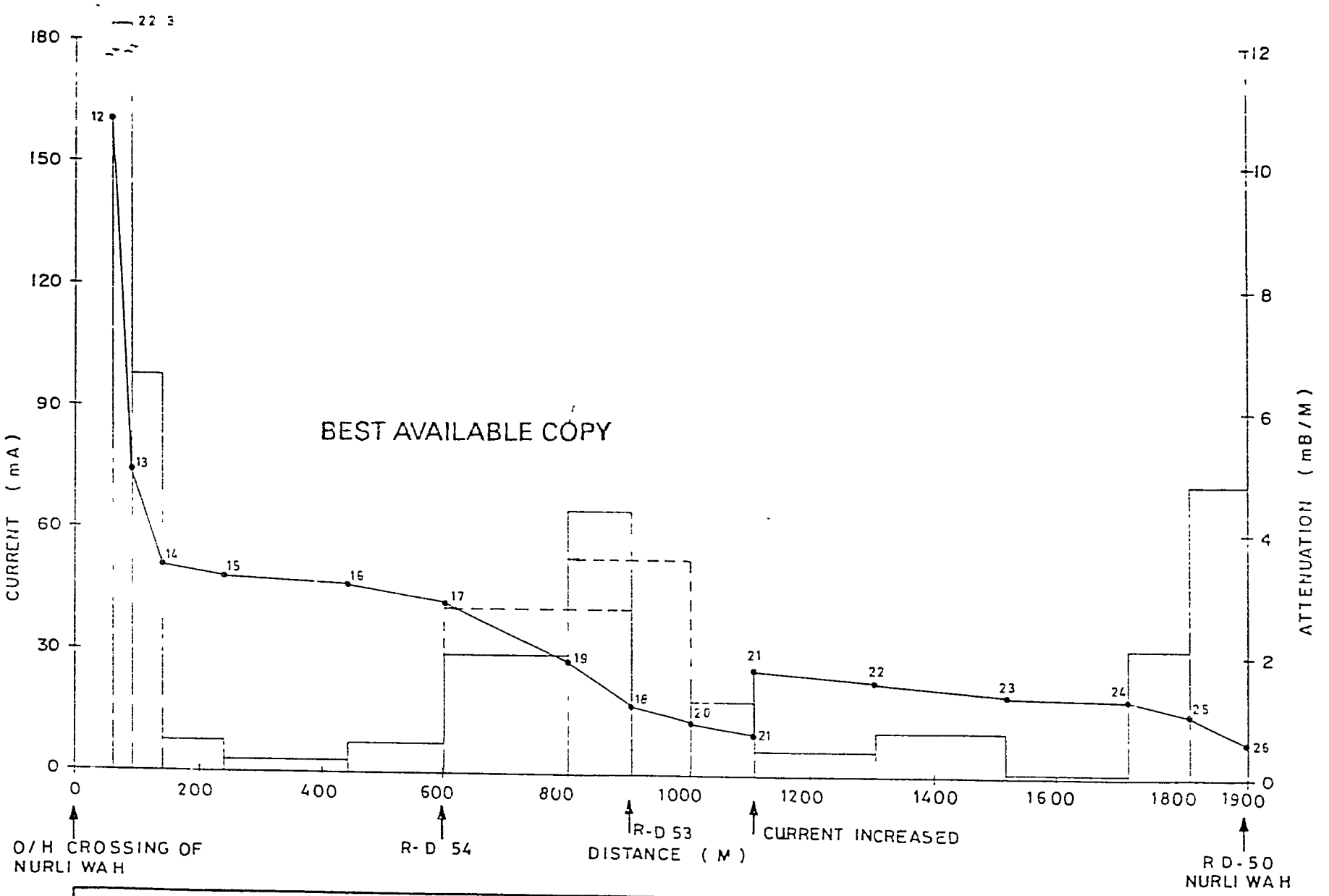
BE[illegible] [illegible]ABLE COPY

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 001
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 19-2-89

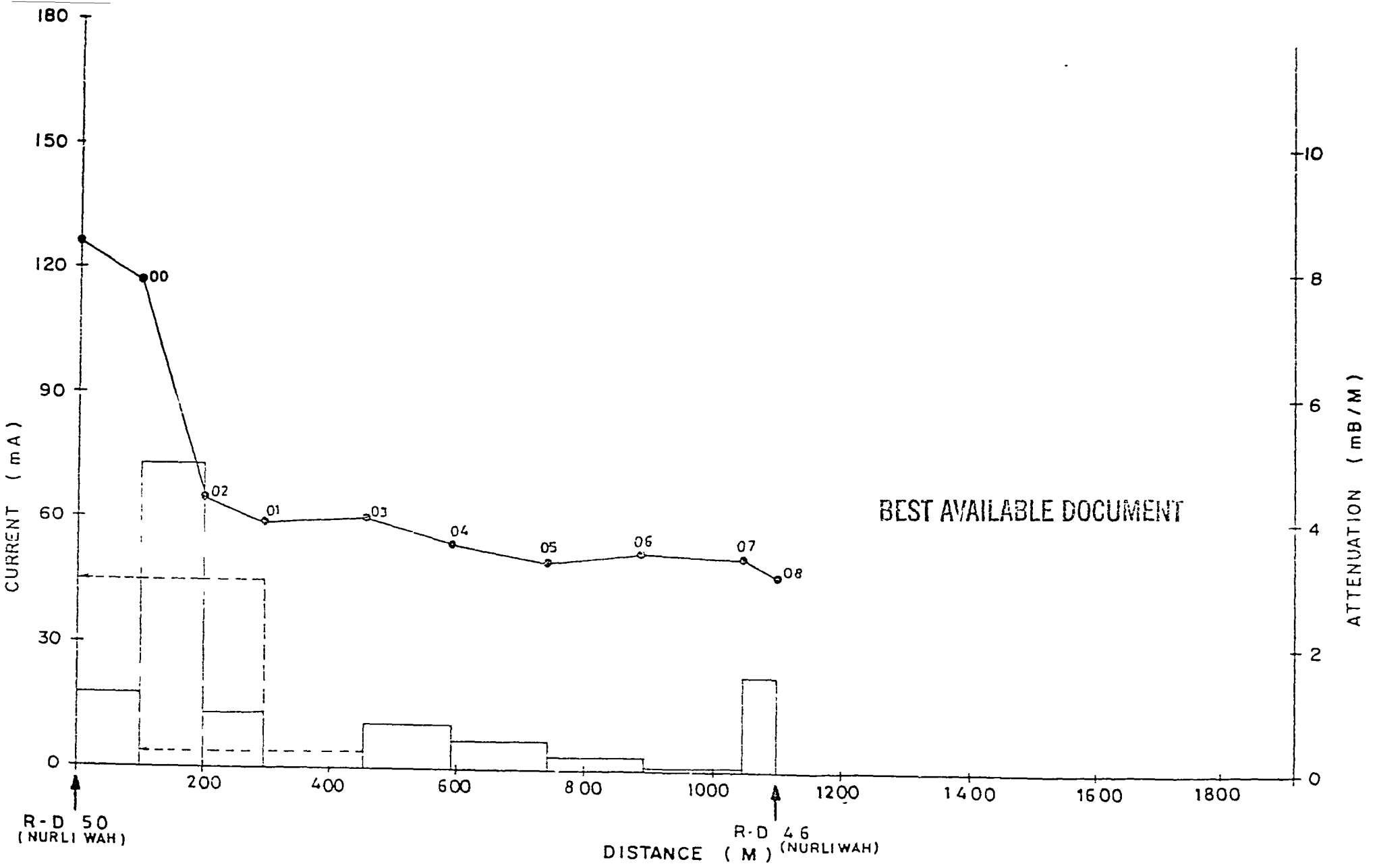


BEST AVAILABLE COPY

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 002 (1)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 20 - 2 - 89

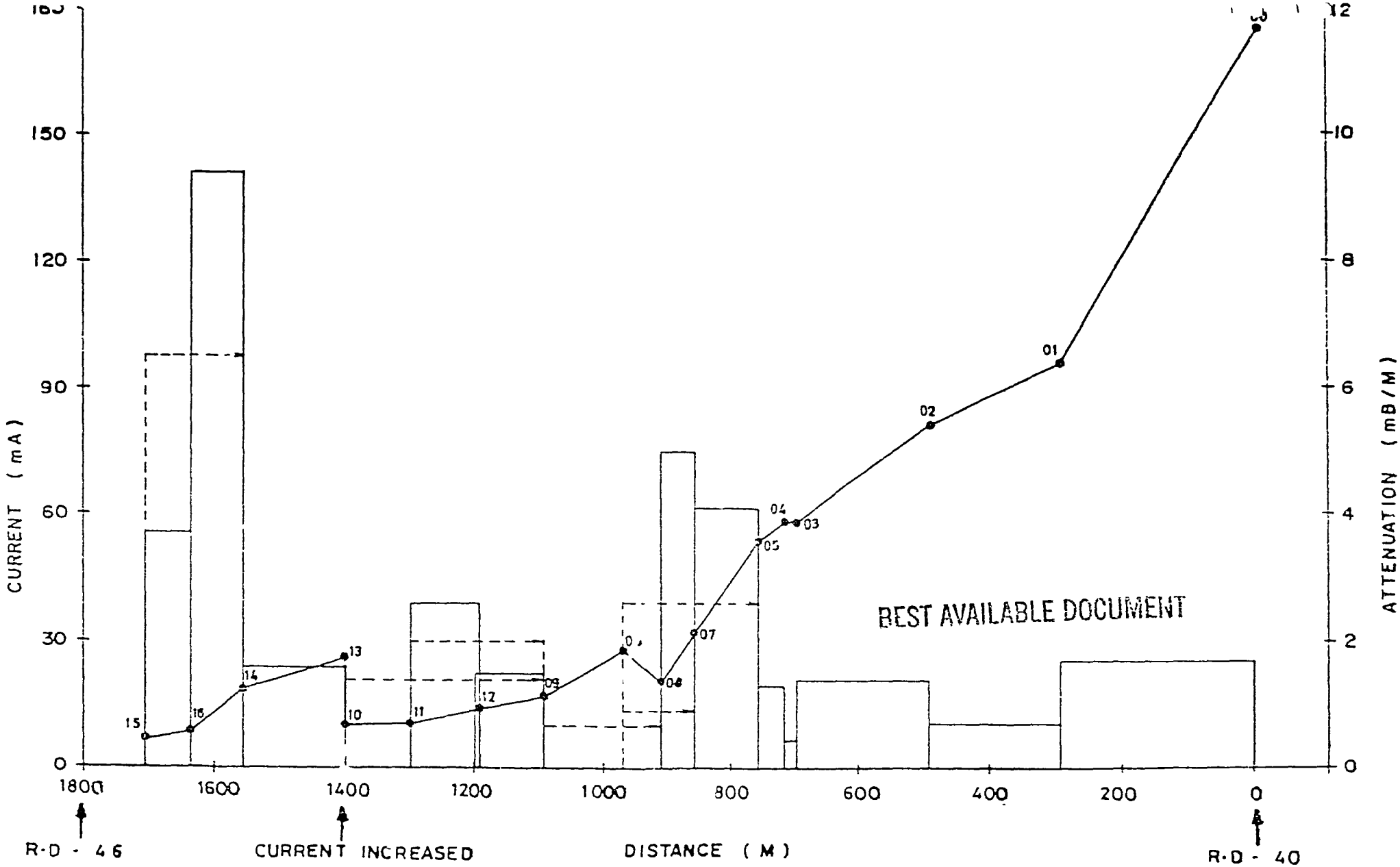


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 002 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 20-2-89

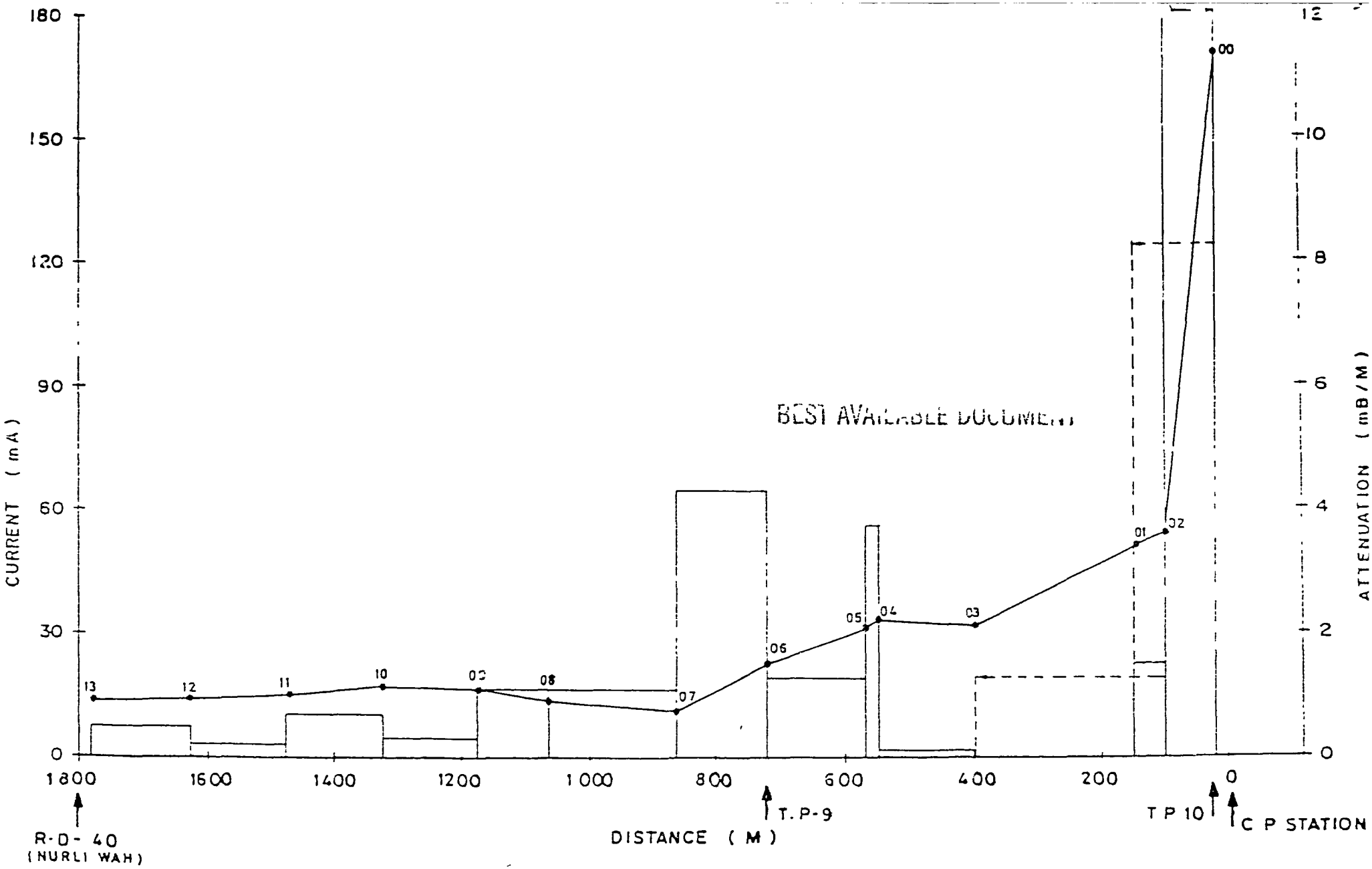


BEST AVAILABLE DOCUMENT

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 003
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 21-2-89

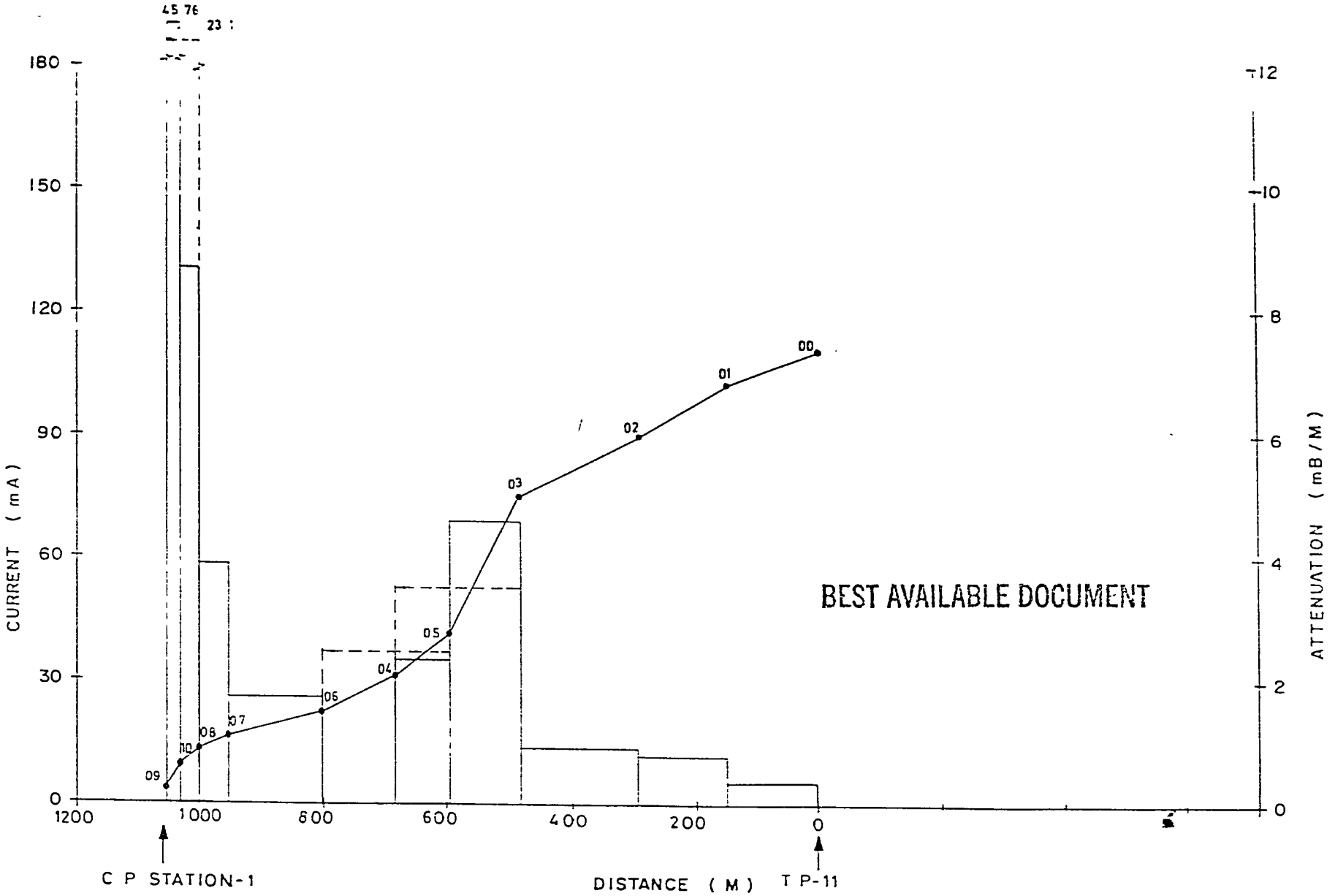


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO: 004
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 21 - 2 - 89



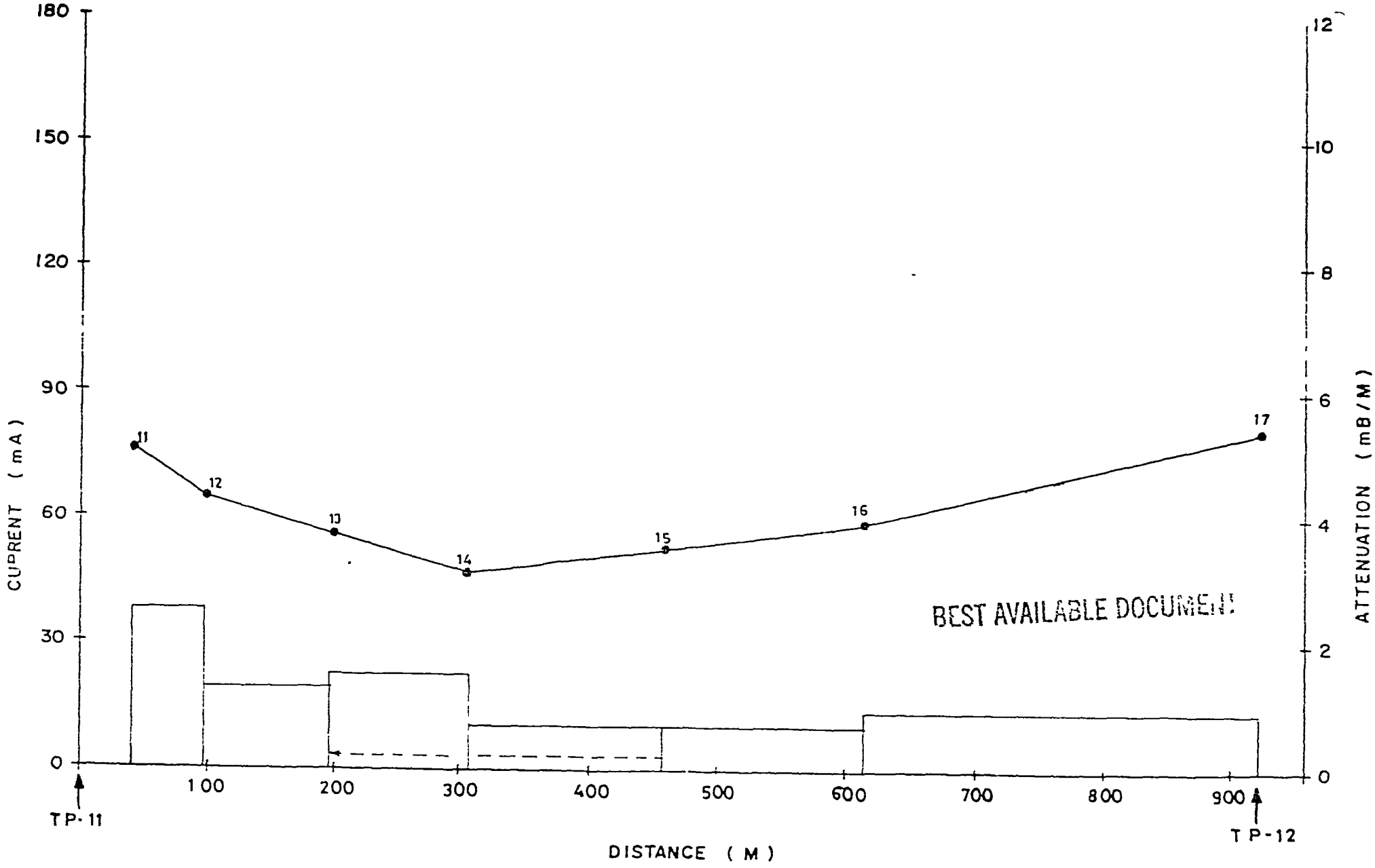
BEST AVAILABLE DOCUMENT

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 005
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE . 20 - 2 - 89



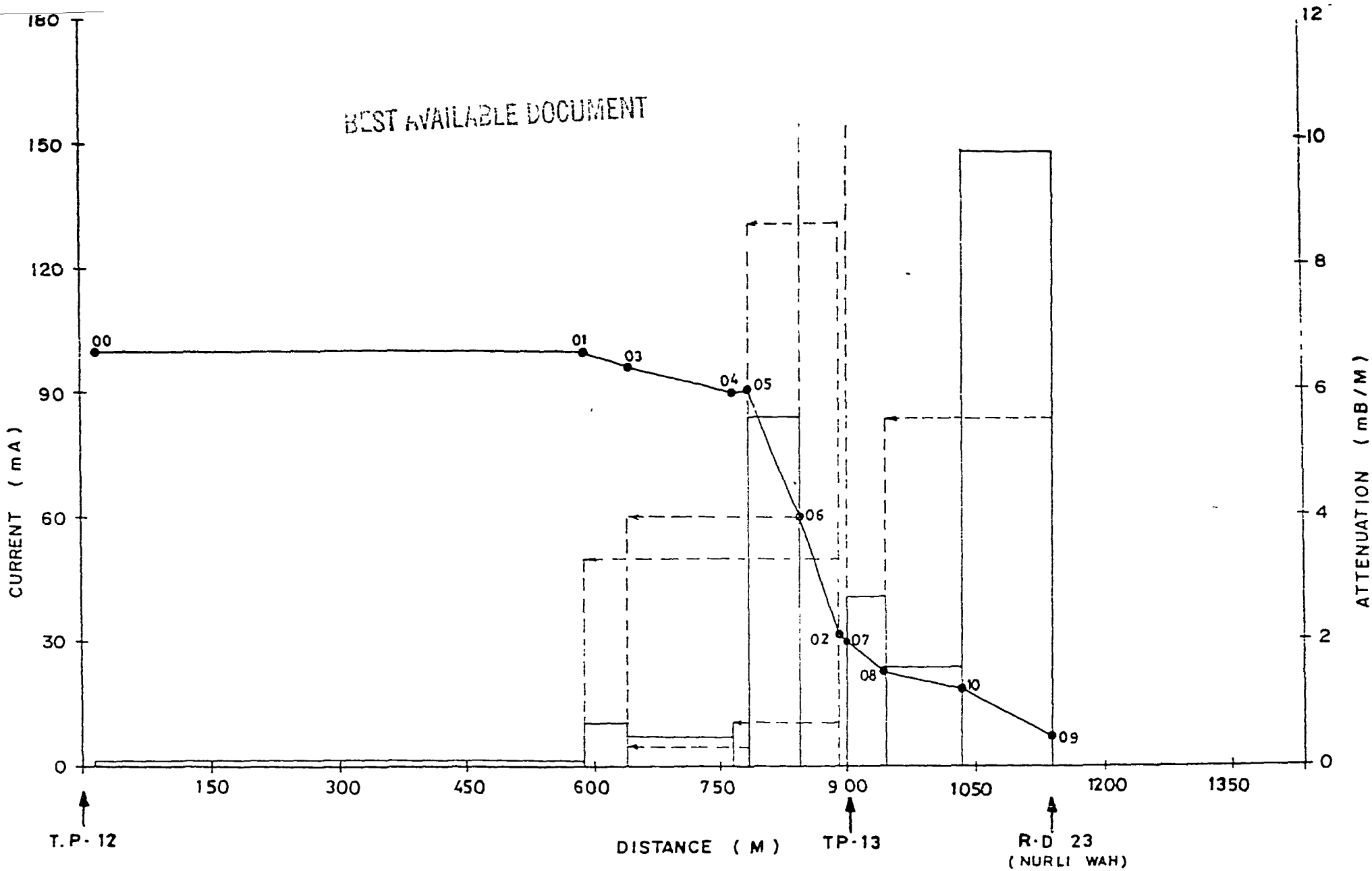
BEST AVAILABLE DOCUMENT

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 006 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 21 - 2 - 89



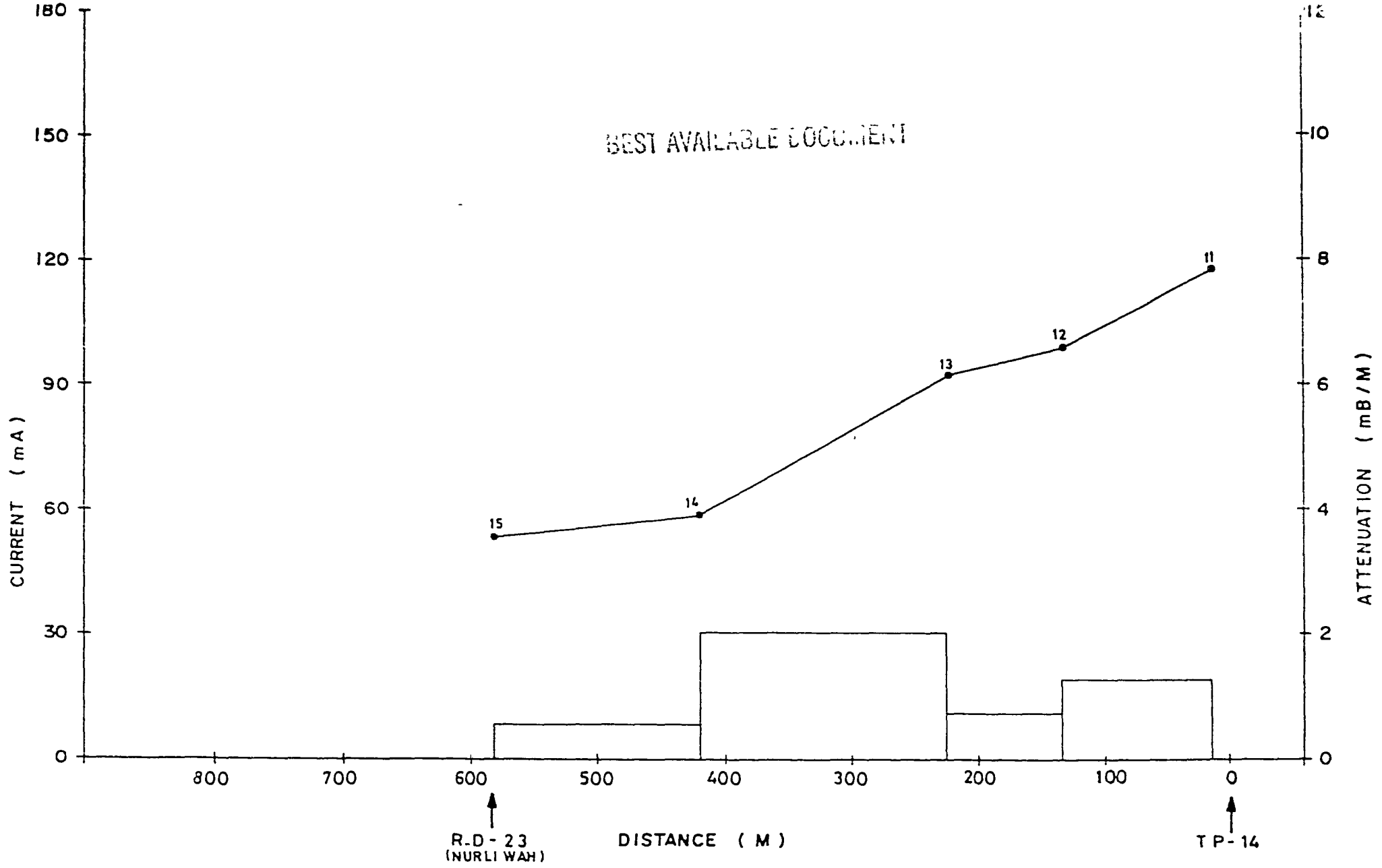
BEST AVAILABLE DOCUMENT

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 006 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 21-2-89

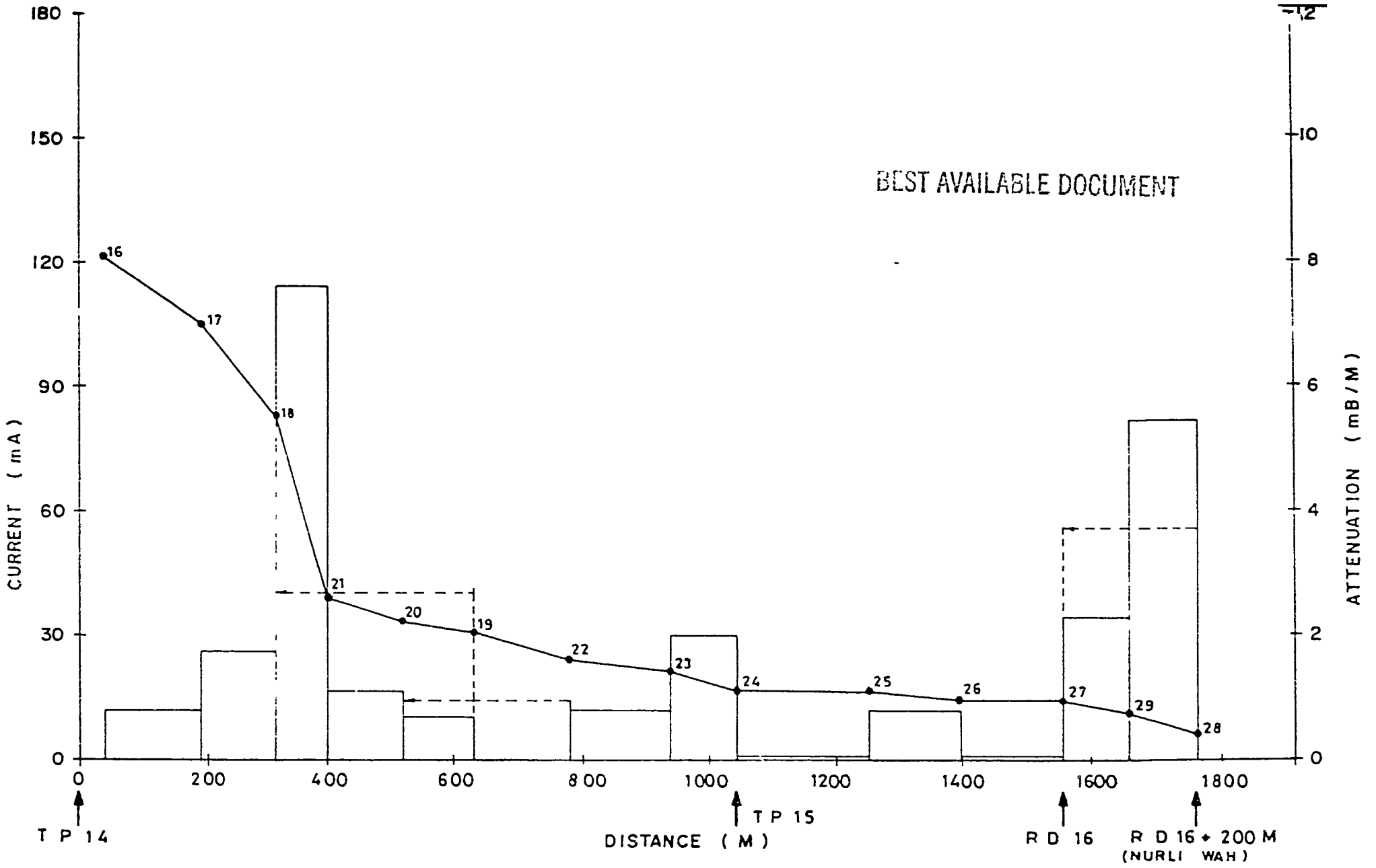


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO: 007 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 22-2-89

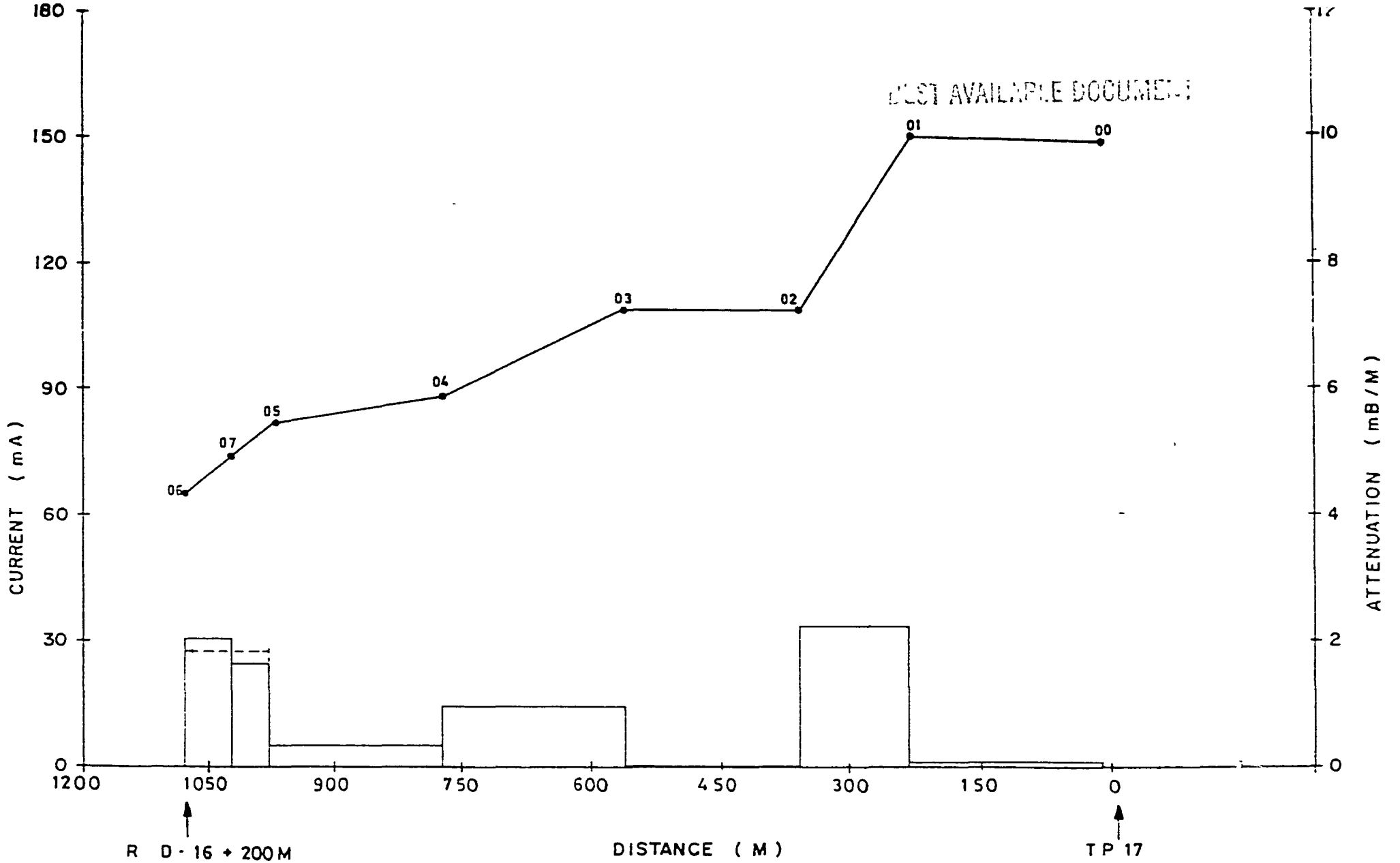
74



C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 007 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 22 - 2 - 89

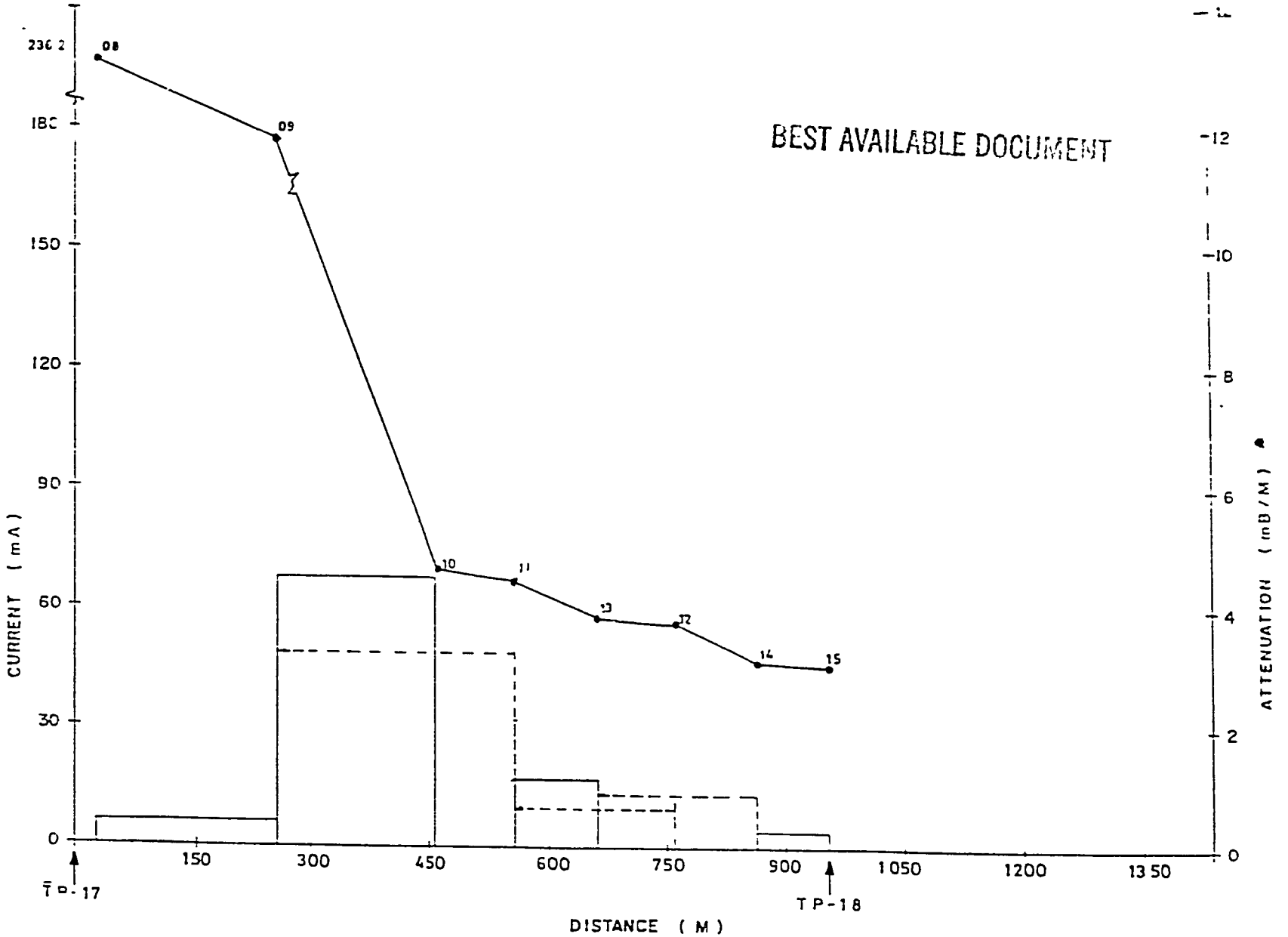


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 007 (III)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 22 - 2 - 89



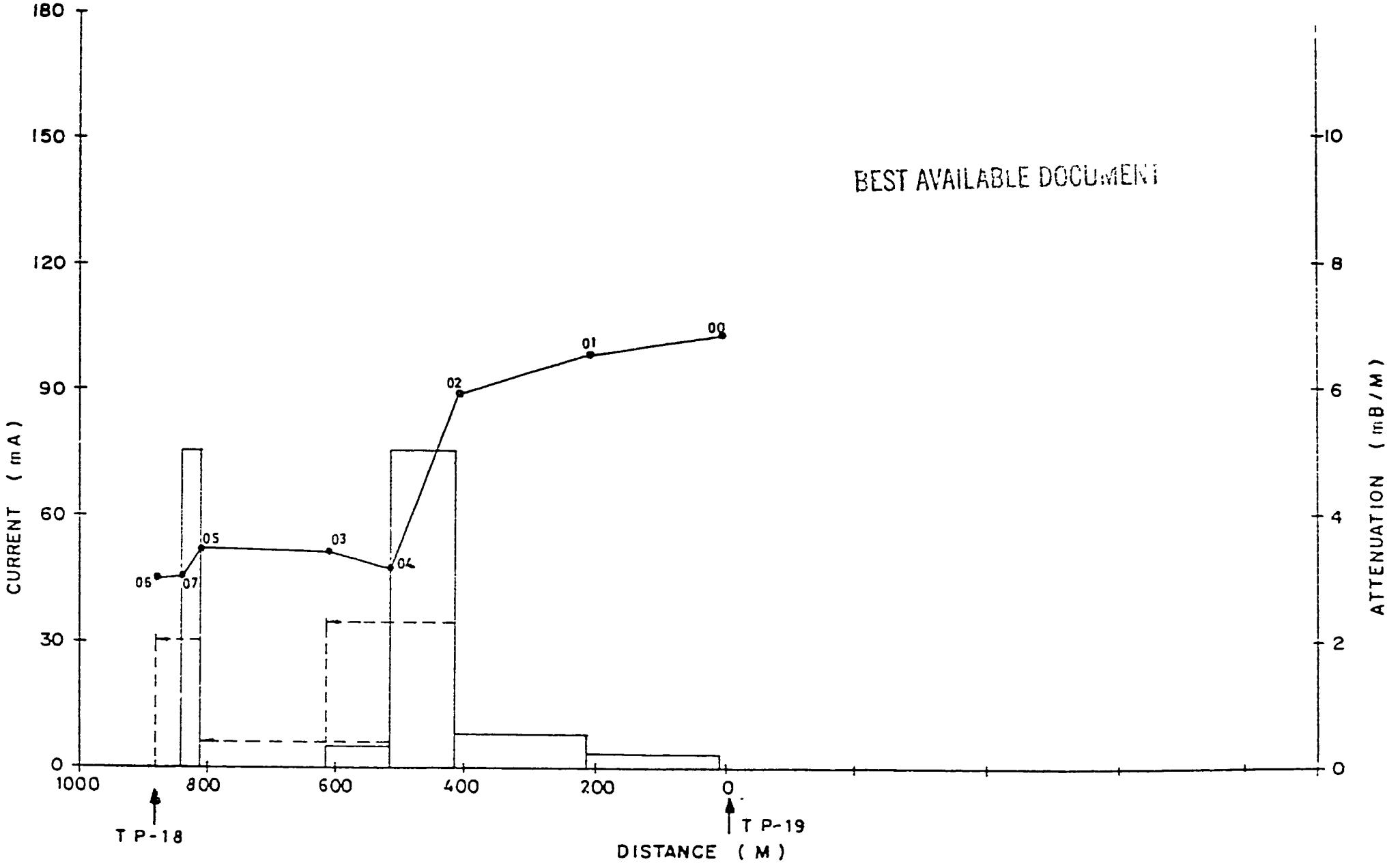
BEST AVAILABLE DOCUMENT

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 008 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 22 - 2 - 89



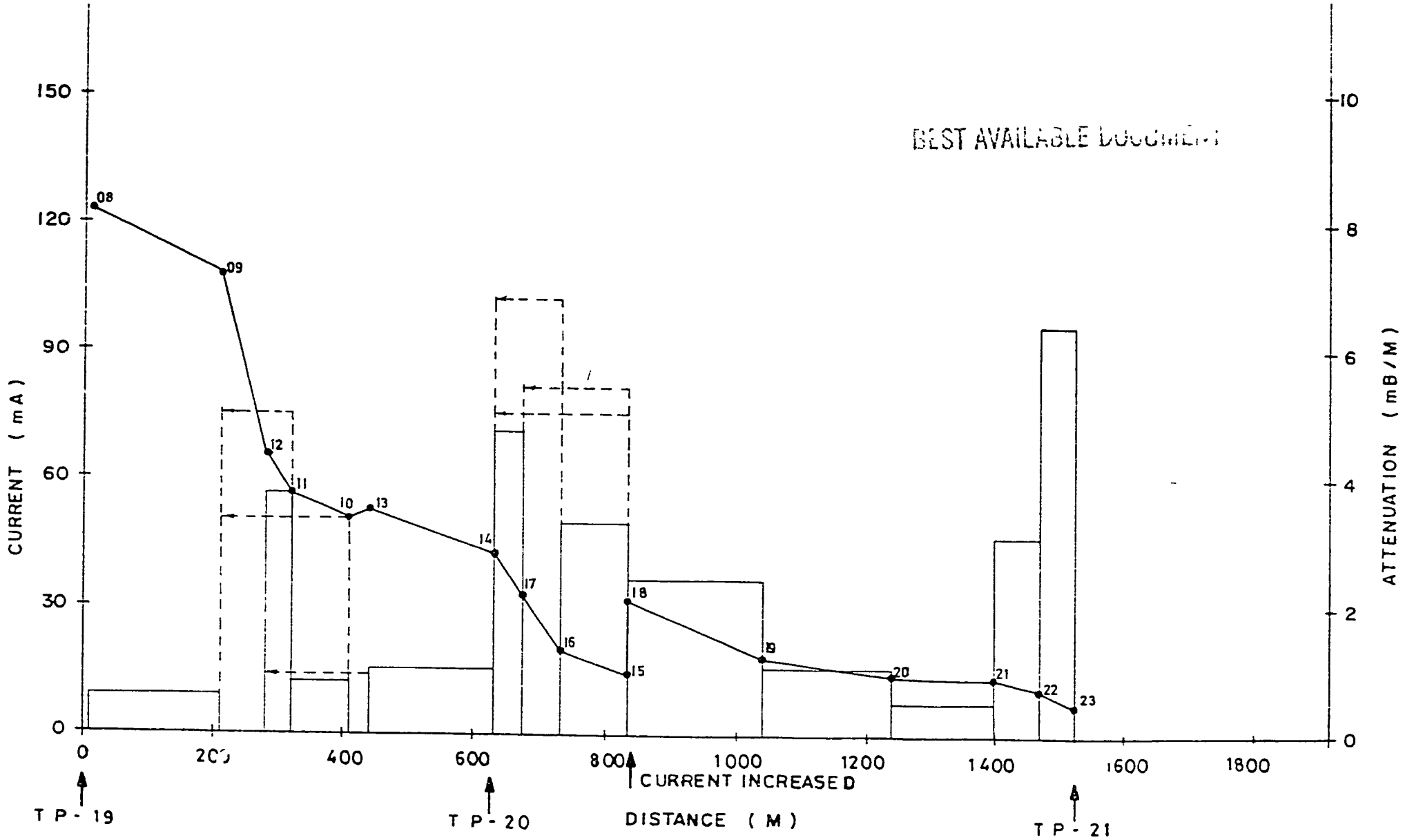
C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 008 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 22-2-89

78



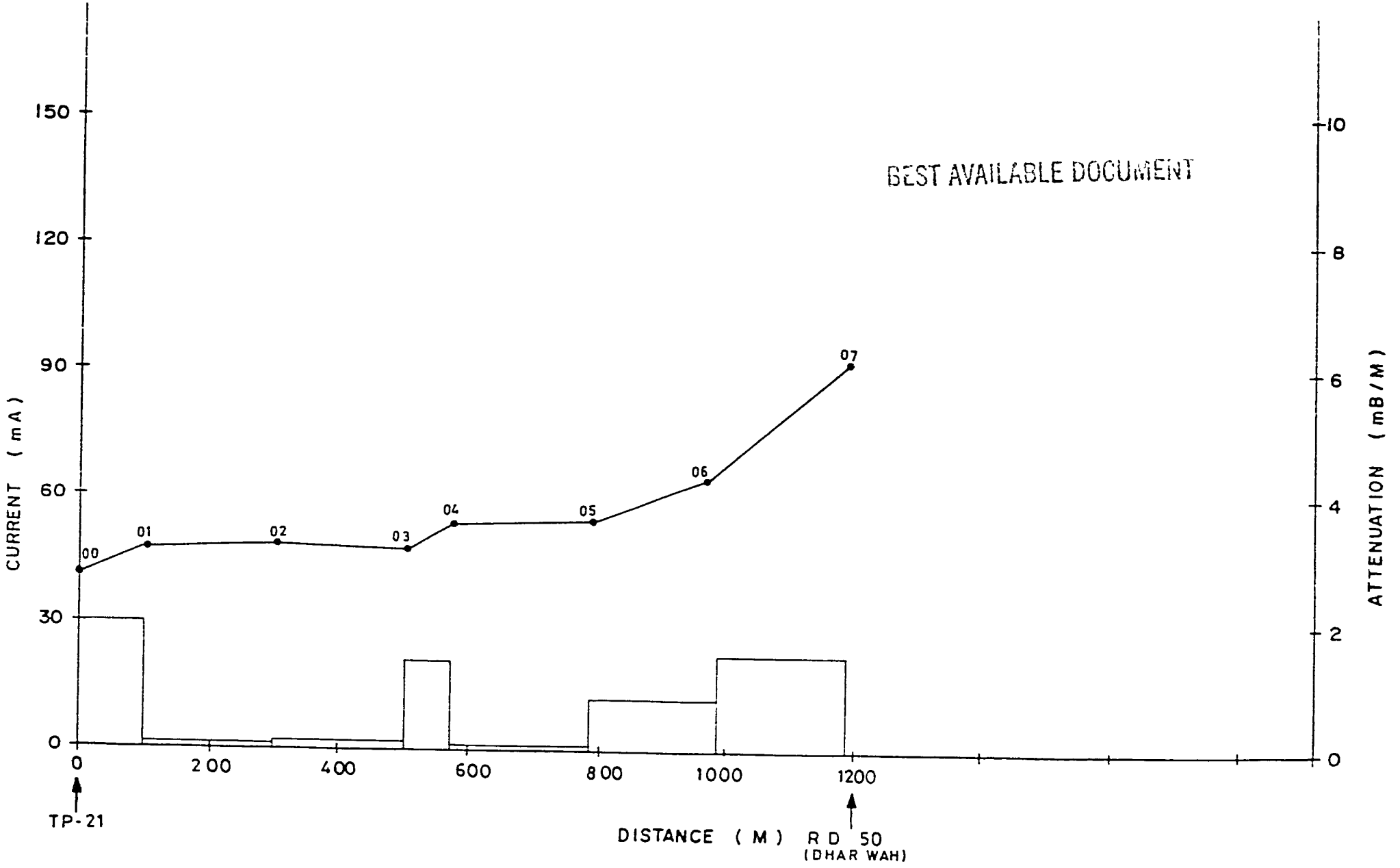
BEST AVAILABLE DOCUMENT

C-SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 009 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 21 - 2 - 89



C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 009 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 21 - 2 - 89

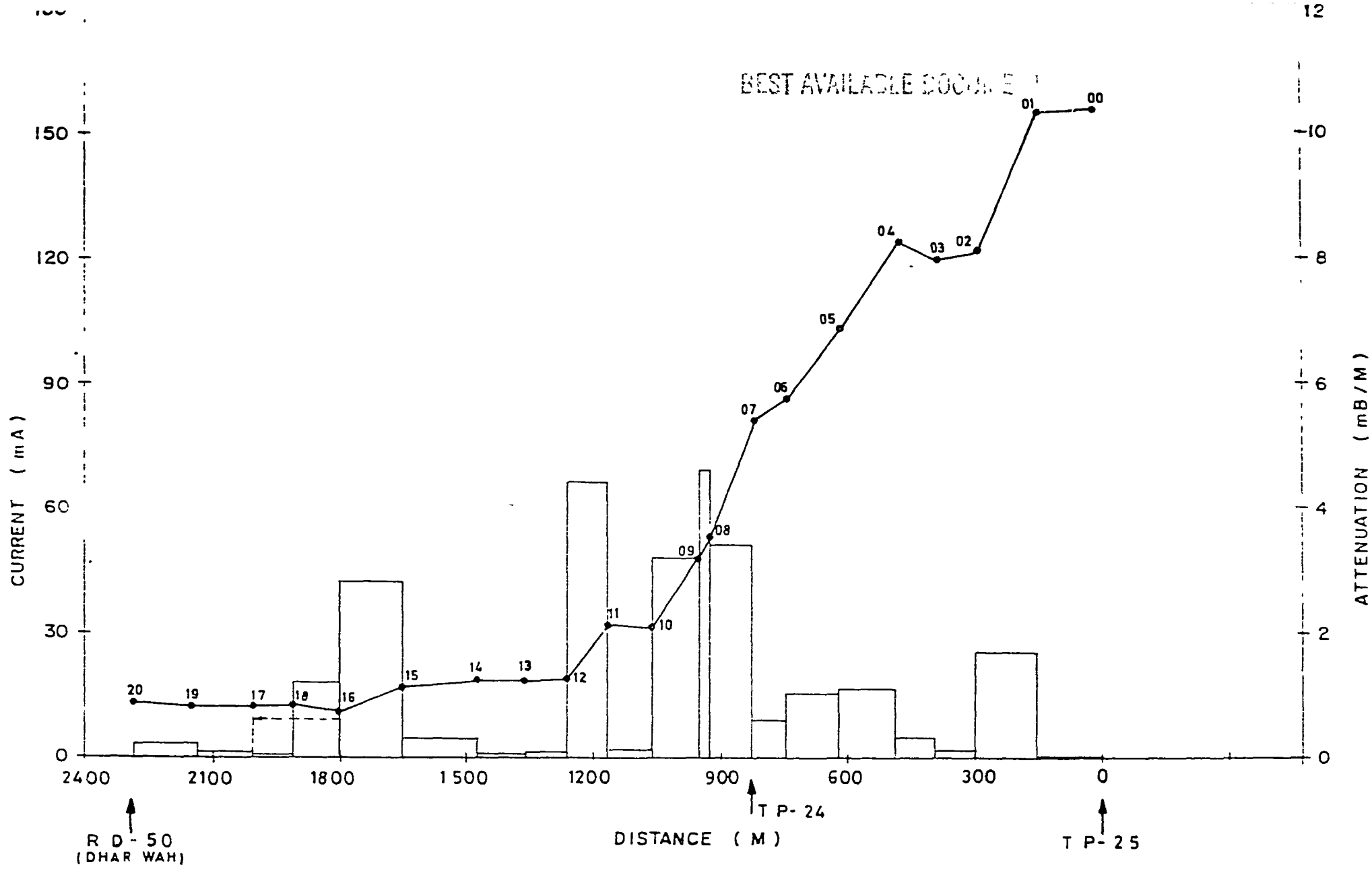
23



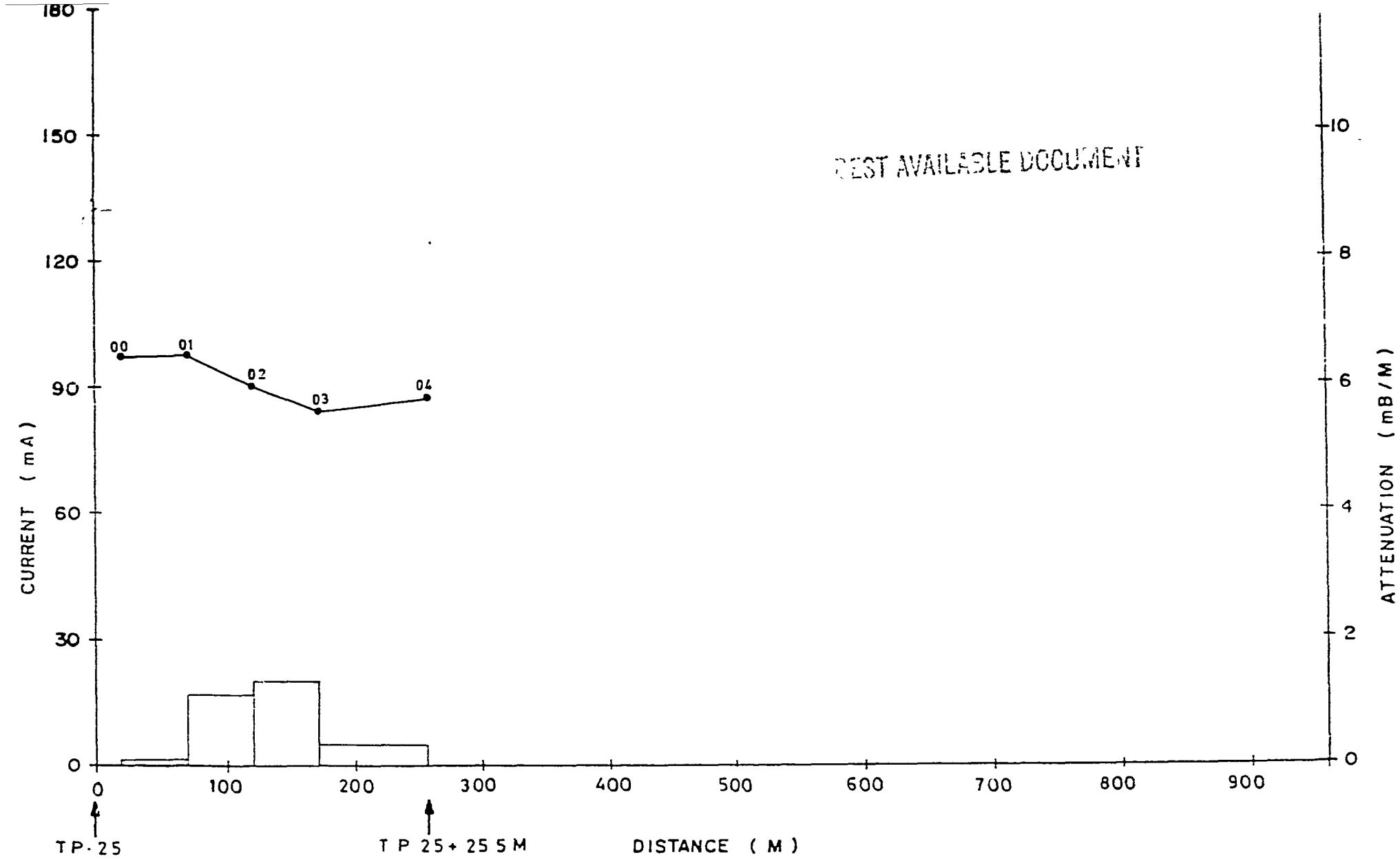
C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 010
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE . 23 - 2 - 89

14

BEST AVAILABLE DOCUMENT

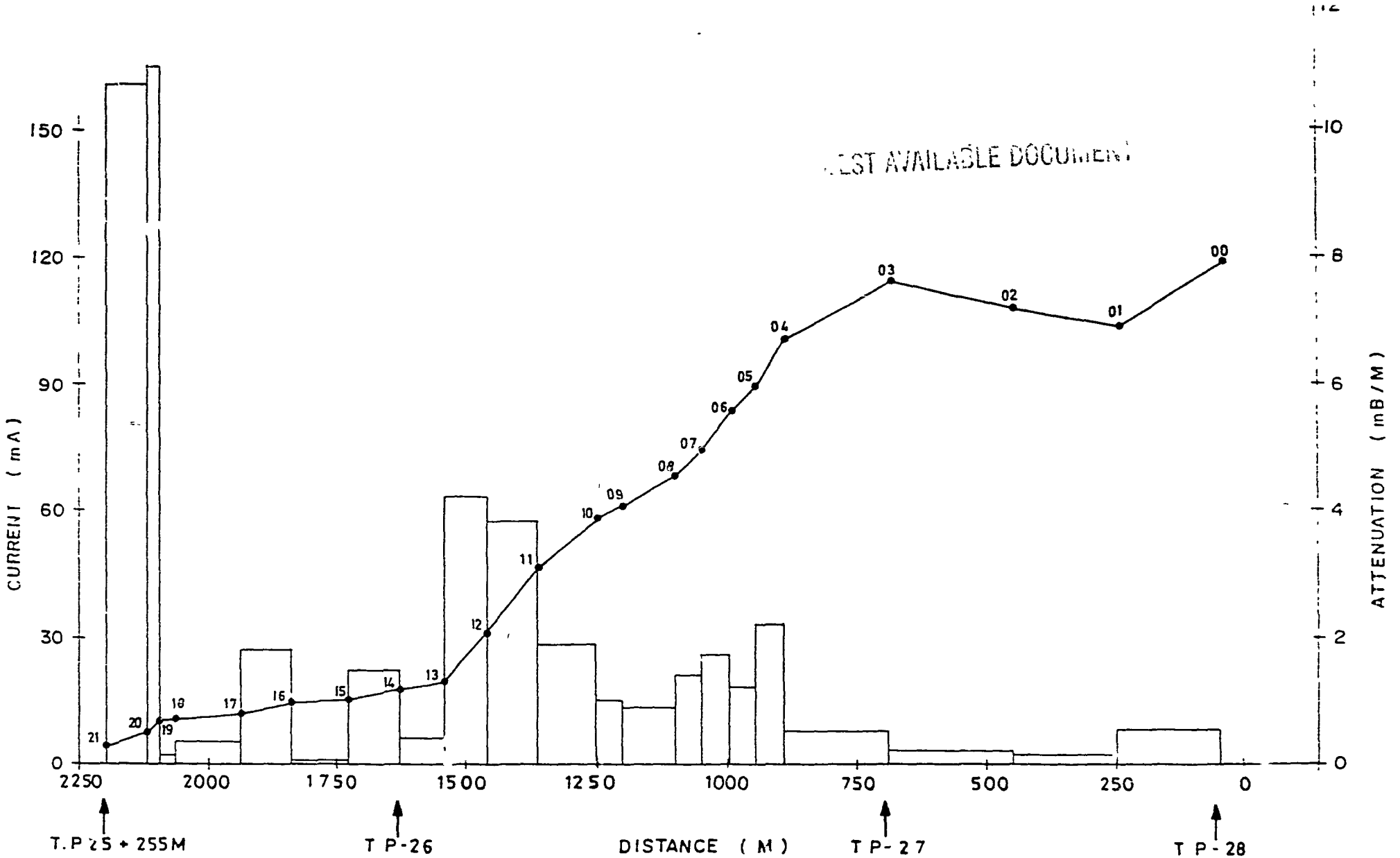


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 011
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89



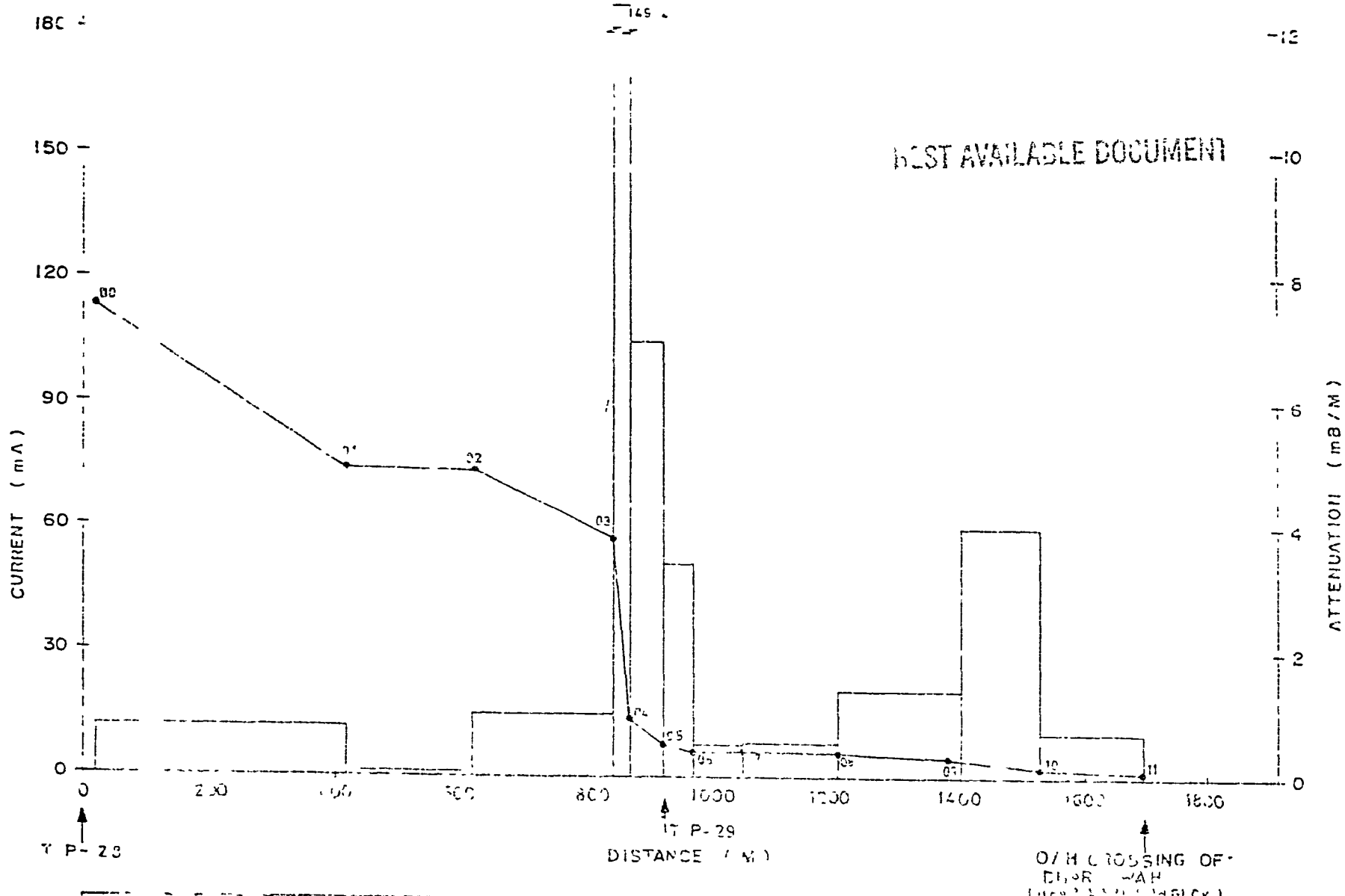
BEST AVAILABLE DOCUMENT

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 012
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89



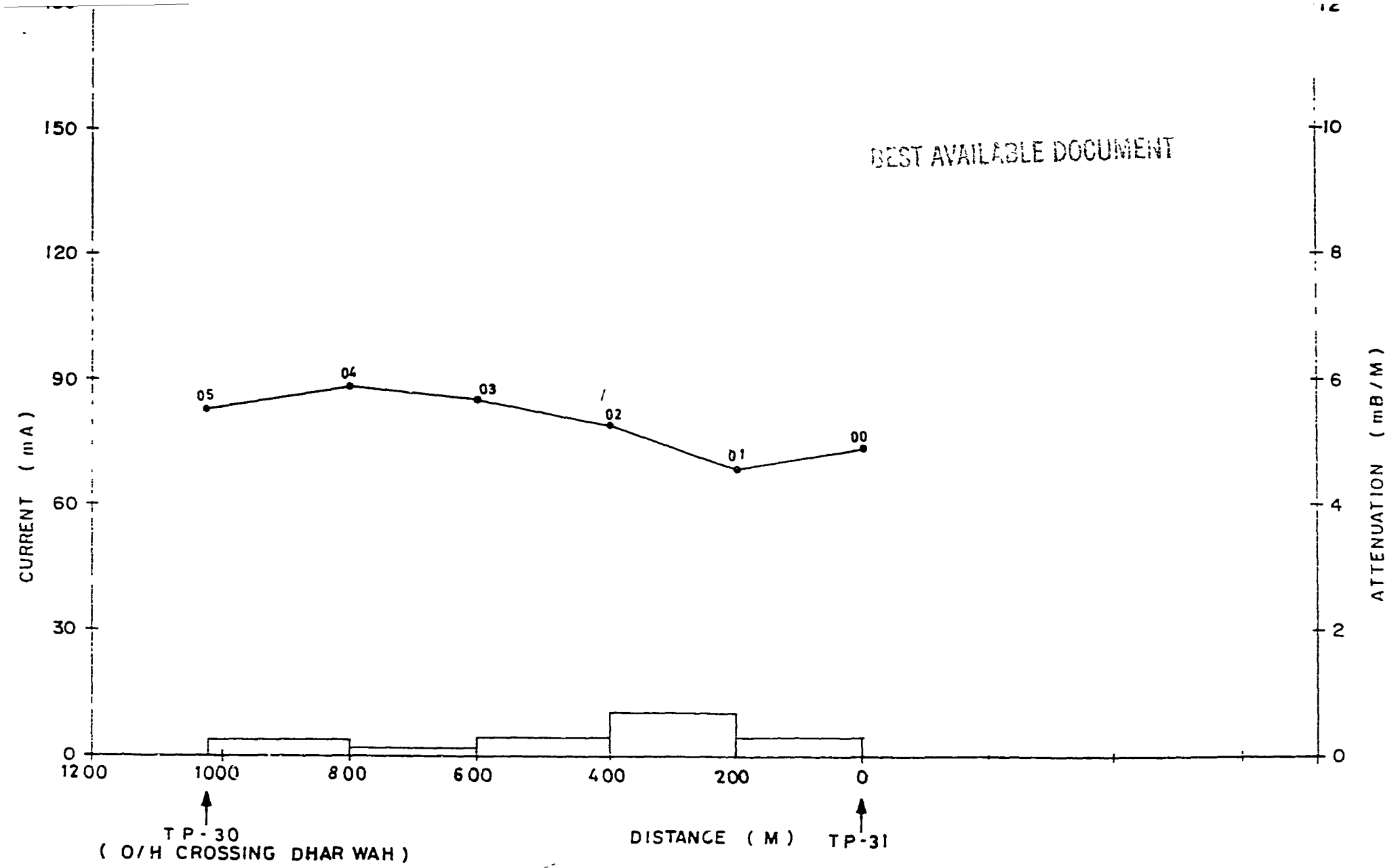
BEST AVAILABLE DOCUMENT

C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 013
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89

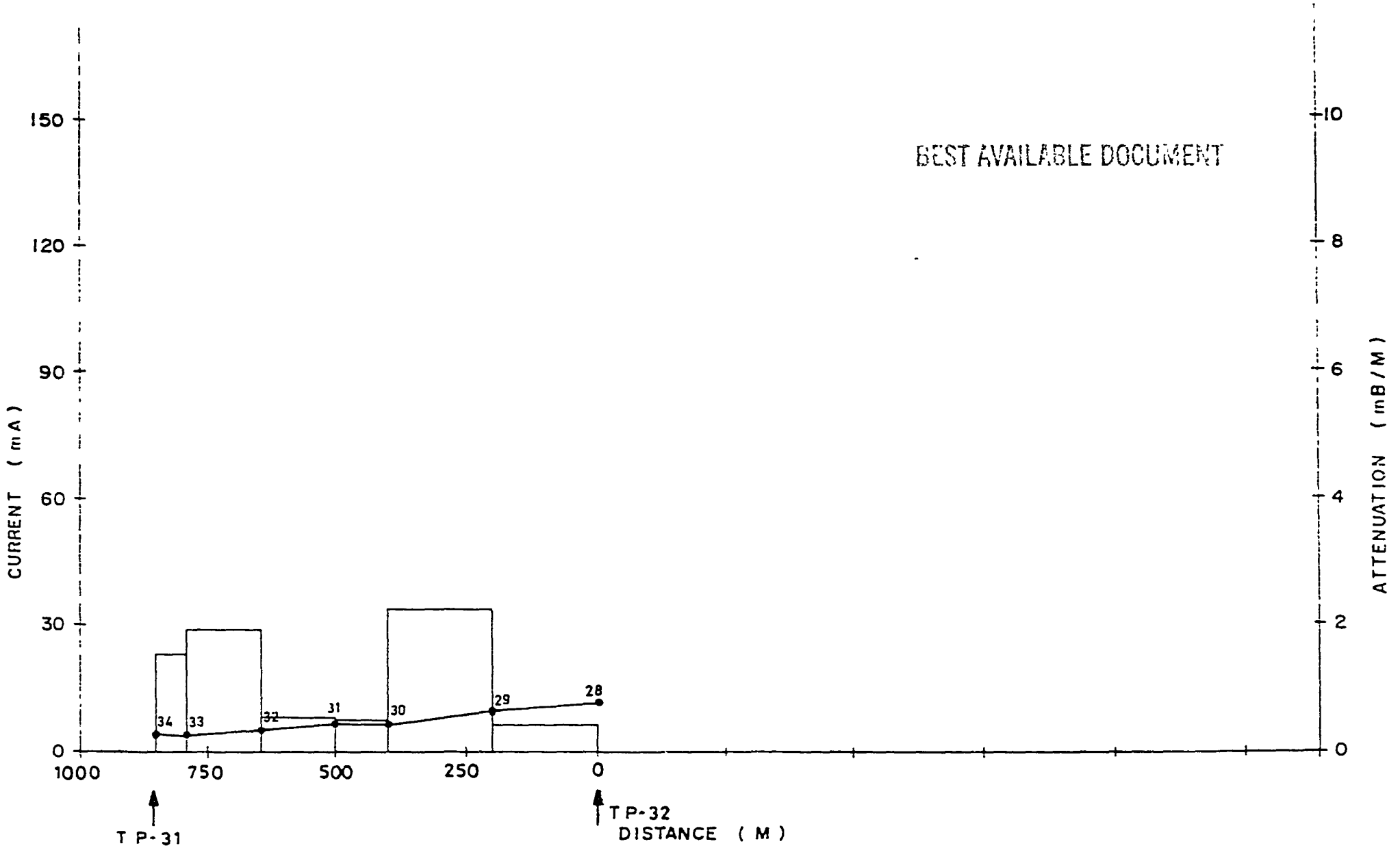


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI - GUDDU GAS PIPELINE	PLOT NO 014
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89

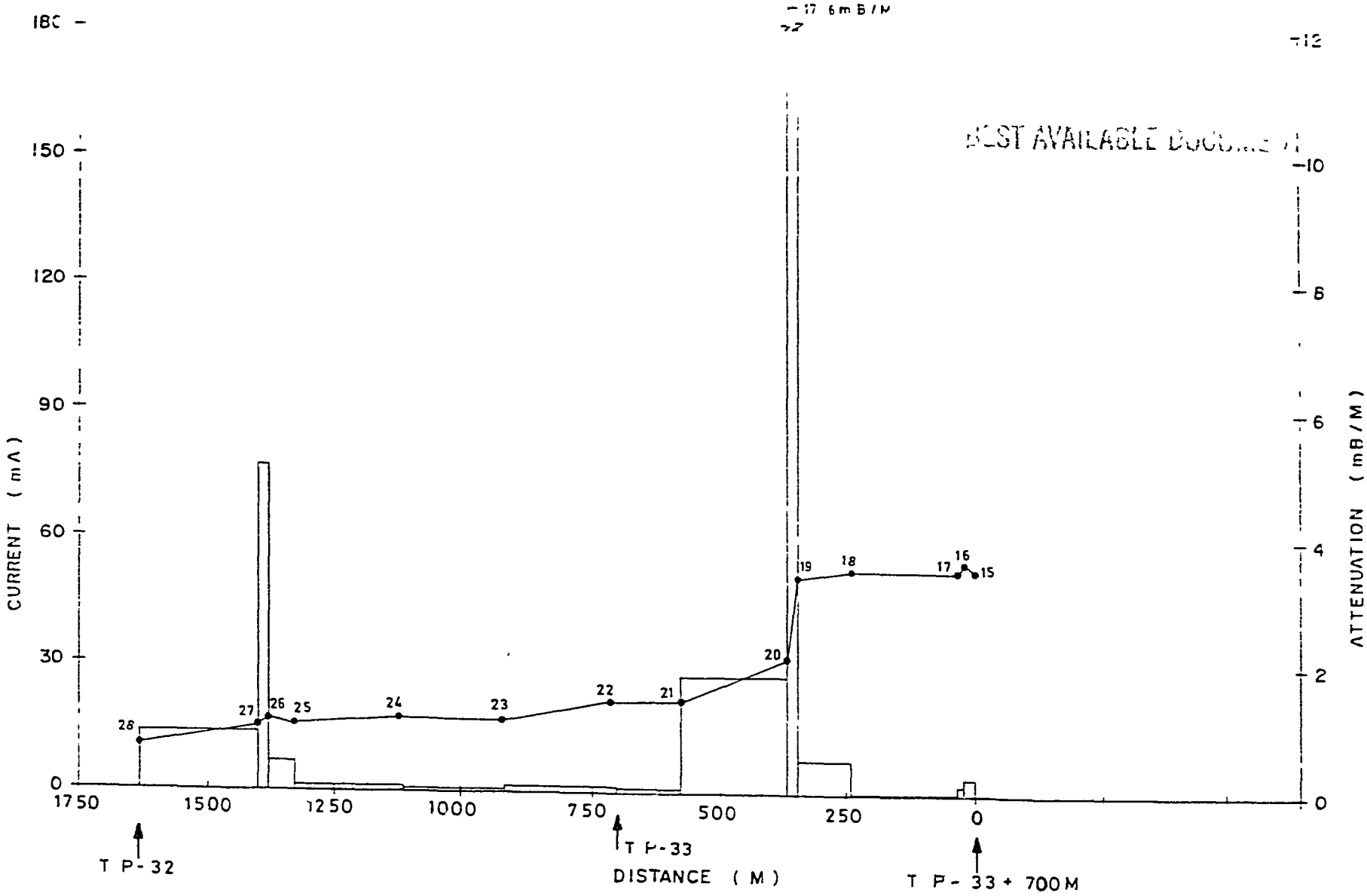
85



C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 015
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 28 - 2 - 89

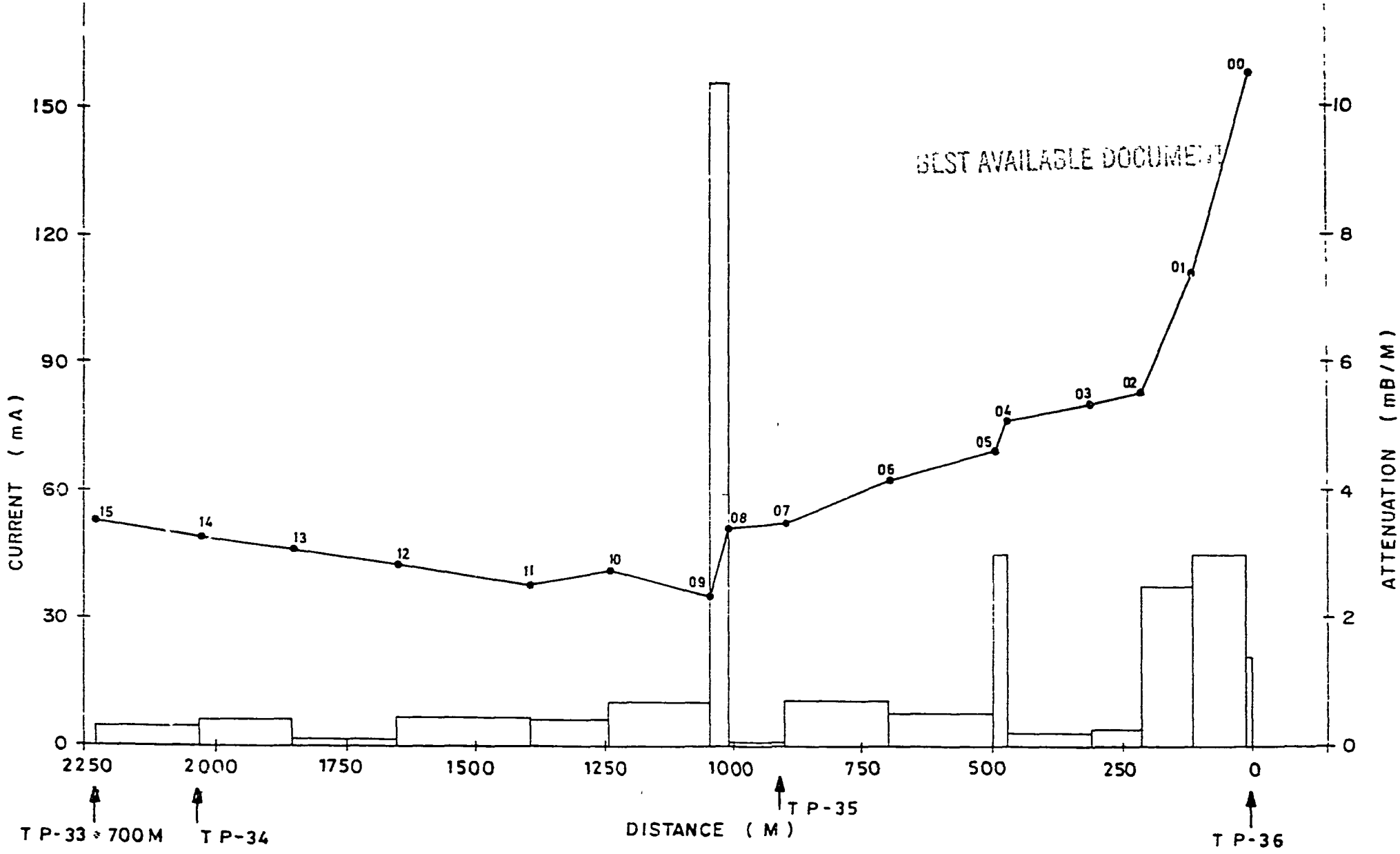


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 016 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89



C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 016 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89

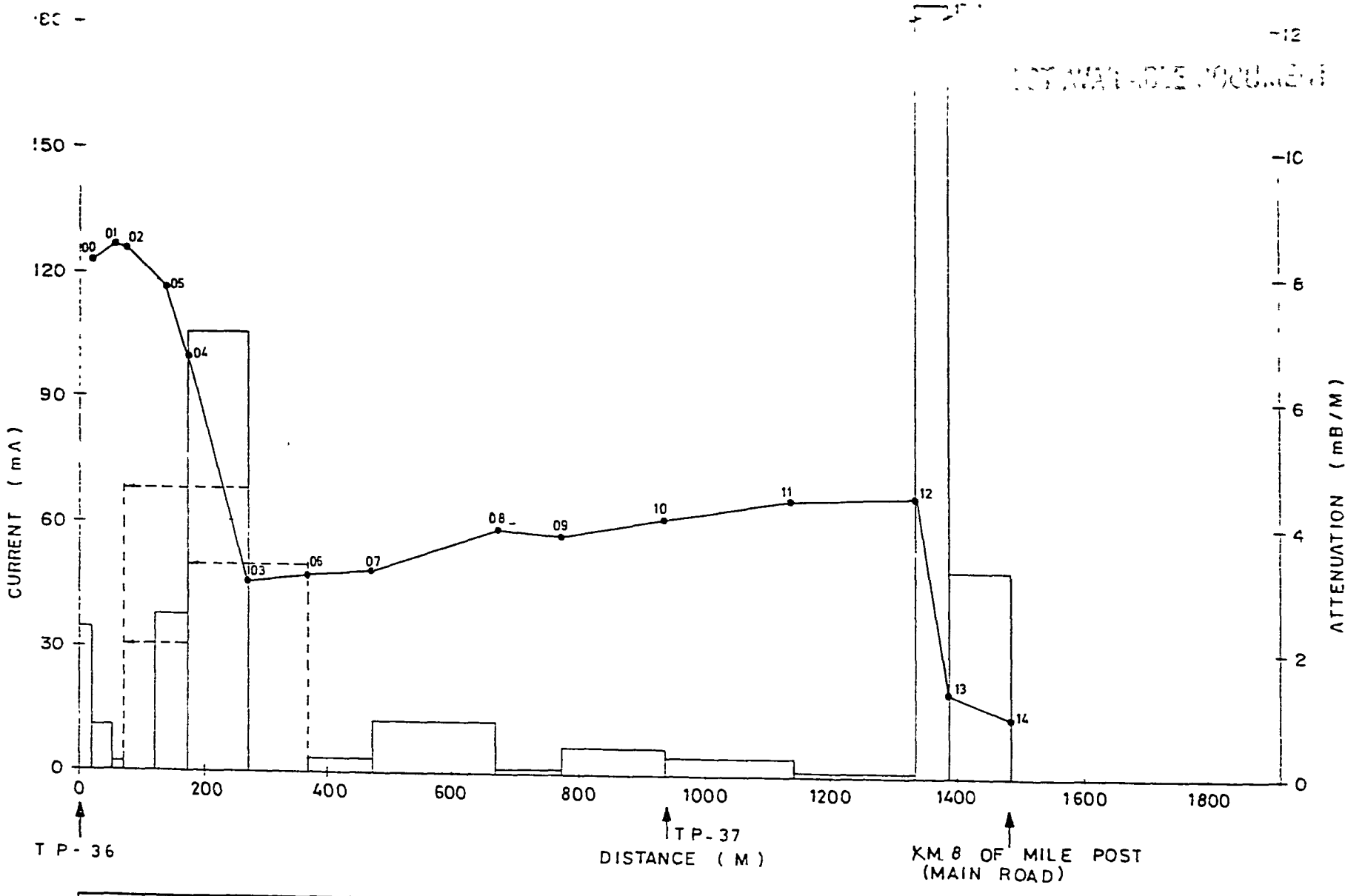
88



BEST AVAILABLE DOCUMENT

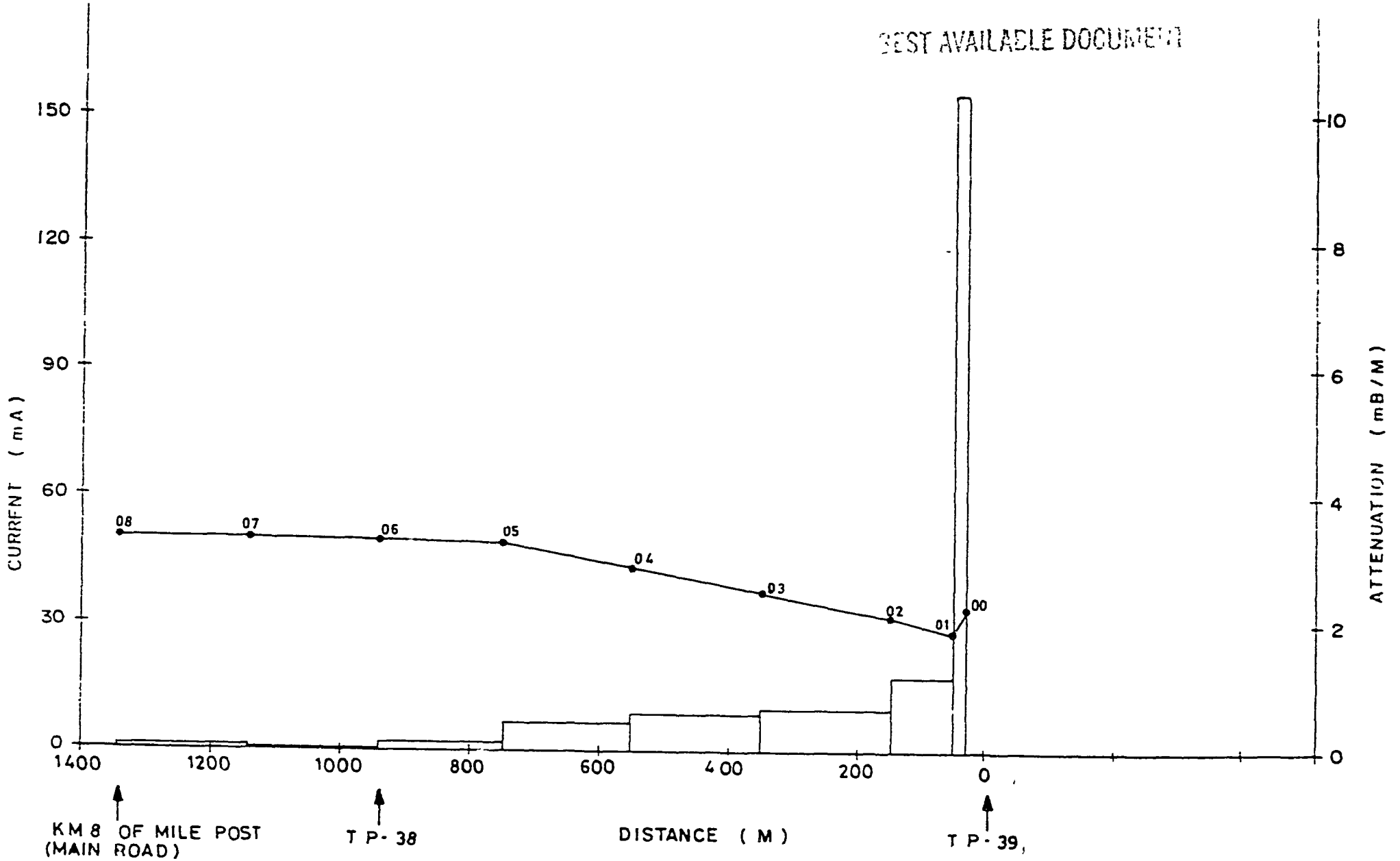
C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 016 (III)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89

53



C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 017
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89

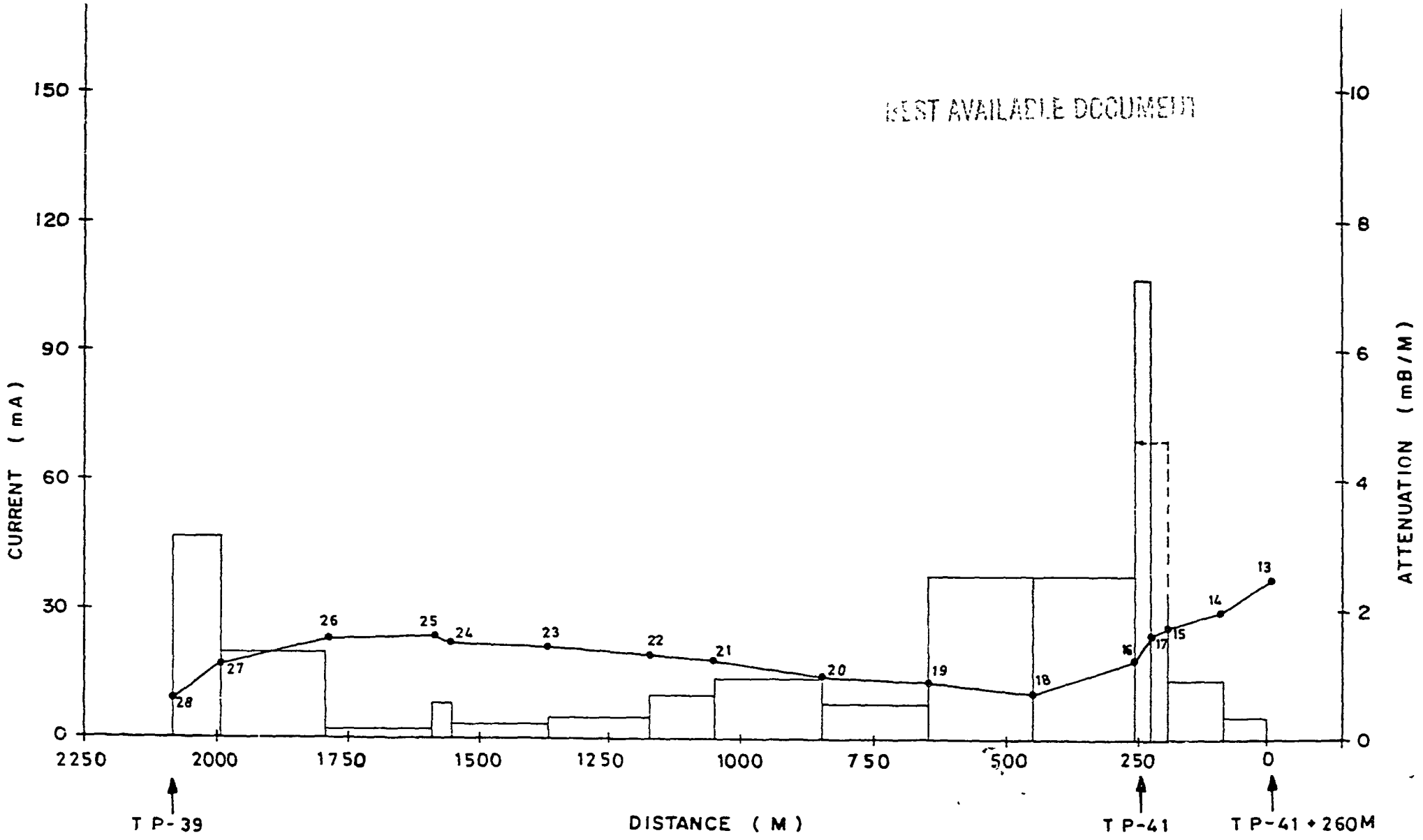
BEST AVAILABLE DOCUMENT



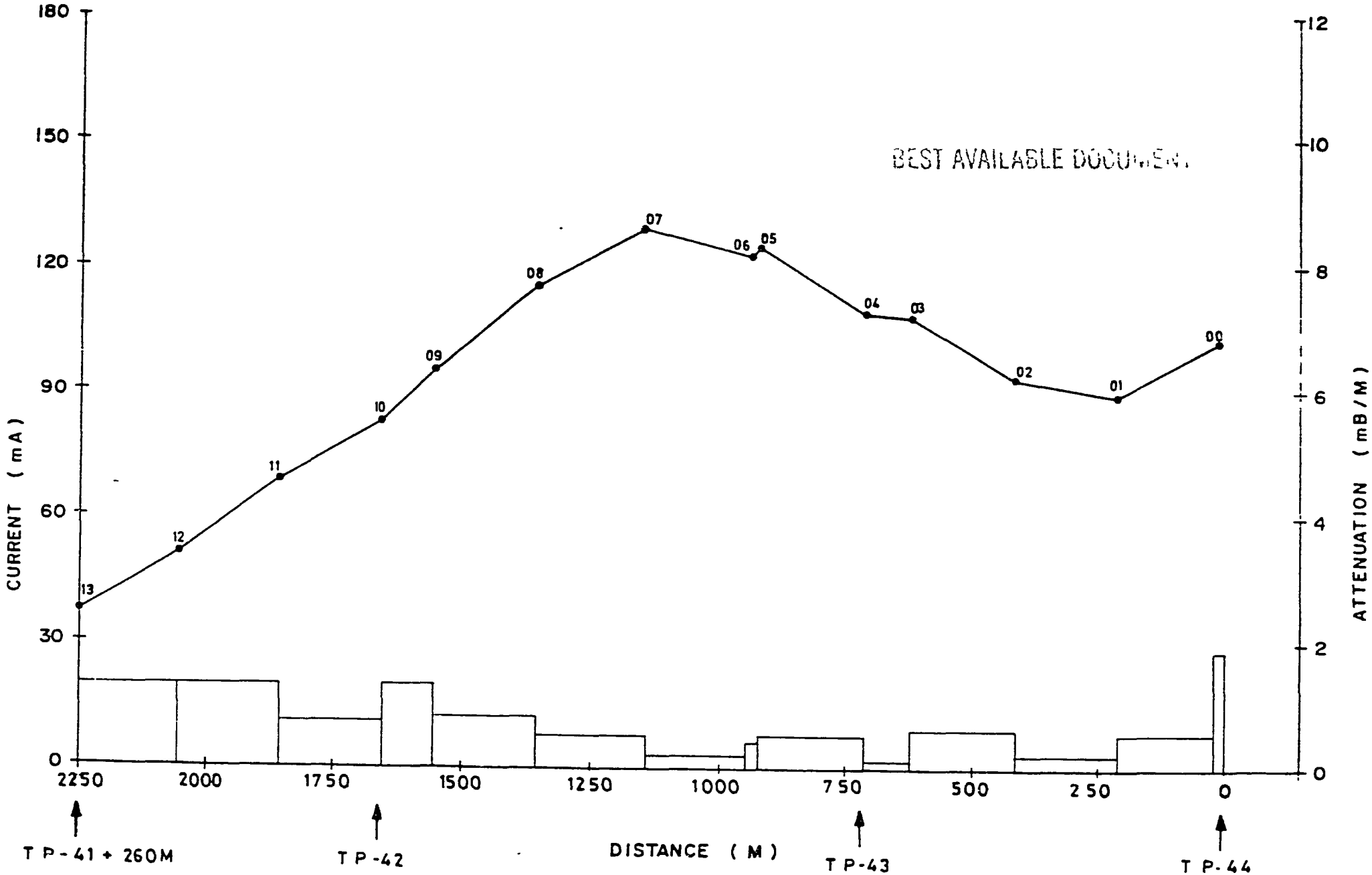
C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 018
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 27 - 2 - 89

11

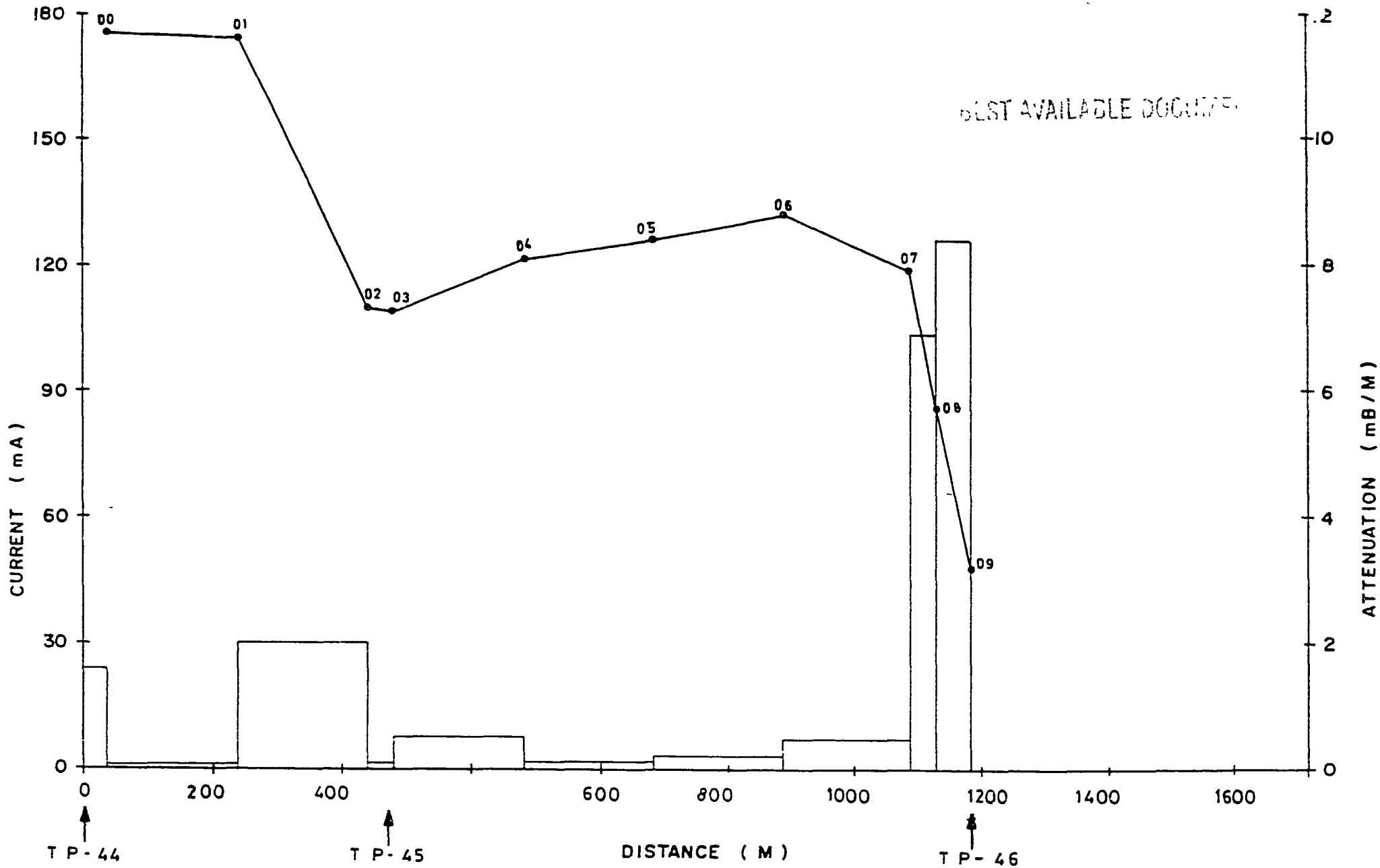
BEST AVAILABLE DOCUMENT



C-SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 019 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 26 - 2 - 89

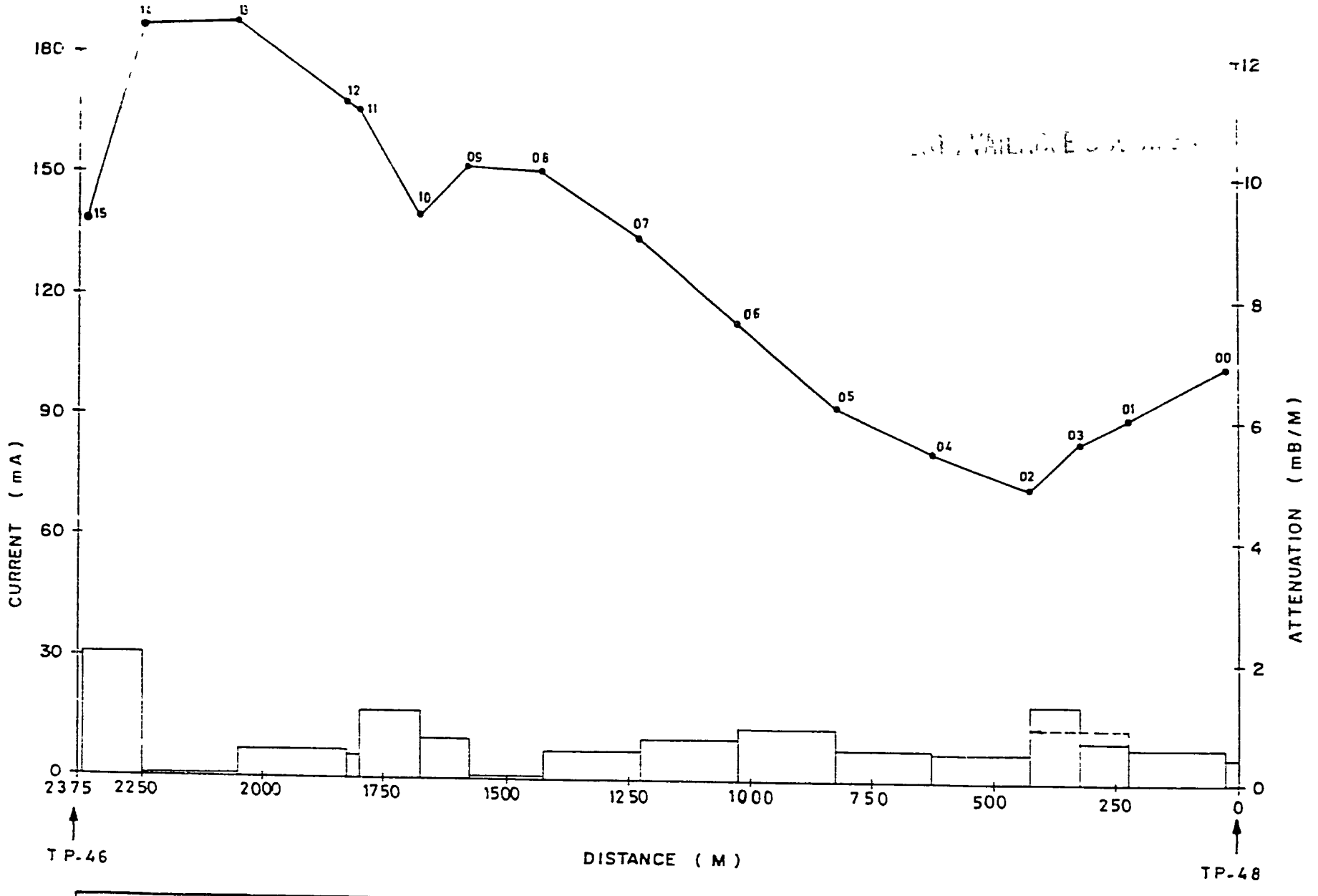


C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 079 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 20 - 2 - 89

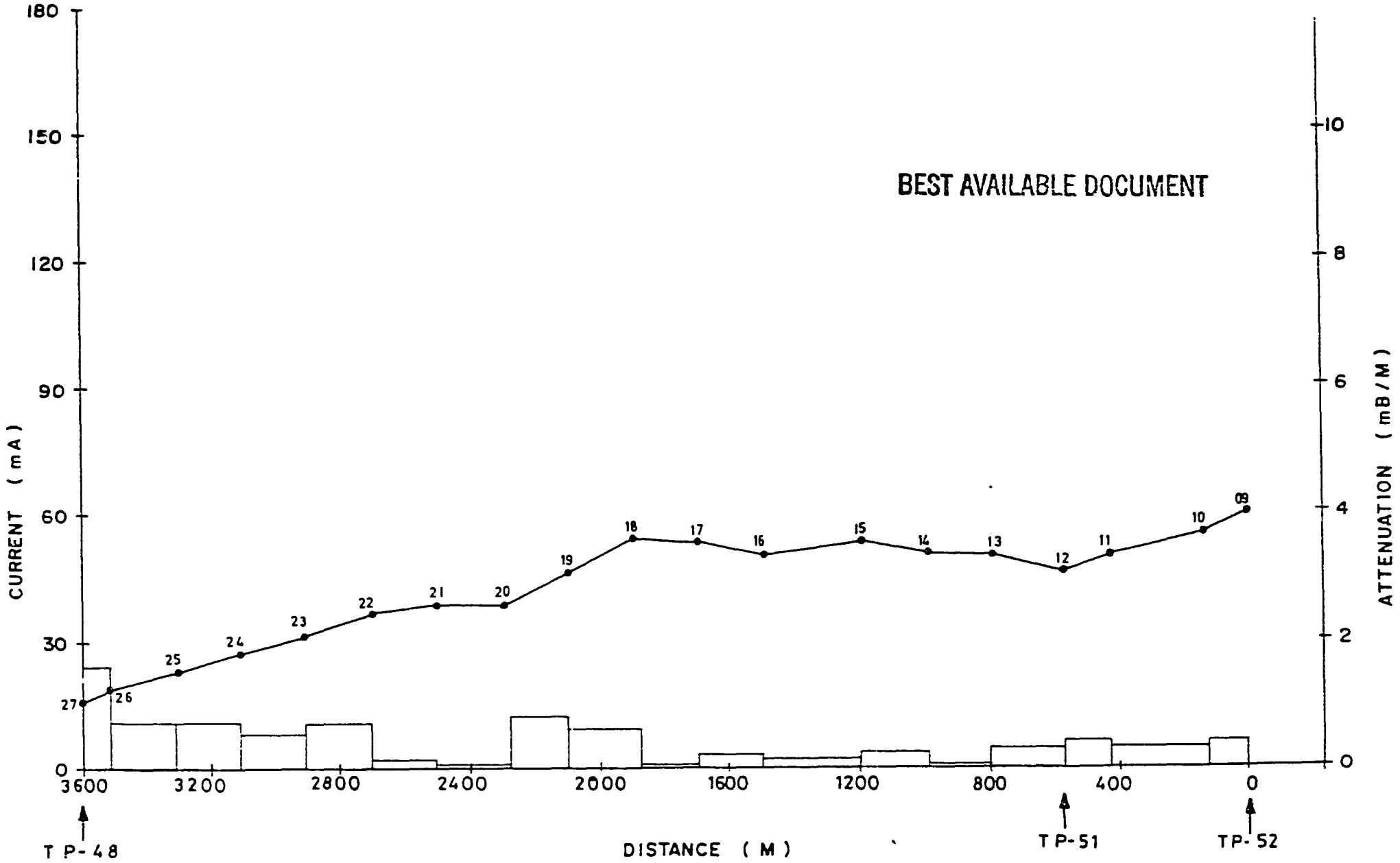


BEST AVAILABLE DOCUMENT

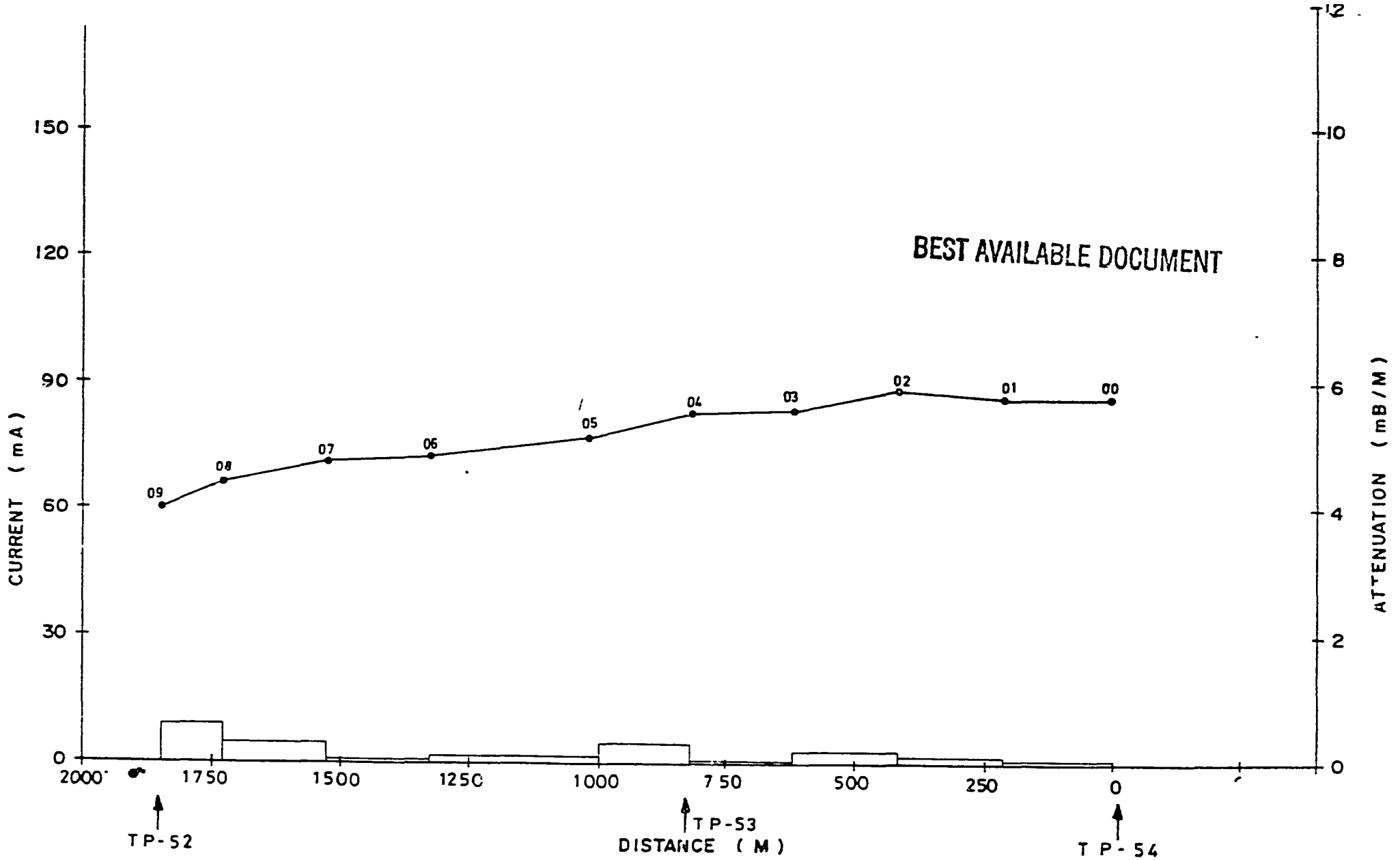
C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 0 20
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 26 - 2 - 89



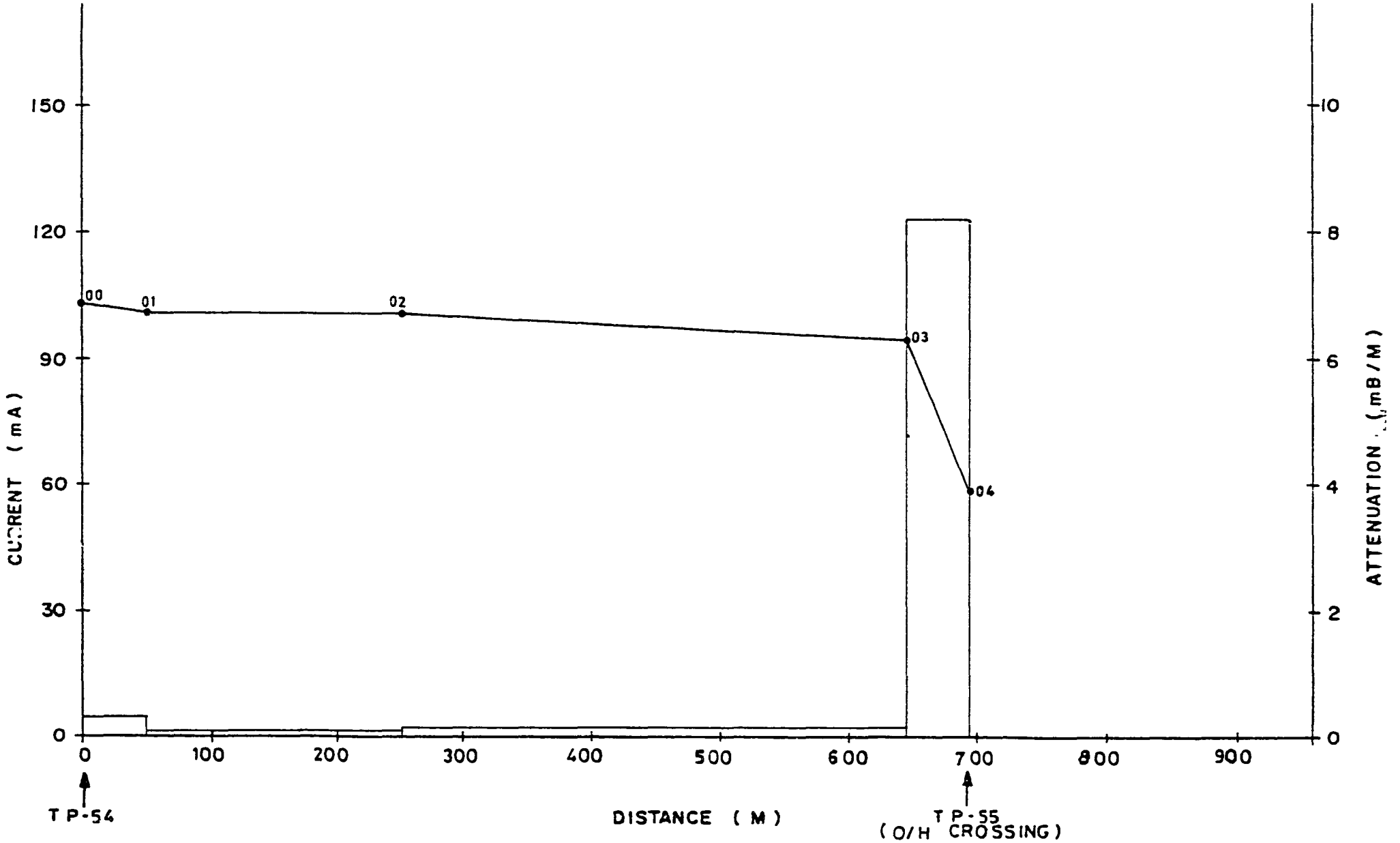
C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 021
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 25 - 2 - 89



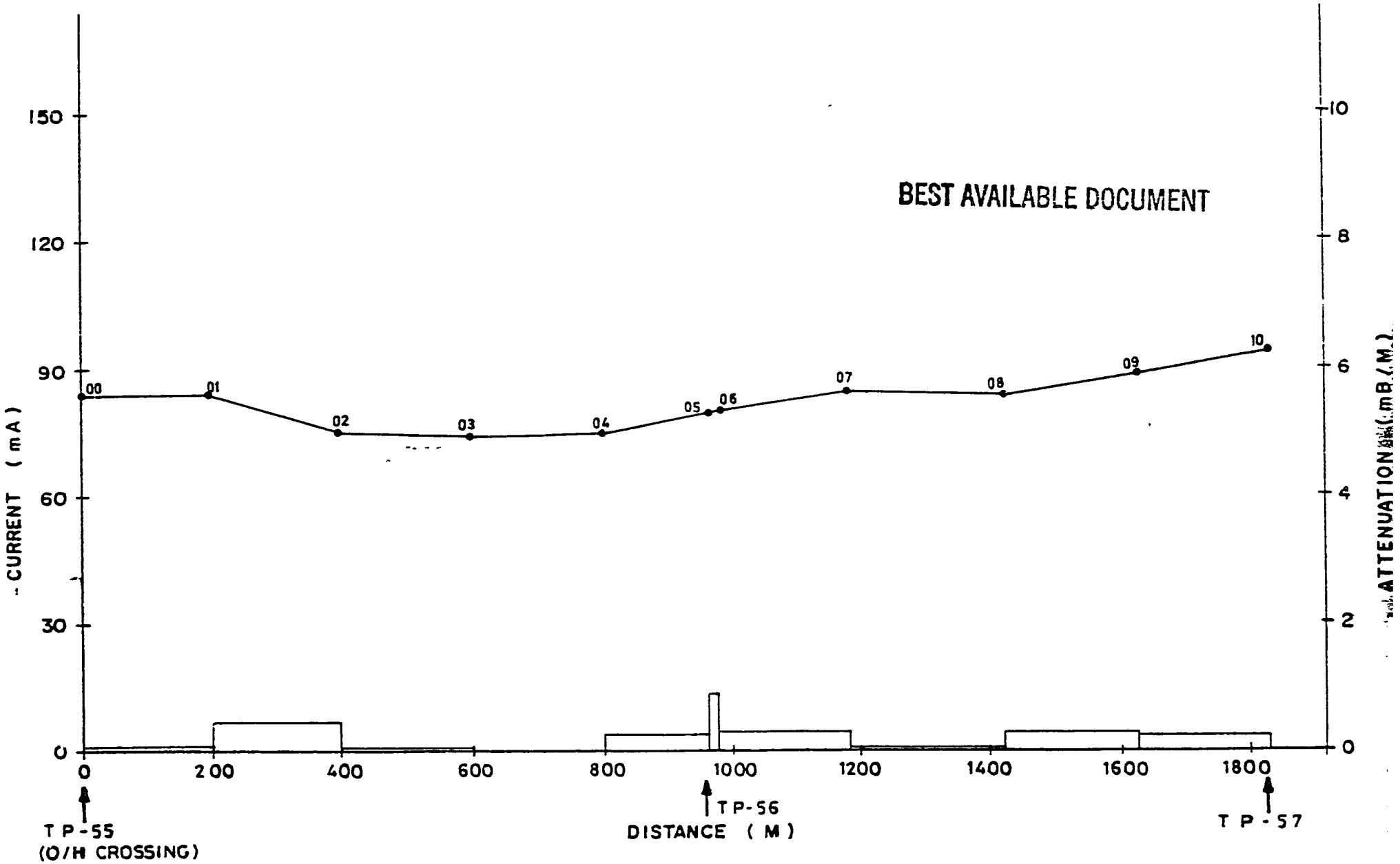
C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO 022 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 25 - 2 - 89



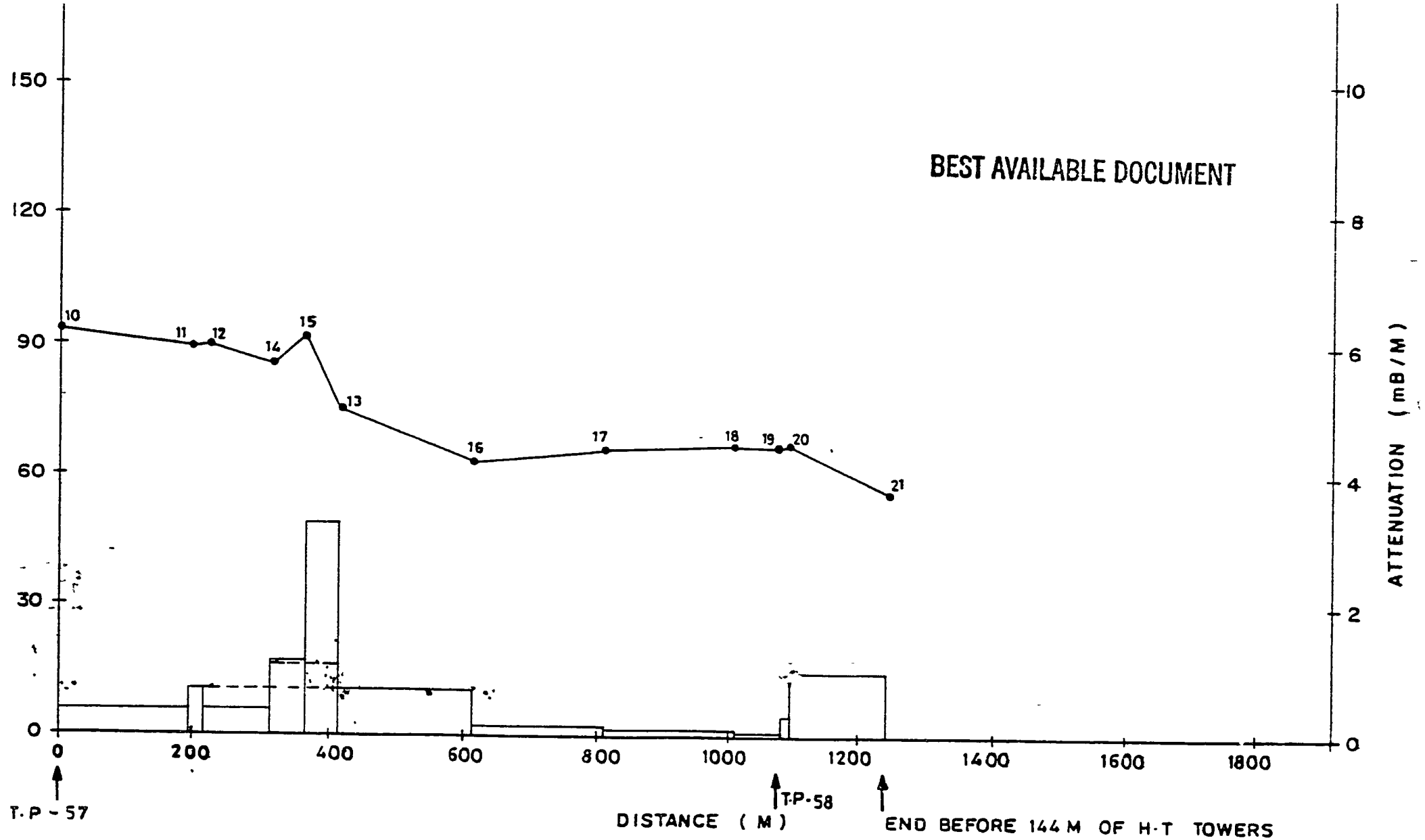
C-SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 022 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 25-2-89



C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO. 023
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE . 28-2-89



C-SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO: 024 (I)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 28 - 2 - 89



C - SCAN SURVEY PLOT	WAPDA'S 20 IN DIAMETER MARRI – GUDDU GAS PIPELINE	PLOT NO: 024 (II)
	PAKISTAN ENGINEERING SERVICES KARACHI	DATE 28 - 2 - 89

201