

# Brisbane Water Engineering Services

Electrical Mechanical Water Meters OM Manual

5 Bunya Street Eagle Farm Q 4009

Ph. (07) 3403 1849

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24th June 1966.

OPERATING MANUAL FOR:

WITTON ROAD /LAMBERT ROAD INDOOROPILLY  
375/600 DIA. RISING SEWER MAIN.

CATHODIC PROTECTION SYSTEM

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE  
SEWERAGE OPERATIONS BRANCH.

## **MANUAL CONTENTS**

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

## **DRAWINGS**

486/6/25-AA1C0021E	<b>Standard Rectifier Wiring Diagram</b>
(No Number)	<b>Monthly Maintenance Program</b>

## **(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 375/600 mild steel cement lined.

**Coating:** Tar Epoxy

**Length:** 2.00 km

**Location:** Witton Road Pumping Station to Lambert Rd. near Carnarvon St.

**Construction Drawings:** 3028/1053375 Dia. Witton Rd. Rising Main.

486/7/6-KIT0004E Witton/Lambert Rd Cathodic Protection System.

486/7/8-KI1C0005E Witton Rd.375 Dia. Rising Main C.P System.

**(4.0) CATHODIC PROTECTION DETAILS**

- (4.1) Type of Cathodic Protection: **Impressed Current.**
- (4.2) Rectifier: Special 32 Volt, 10 amp direct current output enclosed in a stainless steel switchboard. Rectifier has a 240V supply from the nearby Witton Rd. Submersible Sewerage Pumping Station.. With this system, the 100mm cast iron main in Kinloch St, there is a bleed and a bond on to the 375mm main by a 1.5 ohm resistor at the rectifier.
- (4.3) Cathode: The cathode point is located on the 375 dia main adjacent to the submersible pump station. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.
- (4.4) Anodes: Two 1500 x 75mm silicone iron anodes were installed approximately 210 metres from the trunk mains in a vertical bed at the end of Kinloch St. approx. 10 metres from the river bank. 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 five 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      | - 486/6/25-AA1C0021E |
| Vertical Ground bed Details            | - 486/6/25-AA1C0024E |
- (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.

**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 Water Engineering Services**

Ph. 34031838 Fx. 34031839

5 Bunya Street

Eagle Farm Q 4009

**Electrical Engineering Unit****Cathodic Protection System Loop Resistance**

Date: 27th JUNE 1996

Cathodic Protection System:

Witton Rd.- Lambert Rd. Rising Sewer Main

System Operating Volts:

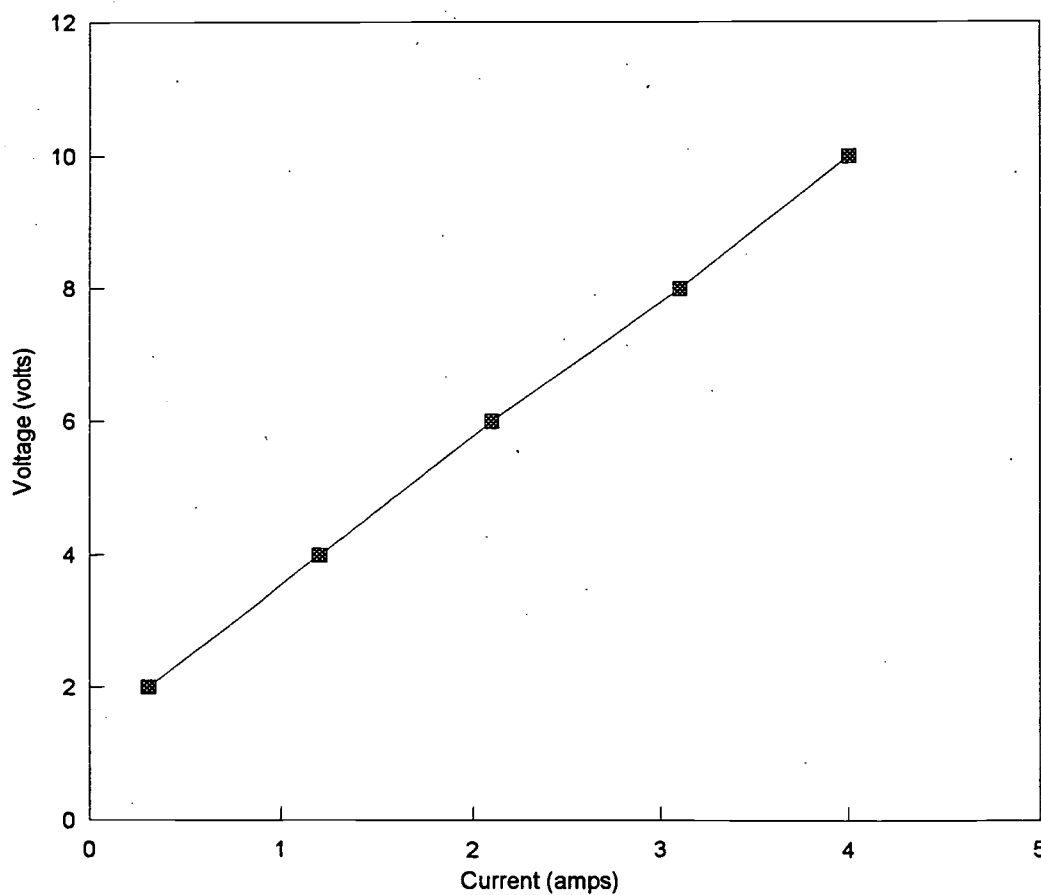
14.5

System Operating amps

6.2

Test Voltage:		Test Current:	
(volts)		(amps)	
2		0.3	
4		1.2	
6		2.1	
8		3.1	
10		4	

Loop Resistance (ohms)
2.105263

**Graph of System voltage vs current.**

06/20/96

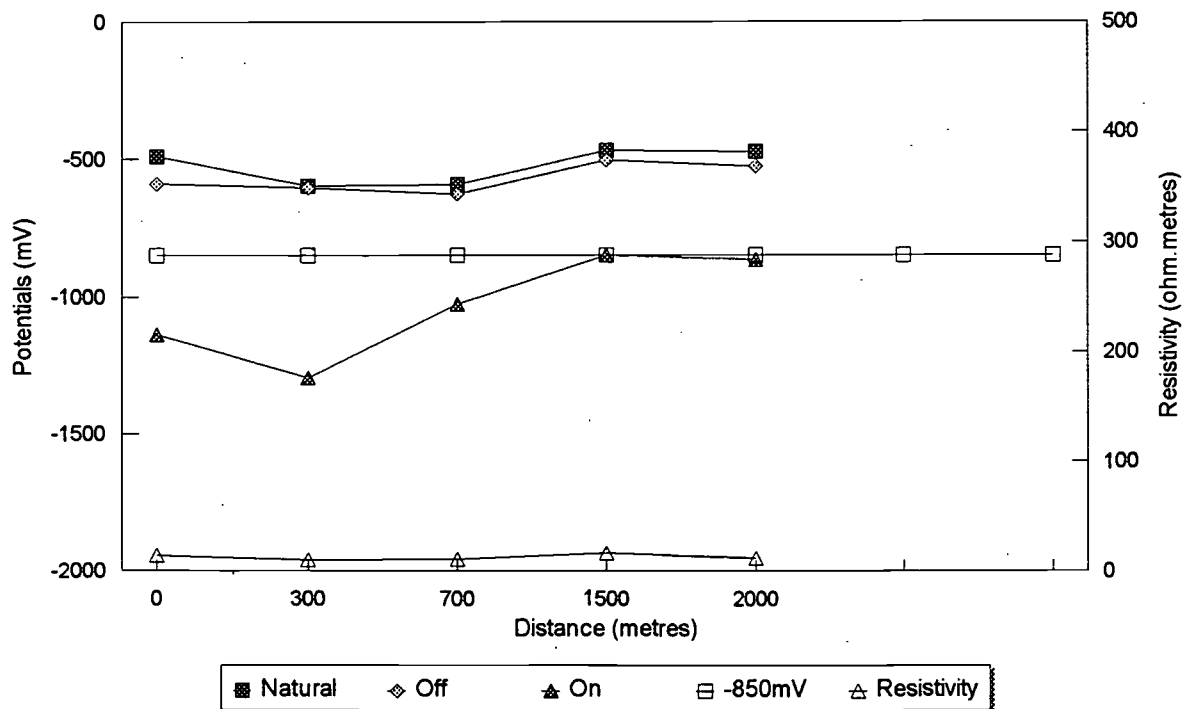
LOOPWITT.WK4

**Brisbane Water Engineering Services**

CP Form No. 23

**Electrical Engineering Unit****Cathodic Protection System Potential Recording Form**Project Witton Rd./Lambert Rd. Rising Sewer MainDate 24th June 1996

Test Point number	Distances to T.P. (metres)	Potentials to CuSO <sub>4</sub>			Resistivities at 2 metres (ohm.metres)
		Natural (mV)	Off (mV)	On (mV)	
1	0	-490	-590	-1136	13.81
2	300	-596	-605	-1295	9.92
3	700	-592	-627	-1026	10.06
4	1500	-471	-505	-850	16.32
5	2000	-475	-527	-865	11.49
6					
7					
8					
9					
10					
11					
12					
13					
14					

**Graph of potentials and resistivity vs pipelength**

Rectifier located at 0M.

Revision 06/26/96

**Brisbane Water Engineering Services**

CP Form No. 27

**Electrical Engineering Unit****Cathodic Protection Interference Survey Results Form**Project Wiltton RdUnit Reading 14.5 V 6.2a Date 29-5-96

	Reading	Test Point I. D.	Location	Swing
On	-543			
Off	-500	SP13	twig st	
On	-666	Water		
Off	-540	Main	House 16 twig st	
On	-472	Water		
Off	-430	main	House 12 Twig St.	
On	-780	Segreb.		
Off	-600	Men	Pole 31 Wiltton Rd	
On	-731	Road		
Off	-725	Rail	Road Rail Wiltton Rd	
On	-440	Hand		
Off	-402	Rail	Hand Rail Wiltton Rd	
On	-612	Water		
Off	-550	main	House 7 twig st	
On	-490	Segreb		
Off	-468	Men	Pole 49890 twigst	
On	-457	Segreb		
Off	-445	Men	Pole 15447 twigst	
On	-612	Hand		
Off	-613	Rail	Bridge St.	
On	-444	Main		
Off	-415	Sub Band	Nudgee School.	
On	-329	Transformer		
Off	-329	Men	Bridge St.	
On	-386	Segreb		
Off	-386	Men	Pole 39570 Bridgest	
On				
Off				
On				
Off				

TESTED BY P. SMYTH

**Brisbane Water Engineering Services**

CP Form No.18

Electrical Engineering Unit

**Standard Cathodic Protection Test Point Data Gathering Form**

Project Witton Rd. Date 27-5-96  
 T P Location Pump Station Witton Rd T P No. 1  
 Mains Size ..... T P Type Coupon.

**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE)  
 ZINC REFERENCE TO PIPE  
 CuSo4 REFERENCE TO PIPE  
 ZINC TO CuSo4

0.4 Ω  
+540 mV  
-490 mV  
990 mV

**EARTH TESTING**TEST NO. 1

PIN SPACING

2m

RESISTIVITY

13.816

MEGGER READING

1.1TEST NO 2

PIN SPACING

5m

RESISTIVITY

29.83

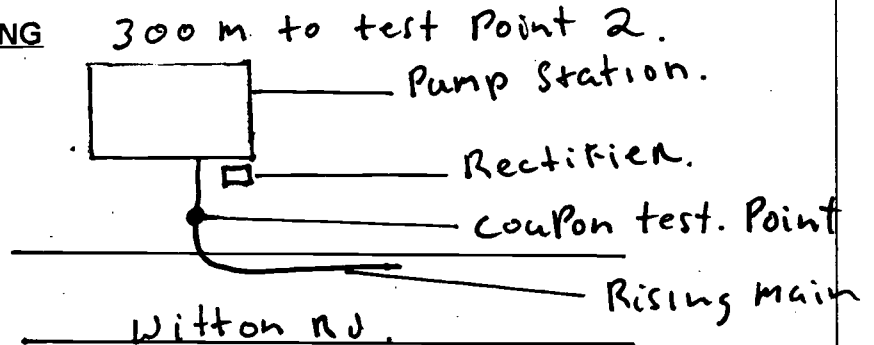
MEGGER READING

0.95TEST NO 3

PIN SPACING

MEGGER READING

RESISTIVITY

**COMMENTS / LOCATION DRAWING**

INSTALLED BY

P. Smyth

Revision 09/28/95

**Brisbane Water Engineering Services**

CP Form No.18

Electrical Engineering Unit

**Standard Cathodic Protection Test Point Data Gathering Form**Project ...Wilton Rd.....Date ...27-5-96...T P Location ...Radnor St Creak.....T P No. ...2.....

Mains Size .....

T P Type ...B.....**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE)

0.4  $\Omega$ 

ZINC REFERENCE TO PIPE

+644

CuSo4 REFERENCE TO PIPE

-596

ZINC TO CuSo4

1182**EARTH TESTING**TEST NO 1

PIN SPACING

2m

RESISTIVITY

9.922  $\Omega$ 

MEGGER READING

0.790TEST NO 2

PIN SPACING

5m

RESISTIVITY

21.509

MEGGER READING

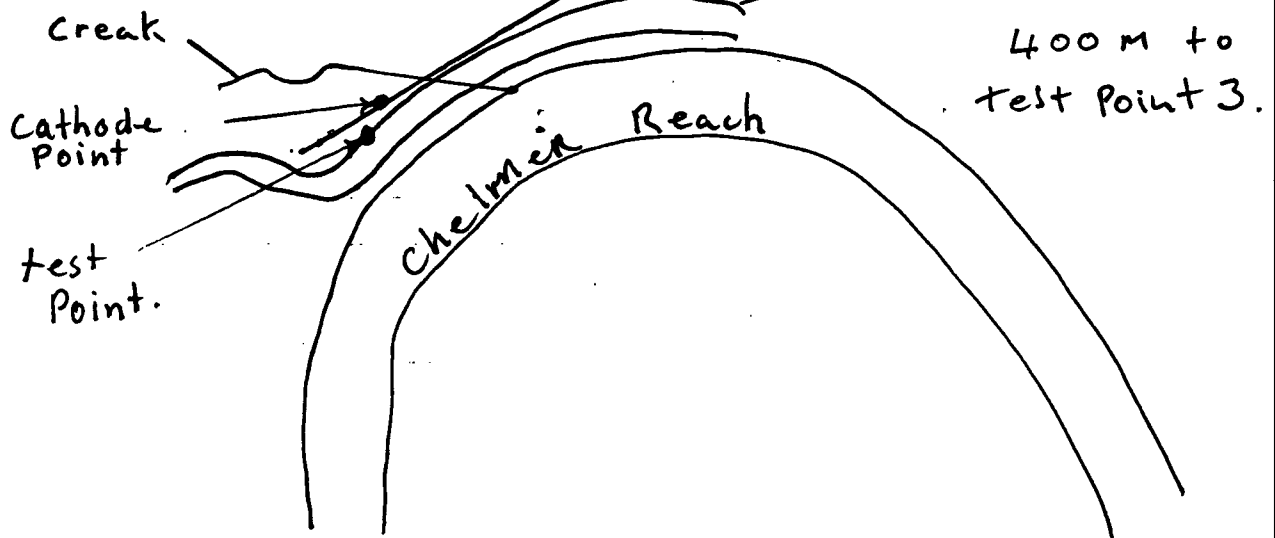
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PIN SPACING

MEGGER READING

Rising Main.

RESISTIVITY

**COMMENTS / LOCATION DRAWING**

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CP Form No.18

Electrical Engineering Unit

**Standard Cathodic Protection Test Point Data Gathering Form**Project Wilton RdDate 27-5-95TP Location Cnr Lambert & CarnarvonTP No. 5

Mains Size .....

TP Type B**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE)

0.5  $\Omega$ 

ZINC REFERENCE TO PIPE

+499 mV

CuSo4 REFERENCE TO PIPE

-475 mV

ZINC TO CuSo4

981 mV**EARTH TESTING**TEST NO. 1

PIN SPACING

2 m

RESISTIVITY

11.49  $\Omega$ 

MEGGER READING

0.915TEST NO 2

PIN SPACING

5 m

RESISTIVITY

24.39  $\Omega$ 

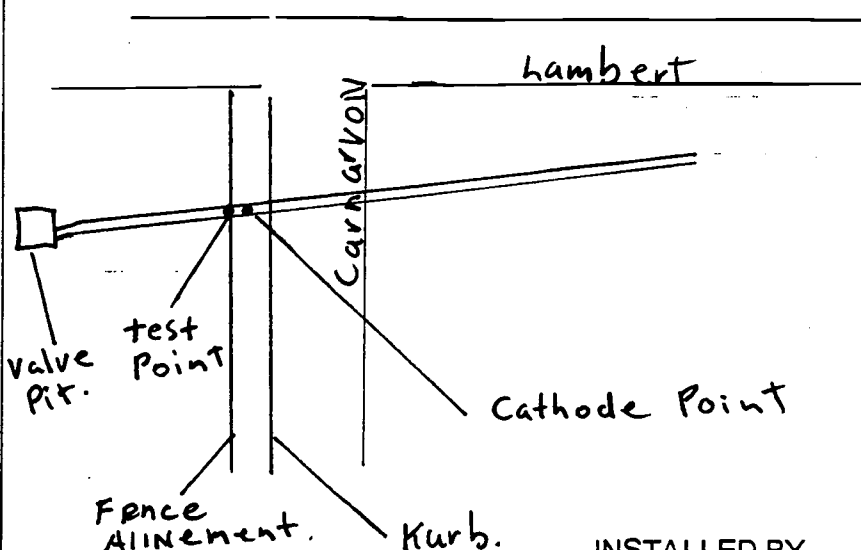
MEGGER READING

0.777TEST NO 3

PIN SPACING

RESISTIVITY

MEGGER READING

**COMMENTS / LOCATION DRAWING**

INSTALLED BY

P. SMYTH.

Revision 09/28/95

Electrical Engineering Unit

Cathodic Protection Interference Survey Results Form

Project WITTON RD Unit Reading 11v 5a Date 20-4-96

	Reading	Test Point I. D.	Location	Swing
On	-367		Pump station water	
Off	-397		Pipe	
On	-527		Witton RD	
Off	-500		Segreg Pole no 18258	
On	-560		Water main 11	
Off	-500			
On	-555		5 meters from	
Off	-555		Water tap. Anode 2	
On	-555		Anode	
Off	-555		Fence 5 meters from 2	
On				
Off				
On				
Off				
On				
Off				
On				
Off				
On				
Off				
On				
Off				
On				
Off				
On				
Off				
On				
Off				

TESTED BY .....



**Brisbane Water Engineering Services**

CP Form No. 17

**Electrical Engineering Unit****Cathodic Protection Anode Bed Testing**Project Witton RdDate 1-7-96ANODE MATERIAL: SILICONE IRON BURIAL: VERTICALANODE SIZE/WEIGHT: 1500 x 75 mm CANISTER 1.78 kg <sup>ANODE 4.8 kg</sup> TEST POINT TYPE: PIT

ANODE PACKAGING: \_\_\_\_\_ SOIL RESISTIVITY: \_\_\_\_\_

ANODE DEPTH: 5.0 m SIGNAGE: YES**RESISTANCE TO GROUND:**ANODE NO.1 2.6  $\Omega$ ANODE No.2 2.4  $\Omega$ 

ANODE No.3 \_\_\_\_\_

ANODE No.4 \_\_\_\_\_

ANODE No.5 \_\_\_\_\_

TOTAL 5.0  $\Omega$ **ANODE CURRENT**ANODE No.1 2.6 ampsANODE No.2 3.5 amps

ANODE No.3 \_\_\_\_\_

ANODE No.4 \_\_\_\_\_

ANODE No.5 \_\_\_\_\_

TOTAL 6.1 amps**LOCATION DRAWING**TESTED BY P Smyth

Revision 09/28/95

**Brisbane Water Engineering Services**

CP Form No.18

Electrical Engineering Unit

**Standard Cathodic Protection Test Point Data Gathering Form**Project Wilton RdDate 27-5-96T P Location Walter taylor Bridge.T P No. 3

Mains Size .....

T P Type B**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE)

.4  $\Omega$ 

ZINC REFERENCE TO PIPE

+592

CuSo4 REFERENCE TO PIPE

-592

ZINC TO CuSo4

1182**EARTH TESTING**TEST NO 1

PIN SPACING

2m

RESISTIVITY

10.06  $\Omega$ 

MEGGER READING

.801TEST NO 2

PIN SPACING

5m

RESISTIVITY

18.84  $\Omega$ 

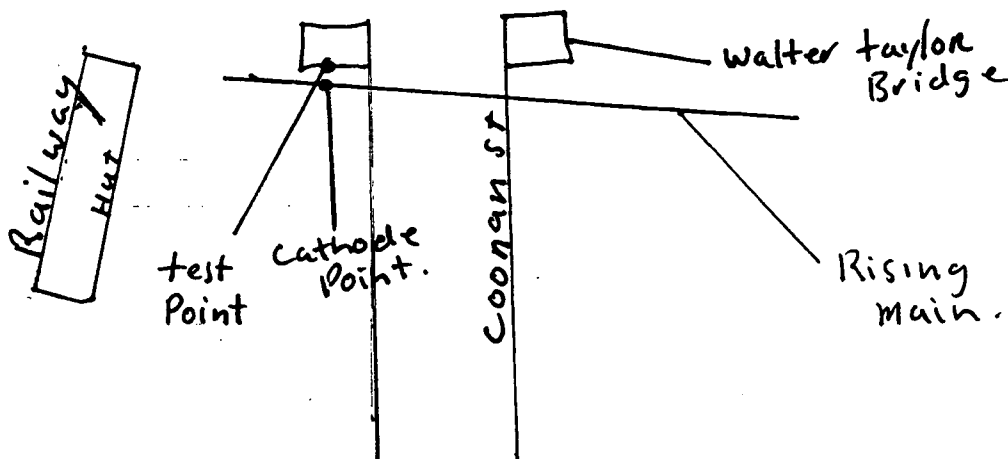
MEGGER READING

.600TEST NO 3

PIN SPACING

RESISTIVITY

MEGGER READING

**COMMENTS / LOCATION DRAWING**800 m to test Point 4

INSTALLED BY

P. Smyth

Revision 09/28/95

**Brisbane Water Engineering Services**

CP Form No.18

**Electrical Engineering Unit****Standard Cathodic Protection Test Point Data Gathering Form**Project Witten RdDate 27-5-96T P Location Lambert RdT P No. 4

Mains Size .....

T P Type B**POTENTIAL TESTING**

CATHODE TO CATHODE RETURN (RESISTANCE)

.3  $\Omega$ 

ZINC REFERENCE TO PIPE

+713

CuSo4 REFERENCE TO PIPE

-491

ZINC TO CuSo4

1186**EARTH TESTING**TEST NO. 1

PIN SPACING

2 mRESISTIVITY 16.32

MEGGER READING

1.3TEST NO 2

PIN SPACING

5 mRESISTIVITY 28.69

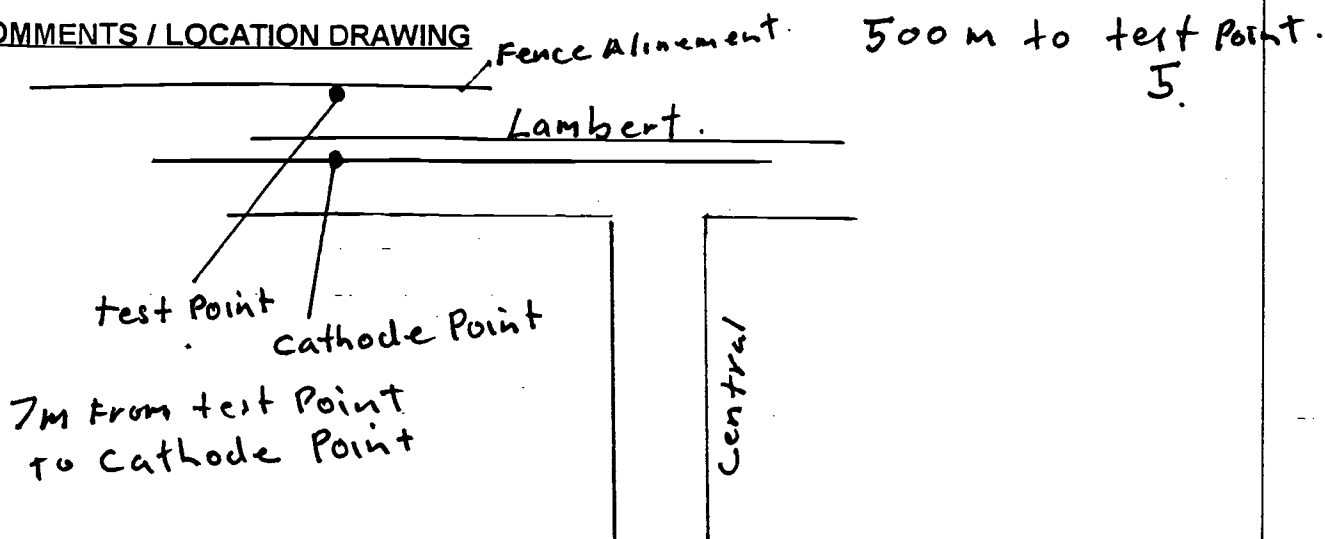
MEGGER READING

.914TEST NO 3

PIN SPACING

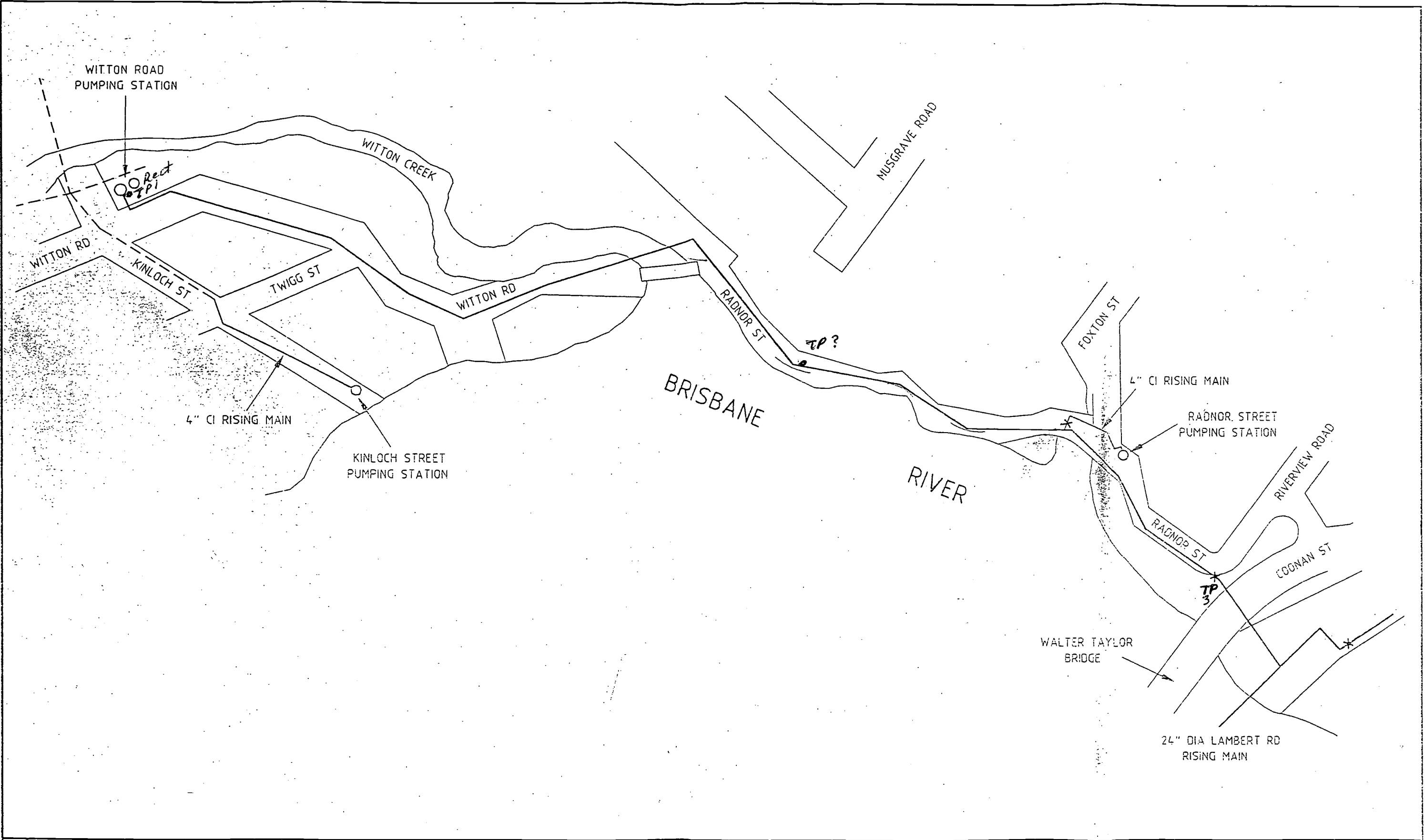
RESISTIVITY

MEGGER READING


**COMMENTS / LOCATION DRAWING**

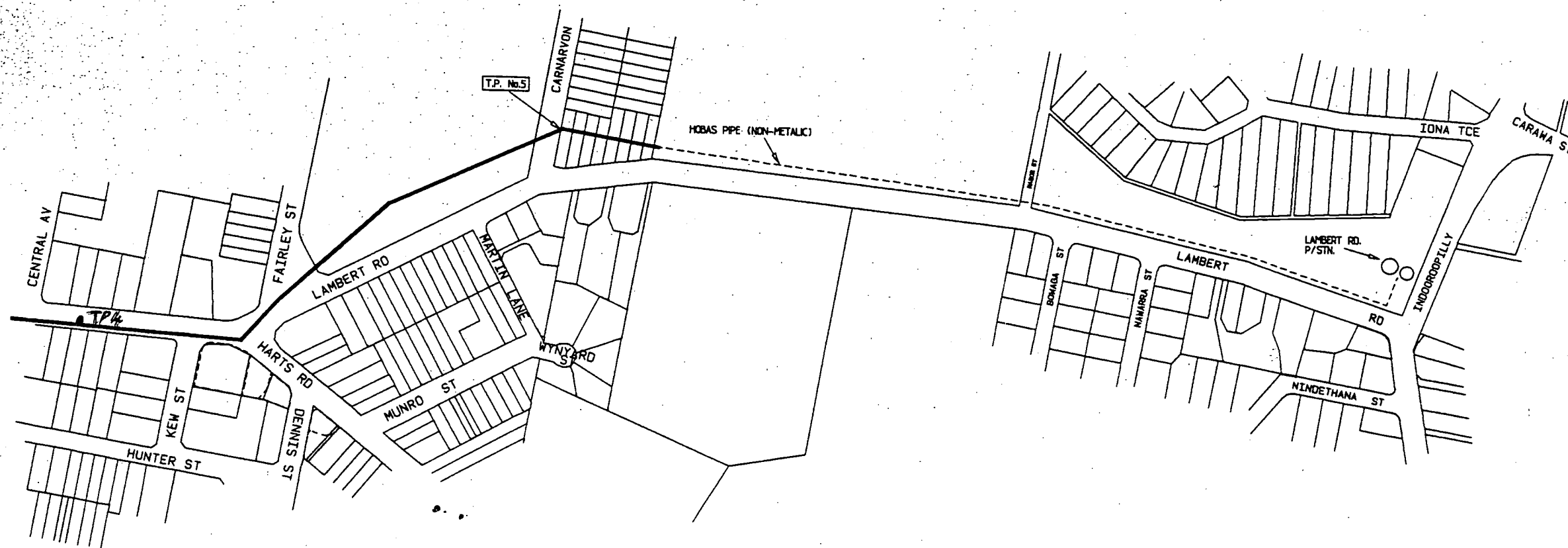
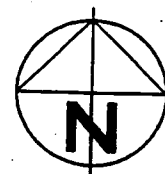
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P. SMYTH



Q	31.10.94	ISSUED FOR CONSTRUCTION	R.L.	MANAGER		DIRECTOR OF PLANNING & DESIGN		DESIGN	J.SAY	2.9.94	PROJECT WITTON ROAD PUMP STATION	
				DATE:		DATE:		DRAWN	R.LISTON	2.9.94		
				DIRECTOR OF CONSTRUCTION		DIRECTOR OF M & E SERVICES		CHECKED				
								DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION		ENGINEER IN CHARGE		
										SUPERVISING ENGINEER		
No	DATE	AMENDMENT	BY	DATE:	DATE:	DATE:	CADD FILE No. 78C0005-					

 BRISBANE CITY COUNCIL DEPARTMENT OF WATER SUPPLY AND SEWERAGE MECHANICAL & ELECTRICAL SERVICES	
SCALE: NTS	No. 1 OF 1 SHEETS
DRAWING No. 486/7/8-K11C0005E	
AMEND. 0	



## NOTES

0	4.96	ISSUED FOR APPROVAL	O.L.P.
No	DATE	AMENDMENT	INITIALS

### AMENDMENT & ISSUE REGISTER

MANAGER	DIRECTOR OF TECHNOLOGY SERVICES
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DATE: DATE:

DIRECTOR OF PLANNING & DESIGN	DIRECTOR OF WATER SUPPLY	DIRECTOR OF CONSTRUCTION
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DATE: DATE: DATE:

DESIGN	J.S.	22.4.96	ENGINEER IN CHARGE
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DRAWN	O.L.P.	23.4.96	SUPERVISING ENGINEER
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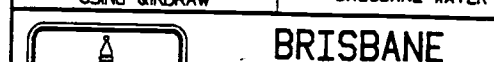
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BRISBANE WATER

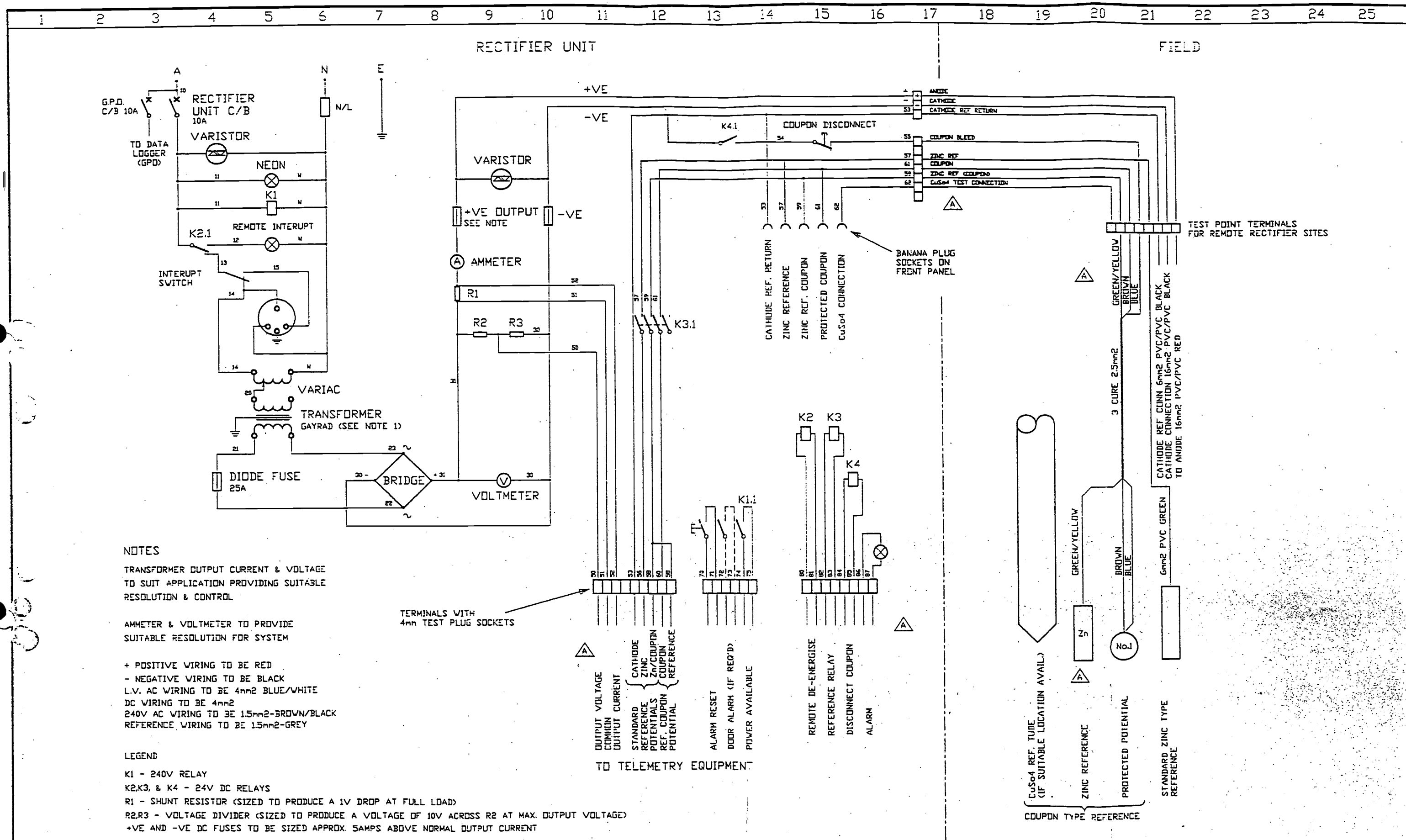
TECHNOLOGY SERVICES BRANCH  
INFORMATION TECHNOLOGY

PROJECT:  
WITTON / LAMBERT RD.  
RISING MAIN  
C.P. SYSTEM

TITLE:  
CATHODIC PROTECTION  
TEST POINT DETAILS

SCALE: N.T.S. No. 2 OF 2 SHEETS

DRAWING No. 486/7/6-KIT0004E AMEND. 0



NO.	BY	DATE	REVISION	CHECK	APPR
A	R.L.	18.10.93	CHANGES AS SHOWN		
D	R.L.	25.8.93	ISSUED FOR CONSTRUCTION		



BRISBANE  
CITY COUNCIL  
DEPARTMENT OF WATER  
SUPPLY & SEWERAGE  
MECHANICAL & ELECTRICAL SERVICES

PROJECT  
STANDARD  
CATHODIC PROTECTION

TITLE  
RECTIFIER UNIT  
WITH DATA LOGGING FACILITIES  
WIRING DIAGRAM

DRAWN	NAME	DATE	SUPER	NAME	DATE	SCALE	SIZE
R.L.	R.L.	3.8.93	ENG.	M.J.	25.8.93		A3
DESIGN	NAME	DATE	SUPER	NAME	DATE	SCALE	SIZE
J.S.	J.S.	3.8.93	ENG.				
CHECKED	NAME	DATE	SUPER	NAME	DATE	SCALE	SIZE
J.S.	J.S.	25.8.93	ENG.				
DRAWING NO. 486/6/25-AA1C0021E						ACAD FILE NO. A625C21	