

# Brisbane Water Engineering Services

Electrical Mechanical Water Meters

5 Bunya Street Eagle Farm Q 4009

Ph. (07) 3403 1849

Fx. (07) 3403 1898

OPERATING MANUAL FOR:

BLUNDER ROAD TO BEATTY ROAD 1220 DIA TRUNK WATER MAIN

CATHODIC PROTECTION SYSTEM

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE  
WATER MAINTENANCE SECTION

30 th October 1995

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## DRAWINGS

JE02/104	Standard Rectifier Wiring Diagram
(No Number)	Monthly Maintenance Program

## **(1.0) INTRODUCTION**

Steel when immersed or covered in water has a tendency to corrode (or rust) as the oxidized form is more stable than the metal.

Because of this, precaution must be taken to stop or minimize the corrosion reaction to an acceptable level consistent with the design life of the structure. This is normally achieved by the use of protective coatings which control the corrosion reaction by isolating the steel from its surrounding environment.

However, it is not practical to achieve a perfect coating and coating damage will always occur with time. Because of this, corrosion may occur at imperfections in the paint coating, causing further deterioration in the coating as well as loss of metal.

As a result of this, the coating defects must be rectified by periodic maintenance or an additional method of protection used to prevent this deterioration and corrosion occurring. This additional protection is achieved by the cathodic protection system.

## **(2.0) CORROSION AND CATHODIC PROTECTION**

Corrosion is an electrochemical process in that it is accompanied by a flow of electrical current.

Corrosion occurs on the surface of metals at active areas known as anodes, which are electrically continuous with less active or passive areas known as cathodes. The electric current flows from the anode through the electrolyte to the cathode, with the circuit being completed by the electrical continuity between the cathode and anode. In practice anodes and cathodes are generally part of the same metallic surface and individual anodic areas may be small.

In applying cathodic protection and external current is applied to the surface so that the entire surface to be protected acts as a cathode. This involves the use of an auxiliary anode and when the current flow from this anode is sufficient, no part of the structure acts as an anode.

An external source of direct current such as a transformer rectifier is used in conjunction with an anode consisting of material with a very slow corrosion rate.

While it is the flow of current which achieves the cathodic protection of the surface it is impractical to measure these currents over individual anodic areas to determine when cathodic protection has been achieved. However, with the flow of cathodic protection current, the structure becomes more negative with respect to the surrounding electrolyte. Because of this, it is possible to state values of metal/electrolyte potential at which corrosion does not occur. This metal/electrolyte potential is generally measured against a standard reference electrode which allows a reproducible potential at which corrosion does not occur to be quoted.

**(3.0) MAINS DETAILS**

**Size:** Dia 1220 mild steel cement lined.

**Coating:** Medium Density Fusion Bonded Polyethylene

**Length:** 5.6 km

**Location:** Cnr Boundary and Blunder Roads, Oxley to Beatty Road Pumping Station, Archerfield.

**Construction**

**Drawings:**

486/4/6-W9000P	Logan City Trunk Main Amplification-to Oxley to Beatty Rd. Pump Station
486/4/6-W9023GD	Trunk Water Main
486/6/6-PE1C0024E	Boundary Rd-Ox/Ar P/S Cathodic Protection System
486/6/6-PE1C0037E	Boundary Rd-Ox/Ar P/S Cathodic Protection System

(4.0) **CATHODIC PROTECTION DETAILS**

(4.1) Type of Cathodic Protection: Impressed Current.

(4.2) Rectifier: Special 32 Volt, 15 amp direct current output enclosed in a stainless steel switchboard. Rectifier has a 240V supply from the nearby Archerfield Submersable Sewerage Pumping Station..

(4.3) Cathode: The cathode point is located on the 1220 dia mian next to Test Point No3, adjacent to Air Valve No1267. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.

(4.4) Anodes: One 1500 x 75mm silicone iron anodes were installed approximately 200 metres from the trunk mains in a vertical bed. The anodes were firstly packaged with cokebreeze thereby improving anode – ground resistance. The anodes are identified by a marker post and label.

(4.5) Test Points: Test points are installed on cathodically protected structures to enable testing to ensure full protection of the mains. On these mains six test points have been installed for details see dwg no. CE02/136.

(4.6) Associated Drawings:  
Cathodic Protection Details – 2/14.213  
Cathodic Protection Test Point Details – 2/14.199  
Standard Rectifier Wiring Diagram – JE02/104

(4.7) Associated Standards:  
AS 3000 1986 Australia Wiring Rules  
AS 2832.1 1985 Pipes, Cables, Ducts, Guide to Cathodic Protection,  
Part One.

(4.8) Government Regulations:  
Queensland Electricity Acts and Regulations.

**(5.0) PERFORMED TESTING**

- (1) Natural Potential Survey.
- (2) Testing of Insulated Flanges, Joints.
- (3) Soil Resistance Testing.
- (4) Current Drain Survey.
- (5) Pipe Coating Anomaly Survey.
- (6) Rectifier Loop Resistance.
- (7) Foreign Structure Interference Survey and Mitigation.
- (8) Final Potential Survey and Commissioning.

**(6.0) CONCLUSION**

Full Cathodic protection has been achieved on this section of trunk mains. The cathodic protection system is registered with the Queensland Electricity Commission and has approval to operate.

**(7.0) MAINTENANCE**

The cathodic protection system is maintained on a monthly basis after commissioning. These checks involve testing rectifier operation and recording of pipe to soil potentials.

12th October 1992

Electrical Workshop

Cathodic Protection

### CPS Monthly Maintenance Details.

#### Required:

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.

#### Labour:

One tradesperson, one vehicle. 20 minutes per site.

#### Procedure:

- 1/ Identify installation.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Comments.
- 6/ Log entry.

13th October 1992

Electrical Workshop

Cathodic Protection

### CPS 6 Monthly Maintenance Details.

#### Required:

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.
- 3/ Set of tools. (Electricians)
- 4/ Multimeter.
- 5/ DC clampmeter.
- 6/ Copper sulphate reference cell and leads.
- 7/ Cleaning equipment.
- 8/ Gatic cover lifters.

#### Labour:

One tradesperson electrical, one laborer, one vehicle.  
Two hours per site.

#### Procedure:

- 1/ Identify system.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Record "on" potentials for all test points.
- 6/ Record "instant off" potentials for all test points.
- 7/ Record "off" potentials for all test points.
- 8/ Perform loop resistance and record.
- 9/ Check and record anode string currents.
- 10/ Comments.
- 11/ Log entry.



13th October 1992

Electrical Workshop

Cathodic Protection

### CPS 60 Monthly Maintenance Details.

#### Required:

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.
- 3/ Set of tools. (Electricians)
- 4/ Multimeter.
- 5/ DC clampmeter.
- 6/ Copper sulphate reference cell and leads.
- 7/ Cleaning equipment.
- 8/ Gatic cover lifters.
- 9/ Rectifier load bank.
- 10/ PCS2000 Detection Equipment.

#### Labour:

One tradesperson electrical, one laborer, one vehicle.  
Eight hours per site.

#### Procedure:

- 1/ Identify system.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Record "on" potentials for all test points.
- 6/ Record "instant off" potentials for all test points.
- 7/ Record "off" potentials for all test points.
- 8/ Perform loop resistance and record.
- 9/ Check and record anode string currents.
- 10/ Load test rectifier for 10 minutes.
- 11/ Check all switchboard and testpoint terminals for tightness.
- 12/ Check all switchboard and testpoints are labelled and I.D. tags attached.
- 13/ Check plans are correctly drawn and modify if necessary.
- 14/ Remove and inspect anodes.
- 15/ Recheck all interference (CPS) bleeds.
- 16/ Pipecamp structure if applicable.
- 17/ Apply for "continue to operate" permit if applicable.

**Brisbane City Council**  
**Dept. W.S.& S.**  
**Metropolitan Division**  
**Eagle Farm Pump Station**

Cathodic Protection System Loop Resistance

Date: 4th October 1995

Cathodic Protection System:

Blunder Rd to Beatty Rd Trunk Main

System Operating Volts: 1

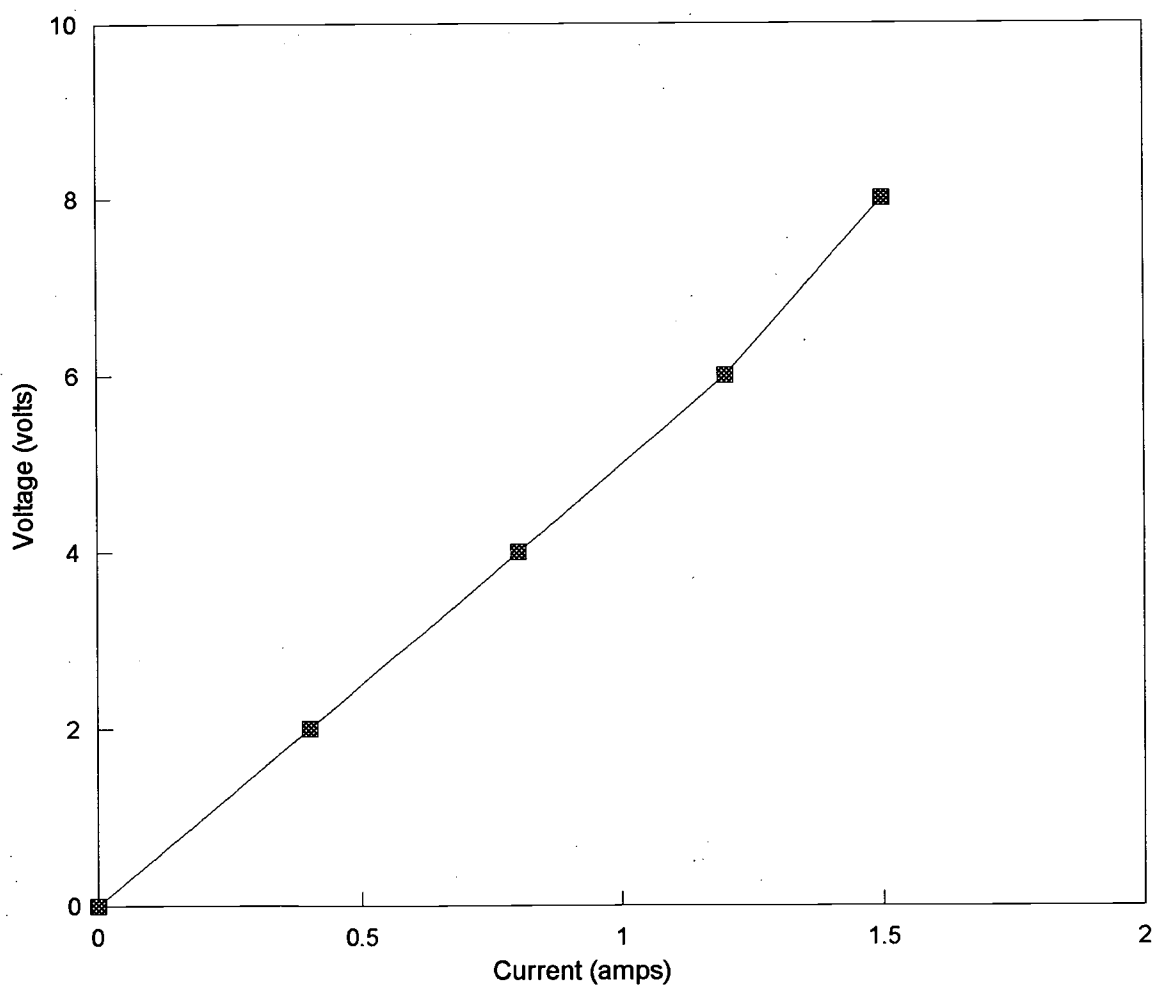
System Operating amps: 0.25

Test Voltage:		Test Current:	
(volts)		(amps)	
0		0	
2		0.4	
4		0.8	
6		1.2	
8		1.5	

Loop Resistance  
(ohms)

5.714286

**Graph of System voltage vs current.**



# Brisbane Water Engineering Services

## Electrical Engineering Unit

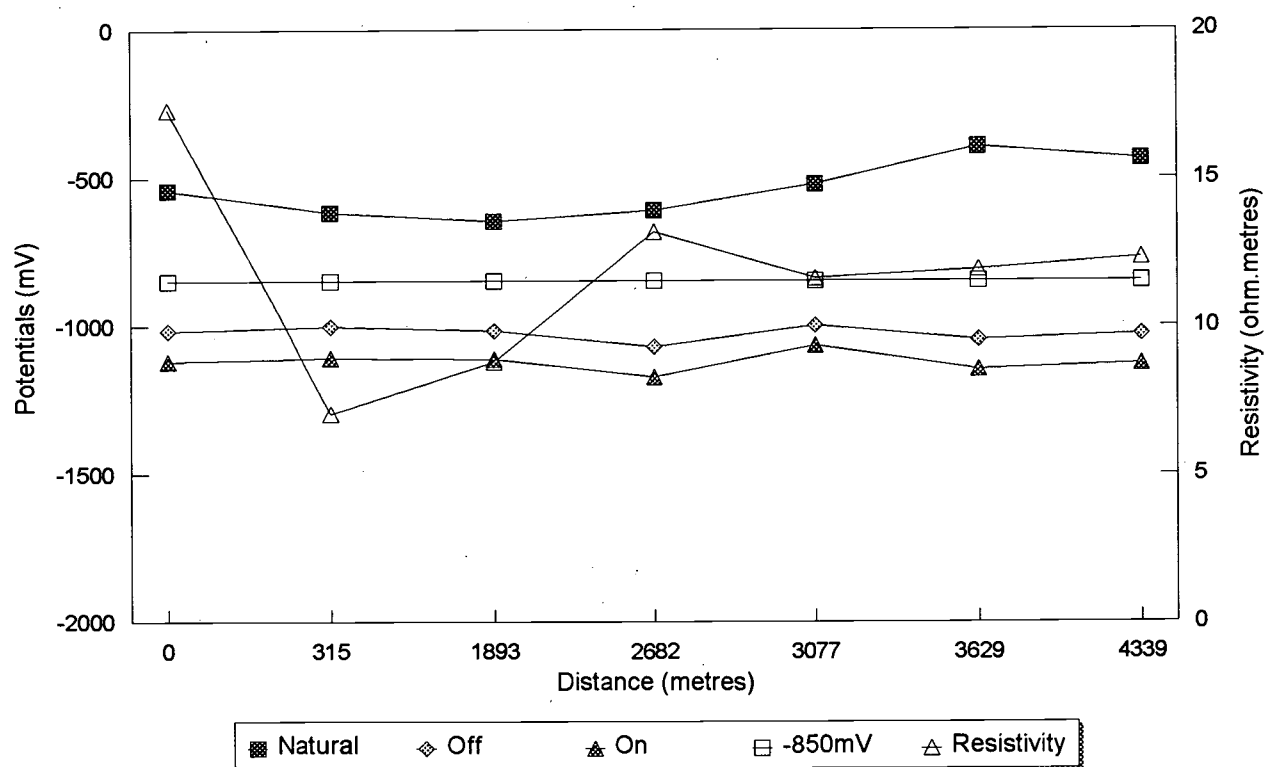
Date: 4th October 1995

System: Blunder to Beatty Rd Trunk Main

Cathodic Protection System reference potential and earth resistivity graph.

Test Point number	Distances to T.P. (metres)	Potentials to CuSO4			Resistivities at 2 metres (ohm.metres)
		Natural (mV)	Off (mV)	On (mV)	
1	0	-540	-1017	-1120	17.3
2	315	-616	-1002	-1109	7.03
3	1893	-646	-1018	-1113	8.79
4	2682	-610	-1072	-1173	13.18
5	3077	-520	-1001	-1067	11.6
6	3629	-395	-1047	-1147	11.9
7	4339	-436	-1028	-1128	12.3
8	4681	-545	-1042	-1141	11.6
9	5207	-531	-982	-1085	14.06
10	5600	-603	-1014	-1110	12.05

Graph of potentials and resistivity vs pipelength



Rectifier located at 1893M.

**BRISBANE CITY COUNCIL**  
**DEPARTMENT OF WATER SUPPLY AND SEWERAGE**  
**MECHANICAL AND ELECTRICAL SECTION**

**INTERFERENCE SURVEY RESULTS**  
**PRELIMINARY RESULTS ONLY**

**JOB DESCRIPTION:-** BLUNDER TO BEATTY RD TRUNK MAIN

27-09-95

UNIT READING:- 3 VOLTS...750 mA

	READING	TEST POINT I.D.	LOCATION	SWING
ON	-475		SEQEB POLE 43505	
OFF	-475		BOUNDARD RD	
ON	-443		SEQEB POLE 44987	
OFF	-443		REGINALD ST	
ON	-28		SEQEB POLE 37772	
OFF	—		REGINALD ST	
ON	-450		SEQEB POLE 36189	
OFF	-450		REGINALD ST	
ON	-430		SEQEB POLE 36717	
OFF	—		RANDOLPH ST	
ON	-440		SEQEB POLE 39737	
OFF	-440		RANDOLPH ST	
ON	-427		SEQEB POLE 41168	
OFF	-428		RANDOLPH ST	
ON	-445		SEQEB POLE N° 44760	
OFF	-445		RANDOLPH ST	
ON	-690		HP	
OFF	—		RANDOLPH ST	
ON				
OFF				
ON				
OFF				
ON				
OFF				

COMPILED BY: M. M<sup>C</sup> CORMICK.

**BRISBANE CITY COUNCIL**  
**DEPARTMENT OF WATER SUPPLY AND SEWERAGE**  
**MECHANICAL AND ELECTRICAL SECTION**

**INTERFERENCE SURVEY RESULTS**  
**PRELIMINARY RESULTS ONLY**

**JOB DESCRIPTION:-** BLUNDER TO BEATTY RD TRUNK MAIN  
27-09-95 **UNIT READING:-** 3 Volts...750 mA

	READING	TEST POINT I.D.	LOCATION	SWING
ON OFF	-395 -395		SEQEB POLE NO 368917 BOUNDARY RD	0
ON OFF	-353 -353		SEQEB POLE 49077 BOUNDARY RD.	0
ON OFF	-89 -89		SEQEB POLE 37768 BOUNDARY RD	0
ON OFF	-28 -28		SEQEB POLE 23052 FACTORY RD	0
ON OFF	-503 -503		SEQEB POLE 23051 FACTORY RD	0
ON OFF	-38 -		SEQEB POLE 21094 (TRANS) FACTORY RD	-
ON OFF	-295 -295		LIGHT POLE - MIRAGE GRAND PRIX FACTORY RD	0
ON OFF	-435 -440		SEQEB POLE X1412 ALBAN ST	+5
ON OFF	-430 -430		SEQEB POLE 24774 (TRANS) ALBAN ST	0
ON OFF	-490 -490		SEQEB POLE NO 4360 BLUNDER RD	0
ON OFF	-462 -462		SEQEB POLE 370084 BLUNDER RD	0
ON OFF	-569 -569		SEQEB POLE 370084 BLUNDER RD	0

COMPILED BY: M. M<sup>C</sup>ORMICK.

**BRISBANE CITY COUNCIL**  
**DEPARTMENT OF WATER SUPPLY AND SEWERAGE**  
**MECHANICAL AND ELECTRICAL SECTION**

**INTERFERENCE SURVEY RESULTS**

**PRELIMINARY RESULTS ONLY**

**JOB DESCRIPTION:-** BLUNDER TO BEATTY RD TRUNK MAIN

27-09-95

UNIT READING:- 3.4VJS...750.mA.

	READING	TEST POINT I.D.	LOCATION	SWING
ON OFF	-371 -373		SEQEB POLE 11025 BALHAM RD	+2
ON OFF	-945 -945		ALL GAS TEST POINT BALHAM RD	0
ON OFF	-368 -368		SEQEB POLE 36070 BALHAM RD	0
ON OFF	-383 -383		SEQEB POLE 36354 ASHOVER RD.	0
ON OFF	-375 -375		SEQEB POLE 33522 ASHOVER RD	0
ON OFF	-1 -1		SEQEB POLE 42251 ASHOVER RD	0
ON OFF	-348 -348		SEQEB POLE 42248 ASHOVER RD	0
ON OFF	-1082 -1082		ALL GAS TEST POINT ASHOVER RD	0
ON OFF	-236 -236		SEQEB POLE 42247 ASHOVER RD	0
ON OFF	-564 -564		SEQEB POLE 45118 BOUNDARY RD	0
ON OFF	-509 -499		SEQEB POLE 45238 (F/STN ENTRY) BOUNDARY RD	-10
ON OFF	-178 -178		SEQEB POLE 44986 BOUNDARY RD.	0

COMPILED BY: J. M. MCCORMICK.

**BRISBANE CITY COUNCIL**  
**DEPARTMENT OF WATER SUPPLY AND SEWERAGE**  
**MECHANICAL AND ELECTRICAL SECTION**

**INTERFERENCE SURVEY RESULTS**

**PRELIMINARY RESULTS ONLY**

**JOB DESCRIPTION:-** BLUNDER TO BEATTY ROAD TRUNK MAIN

27-09-95

UNIT READING: -3 VOLTS....750 mA.

	READING	TEST POINT I.D.	LOCATION	SWING
ON OFF	-494 -494		SEQEB POLE N° 42317 ERROC ST	0
ON OFF	-224 -224		WATER COX 19 ERROC ST	0
ON OFF	-981 -981		SEQEB POLE 369691 ERROC ST	0
ON OFF	-1065 -1065		SEQEB POLE 369692 BEATTY RD	0
ON OFF	-123 -123		SEQEB POLE 29575 BEATTY RD	0
ON OFF	-443 -443		SEQEB POLE 31876 ROCKLEA ST	0
ON OFF	-515 -515		SEQEB POLE 31518 ROCKLEA ST	0
ON OFF	-393 -393		SEQEB POLE 37694 KAWARA ST	0
ON OFF	-385 -385		SEQEB POLE 86 BALHAM RD	0
ON OFF	-188 -188		WATER METER & COX 94 BALHAM RD	0
ON OFF	-350 -350		SEQEB POLE N° 10262 (TRANS) BALHAM RD	0
ON OFF	-349 -349		HP OUTSIDE 94 BALHAM RD	0

COMPILED BY: M. MCFARMICK



# MEMORANDUM

To	File No.	
From	Date 21/09/95	
Subject BLUNDER RD. TO BEATTY RD. TRUNK MAIN ON POTENTIALS - NON POLARIZED		

RECTIFIER SET AT 1 VOLT 250 mA

LOOP RESISTANCE 2 V 400 mA

4 V 800 mA

6 V 1.2A

8 V 1.5A

ANODE CURRENT 147 mA

TEST POINT N°1 VALVE N°1 (CLOSEST TO CREEK)

PROTECTED ZN TO PIPE +70 mV +169 mV

CUSO<sub>4</sub> TO PIPE -939 mV -842 mV

ZN TO CUSO<sub>4</sub> -1009 mV

UNPROTECTED ZN TO PIPE +378 mV +399 mV

CUSO<sub>4</sub> TO PIPE -580 mV -567 mV

ZN TO CUSO<sub>4</sub> -961 mV

VALVE N°2 (CLOSEST TO CALTEX)

PROTECTED ZN TO PIPE +80 mV +175 mV

CUSO<sub>4</sub> TO PIPE -1120 mV -1017 mV

ZN TO CUSO<sub>4</sub> -1189 mV

UNPROTECTED ZN TO PIPE +381 mV +402 mV

CUSO<sub>4</sub> TO PIPE -759 mV -734 mV

ZN TO CUSO<sub>4</sub> -1141 mV

TEST POINT N°2 ZN TO PIPE -115 mV -4 mV

CUSO<sub>4</sub> TO PIPE -1109 mV -1002 mV

ZN TO CUSO<sub>4</sub> -999 mV





## MEMORANDUM

To	File No.	
From	Date / /	
Subject		

TEST POINT N <sup>o</sup> 3 (RECTIFIER)	Zn TO PIPE	+7	mV <sub>on</sub>	+104	mV <sub>off</sub>
	Zn TO PRO COUPON	+6	mV <sub>on</sub>	+105	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PIPE	-1113	mV <sub>on</sub>	-1018	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PRO COUPON	-1116	mV <sub>on</sub>	-1018	mV <sub>off</sub>
	Zn TO CuSO <sub>4</sub>	-1180	mV		
TEST POINT N <sup>o</sup> 4	Zn TO PIPE	-9	mV <sub>on</sub>	+94	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PIPE	-1173	mV <sub>on</sub>	-1072	mV <sub>off</sub>
	Zn TO CuSO <sub>4</sub>	-1165	mV		
TEST POINT N <sup>o</sup> 5 (BRIDGED OUT INSULATED JOINT)	Zn TO PIPE	+505	mV <sub>on</sub>	+534	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PIPE	-1067	mV <sub>on</sub>	-1001	mV <sub>off</sub>
	Zn TO CuSO <sub>4</sub>	-1568	mV		
	Zn TO PIPE	+545	mV <sub>on</sub>	+567	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PIPE	-1061	mV <sub>on</sub>	-996	mV <sub>off</sub>
	Zn TO CuSO <sub>4</sub>	-1605	mV		
TEST POINT N <sup>o</sup> 6	Zn TO PIPE	-35	mV <sub>on</sub>	+63	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PIPE	-1147	mV <sub>on</sub>	-1047	mV <sub>off</sub>
	Zn TO CuSO <sub>4</sub>	-1109	mV		
TEST POINT N <sup>o</sup> 7	Zn TO PIPE	+98	mV <sub>on</sub>	+198	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PIPE	-1128	mV <sub>on</sub>	-1028	mV <sub>off</sub>
	Zn TO CuSO <sub>4</sub>	-1224	mV		
TEST POINT N <sup>o</sup> 8	Zn TO PIPE	+39	mV <sub>on</sub>	+129	mV <sub>off</sub>
	CuSO <sub>4</sub> TO PIPE	-1141	mV <sub>on</sub>	-1042	mV <sub>off</sub>
	Zn TO CuSO <sub>4</sub>	-1171	mV		



BRISBANE CITY COUNCIL

## MEMORANDUM

To	File No.	
From	Date / /	
Subject		

TEST POINT N<sup>o</sup> 9

Zn TO PIPE	+50 mV <sub>an</sub>	+145 mV <sub>off</sub>
CuSO <sub>4</sub> TO PIPE	-1085 mV <sub>an</sub>	-982 mV <sub>off</sub>
Zn TO CuSO <sub>4</sub>	-1135 mV	

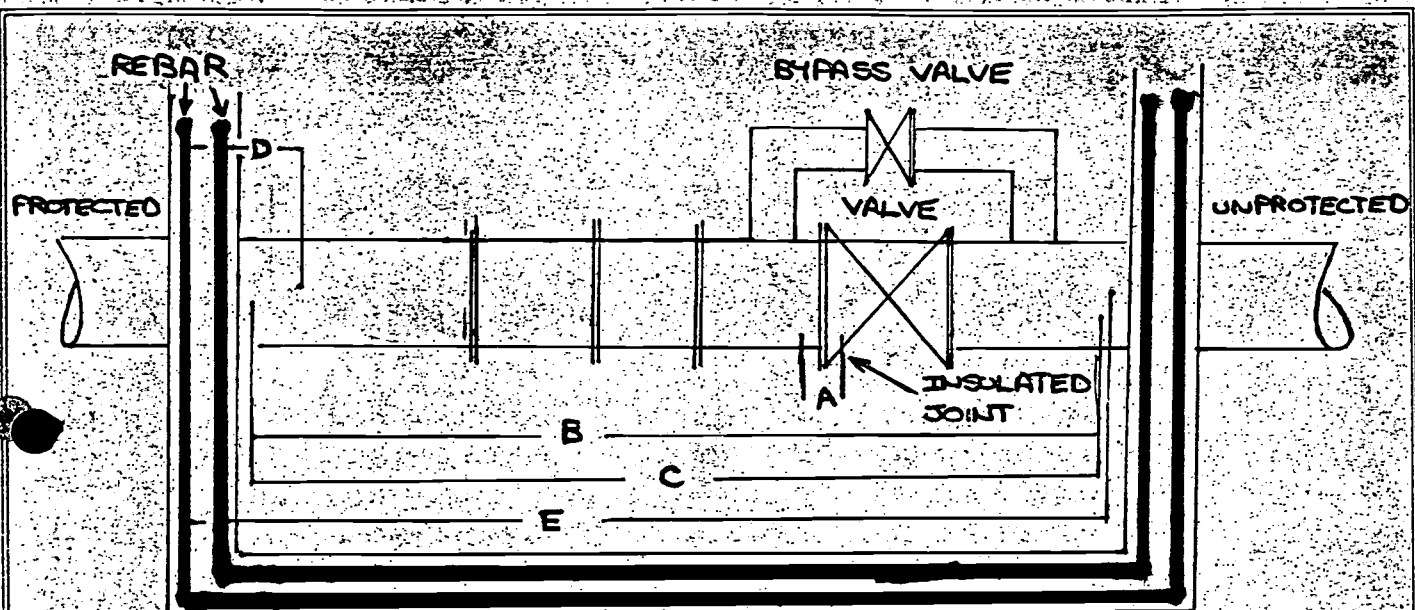
TEST POINT N<sup>o</sup> 10

Zn TO PIPE	+5 mV <sub>an</sub>	+103 mV <sub>off</sub>
CuSO <sub>4</sub> TO PIPE	-1110 mV <sub>an</sub>	-1014 mV <sub>off</sub>
Zn TO CuSO <sub>4</sub>	-1114 mV	

Dept of Water Supply and Sewerage  
Eagle Farm Pump Station  
Electrical Workshop

Date: 26-09-95

Site Plan for: VALVE PIT NEAR CALTEX SERVICE STATION (TEST POINT N°1)



A	2.8 MΩ (INSULATED JOINT)
B	21.5 Ω (BEFORE REBAR WAS DISCONNECTED)
C	817 KΩ (AFTER REBAR WAS DISCONNECTED)
D	REBAR N°1 TO PIPE 819 KΩ
	REBAR N°2 TO PIPE 818 KΩ
E	REBAR N°1 TO PIPE 0.4 Ω
	REBAR N°2 TO PIPE 0.5 Ω

POTENTIAL CHECK USING  $\text{CuSO}_4$

RECTIFIER SET AT	30 VOLTS	4.4 Amps
PROTECTED SIDE	-4.85V <sub>on</sub>	-1.46V <sub>off</sub>
UNPROTECTED SIDE	-456 mV <sub>on</sub>	-488 mV <sub>off</sub>



Facsimile

To KERRY MCGOVERN

COMMERCIAL & CONSUMER  
EPT & Power Co-ordination

Company B C C

LMB 3583, BRISBANE QLD 9008  
144 Arthur Street  
FORTITUDE VALLEY QLD 4006  
AUSTRALIA

Facsimile 3403 1898

From JSM-MORALLB

Telephone  
Facsimile [07]3252 4664

Subject INTER FERRULE TESTS - BLUNDER RD  
TO BEATTY RD.

Date 18-10-95

File

Total Pages 1

Attention

KERRY,  
AS DISCUSSED, TESTING IS NOT  
REQUIRED UNLESS THE OUTPUT OF THIS  
SYSTEM IS INCREASED ABOVE 2 AMPS.

RECALLS

*Jim*



THE SOUTH EAST QUEENSLAND  
ELECTRICITY BOARD

TECHNICAL SERVICES DIVISION

TEST & INVESTIGATIONS GROUP

COMPRISING:	TESTS & INVESTIGATIONS MANAGER	PH. 223 5315
	CABLE & SAFETY TESTS SECTION	PH. 223 5369
	FIELD INVESTIGATIONS SECTION	PH. 223 5433
	FIELD TESTS SECTION	PH. 223 5449
	EQUIPMENT TESTS SECTION	PH. 223 5416

Ref. No.: \_\_\_\_\_  
Date: 26/10/95  
No. of pages following: \_\_\_\_\_

Building One  
Blinzinger Road  
BANYO QLD 4014  
FAX No. : (07) 267 6228

ATTN: KERRY MCGOVERN

LOCATION: BRISBANE WATER ENG. SERVICES

FAX No.: 07 3403 1898

FROM: DARRYL RINGUET

REMARKS: AS DISCUSSED I HAVE NO OBJECTIONS TO THE CP  
SYSTEMS AT BLUNDER RD TO BEATTY RD, AND ALSO THE CP SYSTEM  
AT FORTROSE ST KENMORE. THERE APPEARS TO BE NO SIGNIFICANT  
INTERFERENCE TO SEQEB STRUCTURES AS SHOWN ON YOUR TEST  
RESULTS.

T.P. No 1.

**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: 17-7-95  
TEST POINT TYPE: TYPE B.

LOCATION: BLUNDER RD  
MAINS SIZE: 1200 MM

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE):  
ZINC REFERENCE TO PIPE:  
CuSO<sub>4</sub> REFERENCE TO PIPE:  
ZINC TO CuSO<sub>4</sub>:

PROTECTED	UNPROTECTED
0.3Ω	0.3Ω
+658mV	+819mV
-540mV	-322mV
-1193mV	-1134mV

**EARTH TESTING**

PIN SPACING: 2.0M MEGGER READING: 1.38 RESISTIVITY: 17.3ΩM  
PIN SPACING: 4.0M MEGGER READING: 0.37 RESISTIVITY: 9.3ΩM.

**SACRIFICIAL ANODE  
(IF INSTALLED)**

ANODE TYPE:  
ANODE SIZE:  
ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):  
ZINC REF TO PIPE:  
(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:  
(ANODE CONNECTED)

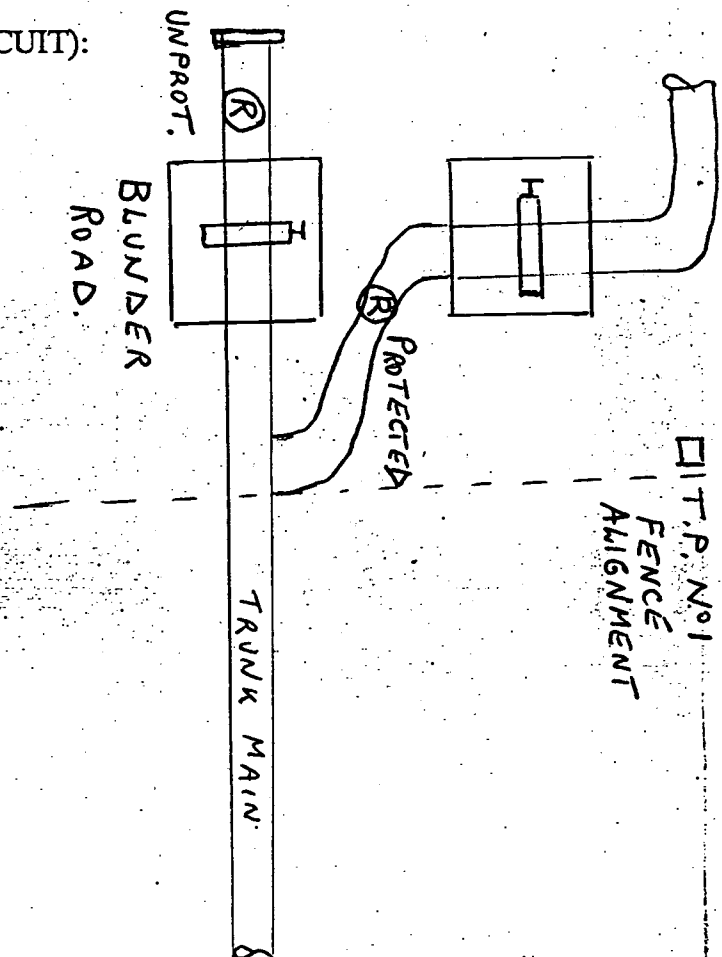
SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:  
(IF INSTALLED)

INSTALLED BY:

COMMENTS:

1 COPY TO FILE  
1 COPY TO T.O.



**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: 10-10-94

TEST POINT TYPE: TYPE B

LOCATION: BOUNDARY/FACTORY RD

MAINS SIZE: MSCL

1220MM.

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE): 0.15V

ZINC REFERENCE TO PIPE: +135 mV

CuSO<sub>4</sub> REFERENCE TO PIPE: -616 mVZINC TO CuSO<sub>4</sub>: -747 mV

**EARTH TESTING**

PIN SPACING: 2.0M MEGGER READING: 0.56 RESISTIVITY: 7.03Ω/M

PIN SPACING: 4.0M MEGGER READING: 0.21 RESISTIVITY: 5.27Ω/M

**SACRIFICIAL ANODE  
(IF INSTALLED)**

ANODE TYPE:

ANODE SIZE:

ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):

ZINC REF TO PIPE:

(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:

(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:

(IF INSTALLED)

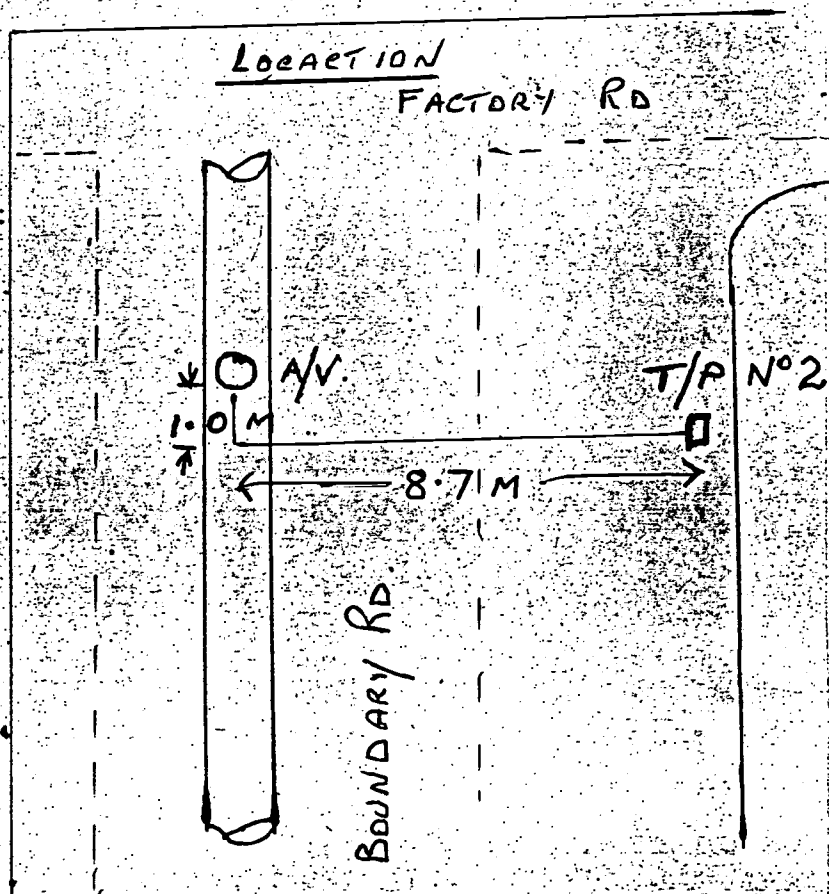
INSTALLED BY:

COMMENTS:

*A. J. Greaves*

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BRISBANE CITY COUNCIL  
EAGLE FARM PUMP STATION  
CORROSION SECTION

*TEST POINT N°3*

COUPON TYPE CATHODIC PROTECTION  
TEST POINT DATA GATHERING

DATE: *1-11-94*  
 MAINS SIZE: *1220 mm*  
 TEST POINT TYPE: *COUPON*

LOCATION: *B.C.C. LAND.*  
 TYPE:

INITIAL POTENTIAL TESTING  
(BOTH COUPONS DISCONNECTED)

ZINC TO PIPE: *+250 mV*  
 ZINC TO PROTECTED COUPON: *+405 mV*  
 ZINC TO UNPROTECTED COUPON: *+488 mV*

CuSO<sub>4</sub> TO PIPE: *-646 mV*  
 CuSO<sub>4</sub> TO PROTECTED COUPON: *-147 mV*  
 CuSO<sub>4</sub> TO UNPROTECTED COUPON: *-413 mV*

CuSO<sub>4</sub> TO ZINC: *+908 mV*  
 PIPE CATHODE TO PIPE CATHODE RETURN (RESISTANCE): *0.15V*  
 COUPON CATHODE TO COUPON CATHODE RETURN (RESISTANCE): *0.15V*

CONNECTION OF TEST POINT

1. PIPE CATHODE IS CONNECTED TO IMPRESSED CURRENT RECTIFIER OR SACRIFICIAL ANODE.
2. PIPE CATHODE RETURN IS CONENCTED VIA TERMINAL STRIP TO PROTECTED COUPON CATHODE.
3. BETWEEN COUPON CATHODE RETURN AND REFERENCES AS SET OUT BELOW.

POTENTIAL TESTING IN SERVICE

AFTER CP SYSTEM HAS POLARIZED CARRY OUT POTENTIAL TESTING AS DETAILED BELOW.

A) WITH SYSTEM ON (STATE IF CuSO<sub>4</sub> IS ON SURFACE OR AJACENT PIPE)

WHILE COUPON IS CONNECTED TO PIPE CATHODE RETURN:

PROTECTED COUPON TO ZINC:  
 PROTECTED COUPON TO CuSO<sub>4</sub>:  
 UNPROTECTED COUPON TO ZINC:  
 UNPROTECTED COUPON TO CuSO<sub>4</sub>:

WHILE COUPON IS DISCONNECTED TO PIPE CATHODE RETURN:

PROTECTED COUPON TO ZINC:  
 PROTECFED COUPON TO CuSO<sub>4</sub>:  
 UNPROTECTED COUPON TO ZINC:  
 UNPROTECTED COUPON TO CuSO<sub>4</sub>:

EARTH TESTING

PIN SPACING *2.0 M. MEGGER READING 0.70 RESISTIVITY 8.79  $\Omega$ /M*  
*4.0 M 0.37 9.29  $\Omega$ /M*



WITH C.P. SYSTEM INTERRUPTING

USE CHART RECORDER TO OBTAIN INSTANTANEOUS OFF POTENTIALS.  
WITH PROTECTED COUPON DISCONNECTED.

PIPE CATHODE RETURN TO ZINC ON:  
PIPE CATHODE RETURN TO  $\text{CuSO}_4$ :

RECONNECT SYSTEM AS ABOVE  
TURN OFF INTERRUPTOR AND MEASURE COUPON (PROTECTED) CURRENT AND  
DIRECTION:

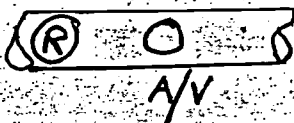
BOUNDARY Rd

F.A.C.

EASEMENT.

2.5/2.5  
M M

T/P  
N° 3



300.0 M

ARCHERFIELD

PUMP STN.

**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: 8/11/94

TEST POINT TYPE: TYPE B

LOCATION: EASEMENT OFF BOUNDARY RD  
MAINS SIZE: 1220 MSC L

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE): 0.25

ZINC REFERENCE TO PIPE: + 290 mV

CuSO<sub>4</sub> REFERENCE TO PIPE: - 610 mVZINC TO CuSO<sub>4</sub>: + 896 mV

**EARTH TESTING**

PIN SPACING: 2.0 M MEGGER READING: 1.05 RESISTIVITY: 13.18  $\Omega$ /MPIN SPACING: 4.0 M MEGGER READING: 0.44 RESISTIVITY: 11.05  $\Omega$ /M

**SACRIFICIAL ANODE  
(IF INSTALLED)**

ANODE TYPE:

ANODE SIZE:

ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):

ZINC REF TO PIPE:

(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:

(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:

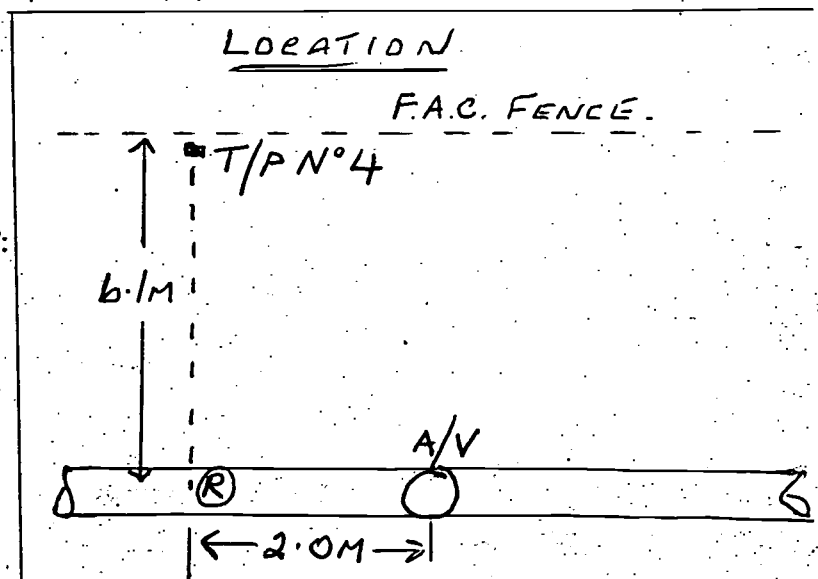
(IF INSTALLED)

INSTALLED BY:

COMMENTS: *L.J. Greaves*

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T.P. N°5.

**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: 31-1-95

TEST POINT TYPE: TYPE B

LOCATION: BOUNDARY RD NEAR

MAINS SIZE: RANDOLPH ST.

1200 MM.

**POTENTIAL TESTING**CATHODE TO CATHODE RETURN (RESISTANCE): 0.2  $\Omega$ 

ZINC REFERENCE TO PIPE: + 683 mV

CuSO<sub>4</sub> REFERENCE TO PIPE: - 520 mVZINC TO CuSO<sub>4</sub>: - 1202 mV**EARTH TESTING**PIN SPACING: 2.0 M MEGGER READING: 0.93 RESISTIVITY: 11.6  $\Omega$ MPIN SPACING: 4.0 M MEGGER READING: 0.56 RESISTIVITY: 14.1  $\Omega$ M.**SACRIFICIAL ANODE**

(IF INSTALLED)

ANODE TYPE:

ANODE SIZE:

ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):

ZINC REF TO PIPE:

(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:

(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:

(IF INSTALLED)

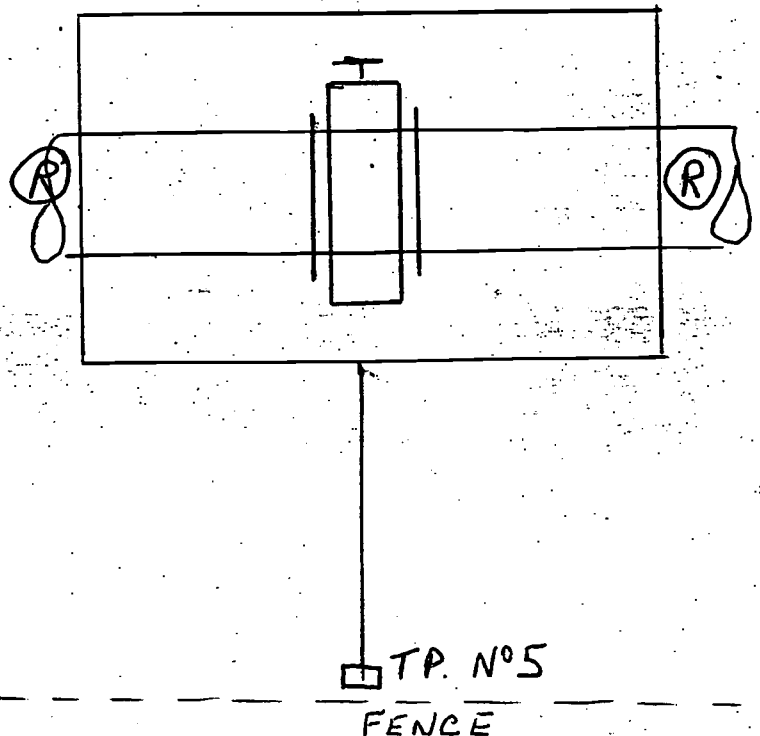
INSTALLED BY: L. Greaves.

COMMENTS:

VALVE BRIDGED OUT  
IN TEST POINT.

1 COPY TO FILE

1 COPY TO T.O.



TEST POINT N° 6  
(NEAR GATE 5 F.A.C.)

**BRISBANE CITY COUNCIL**  
**EAGLE FARM PUMPING STATION**  
**CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: 15-12-94  
TEST POINT TYPE: TYPE B

LOCATION: BOUNDARY RD  
MAINS SIZE: 1220 MM

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE): 0.25  
ZINC REFERENCE TO PIPE: +656 MV  
CuSO<sub>4</sub> REFERENCE TO PIPE: -395 MV  
ZINC TO CuSO<sub>4</sub>: -1048 MV

**EARTH TESTING**

PIN SPACING: 2.0 M MEGGER READING: 0.95 RESISTIVITY: 11.95 M

PIN SPACING: 4.0 M MEGGER READING: 0.48 RESISTIVITY: 12.0 M.

**SACRIFICIAL ANODE**  
(IF INSTALLED)

ANODE TYPE:  
ANODE SIZE:  
ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):  
ZINC REF TO PIPE:  
(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:  
(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

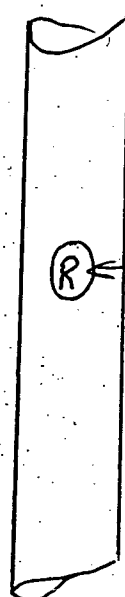
BLEED RESISTOR SIZE:  
(IF INSTALLED)

INSTALLED BY:

COMMENTS: 2 greases

1 COPY TO FILE  
1 COPY TO T.O.

LOCATION



BOUNDARY RD.

F.A.C. FENCE.

TP  
N°6

TEST POINT N° 7

**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE:

TEST POINT TYPE: *TYPE B.*

LOCATION:

*ASHOVER RD.*

MAINS SIZE:

*1220 MM***POTENTIAL TESTING**CATHODE TO CATHODE RETURN (RESISTANCE): *0.2  $\Omega$* ZINC REFERENCE TO PIPE: *+605 mV*CuSO<sub>4</sub> REFERENCE TO PIPE: *-436 mV*ZINC TO CuSO<sub>4</sub>: *-1044 mV***EARTH TESTING**PIN SPACING: *20 M* MEGGER READING: *0.98* RESISTIVITY: *12.3  $\Omega$  M*PIN SPACING: *40 M* MEGGER READING: *0.07* RESISTIVITY: *1.7  $\Omega$  M***SACRIFICIAL ANODE  
(IF INSTALLED)**

ANODE TYPE:

ANODE SIZE:

ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):

ZINC REF TO PIPE:

(ANODE CONNECTED)

CuSO<sub>4</sub> REF TO PIPE:

(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

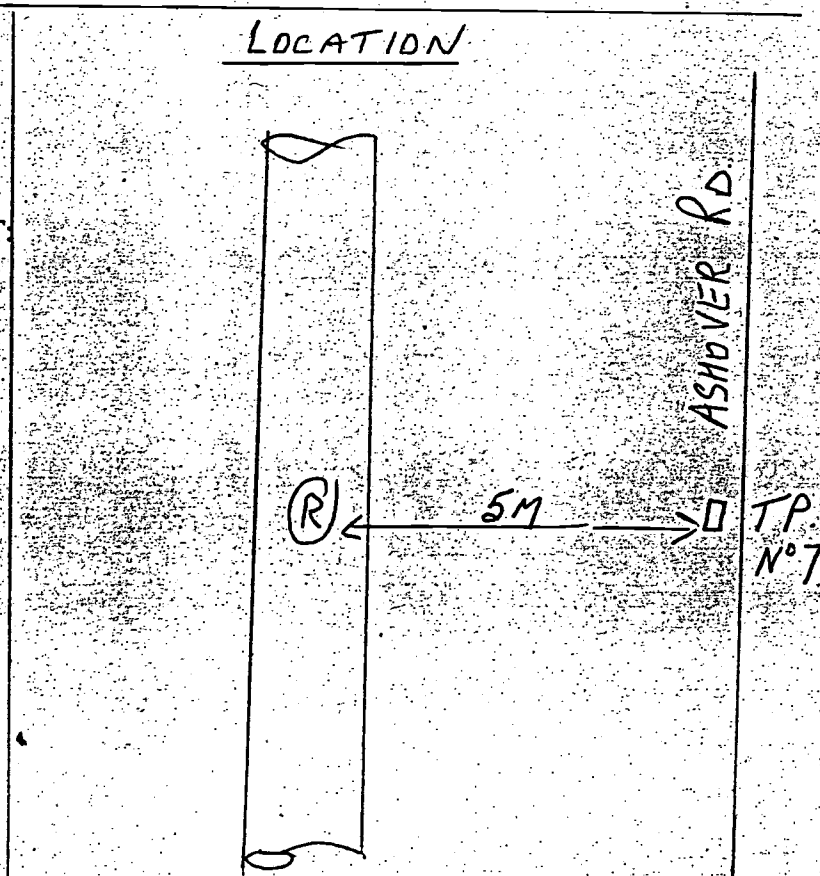
BLEED RESISTOR SIZE:  
(IF INSTALLED)

INSTALLED BY:

COMMENTS:

*2 greases.*

1 COPY TO FILE  
1 COPY TO T.O.



**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: *6-1-95*  
TEST POINT TYPE: *TYPE B.*

LOCATION: *BALHAM RD.*  
MAINS SIZE: *1220MM.*

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE): *0.2Ω*  
ZINC REFERENCE TO PIPE: *+ 333mV*  
CuSO<sub>4</sub> REFERENCE TO PIPE: *- 545mV*  
ZINC TO CuSO<sub>4</sub>: *- 870 mV*

**EARTH TESTING**

PIN SPACING: *2.0M* MEGGER READING: *0.93* RESISTIVITY: *11.6Ωm*  
PIN SPACING: *4.0M* MEGGER READING: *0.56* RESISTIVITY: *14.1Ωm*

**SACRIFICIAL ANODE  
(IF INSTALLED)**

ANODE TYPE:  
ANODE SIZE:  
ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):  
ZINC REF TO PIPE:  
(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:  
(ANODE CONNECTED)

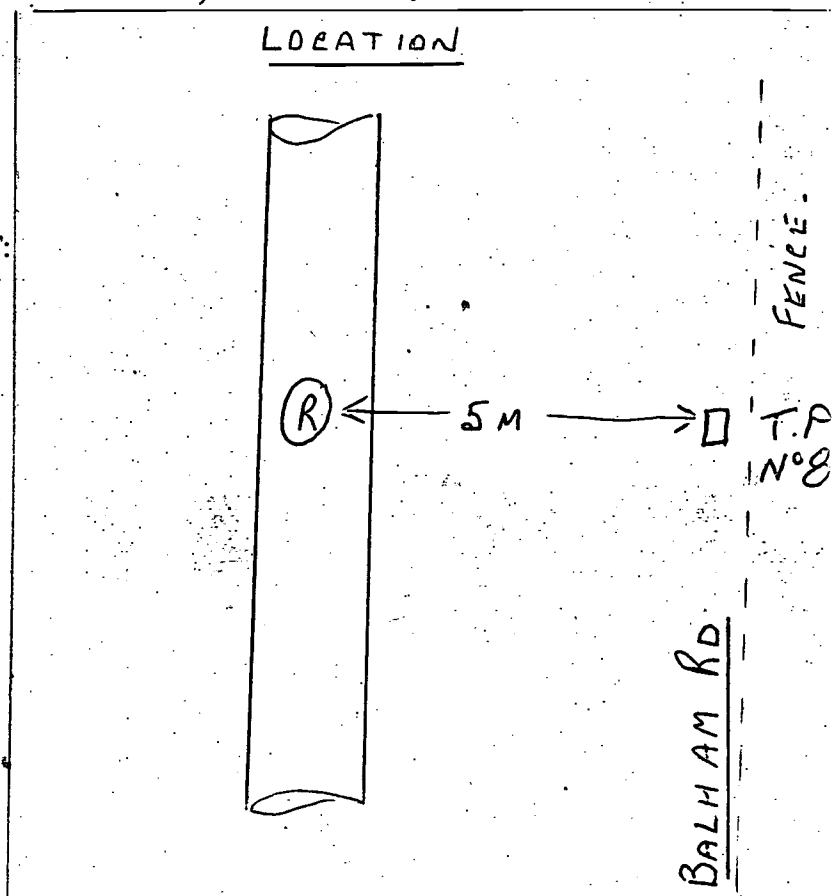
SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:  
(IF INSTALLED)

INSTALLED BY:

COMMENTS: *S. Greaves.*

1 COPY TO FILE  
1 COPY TO T.O.



**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: 8-3-95  
TEST POINT TYPE: B

LOCATION: BALHAM RD  
MAINS SIZE: (OUTSIDE GRACE)

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE): 0.2  $\Omega$   
ZINC REFERENCE TO PIPE: +406 mV  
CuSO<sub>4</sub> REFERENCE TO PIPE: -531 mV  
ZINC TO CuSO<sub>4</sub>: -943 mV

**EARTH TESTING**

PIN SPACING: 2.0M MEGGER READING: 1.12 RESISTIVITY: 14.06  $\Omega$ M  
PIN SPACING: 4.0M MEGGER READING: 0.53 RESISTIVITY: 13.3  $\Omega$ M

**SACRIFICIAL ANODE  
(IF INSTALLED)**

ANODE TYPE:  
ANODE SIZE:  
ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):  
ZINC REF TO PIPE:  
(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:  
(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

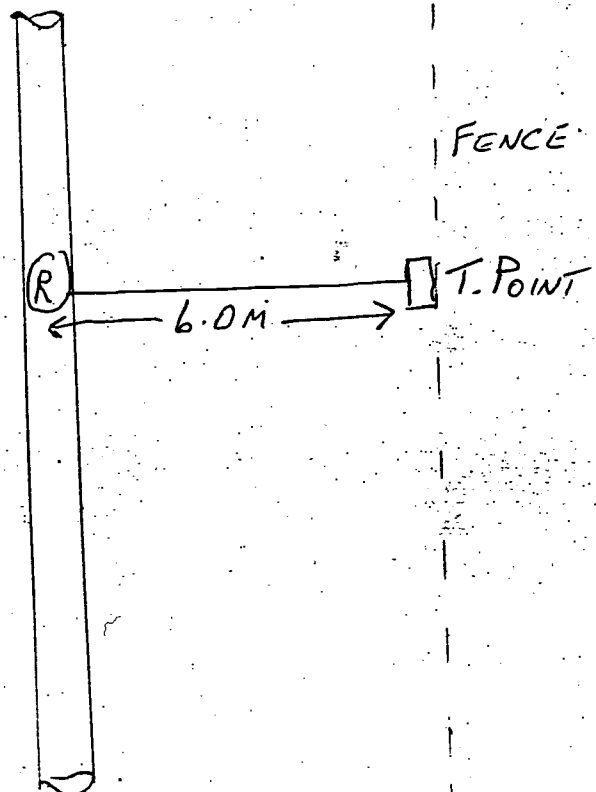
BLEED RESISTOR SIZE:  
(IF INSTALLED)

INSTALLED BY:

COMMENTS:

*L. J. Greaves*

1 COPY TO FILE  
1 COPY TO T.O.



**BRISBANE CITY COUNCIL  
EAGLE FARM PUMPING STATION  
CORROSION SECTION**

**STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING**

DATE: 8-3-95  
TEST POINT TYPE: B

LOCATION: BEATTY RD  
MAINS SIZE: PUMP STATION

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE): 0.25  
ZINC REFERENCE TO PIPE: + 540 MV  
CuSO<sub>4</sub> REFERENCE TO PIPE: - 603 MV  
ZINC TO CuSO<sub>4</sub>: - 1156 MV

**EARTH TESTING**

PIN SPACING: 2.0M MEGGER READING: .96 RESISTIVITY: 12.05  $\Omega$ /M  
PIN SPACING: 4.0M MEGGER READING: .15 RESISTIVITY: 3.76  $\Omega$ /M

**SACRIFICIAL ANODE  
(IF INSTALLED)**

ANODE TYPE:  
ANODE SIZE:  
ANODE TO PIPE POTENTIAL (OPEN CIRCUIT):  
ZINC REF TO PIPE:  
(ANODE CONNECTED)

CUSO<sub>4</sub> REF TO PIPE:  
(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:  
(IF INSTALLED)

INSTALLED BY:

COMMENTS:

1 grease.

1 COPY TO FILE  
1 COPY TO T.O.

SCOUR

1.0M  
T. POINT

FENCE

DRIVE WAY



**Brisbane City Council**  
**Dept. W.S. & S.**  
**Metropolitan Division**  
**Eagle Farm Pump Station**

**Electrical Workshop**

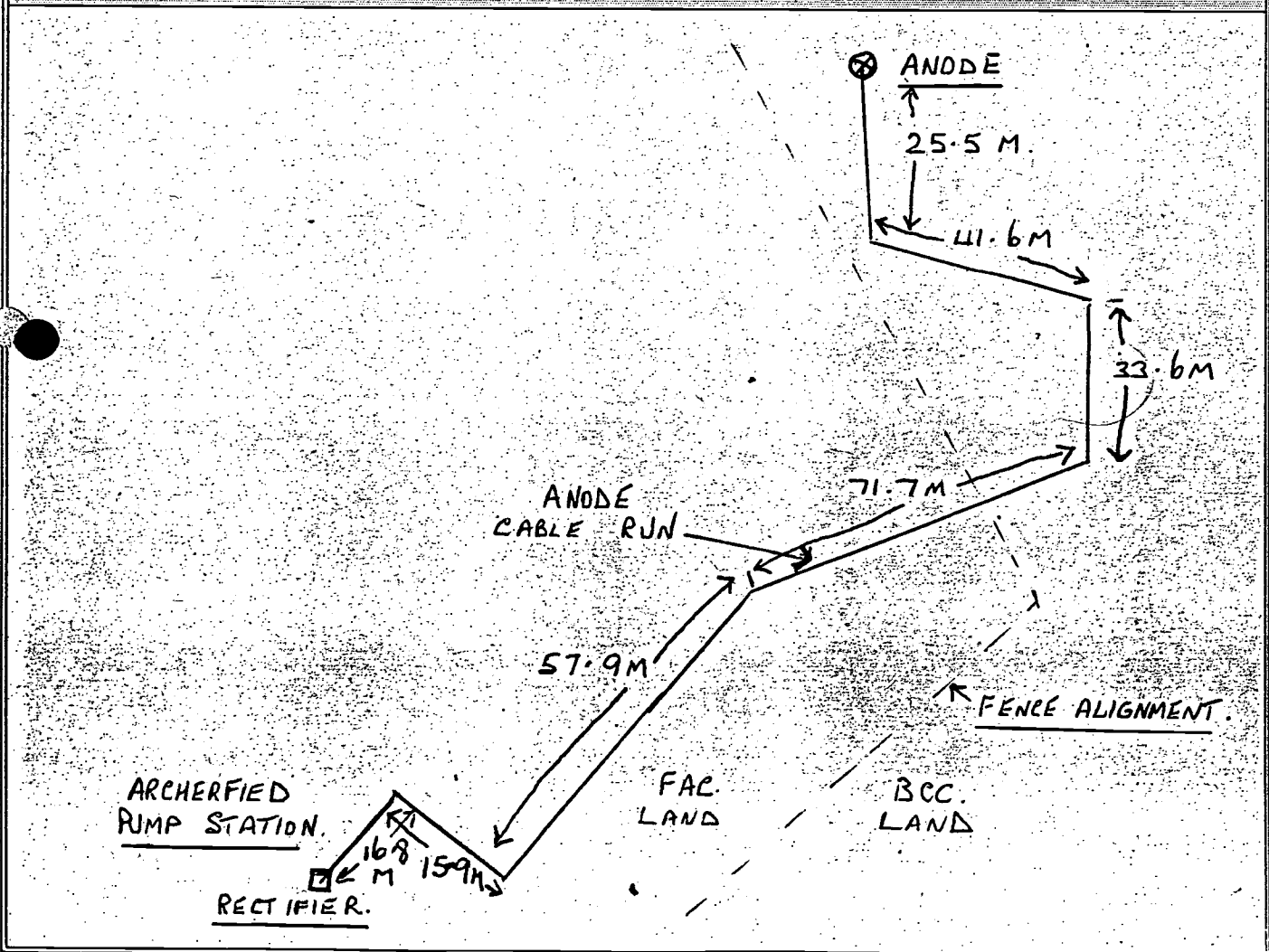
**Cathodic Protection Anode Bed Testing**

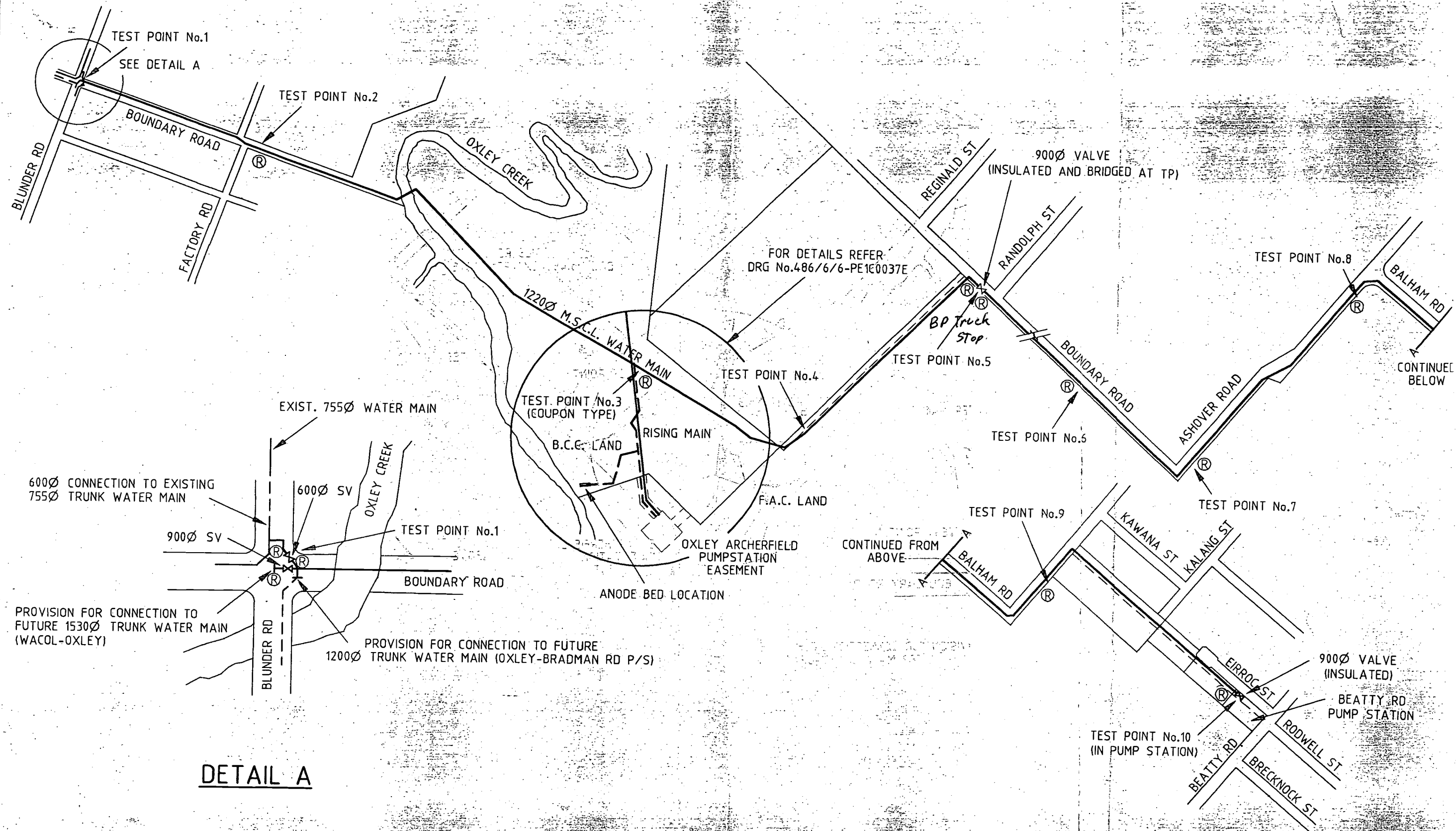
Date: 31-7-95	Structure: OXLEY TO BEATTY RD TRUNK MAIN
Anode material: SILICON IRON	Anode size/weight: 1500 x 75 mm
Packaging: CANISTER	Burial: VERTICAL
Depth: 5.0 M	Resistivity: 22.6 $\Omega$ M at 5.0 M.
Test Point type: POST	Signage: YES

Resistance to ground:


Anode 1 4.6 $\Omega$	Anode 2	Anode 3	Anode 4
Tested by: L. J. Greaves.			Anode 5

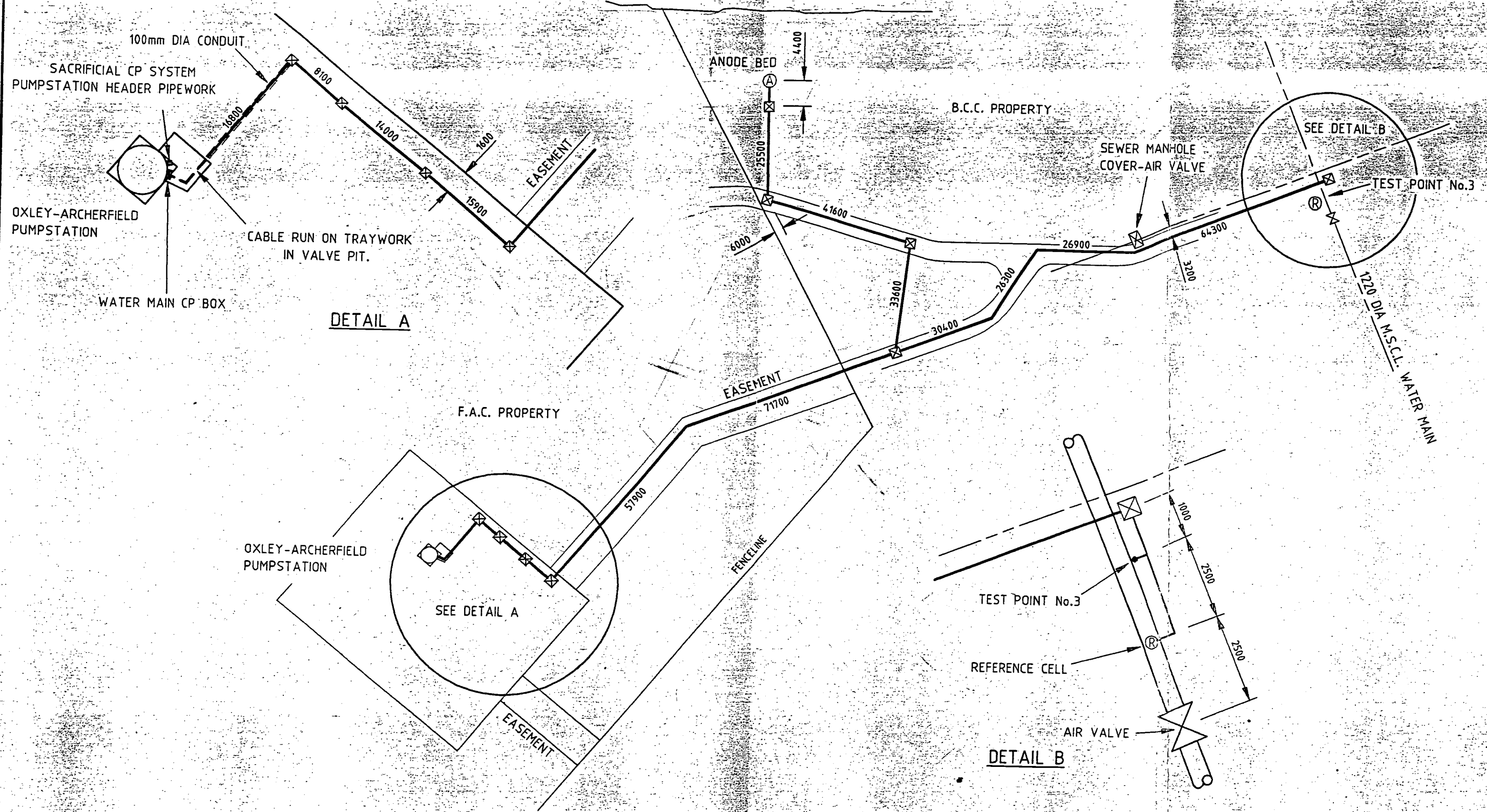
Locality Plan:






DETAIL A

O	4.7.94	AS BUILT	R.L.	MANAGER		DIRECTOR OF PLANNING & DESIGN		DESIGN	J.SAY	4.7.94	PROJECT	OXLEY TO BEATTY RD P/S TRUNK MAIN AMPLIFICATION	 <div>BRISBANE CITY COUNCIL DEPARTMENT OF WATER SUPPLY AND SEWERAGE MECHANICAL &amp; ELECTRICAL SERVICES</div>	
				DATE:		DATE:		DRAWN	R.LISTON	4.7.94				TITLE
				DIRECTOR OF CONSTRUCTION		DIRECTOR OF M & E SERVICES		DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION		CHECKED				
				DATE:		DATE:		DATE:		ENGINEER IN CHARGE		CADD FILE No. 66C0024-		SCALE: NTS
No	DATE	AMENDMENT	BY	DATE:		DATE:		DATE:		SUPERVISING ENGINEER		DRAWING No.	486/6/6-PE1C0024E	AMEND.
													0	



O	3.2.95	AS BUILT	R.L.	MANAGER		DIRECTOR OF PLANNING & DESIGN		DESIGN	48	3.2.95	PROJECT OXLEY TO BEATTY RD P/S TRUNK MAIN AMPLIFICATION	 <b>BRISBANE CITY COUNCIL</b> DEPARTMENT OF WATER SUPPLY AND SEWERAGE MECHANICAL & ELECTRICAL SERVICES	
				DATE:		DATE:		DRAWN	R.LISTON	3.2.95			
				DIRECTOR OF CONSTRUCTION	DIRECTOR OF M & E SERVICES	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION	CHECKED	48	8.3.95	TITLE BOUNDARY RD-OX/AR P/S CATHODIC PROTECTION SYSTEM			
													ENGINEER IN CHARGE
No	DATE	AMENDMENT	BY	DATE:	DATE:	DATE:	SUPERVISING ENGINEER	CADD FILE No. 66C037-		SCALE: NTS	No. 1 OF 1 SHEETS	DRAWING No. 486/6/6-PE1C0037E	AMEND. 0



☐ Electrical ☐ Mechanical ☐ Water Meters  
**5 Bunya Street Eagle Farm Q 4009**  
**Ph. (07) 3403 1849**  
**Fx. (07) 3403 1898**

# **Brisbane Water Engineering Services**

OPERATING MANUAL FOR:

**BLUNDER ROAD TO BEATTY ROAD 1220 DIA TRUNK WATER MAIN**

**CATHODIC PROTECTION SYSTEM**

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE  
WATER MAINTENANCE SECTION

30 th October 1995

## MANUAL CONTENTS

(1.0)	Introduction
(2.0)	Corrosion and Cathodic Protection
(3.0)	Mains Details
(4.0)	Cathodic Protection
(4.1)	Type of System
(4.2)	Rectifier
(4.3)	Cathode
(4.4)	Anodes
(4.5)	Test Points
(4.6)	Associated Drawings
(4.7)	Associated Standards
(4.8)	Government Regulations
(5.0)	Performed Testing
(6.0)	Conclusion
(7.0)	Maintenance

## DRAWINGS

JE02/104	Standard Rectifier Wiring Diagram
(No Number)	Monthly Maintenance Program

## **(1.0) INTRODUCTION**

Steel when immersed or covered in water has a tendency to corrode (or rust) as the oxidized form is more stable than the metal.

Because of this, precaution must be taken to stop or minimize the corrosion reaction to an acceptable level consistent with the design life of the structure. This is normally achieved by the use of protective coatings which control the corrosion reaction by isolating the steel from its surrounding environment.

However, it is not practical to achieve a perfect coating and coating damage will always occur with time. Because of this, corrosion may occur at imperfections in the paint coating, causing further deterioration in the coating as well as loss of metal.

As a result of this, the coating defects must be rectified by periodic maintenance or an additional method of protection used to prevent this deterioration and corrosion occurring. This additional protection is achieved by the cathodic protection system.

## **(2.0) CORROSION AND CATHODIC PROTECTION**

Corrosion is an electrochemical process in that it is accompanied by a flow of electrical current.

Corrosion occurs on the surface of metals at active areas known as anodes, which are electrically continuous with less active or passive areas known as cathodes. The electric current flows from the anode through the electrolyte to the cathode, with the circuit being completed by the electrical continuity between the cathode and anode. In practice anodes and cathodes are generally part of the same metallic surface and individual anodic areas may be small.

In applying cathodic protection and external current is applied to the surface so that the entire surface to be protected acts as a cathode. This involves the use of an auxiliary anode and when the current flow from this anode is sufficient, no part of the structure acts as an anode.

An external source of direct current such as a transformer rectifier is used in conjunction with an anode consisting of material with a very slow corrosion rate.

While it is the flow of current which achieves the cathodic protection of the surface it is impractical to measure these currents over individual anodic areas to determine when cathodic protection has been achieved. However, with the flow of cathodic protection current, the structure becomes more negative with respect to the surrounding electrolyte. Because of this, it is possible to state values of metal/electrolyte potential at which corrosion does not occur. This metal/electrolyte potential is generally measured against a standard reference electrode which allows a reproducible potential at which corrosion does not occur to be quoted.

### (3.0) **MAINS DETAILS**

**Size:** Dia 1220 mild steel cement lined.

**Coating:** Medium Density Fusion Bonded Polyethylene

**Length:** 5.6 km

**Location:** Cnr Boundary and Blunder Roads, Oxley to Beatty Road Pumping Station, Archerfield.

#### **Construction**

**Drawings:** 486/4/6-W9000P Logan City Trunk Main Amplification-to  
Oxley to Beatty Rd. Pump Station 486/4/6-W9023GD Trunk  
Water Main

486/6/6-PE1C0024E Boundary Rd-Ox/Ar P/S Cathodic  
Protection System

486/6/6-PE1C0037E Boundary Rd-Ox/Ar P/S Cathodic  
Protection System

**(4.0) CATHODIC PROTECTION DETAILS**

- (4.1) Type of Cathodic Protection: Impressed Current.
- (4.2) Rectifier: Special 32 Volt, 15 amp direct current output enclosed in a stainless steel switchboard. Rectifier has a 240V supply from the nearby Archerfield Submersable Sewerage Pumping Station..
- (4.3) Cathode: The cathode point is located on the 1220 dia mian next to Test Point No3, adjacent to Air Valve No1267. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.
- (4.4) Anodes: One 1500 x 75mm silicone iron anodes were installed approximately 200 metres from the trunk mains in a vertical bed. The anodes were firstly packaged with cokebreeze thereby improving anode – ground resistance. The anodes are identified by a marker post and label.
- (4.5) Test Points: Test points are installed on cathodically protected structures to enable testing to ensure full protection of the mains. On these mains six test points have been installed for details see dwg no. CE02/136.
- (4.6) Associated Drawings:
- |  |            |
|--|------------|
| Cathodic Protection Details            | - 2/14.213 |
| Cathodic Protection Test Point Details | - 2/14.199 |
| Standard Rectifier Wiring Diagram      | - JE02/104 |
- (4.7) Associated Standards:
- AS 3000 1986 Australia Wiring Rules
- AS 2832.1 1985 Pipes, Cables, Ducts, Guide to Cathodic Protection, Part One.
- (4.8) Government Regulations:
- Queensland Electricity Acts and Regulations.



**(5.0) PERFORMED TESTING**

- (1) Natural Potential Survey.
- (2) Testing of Insulated Flanges, Joints.
- (3) Soil Resistance Testing.
- (4) Current Drain Survey.
- (5) Pipe Coating Anomaly Survey.
- (6) Rectifier Loop Resistance.
- (7) Foreign Structure Interference Survey and Mitigation.
- (8) Final Potential Survey and Commissioning.

**(6.0) CONCLUSION**

Full Cathodic protection has been achieved on this section of trunk mains. The cathodic protection system is registered with the Queensland Electricity Commission and has approval to operate.

**(7.0) MAINTENANCE**

The cathodic protection system is maintained on a monthly basis after commissioning. These checks involve testing rectifier operation and recording of pipe to soil potentials.

**12th October 1992**  
**Electrical Workshop**  
**Cathodic Protection**

**CPS Monthly Maintenance Details.**

**Required:**

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.

**Labour:**

**One tradesperson, one vehicle. 20 minutes per site.**

**Procedure:**

- 1/ Identify installation.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Comments.
- 6/ Log entry.

13th October 1992  
Electrical Workshop  
Cathodic Protection

### CPS 6 Monthly Maintenance Details.

#### Required:

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.
- 3/ Set of tools. (Electricians)
- 4/ Multimeter.
- 5/ DC clampmeter.
- 6/ Copper sulphate reference cell and leads.
- 7/ Cleaning equipment.
- 8/ Gatic cover lifters.

#### Labour:

One tradesperson electrical, one laborer, one vehicle.  
Two hours per site.

#### Procedure:

- 1/ Identify system.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Record "on" potentials for all test points.
- 6/ Record "instant off" potentials for all test points.
- 7/ Record "off" potentials for all test points.
- 8/ Perform loop resistance and record.
- 9/ Check and record anode string currents.
- 10/ Comments.
- 11/ Log entry.

**13th October 1992**  
**Electrical Workshop**  
**Cathodic Protection**

**CPS 60 Monthly Maintenance Details.**

**Required:**

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.
- 3/ Set of tools. (Electricians)
- 4/ Multimeter.
- 5/ DC clampmeter.
- 6/ Copper sulphate reference cell and leads.
- 7/ Cleaning equipment.
- 8/ Gatic cover lifters.
- 9/ Rectifier load bank.
- 10/ PCS2000 Detection Equipment.

**Labour:**

One tradesperson electrical, one laborer, one vehicle.  
Eight hours per site.

**Procedure:**

- 1/ Identify system.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Record "on" potentials for all test points.
- 6/ Record "instant off" potentials for all test points.
- 7/ Record "off" potentials for all test points.
- 8/ Perform loop resistance and record.
- 9/ Check and record anode string currents.
- 10/ Load test rectifier for 10 minutes.
- 11/ Check all switchboard and testpoint terminals for tightness.
- 12/ Check all switchboard and testpoints are labelled and I.D. tags attached.
- 13/ Check plans are correctly drawn and modify if necessary.
- 14/ Remove and inspect anodes.
- 15/ Recheck all interference (CPS) bleeds.
- 16/ Pipecamp structure if applicable.
- 17/ Apply for "continue to operate" permit if applicable.