10 JULY 1995

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY AND SEWERAGE
MECHANICAL AND ELECTRICAL BRANCH
ELECTROLYSIS SECTION
EAGLE FARM PUMPING STATION

OPERATING MANUAL FOR:

MANSFIELD TO MACKENZIE 600 DIA TRUNK WATER MAIN

CATHODIC PROTECTION SYSTEM.

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE
WATER MAINTENANCE SECTION

MANUAL CONTENTS

DRAWINGS

(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 600 mild steel cement lined.	
Coating:	Low Density Fusion Bonded Polyethylene.	
Length:	2.37 km	
Location:	Cnr Broardwater and Newnham Roads,Mansfield to the Cnr Mt Gravatt Capalaba Road and the Gateway Arterial.	
Drawings:	Construction:-	
	486/4/6-W11012P TO 486/4/6-W11021P	600 Dia MSCL Water Main Plan and Longitudinal Section and Details and Pipe List
	486/4/6-W11011LO	600 Dia MSCL Water Main Locality Plan
	486/4/6-W11022GD	600 Dia MSCL Water Main,450 Dia Valve Pit Details.

(4.0) CATHODIC PROTECTION DETAILS

(4.1) Type of Cathodic Protection: Impressed Current.

(4.2) Rectifier: Standard 32V Volt, 15 amp direct current output enclosed in a stainless steel switchboard. Rectifier has a 240V supply from a nearby SEQEB pilar box located at the park end of Culzean St,Mansfield.

(4.3) Cathode: The cathode point is located on the 600 dia. main adjacant to Mansfield Place in Broardwater Rd,where a coupon test point has been installed. 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 anode was installed approximately 400 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 pit and label. Refer dwg no 486/6/6–VH1C0026E.

(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

(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.

NOTE: Details of above testing have not been included in this manual but are available upon request.

(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

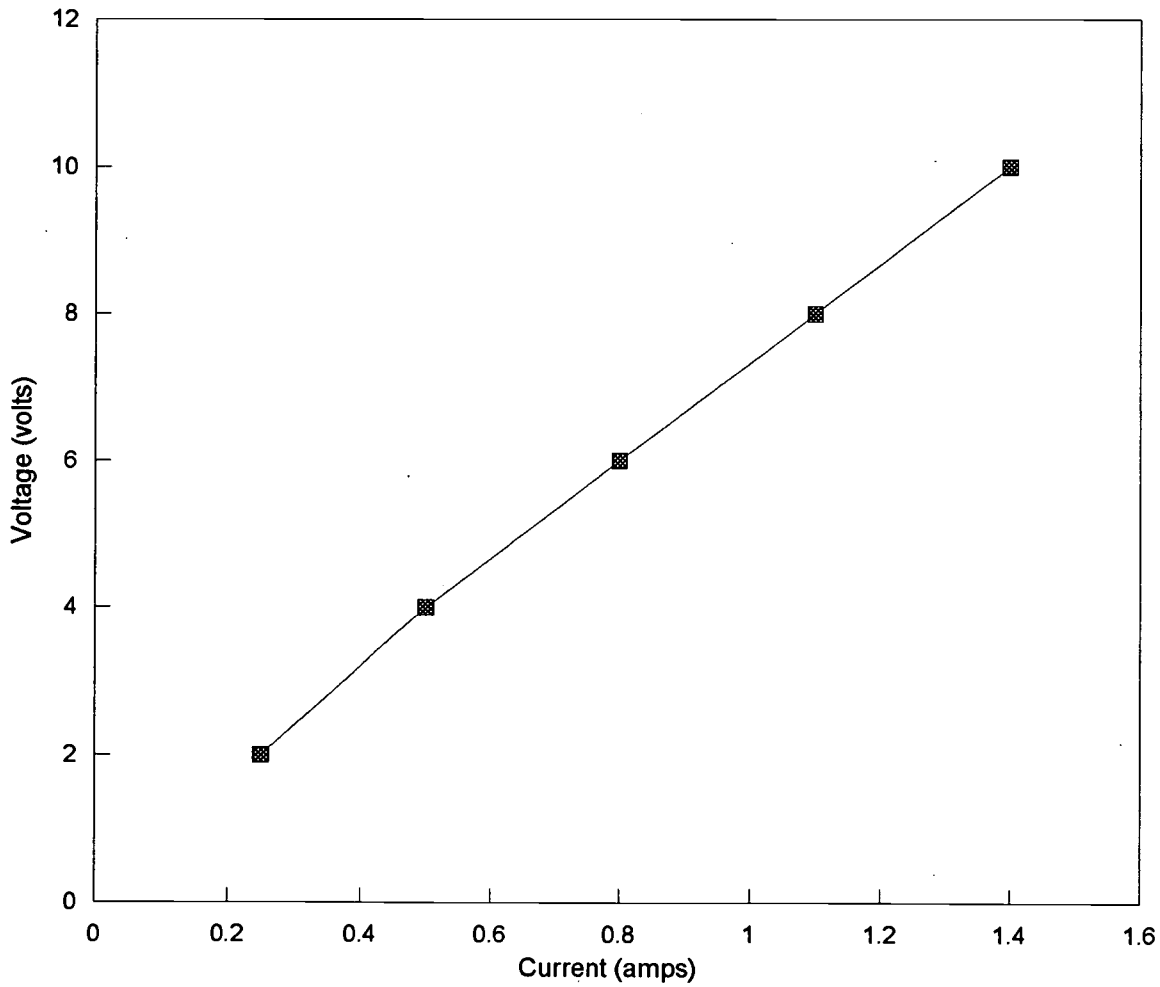
Cathodic Protection System Loop Resistance

Date: 11 July 1995
Cathodic Protection System: Mansfield Mackenzie Trunk Main
System Operating Volts: 0.5 System Operating amps: 0.1

Test Voltage: (volts)	Test Current: (amps)
2	0.25
4	0.5
6	0.8
8	1.1
10	1.4

Loop Resistance (ohms)
6.666667

Graph of System voltage vs current.



BRISBANE CITY COUNCIL

MEMORANDUM

Brisbane City

To	File No.
From	Date 16/05/95

Subject MANSFIELD - MACKENZIE TRUNK MAIN
ON POTENTIAL - NON POLARIZED (ALL EARTHING CONNECTED)

RECTIFIER SET AT 500mV 100mA
$CuSO_4$ TO PIPE -1210 mV

LOOP RESISTANCE 2 V 250 mA
4 V 500 mA
6 V 800 mA
8 V 1.1 A
10 V 1.4 A

ANODE CURRENT 80 mA

TEST POINT N° 1	PRO	Zn TO PIPE	-555 mV
		$CuSO_4$ TO PIPE	-1255 mV
		Zn TO $CuSO_4$	-696 mV
	UNPRO	Zn TO PIPE	+627 mV
		$CuSO_4$ TO PIPE	-501 mV
		Zn TO $CuSO_4$	-1127 mV
TEST POINT N°2		Zn TO PIPE	-40 mV
		$CuSO_4$ TO PIPE	-1134 mV
		Zn TO PIPE	-1145 mV
TEST POINT		Zn TO PIPE	-115 mV
		$CuSO_4$ TO PIPE	-1030 mV
		Zn TO $CuSO_4$	-930 mV

BRISBANE CITY COUNCIL

MEMORANDUM

Brisbane City

To	File No.
From	Date / /

Subject .....

TEST POINT N°4 (REST.)

Zn TO PIPE	-.69
Zn TO PRO COUPON	-.567
$CuSO_4$ TO PIPE	-.120?
$CuSO_4$ TO PRO COUPON	-.538
Zn TO $CuSO_4$	-1.155

TEST POINT N°5

Zn TO PIPE	-.72 mV
$CuSO_4$ TO PIPE	-.1178 mV
Zn TO $CuSO_4$	-.1124 mV

TEST POINT N°6

Zn TO PIPE	+.48
Zn TO PRO COUPON	+.47
Zn TO UNPRO COUPON	+.755
$CuSO_4$ TO PIPE	-.1154
$CuSO_4$ TO PRO COUPON	-.1154
$CuSO_4$ TO UNPRO COUPON	-.445
Zn TO $CuSO_4$	-.1201

TEST POINT No 2

BRISBANE CITY COUNCIL
EAGLE FARM PUMP STATION
CORROSION SECTION

STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING

DATE: 19 JULY 1994
TEST POINT TYPE: D

LOCATION: CNR NEWNMANDS AND BROADWATER ROADS
MAINS SIZE: 600 mm. DIA

POTENTIAL TESTING

	PROTECTED	UNPROTECTED
CATHODE TO CATHODE RETURN (RESISTANCE):	0·1Ω	0·1Ω
ZINC REFERENCE TO PIPE:		
$CuSO_4$ REFERENCE TO PIPE:	-577 mV	
ZINC TO $CuSO_4$:		

EARTH TESTING

PIN SPACING: 2M MEGGER READING: (38×0·31) RESISITIVITY: 2πaR =

PIN SPACING: MEGGER READING: RESISITIVITY:

SACRIFICIAL ANODE
(IF INSTALLED)

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

$CuSO_4$ REF TO PIPE:
(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:
(IF INSTALLED)

INSTALLED BY: M. McCORMICK Murray McCormick.

COMMENTS: UNPROTECTED PIPE IS NOT COVERED YET TO ALLOW TESTING. PROTECTED Zn REFERENCE IS NOT COVERED YET TO ALLOW TESTING. EARTH TESTING AT 5M IS NOT AVAILABLE DUE TO A LACK OF SPACE.

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BRISBANE CITY COUNCIL
EAGLE FARM PUMP STATION
CORROSION SECTION

STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING

DATE: 13-1-95
TEST POINT TYPE: 2 by B

LOCATION: Broad Water Newnhan
MAINS SIZE: 600 mm

POTENTIAL TESTING

	Protected	Un Protected
CATHODE TO CATHODE RETURN (RESISTANCE):	0·2 Ω	0·2 Ω
ZINC REFERENCE TO PIPE:	−191 mV	+630 mV
$CuSO_4$ REFERENCE TO PIPE:	−919 mV	−496 mV
ZINC TO $CuSO_4$:	−729 mV	−1123 mV

EARTH TESTING

PIN SPACING: 5 m MEGGER READING: 1·85 RESISITIVITY: 20 Ω scale

PIN SPACING: 2 m MEGGER READING: 7·09 RESISITIVITY: 20 Ω scale

SACRIFICIAL ANODE
(IF INSTALLED)

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

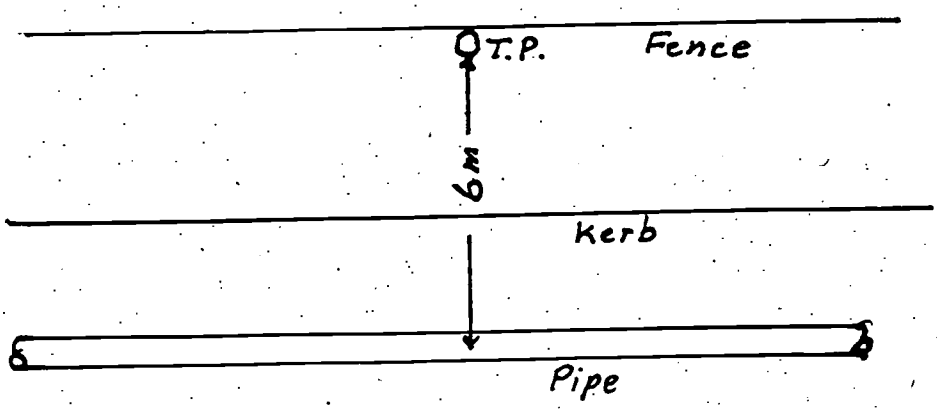
$CuSO_4$ REF TO PIPE:
(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:
(IF INSTALLED)

INSTALLED BY:

COMMENTS:



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DEPARTMENT OF WATER SUPPLY AND SEWERAGE
MECHANICAL AND ELECTRICAL BRANCH
METROPOLITAN DIVISION
EAGLE FARM PUMPING STATION

ELECTRICIAL WORKSHOP

INSULATED JOINT TESTING DETAILS:

DATE 18 JULY 1994

DESCRIPTION

MAINS DETAILS:-
LOCATIONS:- CNR NEWNMANS AND BROADWATER RDS
SIZE:- 600mm
MATERIAL:- MILD STEEL, CEMENT LINED.
COATING:- LOW DENSITY FUSION BONDED POLYETHYLENE
NUMBER:-

IN GROUND TESTING

	1	2	3	4
BOLT TO FLANGE RESISTANCE:-	∞MΩ	∞MΩ	∞MΩ	∞MΩ
NUMBER OF BOLT:-	12	12.	4	4
FLANGE TO FLANGE RESISTANCE:	∞MΩ	∞MΩ	3MΩ	∞MΩ

INSULATION CHECKER MODEL 702:-
POTENTIAL DIFFERENCE TO REFERENCE CELL
PROTECTED SIDE:-
UNPROTECTED SIDE:-

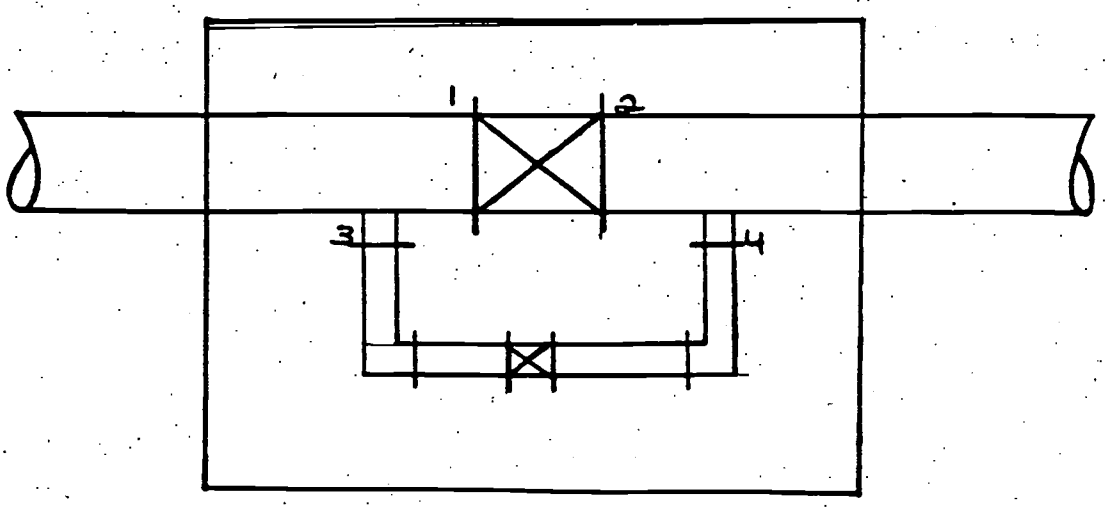
ABOVE TESTING

BOLT TO FLANGE RESISTANCE:-
NUMBER OF BOLTS:-
FLANGE TO FLANGE RESISTANCE:-

COMMENTS

USED COATED BOLTS WITH DELRIM WASHERS FOR INSOLATION

TESTED BY MURRY McCORMICK Murry McCormick



BRISBANE CITY COUNCIL
EAGLE FARM PUMP STATION
CORROSION SECTION

P 2

COUPON TYPE CATHODIC PROTECTION TEST POINT DATA GATHERING

DATE: 13·1·95
MAINS SIZE: 600 mm
TEST POINT TYPE: Coupon

LOCATION: Broadwater Cresthaven
TYPE:

INITIAL POTENTIAL TESTING (BOTH COUPONS DISCONNECTED)

ZINC TO PIPE:	16m²	− 214 mV
ZINC TO PROTECTED COUPON:	Red.	+ 398 mV
ZINC TO UNPROTECTED COUPON:	WHITE	+ 421 mV
$CuSO_4$ TO PIPE:		− 886 mV
$CuSO_4$ TO PROTECTED COUPON:	Red	− 488 mV
$CuSO_4$ TO UNPROTECTED COUPON:	WHITE	− 464 mV
$CuSO_4$ TO ZINC :		−1100 mV
PIPE CATHODE TO PIPE CATHODE RETURN (RESISTANCE):	16m² 6m²	0·2 Ω.
COUPON CATHODE TO COUPON CATHODE RETURN(RESISTANCE):	Red - Blue	0·3 Ω.

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 $CuSO_4$ IS ON SURFACE OR AJACENT PIPE)

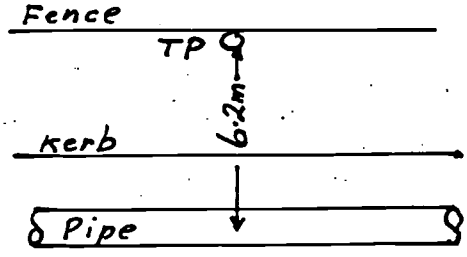
WHILE COUPON IS CONNECTED TO PIPE CATHODE RETURN:
PROTECTED COUPON TO ZINC:
PROTECTED COUPON TO $CuSO_4$:
UNPROTECTED COUPON TO ZINC:
UNPROTECTED COUPON TO $CuSO_4$:

WHILE COUPON IS DISCONNECTED TO PIPE CATHODE RETURN:
PROTECTED COUPON TO ZINC:
PROTECFED COUPON TO $CuSO_4$:
UNPROTECTED COUPON TO ZINC:
UNPROTECTED COUPON TO $CuSO_4$:

Earth Testing

Pin Spacing 5m Reading 0·18 Scale 20 Ω

Pin Spacing 2m Reading 0·47 Scale 20 Ω



BRISBANE CITY COUNCIL
EAGLE FARM PUMP STATION
CORROSION SECTION

T/P N° 3

STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING

DATE: 13-1-95
TEST POINT TYPE: B

LOCATION: 304 Broad Water Rd.
MAINS SIZE: 600 mm

POTENTIAL TESTING

CATHODE TO CATHODE RETURN (RESISTANCE): 0.1 Ω
ZINC REFERENCE TO PIPE: +196 mv
$CuSO_4$ REFERENCE TO PIPE: -820 mv
ZINC TO $CuSO_4$: -1012 mv

EARTH TESTING

PIN SPACING: 5 MEGGER READING: 0.77 RESISITIVITY: 20Ω scale

PIN SPACING: 2 MEGGER READING: 0.88 RESISITIVITY: 20Ω scale

SACRIFICIAL ANODE (IF INSTALLED)

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

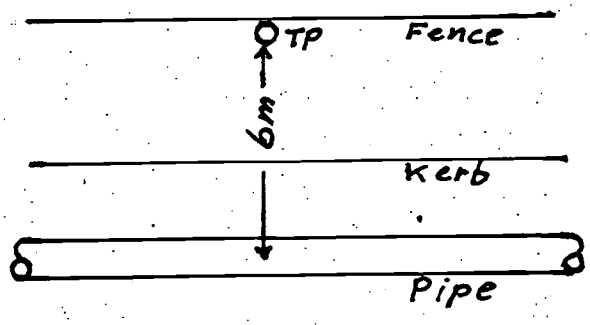
$CuSO_4$ REF TO PIPE:
(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:
(IF INSTALLED)

INSTALLED BY:

COMMENTS:



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BRISBANE CITY COUNCIL
EAGLE FARM PUMP STATION
CORROSION SECTION

COUPON TYPE CATHODIC PROTECTION
TEST POINT DATA GATHERING

RECT
TEST POINT No 4

DATE: 13·1·95
MAINS SIZE: 600mm
TEST POINT TYPE: Coupon

LOCATION: Broadwater Rd Mansfield
TYPE:

INITIAL POTENTIAL TESTING Tested at RTU
(BOTH COUPONS DISCONNECTED)

ZINC TO PIPE:	57-53	+283 mv
ZINC TO PROTECTED COUPON:	· -61	+611 mv
ZINC TO UNPROTECTED COUPON:	· -59	+611 mv
$CuSO_4$ TO PIPE:	53	-882 mv
$CuSO_4$ TO PROTECTED COUPON:	61	-555 mv
$CuSO_4$ TO UNPROTECTED COUPON:	59	-555 mv
$CuSO_4$ TO ZINC :	57	-1165 mv

PIPE CATHODE TO PIPE CATHODE RETURN (RESISTANCE): 4·9
COUPON CATHODE TO COUPON CATHODE RETURN(RESISTANCE): 9·3

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 $CuSO_4$ IS ON SURFACE OR AJACENT PIPE)

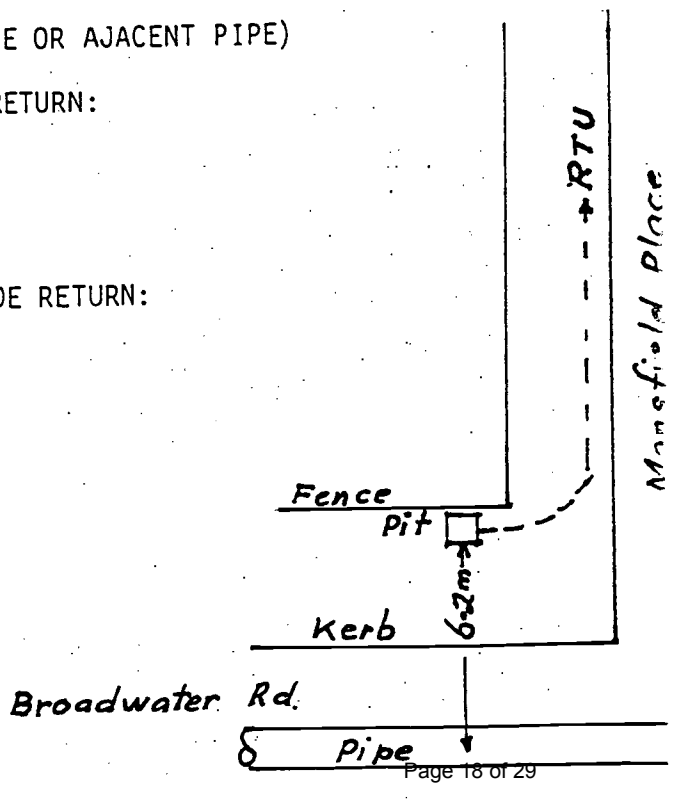
WHILE COUPON IS CONNECTED TO PIPE CATHODE RETURN:
PROTECTED COUPON TO ZINC:
PROTECTED COUPON TO $CuSO_4$:
UNPROTECTED COUPON TO ZINC:
UNPROTECTED COUPON TO $CuSO_4$:

WHILE COUPON IS DISCONNECTED TO PIPE CATHODE RETURN:
PROTECTED COUPON TO ZINC:
PROTECFED COUPON TO $CuSO_4$:
UNPROTECTED COUPON TO ZINC:
UNPROTECTED COUPON TO $CuSO_4$:

EARTH TESTING

Pin Spacing 5 Reading 0·25 Scale 20 Ω

Pin Spacing 2 Reading 3·7 Scale 20Ω



BRISBANE CITY COUNCIL
EAGLE FARM PUMP STATION
CORROSION SECTION

TEST POINT N°5

STANDARD CATHODIC PROTECTION TEST POINT DATA GATHERING

DATE: 13·1·95
TEST POINT TYPE: B

LOCATION: Mt Gravatt Capalaba Rd
MAINS SIZE: 600 mm

POTENTIAL TESTING

Gradient Ring disconnected

CATHODE TO CATHODE RETURN (RESISTANCE):	0·1 ohm	
ZINC REFERENCE TO PIPE:	+234 mv	+272 mv
$CuSO_4$ REFERENCE TO PIPE:	−925 mv	−893 mv
ZINC TO $CuSO_4$:	−1159 mv	−1166 mv

EARTH TESTING

PIN SPACING: 5 MEGGER READING: 1.48 RESISITIVITY: 20Ω scale

PIN SPACING: 2 MEGGER READING: 3.51 RESISITIVITY: 20Ω Scale

SACRIFICIAL ANODE (IF INSTALLED)

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

$CuSO_4$ REF TO PIPE:
(ANODE CONNECTED)

SACRIFICIAL ANODE CURRENT:

BLEED RESISTOR SIZE:
(IF INSTALLED)

INSTALLED BY:

COMMENTS:

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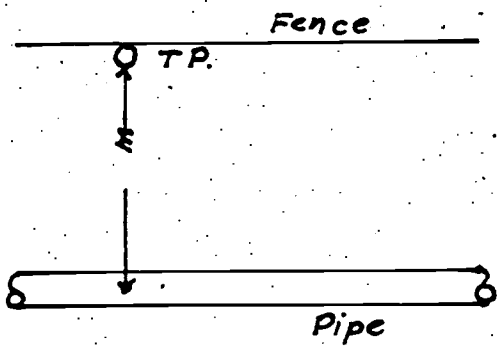


BRISBANE CITY COUNCIL
EAGLE FARM PUMP STATION
CORROSION SECTION

TEST POINT N°6

COUPON TYPE CATHODIC PROTECTION
TEST POINT DATA GATHERING

DATE: 13-1-95
MAINS SIZE: 600 mm
TEST POINT TYPE: Coupon

LOCATION: Light Pole W64504 Mt Gravatt - Capalaba Rd.
TYPE:

	Gradient Ring		Disconnected
ZINC TO PIPE:	+ 309 mv		+ 275 mv
ZINC TO PROTECTED COUPON:	+ 676 mv	Red	+ 675 mv
ZINC TO UNPROTECTED COUPON:	+ 789 mv	white	+ 793 mv
$CuSO_4$ TO PIPE:	- 905 mv		- 957 mv
$CuSO_4$ TO PROTECTED COUPON:	- 538 mv	Red	- 553 mv
$CuSO_4$ TO UNPROTECTED COUPON:	- 424 mv	white	- 436 mv
$CuSO_4$ TO ZINC :	- 1214 mv		- 1234 mv

PIPE CATHODE TO PIPE CATHODE RETURN (RESISTANCE): 0.1 ohm
COUPON CATHODE TO COUPON CATHODE RETURN(RESISTANCE): 0.3 ohm Red - Blue

INITIAL POTENTIAL TESTING
(BOTH COUPONS DISCONNECTED)

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 $CuSO_4$ IS ON SURFACE OR AJACENT PIPE)

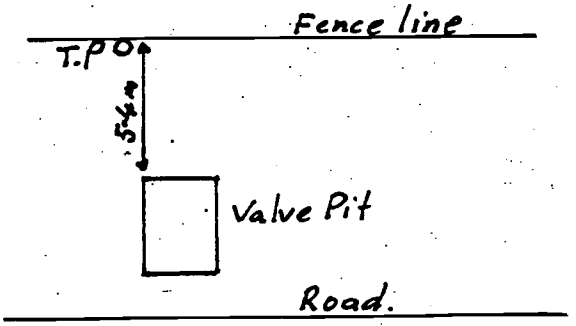
WHILE COUPON IS CONNECTED TO PIPE CATHODE RETURN:
PROTECTED COUPON TO ZINC:
PROTECTED COUPON TO $CuSO_4$:
UNPROTECTED COUPON TO ZINC:
UNPROTECTED COUPON TO $CuSO_4$:

WHILE COUPON IS DISCONNECTED TO PIPE CATHODE RETURN:
PROTECTED COUPON TO ZINC:
PROTECFED COUPON TO $CuSO_4$:
UNPROTECTED COUPON TO ZINC:
UNPROTECTED COUPON TO $CuSO_4$:

EARTH TESTING

Pin Spacing 5 Reading 1.48 Scale 20Ω

Pin Spacing 2 Reading 3.51 Scale 20Ω



BRISBANE CITY COUNCIL
MEMORANDUM

Brisbane City

To	File No.
From	Date 6/04/95

Subject MANSFIELD MACKENZIE
NATURAL POTENTIALS - EARTH & GRADING RINGS DISCONNECT

TEST POINT 1: PROTECTED	Zn TO PIPE	-492 mV
	$CuSO_4$ TO PIPE	-1189 mV
	Zn TO $CuSO_4$	-726 mV
UNPROTECTED	Zn TO PIPE	+618 mV
	$CuSO_4$ TO PIPE	-533 mV
	Zn TO $CuSO_4$	-1150 mV
TEST POINT 2	Zn TO PIPE	+20 mV
	$CuSO_4$ TO PIPE	-1123 mV
	Zn TO $CuSO_4$	-1145 mV
TEST POINT 3	Zn TO PIPE	-34 mV
	$CuSO_4$ TO PIPE	-1107 mV
	Zn TO $CuSO_4$	-1075 mV
TEST POINT 4 (RECT)	Zn TO PIPE	+67 mV
	Zn TO PRO COUPON	+554 mV
	$CuSO_4$ TO PIPE	-1092 mV
	$CuSO_4$ TO PRO COUPON	-596 mV
	Zn TO $CuSO_4$	-1151 mV
TEST POINT N°5	Zn TO PIPE	+7 mV
	$CuSO_4$ TO PIPE	-1156 mV
	Zn TO $CuSO_4$	-1144 mV
TEST POINT N°6	Zn TO PIPE	+109 mV
	$CuSO_4$ TO PIPE	-1124 mV
	Zn TO $CuSO_4$	-1210 mV

Brisbane City

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From	Date 12/04/95

Subject MANSFIELD MACKENZIE TRUNK MAIN
PIPECAMP SURVEY

RECT SET AT 5 VOLTS 500 mA

SWING 1250 - 4250 = 3000

TEST POINT N°6 SWING 0 - 2000 = 2000

TEST POINT N°5 1000 - 4500 = 3500

TEST POINT N°3 750 - 3500 = 2750

TEST POINT N°2 250 - 2000 = 1750

TEST POINT N°1 1750 - 4250 = 2500

NOTE :- NO DEFECTS WERE FOUND.

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

Electrical Workshop

Cathodic Protection Anode Bed Testing

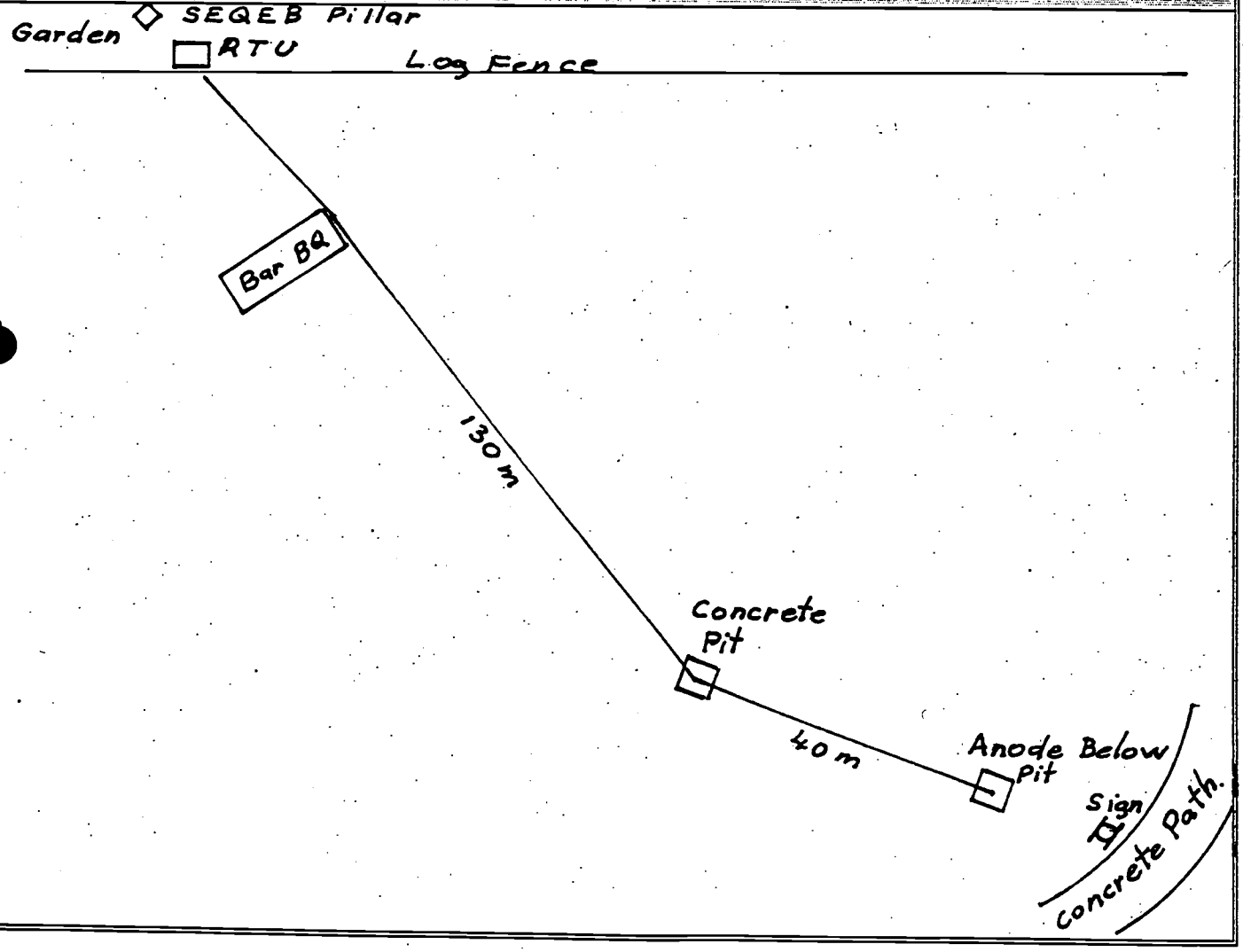
Date: 19·1·95	Structure: Canister
Anode material: Silicon Iron	Anode size/weight:
Packaging:	Burial: Verticle
Depth: 5 meters	Resistivity: •5 on 20Ω scale @ 5 meters •41 on 20Ω scale @ 2 meters
Test Point type:	Signage:

Resistance to ground:

Anode 1	Anode 2	Anode 3	Anode 4
3·42 Ω	—	—	—

Tested by: A. J. TAYLOR

Locality Plan:



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

INTERFERENCE SURVEY RESULTS

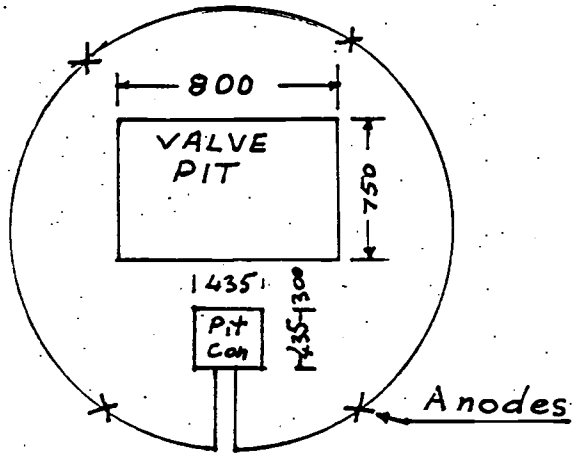
JOB DESCRIPTION:- MANSFIELD MACKENZIE TRUNK MAIN
27 JUNE 1995 (WITH Q.E.C)
UNIT READING:- 1.5V...750mA..

	READING	TEST POINT I.D.	LOCATION	SWING
ON OFF	-475 mV -481 mV	TOWER 231 275KV	MT GRAVATT CAPALABA RD (NEAR BULIMBA CK)	+6
ON OFF	-494 -499	"	"	+5
ON OFF	-466 -477	"	"	+11
ON OFF	-451 -456	"	"	+5
ON OFF	-450 -459	TOWER 1558 110KV	MT GRAVATT CAPALABA RD (NEAR BULIMBA CRK)	+9
ON OFF	-445 -449	"		+4
ON OFF	-465 -465	"		0
ON OFF	-462 -466	"		+4
ON OFF	-460 -460	TOWER 1801 110KV	MT GRAVATT CAPALABA RD (NEAR GATEWAY MOTORWAY)	NIL
ON OFF	-492 -492	"		NIL
ON OFF	-435 -435	"		NIL
ON OFF	-455 -455	"		NIL

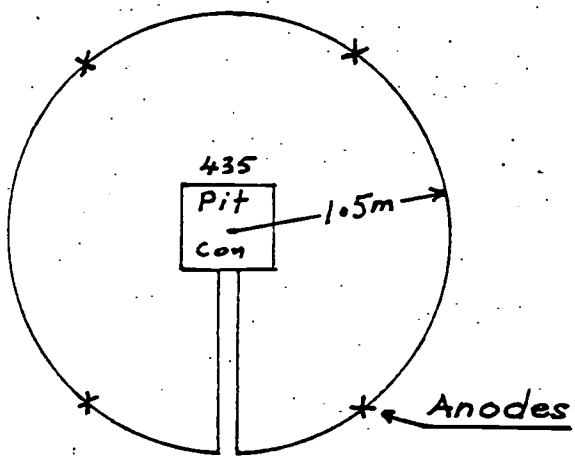
COMPILED BY: M. McCORMICK
Murray McCormick

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

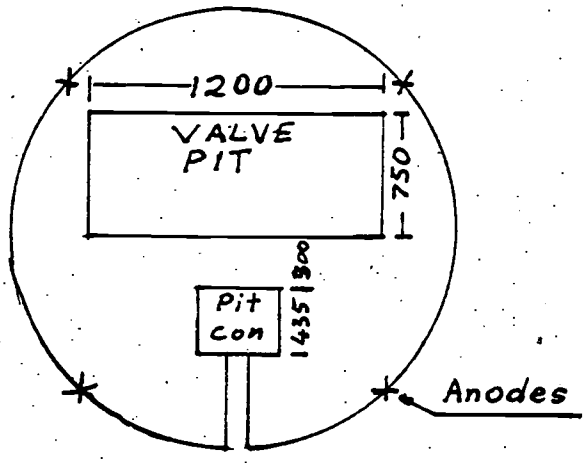
Date: 16 - 1 - 95
Site Plan for: Mansfield To Mackenzie Gradiant Rings
MT Gravatt Capalaba Rd. Refer 486/4/6 - W110191P



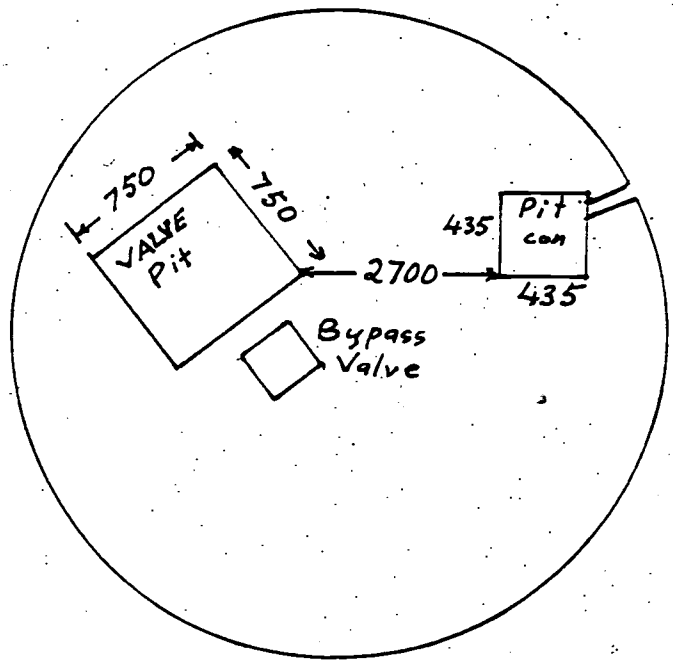
N° 1.



N° 2



N° 3

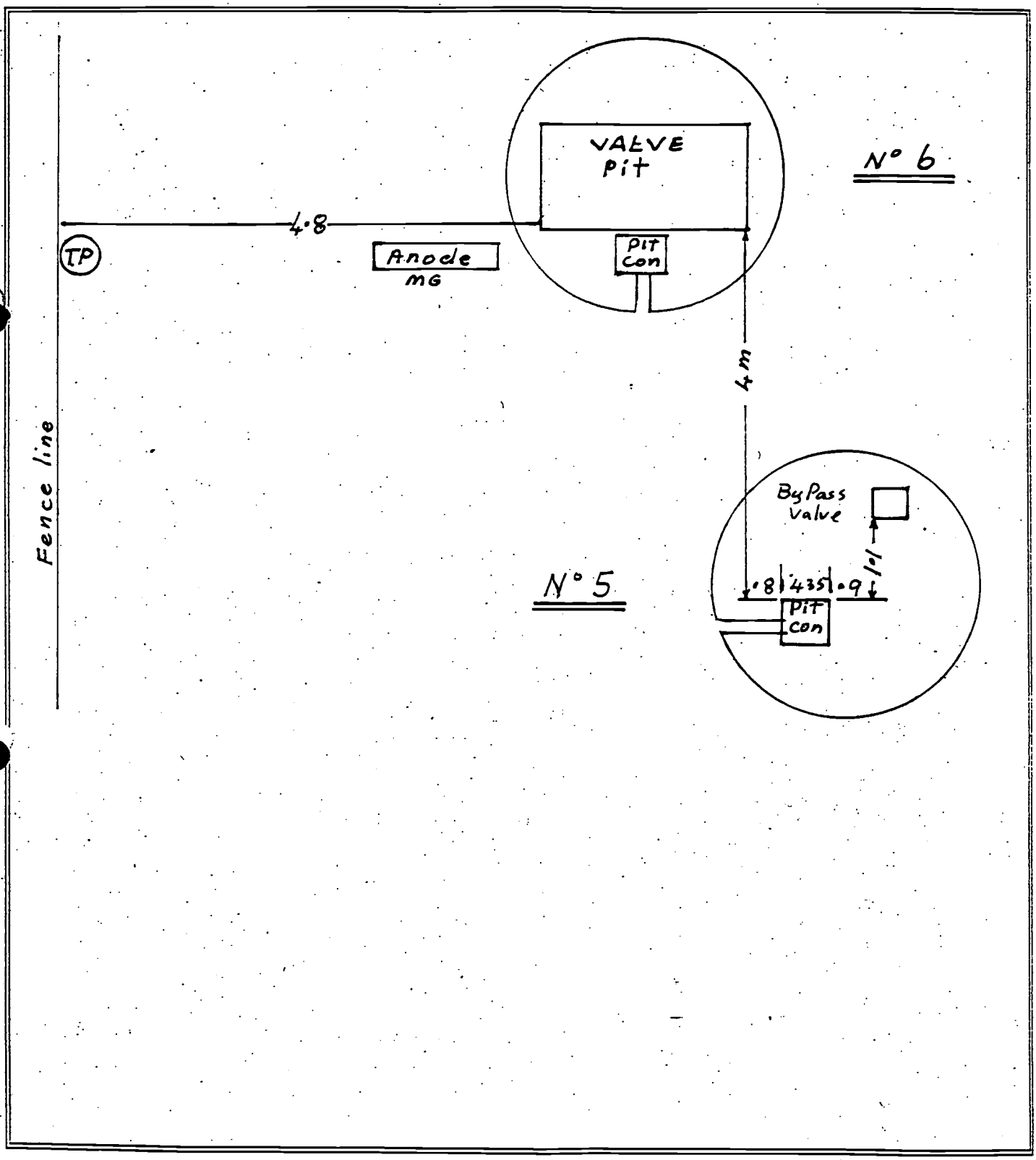


N° 4

D:\123r3cp\siteplan

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

Date: 16-1-95
Site Plan for: Mansfield to Mackenzie Gradiant Rings
MT Gravatt Capalaba Rd Refer 486/4/6-w 11019 P.



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Brisbane City Council
Department of Water Supply and Sewerage
Eagle Farm Pump Station
Electrical Workshop

13-Aug-94

Earth Resistivity Tests

Mansfield to Mackenzie 600 mm dia trunk mains induction study.

To: Jeff Say

From: Kerry Mc Govern

As per your memo dated 8-8-94 requesting soil resistivity tests at above location the following is results obtained using 4 pin method .

Meters used:	
20 and 16 M tests	DET2/2 auto earth tester
4 and 2 M tests	DET3/2 earth tester

Location 1 Cnr Newnham Rd and Broadwater Rd. refer diagram.

Pin spacings metres	Meter reading ohms	Resistivity ohm.metres
20.00	0.28	34.92
16.00	69.80	7013.50
4.00	4.30	108.02
2.00	11.34	142.43

Location 2 Cnr Ham Rd and Broadwater Rd. refer diagram.

Pin spacings metres	Meter reading ohms	Resistivity ohm.metres
20.00	167.00	20975.20
16.00	88.90	8932.67
4.00	0.55	13.82
2.00	1.50	18.84

Location 3a Mt Gravatt-Capalaba Rd near QEC EHV towers. refer diagram.

Pin spacings metres	Meter reading ohms	Resistivity ohm.metres
20.00	113.60	14268.16
16.00	290.00	29139.20
4.00	5.34	134.14
2.00	17.12	215.03

Location 3b Mt Gravatt-Capalaba Rd near QEC EHV towers. refer diagram.

Pin spacings metres	Meter reading ohms	Resistivity ohm.metres
20.00	153.40	19267.04
16.00	150.10	15082.05
4.00	0.97	24.37
2.00	3.11	39.06

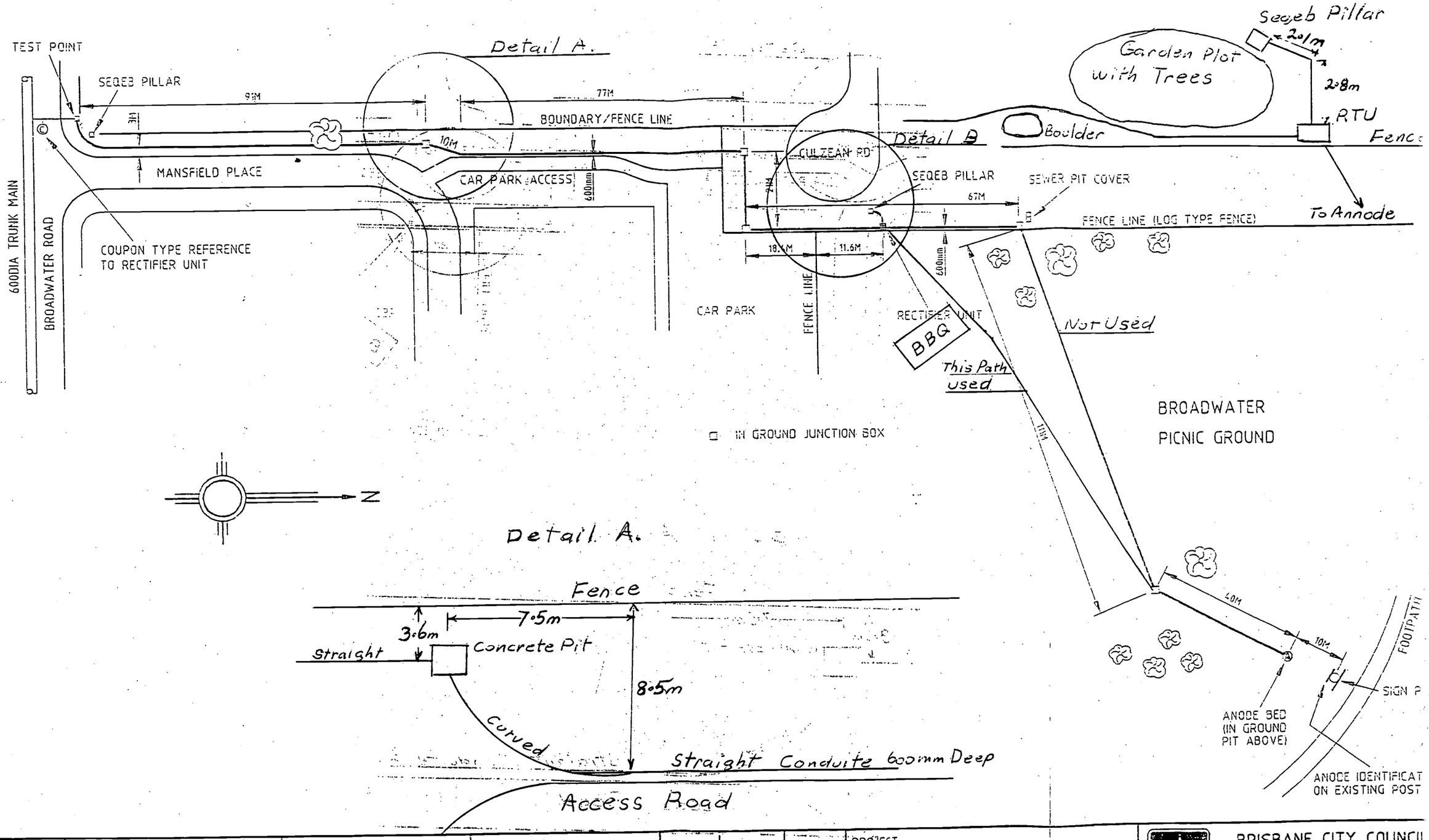
Location 4 Broadwater Rd Park anode site. refer diagram.

Pin spacings metres	Meter reading ohms	Resistivity ohm.metres
4.00	0.54	13.56
2.00	10.10	126.86

Location 5 Broadwater Rd Park anode site . refer diagram.

Pin spacings metres	Meter reading ohms	Resistivity ohm.metres
4.00	0.80	20.10
2.00	3.75	47.15

page 1



No	DATE	AMENDMENT	BY
0	19.10.94	ISSUED FOR CONSTRUCTION	R.L.

MANAGER	DIRECTOR OF PLANNING & DESIGN	
DATE:	DATE:	
DIRECTOR OF CONSTRUCTION	DIRECTOR OF M & E SERVICES	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION
DATE:	DATE:	DATE:

DESIGN	J.SAY	19.10.94
DRAWN	R.LISTON	19.10.94
CHECKED		27.10.94
ENGINEER IN CHARGE		
SUPERVISING ENGINEER		

PROJECT: MANSFIELD MACKENZIE TRUNK MAIN

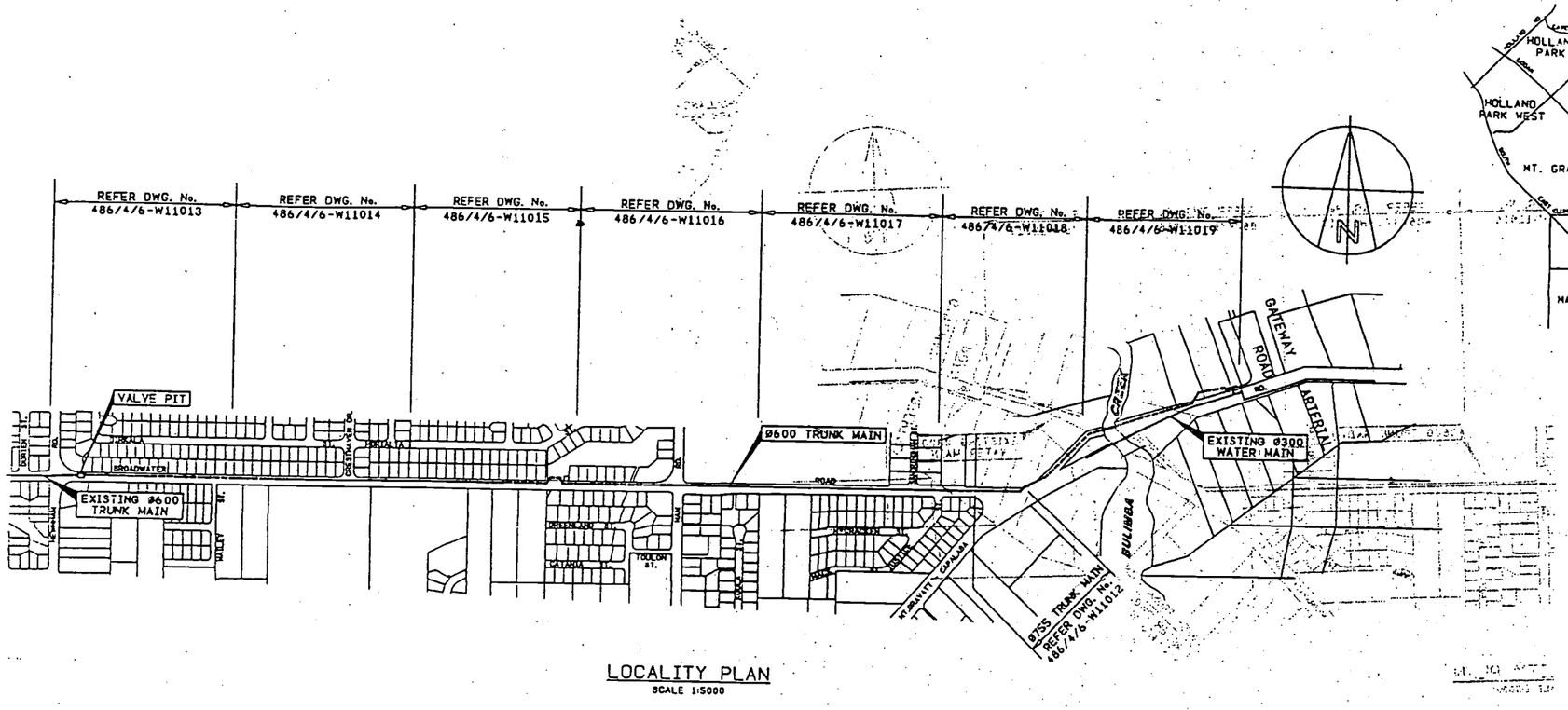
TITLE: BROADWATER ROAD PARK C.P. SYSTEM RECTIFIER & ANODE CONDUIT DETAILS

CADD FILE No. 66C026-

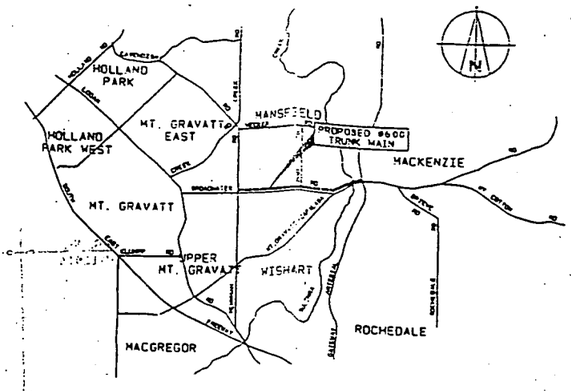
Brisbane City

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPL AND SEWERAGE
MECHANICAL & ELECTRICAL SERVIC

SCALE: NTS	No. 1 OF 1	SHEE
DRAWING No. 486/6/6-VH1C0026E		AME C



LOCALITY PLAN
SCALE 1:5000



SITE PLAN
SCALE 1:50000

DRAWING LIST

DRAWING NUMBER	DRAWING TITLE	PIPE CHAINAGE
486/4/6-W11011LO	LOCALITY PLAN	
486/4/6-W11012P	PLAN AND LONGITUDINAL SECTION	1832.083 - 1933.999
486/4/6-W11013P	PLAN AND LONGITUDINAL SECTION	000.000 - 350.782
486/4/6-W11014P	PLAN AND LONGITUDINAL SECTION	350.782 - 702.970
486/4/6-W11015P	PLAN AND LONGITUDINAL SECTION	702.970 - 1056.640
486/4/6-W11016P	PLAN AND LONGITUDINAL SECTION	1056.640 - 1410.477
486/4/6-W11017P	PLAN AND LONGITUDINAL SECTION	1410.477 - 1757.990
486/4/6-W11018P	PLAN AND LONGITUDINAL SECTION	1757.990 - 2087.394
486/4/6-W11019P	PLAN AND LONGITUDINAL SECTION	2087.394 - 2419.929
486/4/6-W11020GD	DETAILS	
486/4/6-W11021GD	PIPE LIST	
486/4/6-W11022GD	VALVE PIT DETAILS	

CONTROL POINTS DATA

FILENAME	POINT NO.	EASTING	NORTHING	SURFACE LEVEL	DESCRIPTION
R111	9901	2000.000	5000.000	40.671	SCREW IN CONC
"	9902	2067.621	5002.315	40.731	ALIGN. SPIKE
"	9903	2168.982	5002.091	36.092	ALIGN. SPIKE
"	9904	2299.559	5001.803	42.661	ALIGN. SPIKE
"	9905	2447.846	5001.475	46.996	ALIGN. SPIKE
"	9906	2586.819	5001.168	38.325	ALIGN. SPIKE
"	9907	2687.873	5000.945	30.816	ALIGN. SPIKE
"	9908	2787.058	5000.725	26.009	ALIGN. SPIKE
"	9909	2889.228	5000.499	23.057	ALIGN. SPIKE
"	9910	2997.371	5000.260	21.573	ALIGN. SPIKE
"	9911	3082.896	5000.071	21.176	ALIGN. SPIKE
"	9912	3194.589	4999.826	22.249	ALIGN. SPIKE
"	9913	3271.752	4999.653	23.362	ALIGN. SPIKE
"	9914	3236.952	5000.383	22.810	SCREW IN CONC
"	9915	3411.384	4999.561	25.753	ALIGN. SPIKE
"	9916	3512.429	4999.6757	23.697	ALIGN. SPIKE
"	9917	3611.066	4999.426	24.234	ALIGN. SPIKE
"	9918	3705.079	4999.368	28.715	ALIGN. SPIKE
"	9919	3791.331	4999.321	34.220	ALIGN. SPIKE
"	9920	3892.753	4995.683	34.806	SCREW IN CONC
"	9921	3976.523	5017.976	29.979	SCREW IN CONC
"	9922	4077.635	5098.550	18.575	PEG
"	9923	4111.008	5103.813	12.420	PEG
"	9924	4084.883	5144.138	16.412	ALIGN. SPIKE

50 0 50 100 150 200 250
SCALE OF METRES
1:5000

NOTES

NO.	DATE	AMENDMENT/ISSUE TO/ISSUE FOR	INITIALS

AMENDMENT & ISSUE REGISTER

MANAGER — DATE
DIRECTOR OF PLANNING & DESIGN — DATE
DIRECTOR OF CONSTRUCTION — DATE
DIRECTOR OF M&E SERVICES — DATE
DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION — DATE

DESIGN	K.C.L.	MAY'93	ENGINEER IN CHARGE
DRAWN	B.G.D.	APRIL'93	SUPERVISING ENGINEER
TRACED			LEVEL BOOK
CHK'D	K.S.L.	MAY'93	FIELD BOOK - 8155 - 1
A.M. DATUM			SURVEYED K.JOHNSON

REFERENCES
CADD FILE No. 46W11011
JOB FILE No.(2)705/S(205)

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
PLANNING & DESIGN BRANCH

PROJECT
MANSFIELD TO MACKENZIE TRUNK MAIN

TITLE
600 DIA. MSCL WATER MAIN LOCALITY PLAN

SCALE AS SHOWN — N° 1 OF 12 SHEETS
DRAWING N° 486/4/6-W11011LO — AMEND. 0