## Appendix A

.

Locality Map - Hillcrest Hospital





#### Appendix B

Site Plan, October 1994 Site Plan, 1988



LEGEND	
	DEMOLISHED BUILDING
	COVERED WALKWAY

#### KEY TO BUILDINGS

1	Ward 1		
2	Ward 2		
3	Ward 3		
4	Ward 4, Dibden Hou	se	
5	Ward 5, Robertson	House	
6	Ward 6, Anderson H	louse	
7	Ward 7, Repatriation	1	
8	Ward 8, Apps Hous	e	
9	Ward 9, Davenport	House	
0	Ward 10, Howard He	ouse	
11	Mortuary		
2	Boiler/Incinerator Ho	use	
3	Occupational Therap	y Building	
4	Garage/Garden Com	plex	
15	Canteen		
6	Salter Hall		
17	Administration		
8	Chapel		
9	Groundwater Pump		
0	Telecom Radio Tow	er	
21	Psychogeriatric War	d	
2	Mason House		
3	Litchfield House		
4	Industrial Inerapy (I	I) worksnop	
5	Linen Sorting		
0	Lamon Nach House		
	James Nash House		
FEN		CTION	
	PROPUSED TO DIVIDE SEC	LIUN	
100,	101, 102 AND 103		
C T	HOSDITAL	UP	
51	HUJEHAL	DRAWN	
_	NCTOBER 1994		
		DATE 22.9.94	

DRAWING No.

27F306A/01/0

100 NORTH TCE., ADELAIDE STH.AUST., ADELAIDE 5000 TELEPHONE (08) 2125733



## Appendix C

Aerial Photograph



#### Appendix D

Photographic Record of Site Inspection



Photo 1: "Square Acre" (looking west towards the chapel and Ward 4) is possibly landscaped with coke ash



Photo 1a: Lawns to the south of the Industrial Therapy (IT) Workshop are possibly landscaped with coke ash



Photo 2: The Central Boiler House. Lawns to the south of the Boiler House are possibly landscaped with coke ash



Photo 3: Western wall of Boiler House/Incinerator building. Shows concrete bunding around an old oil storage area. The incinerator may have been oil fired



Photo 5: Diesel bowser and underground fuel storage tank on the eastern side of the Garage/Garden complex



Photo 6: Old batteries and service oil stored outside against the western wall of the vehicle maintenance shed



Photo 7: Area previously occupied by old substation may have contained PCB's in the transformer oil



Photo 8: Lawn on the southern side of Hall. Old carpark, possibly bitumen, may be buried underneath



Photo 9: Possible location of white ant treatment at the northern edge of "Square Acre"



Photo 10: Site which was occupied by Ward 3. An old bitumen pathway remains, possibly contaminated with PAH's



Photo 11: Building rubble is understood to have been used as landfill in this area which lies to the north of Ward 3 (now demolished)



Photo 12: Looking west between Section 100 and the hospital paddock. Soil subsidence has occurred in this area due to the burial of building salvage over 10 years ago



Photo 13: Waste heap to the east of Section 100, near the hospital paddock. Contains large slabs of concrete and bitumen



Photo 14: The Mortuary, now a paint workshop is Heritage Listed



Photo 15: Stormwater drainage from behind Ward 6 on eastern side of property



Photo 16: Overhead diesel storage tank located on western side of section 855



I

I,

Photo 17: Local spillage onto bare earth from overhead storage tank, Section 855



Photo 18: Waste heap north of carpark on section 855



Photo 19: Old foundations of a small concrete building on western side of section 855



Photo 20: Redundant underground steam and condensate piping between Anderson House (Ward 5) and Howard House (Ward 10). Deteriorated outer pipe casings reveal possible asbestos insulation



Photo 21: Redundant steam and condensate piping at the south western corner of the industrial Therapy (IT) Workshop. Deteriorated outer pipe casings reveal possible asbestos insulation



Photo 22: Redundant steam and condensate piping at the southern side of the IT Workshop. Again, deteriorated outer pipe casings reveal possible asbestos insulation



Photo 23: Redundant steam and condensate piping between two expansion bends on the eastern side of the IT Workshop. Scattered debris from outer pipe casing may contain asbestos



Photo 24: Redundant steam and condensate piping between Linen Sorting Room and IT Workshop. Deteriorated outer pipe casings reveal possible asbestos insulation



I

I

Photo 25: Leaded and unleaded petrol bowsers located approximately 30m west from the mortuary.



Photo 26: Fill points for the unleaded petrol underground storage tank located west from the mortuary.

### Appendix E

Í

•

Former Certificates of Title



Anstralia Sursuant to Memorandum of Transfer A. 329 308. Johnna ロロメオ of Daisy Fills near Galbank iamo is the proprietor of an estate in fee simplesubject nevertheless to such incumbrances liens and interests as are notified by memorial underwritten or endors hereon SECTION of land situated in the Hundred of yatala Adelaide County of. 496 containing one hundred and thirty four acres and rood or Bi \_\_\_and bounded as appears in the plan in the margin hereof delineated in the public map of the said - Fundred . -deposited in the office of the Surveyor General. In witness whereof I have hereunto signed my name and affixed my seal this from June <u>\_18</u>QX Signed the day of 18 i in the presence of iRegistrar-General ongageho 329 309 7 williams to lames Harbey to arthur you a Cha Helcher Fer registration at 12. 30hon 497 Ъ. Э DISCHARGE OF THE COMMORTGAGE THEREON, PRODUCED FOR REGISTRATION THE ...... 9G 499 ..... DAY OF ..... 5 Ü PEP REG GENL . .. .. • • • • urauna - 500 Varah Nannah Aflians of YUL Widow Menry Williamic of and William to owen of frictande helining PROPRIETOR OF AN ESTATE IN FEE SIMPLE IN WITHIN AND AS THE EXEOUT THE-WILL DATED Kints dahd Unil 1910 will bod will Johner Wil 21- OF THE ABOVE 25 DA THE. NAMED ... WHO DIED ON THE 2 DAY OF 1916 AS APPEARS BY MOBATE DATED THE 19 DAY OF RELEWER 1946 SPRODUCED FOR RED TRATION THE 26. DAY OF May 2014 AT 21 TRATION THE 26. DAY OF May 2014 AT 21 WH JOSHER

, Ĉ≹jr 15544 5 1994 S 5-90 ----÷ . . a · Augusta registr d. 7 . · . . . 4 chal 1.1 3alas \$ Mailuit 0 .2. ---ano e · . 10 1 19 au //, emlan kindle K.M. A.C.a. Cancelled - the within land having reserted Sec. Sec. Se to the brown 4269 vide Lito 1962 ÷. •  $e_{\mu}$ 6. Nain Dep Reg Ben ۴., विके दुर्ग Ϊ. 2 . . · · · · · · · : 3 - <sup>-</sup> . . . . . <u>.</u> Physics and the second ..... 1 a har a co 1.53 *...* > 6.6.2.2 . . Ξ. 1 • 1 • . • • Ŀ. . . ۰. ۲ . 2.3 . 5 ÷ . • . ۱, · . ۰. - : C - -1444 . . ....: . . . . . . 2.5.2. - x - x the second second -----وللموقد المراجع المراجع والمراجع : .. -: ç. . . . . • 4 Ň 30 • • • · .\* · · · · · VE REPART a second and the second at the -÷. - . · A ..... ٠. a Part and and . . . 5 1.3 ii . -1.1. 1.1. · · · · · · · ·. • . · Lot of March 19 1.1 2 · • • • • and the second second × . 1 ---· · ۰۰. 。 如此 自己 的 一個 人 相關 - <u>199</u> 1 - 19<u>1</u>7 , , > > \_ . ÷., and the second 2 ..... ÷. .... Enderson and and and a · · · · · No alexander \_. . Strate - A star . Contraction of the second 5 £ 34 1.1 . . .... . • • . . ...... 1. A. A. ¥ 1. Alt ..... a start and a start and a start and a start a s 14 - E w11.4 ...... - 5

an the second 12

ې برشېږو و د د د د

Australia Surouant to Mormorandum of Transfer A: 329308. Thalliamo of Daisy Sills near Calband Innni is the proprietor of an estate in fee simple subject nevertheless to such incumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in Those Sections of land scheded in the Hundred of yatala bounty of -Idelaide Nod 497 containing one hundred and thirty four acres or the wallouts and 498 containing one hundred and thirty lour acres one rood and twenty six perches a thereabouts and bounded as appears in the plan in the margin hereof Subject nevertheless Right of Way and Easement granted by Memorandum of Transfer A: 323879 10 Commissioner of Walerworks and his successors and assignover porte on or the Hors marked " Easement" in the said blan which said Section Sare- delinested in the public map of the said Kindred deposited in the office of the Surveyor-General In witness whereof I have hereanto signed my name and affixed my seal this Than the <u>-30--</u>-Signed the day of 1898 in the presence of Un Registrar-General. lougage no 329309 Williams 10 James rvey ey and Cha arthur you 9 hro Elcicher Penn end for reg tration the sday c 1898 al 2. iou therproperty). eludin Cep Reg DISCHARGE OF THE MORTGAGE 39 30 9 BY RECEIPT ENDORSED Not THEREON, PRODUCED FOR REGISTRATION 496 DEP. REG. GENI in 10

unuant to Application Noyygor 15.9.1994 arah Hannah Williams chain, Hurri chure Williams. of Telaure .. and Mullique 16 Ewen Tot Idela Ъ, CCCF K and FEE SIMPLE IN THE WITHI LAND AS (day 0 with lideril thes & deted 1911 ril والمتركيت المتحار المراجر merch 913 JE VHEAROVE trong Williams NAMED ..... WHO DIED .....DAY --*q* - ADUALL SATED THE £Υ . ÷ : :. 2067 Martin Diraco FOR REGIS-÷., •••• • . . . . . . . : :, aus - . - - - - --Inde ell lla. The fighter inflating state and ile vanifalie .. 1. Mar. Son 32 ..... aus and a west 1 to real watas our in 1.4 • : " \. Statistics and states and states and State Strates 1.1.1 to conservable in Altrice "; 11. 1 Barrow - . 1 : ; . .... kh Q . Nonill f lannag • · . . l. morted 5 ТĿ, 42(9 A. 1. 1. 1  $\hat{a}$ Zyn Reg 1 9 m m Na 1 10 Si . . . . . . and the same second . . . . . 100 - نها پر مدین وا. ک : .:. ۰. · . 1 ..... -٠. 1999 - 1995 1995 - 1995 1995 - 1995 8° 15 6 ÷ 77 82.23 3.1 5 **t** , s 3 . 31 **动动行动将**国际 e, ź ÷. 7.1.22 •• ÷ ...  $\dot{a}_{\mu}$ . and the second S .... . . . .... Sec. 25 an a state and a state of a · . .... 1 - , 5 . . . - : 地名美国马尔 ٠, ٠ -E. CONSTRUCTION OF THE PARTY OF THE PARTY OF -4-----The second s (and the first 51.75 • 1  $\overline{\mathbb{C}}$ . . .... ٢. Ξ. .;

Surge and Station all and the second states

HP YATALA Sections 496. 497. 498 and part of 499 containing 497 and hansfired to this Majesty Hing George the Fifth 9.6. 1917 ride 6. S. O. 271/17 and 6. of Titles Tol 635 30. 7 & 8. Vol 611 30 54. abb 8/12/24 all to be dedicated for "Northfield Mental Hospital" J. G. M. 264/29 Resumption & Rededication Gaz. 12.963 Vide P.494/5 3040 :3039 313 Resubdivieled 34 ac Waterworks Easement Certificate of Title Vol 635 Folio 8 °2060 319 - Certificate of Titl Vol. 611 Folio 34 certificate of Title 50ac PT 499 Vol 635 Falio 7 318 503 495 500 +\*\*\* For Original Survey Vide page 9 VECC 21 Sections 496, 497, 498, and portions of section 499, 济 ET.S.A. Isolink eason containing 497. 1. 4 were transferred to the Crown, Vide UL 500 the date of registration of the transfer being 9th June 1917. The Titles are in the name of His Majesty King George the Fifth r that and it

# Appendix F

Borehole Logs

.

Į



SHEET No. 6628-





# HILLCREST HOSPITAL, MULTI-PURPOSE HALLBORE LOGSNote: In all six bores the

٠.

•	clay is highly leached-low salt content; conductivity 0.2-0.7 mho, typical values below 0.6 m being 0.2 - 0.3 mho
Bore 1 662	8 390 EN 1191 <u>3</u>
0 - 0.35 m 0.35 - 0.65m	FILL - imported_garden loam CLAY, red-brown; high plasticity, blocky structure
0.65-1.1 m	SILTY CLAY to CLAYEY SILT, pale brown, highly
1.1 - 1.7m	CLAY, brown, calcareous; small highly calcareous silt pockets decreasing with depth; high plasticity
1.7-2.5 m	sub-blocky to granular structure; wswp, friable (CH) CLAY, grey and brown mottled, calcareous; high plasticity, blocky structure; wswp, friable to 2.2 m;
2.5-3.5 m	CLAY, red-brown, slightly sandy; trace of yellow sandstone fragments at 2.9 m; wswn bard (CH)
3.5 - 4.3m	CLAYEY M-F SAND, red; moist, dense - probable decomposed sandstone (SC)
4.3 - (end)	SANDSTONE, too hard to per etrate.
Bore 2 6	628 390 EW 11714
0 - 0.25 m 0.25-0.5m	FILL - garden loan over old bitumen on crushed CLAY, red-brown; high plasticity, blocky structure; wswn friable (CH)
0.5 - 1.1 m	CLAY, pale brown, calcareous, with approx. 50% highly calcareous clayey silt in discrete seams and
1.1-2.9m	pockets; wswp, friable (CH & ML-CL) CLAY, light brown to 2.3 m and red-brown below 2.3m, with approx. 10% earthy lime in scattered pockets; high plasticity blocky structure: wswp friable (CH)
2.9-3.75m	SANDY CLAY stratified with CLAYEY M. SAND, red-brown, red and yellow mottled; medium plasticity;
3.75-4.5m (end)	Core lost
Bore 3	6628 340 EW 11715
0 -0.25 m 0.25-0.55 m	FILL - imported garden loam CLAY, red-brown; high plasticity, blocky structure; wswn_friable (CH)
0.55-2.2m	CLAY, pale-brown, highly calcareous, with approx. 20% pockets of earthy lime; high plasticity, structure
2.2-3.75m	SANDY CLAY to CLAYEY M. SAND, red-brown; root casts filled with f. sand; medium-high plasticity, blocky
3.75 m - (end)	Cemented sand, too hard to penetrate.

.:.

Bore 4 6628	390 EW 11716
0 - 0.15 m	FILL - garden loam over bitumen cap.
0.150.3 m	SILTY CLAY, brown; wswp, friable (CL-CH)
0.3-0.62 m	CLAY, red-brown; high plasticity, sub-blocky
	structure; wswp, friable; large tree roots (CH)
0.62-1.15m	CLAY, pale brown and brown mottled, highly cacareous
	approx. 50% pockets of earthy lime; wswp, friable
	(CH + ML-CL)
1.15-1.75m	CLAY, brown, slightly calcareous; approx. 10% pockets
	of earthy lime; high plasticity, granular structure;
·	wswp, friable (CH)
1.75-2.5m	CLAY, light brown calcareous; high plasticity,
	blocky structure; wswp, hard (CH)
2.5-2.8m	SANDY CLAY, red-brown; sandy high plasticity, blocky
· •	structure; wswp, hard (SC-CH)
2.8-3.5m	SANDY CLAY, yellow and red-brown mottled, high
(end)	plasticity, structure indistinct; wswp, hard(SC)

Bose No.1 contains Note: / the only trace of Keswick Chay in this group of bores. Have we found its boundary? Or is the other soil just an island patch?

HILLCREST HOSPITAL FOSTERS ROAD, GILLES PLAINS

10.00



6628 390 EW 11717

A - Series

SAMPLED 19th March 1981

LOCATION

Salter Hall S-E corner of main hall 600 mm from South wall 900 mm from stage

- 0 0150 Concrete slab
- 0150 0590 Compacted fill

0590 - 0750 Moist red brown city >PL

Dry, friable clayer marl, brown and pink. Becoming more clayer from 1300

at 4000 - becoming moister.

AT 4900

1500 - 3500

0750 - 1500

Stiff, red brown, highly structured clay > PL
with some pockets of marl. Becoming slightly moister with depth - fissures filled with darker clay and some pockets of sand and black silty specks at 0270.
Becoming sandier with depth - (the sand is orange) small pockets of grey sandy clay.

Orangish brown clayey sand with large pockets of orange sand. Some red and yellow staining

3500 - 4900

ENDED HOLE IN YELLOW AND FAWN SAND WITH RED STAINING

#### HILLCREST HOSPITAL FOSTERS ROAD, GILLES PLAINS



6628 390 EW 11718

#### A - Series

SAMPLED19th March 1981LOCATIONSalter HallSalter HallS-W corner of main hall

alter Hall S-W corner of main hall 600 mm from South wall & 600 mm from West wall

- 0 0150 0150 - 0590
- Concrete slab

1150 - 0590 Compacted fill

0590 - 0890 Red brown slightly moist clay=PL

0890 - 1450

1450 - 2700

Very dry, powdery pink marl - some nodules with pockets of stiff, very dry clay. Becoming clayier with depth.

Dry, reddish brown marly clay - friable with large pockets of highly structured clay.

2700 - 3150

Stiff, red brown, highly structured clay≯PL - some small pockets of marl still evident -Becoming slightly moister with depth. (unable to retrieve 3000 mm sample)

3150 - 4200

4 200 ; - 4900"

Becoming sandy with pockets of greyish green sandy clay, very highly structured, with some black mottling. - Colour change to red brown from 3400.

Pockets of fine fawn sand in brown, yellow and grey slightly clayey coarse sand.

ENDED HOLE IN SAME

受到的 建建物 化


HILLCREST HOSPITAL - ASSESSMENT AND PSYCHOGERIATRIC UNITS

#### 6628 390 EW 11709

West Hard I.

BORE LOGS

-				
1				
	BC	re	9 I	
1			<u> </u>	•
ľ				
	0	-	0.3	77

 $0.3 - 1.0 m^{-1}$ 

1.0 - 4.5 m

4.5 - 5.0 m

5.0 - 5.5 m

CLAY, brown and red; high plasticity, granular structure; W > Wp, friable (CH).

CLAYEY SILT to SILTY CLAY, pale brown, highly calcareous, gritty; W > Wp, loose and friable (ML - CL).

CLAY, grey brown and yellow mottled; high plasticity; blocky structure with slickensides;  $W \approx Wp$ , stiff to 1.5 m and hard below 1.5 m (CH).

SANDY CLAY, grey & red mottled, with thin seams of white fine sand; W > Wp, very stiff (CH - SC).

CLAY, grey, with small patches of red fine sand; W < < Wp, hard (CHO.

CLAYEY FINE SAND, grey yellow & red; dry, weakly ' cemented - v. weak (decomposed) SANDSTONE.

5.5 - 5.75 m (end)

Water not cut.

ine of the construction of the contraction of the state of the

HILLCREST HOSPITAL - ASSESSMENT & PSYCHOCERIATRIC UNITS

	BORE LOGS
Bore 5	
0 - 0.2 m	FILL - dk. brown clay and gravel.
0.2 - 0.5 m	CLAY, red-brown; high plasticity, granular structure; W > Wp, friable (CN).
0.5 - 1.2 m	CLAYEY SILT to SILTY CLAY, pale brown and white, highly calcareous; $W >> Wp$ , soft (ML - CL).
1.2 - 4.15 m	CLAY, grey brown & yellow mottled; off-white highly calcareous patches to 1.5 m; high plasticity, blocky structure with slickensides; $W \gtrsim Wp$ , hard (CH).
4.15 - 4.55 (end)	CLAYEY FINE SAND, grey yellow & red; dry weakly cemented - very weak SANDSTONE. Noderately weathered at 4.55 m - unable to sample.

1111

Ę

Water not cut.

.

.

HILLCREST HOSPITAL - ASSESSMENT & PSYCHOGERIATRIC UNITS

· BORE LOGS

### 6628 390 ww 11711

and services of the services o

-

Ì	Bore 7	
	0 - 0.5 m	SILTY CLAY, brown; $W \approx Np$ , friable (CL - CN).
	0.5 - 1.45 m	SILTY CLAY, pale brown & white, highly calcareous; W > Wp, firm (CL - CH).
· · ·	1.45 - 5.2 m	CLAY, grey & brown mottled; small sand pockets below 4.0 m; high plasticity, blocky structure with slickensides; W & Wp, very stiff to hard (CH).
1 1 1 1	5.2 — 5.7 m (end)	CLAYEY FINE SAND, grey yellow & red; dry, weakly cemented with strongly cemented seams - very weak SANDSTONE with moderately weathered seams.
	Water not cut.	•
	· · ·	
• · · · • • •		
•		
e 		
•	•	
; .		
•		
		· · · · ·

SA SECON

•

and the second second

HILLCREST HOSPITAL - ASSESSMENT & PSYCHOGERIATRIC UNITS

#### BORE LOGS

6628 390 EW 11712

The second s

0 - 0.4 m SILTY CLAY, brown; W < Wp, friable (CL - CH).
0.4 - 1.2 m (approx.) SILTY CLAY, pale brown & white, highly calcareous;
W Wp, friable; very weak crust at 0.65 m (CL - CH).
Merges with the next layer.</pre>

The second and the second s

.

1.2 - 5.6 m CLAY, grey & brown mottled, with highly calcareous pacelles to 2.8 m; high plasticity, blocky structure, W < Wp, very stiff to hard (CH).

SANDY CLAY, yellow brown & red mottled; W << Wp, hard (CH - SC).

CLAYEY FINE SAND, grey brown & red; dry, very weakly cemented - very weak (decomposed) SANDSTONE.

5.C - 6.1 m

Bore 9

6.1 - 6.3 m (end)

Water not cut.

	662839 EW11583
KOLE No. 3-53       SILLES PLAINS       HILLCREST -05017A, SOUTHERST O         DALICED $\chi_1/\chi_{83}$ $\zeta$ $\zeta$ $\zeta_1$ $\zeta_2$ $\zeta_3$ $\zeta_4$ $\zeta_2$ $\zeta_4$ $\zeta_6$ $\zeta_6$ $\zeta_4$ $\zeta_6$	MURE CONTENT & LICHT-TURERX TTION LINIT O R.H. (PF *.3) A VERTICAL * A HORIZON: AL * A HORIZON: A HORIZON: AL * A HORIZON: A HORIZON: A
$\begin{array}{c} 0.2 \\ \hline 0.4 \\ \hline$	$\frac{1}{100} = \frac{1}{100} = \frac{1}$
Remarks 1 Flat level e. le, dritting transacted	high the second se
۲۵ <u>۵۵ کار کار کار محمد میں محمد میں محمد میں محمد میں محمد میں معمد میں محمد میں محمد میں محمد میں محمد میں محمد م</u>	a gan an a

:

-

,

. ?

### Appendix G

Site Plans Showing Potentially Contaminated Areas and Other Potential Liabilities









#### KEY TO BUILDINGS

1 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 21 3 4 5 16 7 8 2 2 3 4 5 2 3 4 5 2 3 4 5 6 7 8 9 10 11 21 21 21 21 21 21 21 21 21 21 21 21	Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport House Ward 10, Howard House Ward 10, Howard House Mortuary Boiler/Incinerator House Occupational Therapy Building Garage/Garden Complex Canteen Salter Hall Administration Chapel Psychogeriatric Ward Mason House Litchfield House Industrial Therapy (IT) Workshop Linen Sorting Barnett House
26	Barnett House
>	0 10 50 90m

ST HOSPITAL	CHECKED UP
EAS CONTAMINATED	JD
COKE ASH	DATE 28.9.94
	DRAWING No.
100 NORTH TCE., ADELAIDE STH.AUST., ADELAIDE 5000 TELEPHONE (08) 2125733	27F306A/02/0



REVISIONS

<u>ID</u>	
	THIS INCLUDES AREAS IN WHICH BUILDING RUBBLE HAS BEEN USED AS LANDFILL OR OR WHERE BUILDING FOUNDATIONS HAVE NOT BEEN PROPERLY CLEARED AFTER DEMOLITION.
	DEMOLISHED BUILDING
=	COVERED WALKWAY
$\rightarrow$	PHOTOGRAPH LOCATION & NUMBER
KEY	Y TO BUILDINGS
<u>KE</u> 1	<u>Y TO BUILDINGS</u> Ward 1
<u>KE</u> 1 2	<u>Y TO BUILDINGS</u> Ward 1 Ward 2
<u>KE</u> 1 2 3	Y TO BUILDINGS Ward 1 Ward 2 Ward 3
1 2 3 4	<u>Y TO BUILDINGS</u> Ward 1 Ward 2 Ward 3 Ward 4, Dibden House
1 2 3 4 5	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House
1 2 3 4 5 6	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 6, Anderson House
1 2 3 4 5 6 7	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 6, Anderson House Ward 7, Repatriation
1 2 3 4 5 6 7 8	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 6, Anderson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House
1 2 3 4 5 6 7 8 9	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 6, Anderson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport House
1 2 3 4 5 6 7 8 9 10	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 5, Robertson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport House Ward 10, Howard House
1 2 3 4 5 6 7 8 9 10	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 6, Anderson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport House Ward 9, Davenport House Ward 10, Howard House Mortuary
KEY 1 2 3 4 5 6 7 8 9 10 11 12	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 5, Robertson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport House Ward 10, Howard House Mortuary Boiler/Incinerator House
KEY 1 2 3 4 5 6 7 8 9 10 11 12 13	Y TO BUILDINGS Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 6, Anderson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport House Ward 9, Davenport House Ward 10, Howard House Mortuary Boiler/Incinerator House Occupational Therapy Building Garage/Garden Complex

- Canteen
- Salter Hall
- Administration
- Chapel
- Psychogeriatric Ward
- Mason House
- Litchfield House
- Industrial Therapy (IT) Workshop
- Linen Sorting
- **Barnett House**
- James Nash House

SCALE 1:2500

ST HOSPITAL	CHECKED UP
SUSPECTED BURIAL	JD JD
LDING RUBBLE	DATE 28.9.94
	DRAWING No.
100 NORTH TCE., ADELAIDE STH.AUST., ADELAIDE 5000 TELEPHONE (08) 2125733	27F306A/03/0



	POSSIBLE LOCATION OF ASBESTOS CLAD PIPING. (STEAM & CONDENSATE PIPES RUN PARALLEL)
	EXPANSION BEND
] ]	DEMOLISHED BUILDING
_	COVERED WALKWAY
Z	PHOTGRAPH LOCATION AND NUMBER

#### KEY TO BUILDINGS

12345678901123456781223456	Ward 1 Ward 2 Ward 3 Ward 4, Dibden House Ward 5, Robertson House Ward 5, Robertson House Ward 6, Anderson House Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport House Ward 9, Davenport House Ward 10, Howard House Mortuary Boiler/Incinerator House Occupational Therapy Building Garage/Garden Complex Canteen Salter Hall Administration Chapel Psychogerlatric Ward Mason House Litchfield House Industrial Therapy (IT) Workshop Linen Sorting Barnett House		
	0,10	50 90m SCALE 1:2000	
ST DER W CO	HOSPITAL GROUND PIPEWORK ITH MATERIAL NTAIN ASBESTOS	CHECKED UP DRAWN FG DATE 28.9.94 DRAWING No. 27F306A/04/0	



1	Ward 1				
2	Ward 2				
3	Ward 3				
4	Ward 4, Dibden House				
5	Ward 5, Robertson House				
6	Ward 6, Anderson House				
7	Ward 7, Repatriation	1			
8	Ward 8, Apps Hous	е			
9	Ward 9, Davenport	House			
10	Ward 10, Howard He	ouse			
11	Mortuary				
12	Boiler/Incinerator Ho	use			
13	Occupational Therap	y Building			
14	Garage/Garden Com	plex			
15	Canteen				
16	Salter Hall				
17	Administration				
18					
19	Groundwater Pump				
:0	Telecom Radio Tower				
21	Psychogeriatric Ward				
22	Mason House				
2.3	Litchfield House Industrial Therapy (IT) Workshop				
14 05	Industrial Therapy (IT) Workshop				
10	Linen Sorting Barnett House				
	Barnett House James Nash House				
_ /	/ Jaines Nash House				
nent may have occurred on any structure containing & possibly on dead trees. PROPOSED TO DIVIDE SECTION					
S 100, 101, 102 AND 103					
TENT					
LANEUUS SUUKLES 22.9.94					
	DRAWING No.				
ہے ہ	100 NORTH TCE., ADELAIDE	127520/ A /AE /A			



I

DEMOLISHED BUILDING

#### COVERED WALKWAY

	1949 - 1959		1949 - 1970
***	1949 - 1965		1959 - 1970
	1959 - 1965	14	1949 - 1985

#### KEY TO BUILDINGS

1	Ward 1
2	Ward 2
3	Ward 3
4	Ward 4, Dibden House
5	Ward 5, Robertson House
6	Ward 6, Anderson House
7	Ward 7, Repatriation
8	Ward 8, Apps House
9	Ward 9, Davenport House
0	Ward 10, Howard House
11	Mortuary
12	Boiler/Incinerator House
13	Occupational Therapy Building
4	Garage/Garden Complex
15	Canteen
16	Salter Hall
17	Administration
18	Chapel
19	Groundwater Pump
20	Telecom Radio Tower
21	Psychogeriatric Ward
22	Mason House
23	Litchfield House
24	Industrial Therapy (IT) Workshop
25	Linen Sorting
26	Barnett House
27	James Nash House

Orchards and market gardens may have existed on this site prior to 1949, however this can not be verified since aerial photography is unavailable.

ST HOSPITAL	CHECKED UP
IFRLY OCCUPIED BY	JD JD
RDENS OR ORCHARDS	DATE 22.9.94
100 NORTH TCE., ADELAIDE STH.AUST., ADELAIDE 5000 TELEPHONE (08) 2125733	27F306A/06/0



### LEGEND

	DEMOLISHED BUILDING
$\bigotimes$	SITE OF LANDSCAPING OR BURIAL WITH UNKNOWN SOURCES OF FILL
	COVERED WALKWAY

#### KEY TO BUILDINGS

100 NORTH TCE., ADELAIDE STH.AUST., ADELAIDE S000 TELEPHONE (08) 2125733 

RAWING No.

27F306A/07/0



1	Ward 1
2	Ward 2
3	Ward 3
4	Ward 4, Dibden House
5	Ward 5, Robertson House
6	Ward 6, Anderson House
7	Ward 7, Repatriation
8	Ward 8, Apps House
9	Ward 9, Davenport House
0	Ward 10, Howard House
11	Mortuary
2	Boiler/Incinerator House
3	Occupational Therapy Building
4	Garage/Garden Complex
5	Canteen
6	Salter Hall
7	Administration
8	Chapel
9	Groundwater Pump
21	Psychogeriatric Ward
2	Mason House
3	Litchfield House
4	Industrial Therapy (IT) Workshop
5	Linen Sorting
6	Barnett House
7	James Nash House

### Appendix H

Site Plans Showing Sampling Locations



ĺ

ļ

ľ

Ì

LEGEND	
	DEMOLISHED BUILDING
<b>:</b>	COVERED WALKWAY

### KEY TO BUILDINGS

1 Ward 1	
2 Ward 2	
3 Ward 3	
4 Ward 4, Dibden Hou	se
5 Ward 5, Robertson	House
6 Ward 6, Anderson H	louse
7 Ward 7, Repatriation	1
8 Ward 8, Apps House	e
9 Ward 9, Davenport	House
IO Ward 10, Howard He	ouse
11 Mortuary	
12 Boiler/Incinerator Ho	use
I3 Occupational Therap	y Building
I4 Garage/Garden Com	plex
15 Canteen	
16 Salter Hall	
17 Administration	
18 Chapel	
19 Groundwater Pump	
O Telecom Radio Tow	er
21 Psychogeriatric War	a
2 Mason House	
23 Litchfield House	
4 Industrial Inerapy (I	I) worksnop
25 Linen Sorting	
D Barnett House	
James Nash House	
NATES SAMPLE LACATION	
EEN PROPOSED TO DIVIDE SEC	LIIUN
100, 101, 102 AND 103	
	UP
SI NUSPITAL	DRAWN
	۵۲
ULATION SHE PLAN	DATE 22 9 9/
	UKAWINU NO.

100 NORTH TCE., ADELAIDE STH.AUST., ADELAIDE 5000 TELEPHONE (08) 2125733

27F306A/09/0



501

HILER'S VINCE IN A



.<u>..</u>

7

S.

**D**NA



<u>N</u>

4

S

NMA .

Š



### Appendix I

Field Work and Sample Details

### Field Work and Sample Details

#### I1. Field Work Notes

Sampling Date:	28 October, 1994
Samplers:	Uma Preston (Chemical Engineer)
	Brenton Harris (Geotechnical Engineer)
Drilling Contractor:	K&W Drilling

#### I2. Sample Details

Sample No	Location No	Sample Depth (metres)	Soil Comments	Selected for Analysis
1	1B	0.2-0.35	FILL. Some flecks of ash	Analysis
2	2B	0.3-0.43	FILL. Some flecks of ash	Analysis
3	3B	0.25-0.40	FILL. Some flecks of ash.	Analysis
4a	4B	0.30-0.45	FILL. Some fine gravel	Analysis
5b	5B	0.33-0.50	FILL. Some bitumen fragments and ash	Analysis
6	6B	0.3-0.45	FILL. Some flecks of ash	Analysis
7a	7B	0.17-0.40	FILL. Bitumen fragments and some ash	Analysis
7b	7B	0.40-0.70	SILTY CLAY.	Analysis
8	8B	0.20-0.50	FILL. Some ash fragments	Analysis
9a	9B	0.40-0.75	FILL. Some bitumen and some ash	Analysis
9b	9B	0.75-0.95	FILL. Flecks of ash	Analysis
10	10D	0-0.15		Analysis
11	11D	0-0.15		Analysis
12	12D	0-0.15		Analysis
13	13D	0-0.15		Analysis
14	Composite of	0-0.15		Analysis
	Samples 12 and 13			
15	Composite of	0-0.15		Analysis
	Samples 10 and 11			
16	Composite of	N/A		Analysis
	Samples 1 and 6			·

Notes:

• Suffix "B" after location number implies that borehole cores were recovered using truck mounted hydraulic push tube equipment.

• Suffix "D" after location number implies that sampling was carried out by hand with dig stick and hammer.

## Appendix J

Borehole Logs and Explanatory Notes

# RUST PPK

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

TESTING

MATERIALS

Client: Projec	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex							Job No. Date Tested by Checked by		58A 0/94 BJH TWL	
Drilling	g Method: H	ydraulic Push Tube	& Hydraulic Hammer				Bore	Locat	ion:		
Groun	Groundwater Struck: Nil Groundwater Stands:=							1			
Depth (m)		Soil Description Sombol Content								Depth (m)	
0.0- 0.05	Bitumen.										
0.05- 0.2	FILL. San coarse sand	dy silty gravel, pale gr I, gravel to 20 mm.	eyish yellow, fine to			н	NP/ T				
0.2- 0.3	FILL. San fine to mee	dy silty clay, grey brow dium sand, some flecks	wn, greyish orange brov ; of ash.	vn,		<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L				
0.3- 0.4	Silty CLA	Y. Orange brown, som	ne fine sand.		CL∕ CH	<pl< td=""><td>м/н</td><td>Fb</td><td></td><td></td></pl<>	м/н	Fb			
0.4- 1.0	Clayey gra fine sand,	velly SILT. Creamy b calcrete fragments to 1.	rown over off-white, so 5 mm, highly calcareou	me s.	ML	н	VL				
1.0- 1.55	Silty CLA calcareous.	Silty CLAY. Off-white and brown, some fine sand, highly calcareous. CL <pl Over CL/ CH</pl 						Fb/ Н			
1.55- 2.4	Silty CLA sand.	Silty CLAY. Brown, some grey green mottling, some fine $CH \leq PL$ sand.							500+		
	END OF BOREHOLE 2.4 m										
0-12											
Moistu D = D H = H Da = D M = M W = W PL = P LL = L PI = P	re Content ry umid amp loist /et lastic Limit iquid Limit lastic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	$\begin{array}{l} \textbf{Consistency} \\ \textbf{VS} = \textbf{Very Soft} \\ \textbf{S} = \textbf{Soft} \\ \textbf{F} = \textbf{Firm} \\ \textbf{St} = \textbf{Stiff} \\ \textbf{VSt} = \textbf{Very Stiff} \\ \textbf{H} = \textbf{Hard} \\ \textbf{Fb} = \textbf{Friable} \end{array}$	Plan/Rema	rks				<u> </u>		

#### N.A.T.A. RE GISTERED

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

MATERIALS TESTENG

Client: Project	Department of Environment & Natural Resources Hillcrest Hospital Complex								27F358A 28/10/94 BJH y PTWL			
Drilling	Drilling Method: Hydraulic Push Tube & Hydraulic Hammer								Bore Location:			
Ground	Groundwater Struck: Nil Groundwater Stands:-									2		
Depth (m)		Soil Description						Consistency	Pocket Pene - trometer (kPa)	Depth (m)		
0.0- 0.05	Bitumen.											
0.05- 0.3	FILL. San coarse sand	ndy silty gravel, pale gr d, gravel to 20 mm.	eyish yellow, fine to			н	NP/ T			:		
0.3- 0.45	FILL. Sar some fleck	ndy silty clay, grey brow rs of ash.	wn, fine to medium san	d,		<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L					
0.45- 0.55	Silty CLA	Y. Orange brown, som	e fine sand.		CL/ CH	<pl< td=""><td>м/н</td><td>Fb</td><td></td><td></td></pl<>	м/н	Fb				
0.5 <i>5-</i> 0.9	Silty CLA highly calc	Y/Clayey SILT. Crean careous.	ny brown, some fine sa	nd,	CL/ ML	<pl <br="">H</pl>	L/ VL					
0.9- 1.1	Silty CLAY. Brown, creamy brown, some fine sand, highly calcareous.					<pl< td=""><td>M/H</td><td>H/ Fb</td><td></td><td></td></pl<>	M/H	H/ Fb				
	END OF BOREHOLE 1.1 m											
	re Content y umid amp oist et astic Limit quid Limit astic Index	Plasticity $NP =$ $NP =$ $T =$ $T =$ $T =$ $VL =$ $Very Low$ $L =$ $L =$ $L =$ $M =$	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks							

#### . ( N.A.T.A.

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

RE GISTERED MATERIALS TESTING

LABORATORY

Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex								Job No. 27F358/ Date 28/10/9 Tested by BJ Checked by PTW			
Drilling Ground	Drilling Method: Auger, Hydraulic Push Tube & Hydraulic HammerBore LocGroundwater Struck: NilGroundwater Stands:-								ation: 3		
Depth (m)		Soil Description Moisture Content								Depth (m)	
0.0- 0.05	Bitumen.										
0.05- 0.25	FILL. San coarse sand	idy silty gravel, pale gr å, gravel to 20 mm.	eyish yellow, fine to			н	NP/ T				
0.25- 0.4	FILL. Silt of ash.	y sandy clay, brown, f	ine sand, some flecks			<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L				
0.4- 0.6	Silty CLA	Y. Orange brown, som	ne fine sand.		СН	<pl< td=""><td>н</td><td>Fb</td><td></td><td></td></pl<>	н	Fb			
0.6- 0.95	Silty CLAY/Clayey SILT. Creamy brown, some fine sand, highly calcareous.					<pl <br="">H</pl>	L/ VL				
0.95- 1.1	Silty CLAY. Creamy brown, some fine sand, highly calcareous.						L/M	Fb			
	END OF BOREHOLE 1.1 m										
21-02											
5 Moistu D = Di H = H Da = Di M = M W = W PL = PI LL = Li PI = PI	re Content ry umid amp oist et astic Limit quid Limit astic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	$\begin{array}{l} \textbf{Consistency} \\ \textbf{VS} = \textbf{Very Soft} \\ \textbf{S} = \textbf{Soft} \\ \textbf{F} = \textbf{Firm} \\ \textbf{St} = \textbf{Stiff} \\ \textbf{VSt} = \textbf{Very Stiff} \\ \textbf{H} = \textbf{Hard} \\ \textbf{Fb} = \textbf{Friable} \end{array}$	Plan/Rema	rks						

#### $\Gamma$ N . A . T . A . REGISTERED

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

TESTING MATERIALS LABORATORY

## **Borehole Log**

Client: Project	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex							Job No. 27F358A Date 28/10/94 Tested by BJH Checked by PTWL			
Drilling	Method: H	ydraulic Push Tube &	& Hydraulic Hammer				Bore Location:				
Ground	lwater Struc	k: Nil Gro	undwater Stands:-						4	۱ 	
Depth (m)		Soil Description Symbol Moisture						Consistency	Pocket Pene - trometer (kPa)	Depth (m)	
0.0- 0.2	FILL. Silty slightly mic	FILL. Silty sand, grey brown, fine to medium grained, slightly micaceous, some fine roots.									
0.2- 0.35	FILL. Silty calcareous,	FILL. Silty clay, grey brown, some fine sand, slightly calcareous, pockets of sand, some bitumen.									
0.35- 0.45	FILL. Sandy silty clay, greyish yellow brown, fine to coarse sand, some fine gravel.						L				
0.45- 0.55	FILL. Silty sandy clay, brown, fine sand, some flecks of ash.					<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L				
0.5 <i>5-</i> 0.7	Silty CLA	Silty CLAY. Brown, orange brown, some fine sand.					н	Fb			
0.7- 0.95	Silty CLA fine sand, I	Silty CLAY/Clayey SILT. Creamy, creamy brown, some fine sand, highly calcareous.					L/ VL				
0.95- 1.1	Silty CLA calcareous.	Y. Creamy brown, som	ne fine sand, highly		CL	<pl< td=""><td>Ļм</td><td>Fb</td><td></td><td></td></pl<>	Ļм	Fb			
	END OF BOREHOLE 1.1 m										
Moistur D = Dr H = HL Da = Da M = Mc W = Wc PL = Pla LL = Lic Pl = Pla	Moisture ContentPlasticityD = DryNP = Non-plasticH = HumidT = TraceDa = DampVL = Very LowM = MoistL = LowW = WetM = MediumPL = Plastic LimitH = HighLL = Liquid LimitVH = Very High		Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks						

#### T P RLK N.A.T.A. REGISTERED

100 North Terrace, Adelaide S.A. 5000 Focsimile (08) 212 4686 Telephone (08) 212 5733

TESTING MATERIALS LABORATORY

	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex							Job No. 27F358A Date 28/10/94 Tested by BJH Checked by PTWL			
	Drilling	Method: H	ydraulic Push Tube d	k Hydraulic Hammer				Bore	Locat	ion:	
	Ground	water Struc	k: Nil Gro	undwater Stands:-						:	5
	Depth (m)		. Soil Description					Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.2	FILL. Silty some grave		Н	VL						
	0.2- 0.5	FILL. Clay some fine to to 40 mm,	FILL. Clayey silty gravel, mottled grey brown and black, some fine to medium sand, gravel and bitumen fragments to 40 mm, some ash, some roots.					VL			
	0.5- 0.7	FILL. Silty sandy clay, grey brown, fine sand, some flecks of ash.					<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L			
	0.7- 0.9	Silty sandy CLAY. Grey brown, fine sand.					<pl< td=""><td><b>Ļ</b>М</td><td>Fb</td><td></td><td></td></pl<>	<b>Ļ</b> М	Fb		
	0.9- 1.1	Silty CLA	Silty CLAY. Orange brown, some fine sand.				<pl< td=""><td>н</td><td>H/ Fb</td><td></td><td></td></pl<>	н	H/ Fb		
		END OF E	OREHOLE 1.1 m								
3EO-12											
	Moisture           D         =         Dry           H         =         Hur           Da         =         Dar           M         =         Mo           W         =         We           PL         =         Plar           LL         =         Liqu           PI         =         Plar	e Content mid mp ist t stic Limit uid Limit stic Index	Plasticity $NP = Non-plastic$ $T = Trace$ $VL = Very Low$ $L = Low$ $M = Medium$ $H = High$ $VH = Very High$ $EH = Extra High$	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks	L			LI	

#### R 5 N.A.T.A. REGISTERED

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

TESTING MATERIALS LABORATORY

Client: Project	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex								Job No. 27F358A Date 28/10/94 Tested by BJH Checked by PTWL			
Drilling	Method: H	lydraulic Push Tube	& Hydraulic Hammer				Bore Location:					
Ground								r	, 	, 		
Depth (m)		Soil Description					Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)		
0.0- 0.05	FILL. Silt some fine	FILL. Silty sand, grey brown, fine to medium grained, some fine roots.								1		
0.05- 0.3	FILL. San fine to coa 30 mm.		н	Т								
0.3- 0.45	FILL. Silty sandy clay, greyish orange brown, fine sand, some fine roots, some flecks of ash.					<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L					
0.45- 0.75	Silty CLAY. Greyish orange brown, some fine sand.					<pl< td=""><td>M/H over H</td><td>Fb</td><td></td><td></td></pl<>	M/H over H	Fb				
0.75- 1.0	Clayey gra calcrete fra	Clayey gravelly SILT. Creamy brown, some fine sand, calcrete fragments to 20 mm, highly calcareous.					VL					
1.0- 1.1	Silty CLA calcareous.	Y. Creamy brown, son	ne fine sand, highly		CL	<pl< td=""><td>м</td><td>Fb</td><td></td><td></td></pl<>	м	Fb				
	END OF BOREHOLE 1.1 m											
Moistur D = Dry H = Hu Da = Da M = Mc W = We PL = Pla LL = Lio PI = Pta	re Content y imid mp oist et istic Limit juid Limit istic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks							

### N.A.T.A.

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686

R E G I S T E R E D M A T E R I A L S TESTING LABORATORY

### Telephone (08) 212 5733

## **Borehole Log**

Client: Project	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex							Job No. 27F358A Date 28/10/94 Tested by BJH Checked by PTWL			
Drilling Ground	Method: H water Struc	lydraulic Push Tube o k: Nil Gro	& Hydraulic Hammer bundwater Stands:-				Bore	Loc <b>a</b> t	ion: ,	7	
Depth (m)		Soil Description					Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)	
0.0- 0.05	FILL. Silt fine roots.	FILL. Silty sand, grey brown, fine to medium sand, some fine roots.									
0.05- 0.3	FILL. Silt gravel/bitu roots.	FILL. Silty sandy clay, grey brown, fine sand, some gravel/bitumen fragments to 40 mm, some ash, some fine roots.					ĻМ				
0.3- 0.45	Silty CLAY. Orange brown, some fine sand, some fine roots.					<pl< td=""><td>Н</td><td>Fb</td><td></td><td></td></pl<>	Н	Fb			
0.45- 1.1	Silty CLA calcrete fra	Silty CLAY. Creamy brown, some fine sand, some fine CL calcrete fragments, highly calcareous.									
	END OF E	SOREHOLE 1.1 m									
	e Content mid mp ist stic Limit stic Limit stic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rem <b>a</b>	rks						

# RUST PPK

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

.T.A. REGISTERED MATERIALS

TESTING LABORATORY

### Borehole Log

Client: Project	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex							Job No. 27F358 Date 28/10/9 Tested by BJ Checked by PTW		
Drilling	Method: H	lydraulic Push Tube	& Hydraulic Hammer				Bore	Locat	ion:	و
Ground			r · · ·	r		r	, 			
Depth (m)		Soil Description						Consistency	Pocket Pene - trometer (kPa)	Depth (m)
0.0- 0.2	FILL. Silty clay, grey brown over greyish orange brown, some fine sand, fine roots.						M/H over H			
0.2- 0.55	FILL. Silt ash fragme	FILL. Silty sandy clay, greyish dark brown, fine sand, ash fragments.					ĻМ			
0.5 <b>5-</b> 0.7	Silty sandy	Silty sandy CLAY. Orange brown, fine to medium sand.					L	Fb		
0.7- 0.9 <b>5</b>	Silty CLA	Silty CLAY. Orange brown, some fine sand.						H/ Fb		
0.95- 1.1	Clayey SII calcrete fra	Clayey SILT. Creamy, creamy brown, some fine sand, fine calcrete fragments, highly calcareous.					T/ VL			
	END OF B	BOREHOLE 1.1 m								
							]			
-					ļ ,					
	re Content y imid pist pist et istic Limit quid Limit	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High	Consistency VS = Very Soft $S \approx Soft$ F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks					L

# N . A . T. A . R E G I S T E R E D

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

MATERIALS TESTING

## Borehole Log

	Client: Project:		Job No. 27F358A Date 28/10/94 Tested by BJH Checked by PTWL								
	Drilling	Method: H	ydraulic Push Tube &	& Hydraulic Hammer				Bore Location:			
	Groundwater Struck: Nil Groundwater Stands:-									9	)
	Depth (m)		Soil Description					Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.1	FILL. San roots.	FILL. Sandy silt, grey brown, fine to medium sand, fine roots.								
	0.1- 0.55	FILL. Silt roots, some some bitum	FILL. Silty sandy clay, grey brown, fine sand, some fine roots, some fine calcrete fragments, some brick fragments some bitumen.								2
	0.55- 0.75	FILL. Silt calcareous,	y clay, creamy brown, some bitumen, some a		<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L					
	0.75- 0.95	FILL. Silt of ash.	TLL. Silty clay, dark brown, some fine sand, some flecks of ash.					н			
	0.95- 1.1	Silty CLA	CLAY. Dark brown, some fine sand.					Н	H/ Fb		
		END OF E	END OF BOREHOLE 1.1 m								
GEO-12											
	MoistureD = DryH = HuiDa = DaiM = MoW = WePL = Pla:LL = LiqPl = Pla:	e Content mid mp ist t stic Limit uid Limit	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High FH = Extra High	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks					

### Appendix K

.

Laboratory Methodology and Quality Assurance; Laboratory Analytical Reports





### **ANALYTICAL REPORT**

PAGE 1 of 1

CONTACTION 1. GEAY CLIENTIRUST PER PITY LTD ADDRESS: (0) HOPTH DERPACE

ADPLATOE SA 5000

LABORATORY: ENVIRONMENTAL BATCH NUMBER: ERI0568-0

No. of SAMPLES: 14 DATE RECEIVED: 31/10/04 DATE COMPLETED: 14/11/04

ORDER No: 國際調整	SAN							
SAMPLE NUMBER	ELEMENT UNIT METHOD	Noisture X EA+055	∧s mç∕kg nç⊷vost	CU mg/ku EG-0051	₽b #g/kg EG+005T	Zn md/150 EG-0051		
1.1 + S. $0.2 + 0.35$ $1.2 + 2.2$ $0.2 + 0.42$ $1.5 + 7.6$ $0.2 + 0.42$ $1.5 + 7.6$ $0.32 + 0.42$ $1.5 + 7.6$ $0.32 + 0.42$ $1.7 + 7.6$ $0.37 + 0.42$ $1.7 + 7.6$ $0.3 + 0.42$ $1.7 + 7.6$ $0.37 + 0.42$ $1.7 + 7.6$ $0.37 + 0.42$ $1.7 + 7.6$ $0.3 + 0.42$ $1.7 + 7.6$ $0.3 + 0.42$ $1.7 + 7.6$ $0.4 + 0.72$ $1.7 + 7.6$ $0.4 + 0.72$ $1.0 - 0.15$ $0.75 + 0.9$ $1.10 - 0.16$ $0 - 0.155$ $1.11 - 0.11$ $0 - 0.155$ $1.12 - 512$ $0 - 0.156$ $0.12 - 512$ $0 - 0.156$	im 28/1 im 28/10/ 28/10/ 28/10/	13.6 12.1 11.4 12.9 0.9 7.8 13.4 9.0 11.1 12.1 8.7 5.0 7.5 6.6	4 3 4 2 5 0 3 5 3 4 3 5 3 4 3 7 3 3	10 36 12 8 18 17 25 17 30 11 11 11 7 3 8	10 25 15 35 31 30 63 11 17 19 10 17 12	16 49 24 14 24 25 44 129 92 40 16 15 19		
				No. 825 This Laboratory is regio Association of Testing /.u lest(s) reported hordin his accordance with its term document shall not be regioned	THE SYSTEM STREAM ST			
		0.1	1	1	1	1		
IOMMENTS:     Image: State pice and the stat	ineceived ion of Me oncurry Laboratory one: (077) 42 1323 Fax: Ingoorie Laboratory	(077) 42 1685 Torn	by USEPA ne lts reporte th Laboratory ne: (09) 249 2989 Fax: (09) 2	ethod 3051 p ed on a dry 2492942 All pa	eight basi	report		
hone:         (054)         46         1390         Fax:         (054)         46         1389         Ph           risbane         Laboratory         Mi	ione: (090) 21 1457 Fax: t iss Laboratory ione: (077) 49 5545 Fax: range Laboratory ione: (063) 63 1722 Fax:	(090) 21 6253 Pho (077) 48 5548 (063) 63 1189	ine: (077) 79 9155 Fax: (077)	approv	een checked ed for rele	1 ลทย์ คลระ		

### **ANALYTICAL REPORT**

AUSTRALIAN

LABORATORY

**SERVICES P/L** 

A.C.N. 009 936 029

well and the dealer a weath 2. au

CONTACT:  $\mathbb{M}_{\mathbb{K}} = \mathbb{L} = \mathbb{M}_{\mathbb{K}} / \mathbb{M}_{\mathbb{K}}$ CLIENT: RUSST FER FIT LTD ADDRESS: 100 HOPTH TERRACE

Ą

ADECAIDE 5A 5000 PAGE 1 of 1

LABORATORY: ENVIRONMENTAL BATCH NUMBER: EN1.056.9+0

No. of SAMPLES: 1-4 DATE RECEIVED: 31710294 DATE COMPLETED: 14711794

ORDER No: 10 Above 20	SAMPLE TYPE: OUAL ITY CONTROL PROJECT No:								
SAMPLE NUMBER	ELEMENT UNIT METHOD	Molsture X EA-055	As mg∕kg EG-005T	Cu mg/kg ES-005T	Pb mg∕kg EG-009T	20 009780 EG-0057			
- 54 L1 01 0.2- XSPK R 544 L2 504 0 4 CHK 28 581 L9 95 0.25 XSFK R	EC 2 /10/ EC 2	10.7	79.0% 7 86.0%	76.0% 9 70.0%	70,0% 3 89,0%	75.0% 18 75.0%			
				No. 825 This Laboratory is reg Association of Testing A test(a) reported herein accordance with its ten document shell not be to	Herad by the National Socializes Australia. The area beformed in 3 or registration. This arealuesd excert in full.				
		0.1	1	1	1	1			
OMMENTS: Regults which checks for Q	ן א appear JALITY (	on this r CONTROL pur	l report are r rposes.	routine labo		$\sim$			

endigo Laboratory hone: (054) 46 1390 Fax: (054) 46 1389 risbane Laboratory none: (07) 352 5577 Fax: (07) 352 5109 hurters Towers Laboratory hone: (077) 87 4155 Fax (077) 87 4220

Kelgoorile Laboratory Phone: (090) 21 1457 Fax: (090) 21 6253 Mt las Laboratory Phone: (077) 49 5545 Fax: (077) 48 5546 Orange Laboratory Phone: (063) 63 1722 Fax: (063) 63 1189

Phone: (077) 79 9155 Fax: (077) 79 9729

.

U

• •


	MR L GRAY RUST PPK PTY LTD				Page 1	of 4	
	100 NORTH TERRACE				ENVIRONMENTAL	L	
					Batch-no:	10568	
	ADELAIDE SA 5000				Sub-batch:	1	
					No.samples:	11	
ORD	BR-NO	SAM	PLE-TYPI	3	Received:	31/10/94	Ł
305	7	SOII	ն		Completed:	14/11/94	L
				L1 S1	L2 S2		L3 \$3
ethod	Analysis description	Units	LOR	0.2-0.35m	0.3-0.4	3m	0.25-0.4m
				28/10/94	28/10/9	94	28/10/94
4-055 P-0758-SS	Moisture Content (dried @ 103/C) POLYNUCLEAR AROMATICS	x	0.1	13.6	12.1		11.4
	Naphthalene	mg/kg	0.5	<0.5	<0.5		<0.5
	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5		<0.5
	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.5		<0.5
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5		<0.5
	Acenaphthene	mg/kg	0.5	<0.5	<0.5		<0.5
	fluorene	mg/kg	0.5	<0.5	<0.5		<0.5
	Phenanthrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Fluoranthene	mg/kg	0.5	<0.5	<0.5		<0.5
	Pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	N-2-Fluorenylacetamide	mg∕kg	0.5	<0.5	<0.5		<0.5
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Chrysene	mg/kg	0.5	<0.5	<0.5		<0.5
	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1		<1
	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0,5		<0.5
	Benzo(g.h.i)pervlene	mg/kg	0.5	<0.5	<0.5		<0.5

SAMPLES ANALYSED AS RECEIVED Samples analysed on an as received basis. Results reported on a dry weight basis. Sample preparation techniques: Semivolatile - Separatory Funnel and Tumbler, Volatile - Purge and Trap. Sample analysis techniques: Semivolatile - GC/MS, TPH - GC/FID; Volatile - GC/MS;

M. Klow



E/ El

### AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

**BRISBANE** Phone: (07) 352 5577 Fax: (07) 352 5109 A.C.N SYDNEY Phone: (02) 899 5722 Fax: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

**PERTH** Phone: (09) 249 2988 Fax: (09) 249 2942





	MR L GRAY RUST PPK PTY LTD 100 NORTH TERRACE				Page 2	<b>of</b> 4	
	100 NORTH TERRACE				Batch-po:	10568	
	ADELATOR SA 5000				Sub-batch	1	
	ADDIAIDE SA SUUU				No samples	11 11	
ÓRD	BR-NO	CANDLE-TYDE			Received:	$\frac{11}{31/10/9}$	4
3057		SOLL			Completed:	14/11/9	4
				L4 \$4a	L5 \$5b		L6 S6
lethod	Analysis description	Units	LOR	0.3-0.45m	0.33-0.	5m	0.3-0.45m
		<u></u>		28/10/94	28/10/	94	28/10/94
A-055	Moisture Content (dried @ 103/C)	¥	0 1	12.9	0 9	,	7.8
P-0758-SS	POLYNUCLEAR AROMATICS		•••				
	Naphthalene	mg∕kg	0.5	<0.5	<0.5		<0.5
	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5		<0.5
	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.5	I	<0.5
	Acenaphthylene	mg∕kg	0.5	<0.5	<0.5	i	<0.5
	Acenaphthene	mg/kg	0.5	<0.5	<0.5	1	<0.5
	Fluorene	mg/kg	0.5	<0.5	<0.5	I	<0.5
	Phenanthrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Fluoranthene	mg/kg	0.5	<0.5	<0.5		<0.5
	Pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.5		<0.5
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Chrysene	mg/kg	0.5	<0.5	<0.5		<0.5
	Benzo(b) & (k)fluoranthene	<i>mg</i> ∕kg	1	<1	<1		<1
	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Dibenz(a.h)anthracene	mg∕kg	0.5	<0.5	<0.5		<0.5
	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.5		<0.5

SAMPLES ANALYSED AS RECEIVED



### AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

**BRISBANE** Phone: (07) 352 5577 Fax: (07) 352 5109 A.C.IN. **S Y D N E Y** Phone: (02) 899 5722 Fax: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

**PERTH** Phone: (09) 249 2988 Fax: (09) 249 2942

. .

• , ,



M. Ken-

ゴコンス



	MR L GRAY RUST PPK PTY LTD 100 NORTH TERRACE				Page 3 ENVIRONMENTA	of .	4
					Batch-no:	10568	
	ADELATOE SA 5000				Sub-batch	1	
					No.samples:	11	
		SAM	PLE-TYP	R	Received:	31/10/	94
30	)57	SOI	L .	-	Completed:	14/11/	94
				L7 \$7a	L8 \$8		L9 \$9a
Method	Analysis description	Units	LOR	0.17-0.40m	0.2-0.	.5m	0.4-0.75m
	· · · · · · · · · · · · · · · · · · ·			28/10/94	28/10/	94	28/10/94
EA-055	Moisture Content (dried @ 103/C)	*	0.1	13.4	9.8	3	11.1
EP-0758-SS	POLYNUCLEAR AROMATICS						
	Naphthalene	mg∕kg	0.5	<0.5	<0.5	5	<0.5
•	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	Acenaphthylene	mg∕kg	0.5	<0.5	<0.5	5	<0.5
	Acenaphthene	mg∕kg	0.5	<0.5	<0.5	i	<0.5
	Fluorene	mg∕kg	0.5	<0.5	<0.5	i	<0.5
	Phenanthrene	mg∕kg	0.5	<0.5	<0.5	i	<0.5
	Anthracene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	Fluoranthene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	Pyrene	mg/kg	0.5	<0.5	<0.5	j	<0.5
	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Chrysene	mg∕kg	0.5	<0.5	<0.5	;	<0.5
	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1		<1
	7.12-Dimethylbenz(a)anthracene	mg∕kg	0.5	<0.5	<0.5	5	<0.5
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	;	<0.5
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	;	<0.5
	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.5		<0.5

SAMPLES ANALYSED AS RECEIVED



### AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

**BRISBANE** Phone: (07) 352 5577 Fax: (07) 352 5109 A.C.IN. **S Y D N E Y** Phone: (02) 899 5722 Fax: (02) 899 3200 MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

**PERTH** Phone: (09) 249 2988 Fax: (09) 249 2942

19 Ment





	MR L GRAY RUST PPK PTY LTD				Page 4	of 4	
	100 NORTH TERRACE				ENVIRONMENTA	L	:
					Batch-no:	10568	
	ADELAIDE SA 5000				Sub-batch:	1	
					No.samples:	11	
ORDER-NO		SAM	PLE-TYP	B	Received:	31/10/94	
305	7	SOI	L		Completed:	14/11/94	
				L9 S9b	COMP 10/11		
Method	Analysis description	Units	LOR	0.75-0.95m	s15 0-0	.15	
<u> </u>				28/10/94	28/10/	94	······································
EA-055	Moisture Content (dried @ 103/C)	*	0.1	12.1	6.8	l	
EP-0758-SS	POLYNUCLEAR AROMATICS						
	Naphthalene	mg/kg	0.5	<0.5	<0.5		
	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5		
	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.5		
	Acenaphthylene	mg∕kg	0.5	<0.5	<0.5		
	Acenaphthene	mg∕kg	0.5	<0.5	<0.5	i i	
	Fluorene	mg/kg	0.5	<0.5	<0.5		
	Phenanthrene	mg/kg	0.5	<0.5	<0.5		
	Anthracene	mg/kg	0.5	<0.5	<0.5		
	Fluoranthene	mg/kg	0.5	<0.5	<0.5		
	Pyrene	mg∕kg	0.5	<0.5	<0.5		
	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.5		
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5		
	Chrysene	mg∕kg	0.5	<0.5	<0.5		
	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1		
	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5		
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5		•
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5		
	Indeno(1.2.3-cd)pyrene	<i>mg/</i> kg	0.5	<0.5	<0.5		
	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.5		
	Benzo(g.h.i)perylene	mg∕kg	0.5	<0.5	<0.5		

SAMPLES ANALYSED AS RECEIVED

BRISBANE

Phone: (07) 352 5577

Fax: (07) 352 5109

A.C.N **S Y D N E Y** Phone: (02) 899 5722 Fax: (02) 899 3200

A.C.N. 009 936 029 **NEY** 899 5722 99 3200 **MELBOURNE** Phone: (03) 853 5299 Fax: (03) 853 0730

**AUSTRALIAN LABORATORY SERVICES P/L** 

·- ..

 $\cdot$ 

**PERTH** Phone: (09) 249 2988 Fax: (09) 249 2942

ۍ د ۱

19 Henr





<b>ORD</b> 305	MR L GRAY RUST PPK PTY LTD 100 NORTH TERRACE ADELAIDE SA 5000 ER-NO 7	SAM SOI	PLE-TYPE L		Page1ENVIRONMENTALBatch-no:10Sub-batch:2No.samples:4Received:31Completed:14	>f 2 )568 ↓/10/94 ↓/11/94
ethod	Analysis description	Units	LOR	L7 S7b 0.4-0.4m 28/10/94	COMP 12/13 S14 0-0.15 28/10/94	COMP 10/11 S15 0-0.15 28/10/94
A-055 P-0674-55	Moisture Content (dried @ 103'C) OPCANOCHLORINE PESITIONES	x	0.1	14.7	6.9	6.8
00.1 00	alpha-BKC	mg/kg	0.05	<0.05	<0.05	<0.05
	beta- & gamma-BKC	mg/kg	0.1	<0.1	<0.1	<0.1
	delta-BHC	mg/kg	0.05	<0.05	<0.05	<0.05
	Keptachlor	mg/kg	0.05	<0.05	<0.05	<0.05
	Aldrin	mg/kg	0.05	<0.05	<0.05	<0.05
	Heptachlor epoxide	mg/kg	0.05	<0.05	<0.05	<0.05
	Endosulfan 1	mg/kg	0.05	<0.05	<0.05	<0.05
	4.4'-DDE	mg/kg	0.05	<0.05	<0.05	<0.05
	Dieldrin	mg/kg	0.05	<0.05	<0.05	<0.05
	Endrin	mg/kg	0.05	<0.05	<0.05	<0.05
	Endosulfan 2	mg/kg	0.05	<0.05	<0.05	<0.05
	4.4'-DDD	mg/kg	0.05	<0.05	<0.05	<0.05
	Endrin aldehyde	mg/kg	0.05	<0.05	<0.05	<0.05
	Endosulfan sulfate	mg/kg	0.05	<0.05	<0.05	<0.05
	4.4'-DDT	mg/kg	0.2	<0.2	<0.2	<0.2

SAMPLES ANALYSED AS RECEIVED Samples analysed on an as received basis. Results reported on a dry weight basis. Sample preparation techniques: Semivolatile - Separatory Funnel and Tumbler, Volatile - Purge and Trap. Sample analysis techniques: Semivolatile - GC/MS, TPH - GC/FID; Volatile - GC/MS;



**BRISBANE** Phone: (07) 352 5577 Fax: (07) 352 5109

**S Y D N E Y** Phone: (02) 899 5722 Fax: (02) 899 3200 MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

**PERTH** Phone: (09) 249 2988 Fox: (09) 249 2942





	MR L GRAY				Page 2	of 2	
	RUST PPK PTY LTD				rage 2	V2 L	I
	100 NORTH TERRACE				ENVIRONMENTA	т.	
	100 Honth Thinke				Batch-no:	10568	
	ADELATDE SA 5000				Sub-batch.	20000	
	ADDIAIDD BA 5000				No samples	2 4	
ORD	RR - NO	STW	DI.R.TYPR		Received	31/10/94	
305	7	SOT	1.		Completed:	14/11/94	
	· · · · · · · · · · · · · · · · · · ·		<u> </u>				
			(	COMP 1/6			
Method	Analysis description	Units	LOR	\$16			
				28/10/94			
EA-055	Moisture Content (dried @ 103'C)	X	0.1	11.2			
EP-067A-SS	ORGANOCHLORINE PESTICIDES						
	alpha-BHC	mg∕kg	0.05	<0.05			
	beta- & gamma-BHC	mg/kg	0.1	<0.1			
	delta-BKC	mg/kg	0.05	<0.05			
	Heptachlor	mg/kg	0.05	<0.05			
	Aldrin	mg∕kg	0.05	<0.05			
	Heptachlor epoxide	mg/kg	0.05	<0.05			
	Endosulfan 1	mg∕kg	0.05	<0.05			
	4.4'-DDE	mg/kg	0.05	<0.05			
	Dieldrin	mg/kg	0.05	<0.05			
	Endrin	mg/kg	0.05	<0.05			
	Endosulfan 2	. mg/kg	0.05	<0.05			
	4.4'-DDD	mg/kg	0.05	<0.05			
	Endrin aldehyde	mg/kg	0.05	<0.05			
	Endosulfan sulfate	mg/kg	0.05	<0.05			
	4.4'-DDT	mg/kg	0.2	<0.2			

SAMPLES ANALYSED AS RECEIVED

M? Blan



 B R I S B A N E
 S

 Phone: (07) 352 5577
 Phon

 Fax: (07) 352 5109
 Fa

A.C.N. 009 936 029 **SYDNEY MELB** Phone: (02) 899 5722 Phone: ( Fax: (02) 899 3200 Fax: (0

**AUSTRALIAN LABORATORY SERVICES P/L** 

•

MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

• •• • •

> **PERTH** Phone: (09) 249 2988 Fax: (09) 249 2942





### ORGANICS QUALITY CONTROL REPORT

BATCH No. : EN10568

DATE BATCH RECEIVED : 31/10/94

CLIENT : Rust PPK Pty Ltd

DATE BATCH COMPLETED : 17/11/94

					1. Mar.
Method	Test	Matrix	QC Lot	Date	Date
Code			Number	Samples	Samples
				Extracted	Analysed
EP-067	Pesticides	Soil	OCOPS246	07/11/94	10/11/94
EP-075	Semivolatile Scan	Soil	SVOCS145	07/11/94	10/11/94

ORGFORM(60/0)





**BRISBANE** Phone: (07) 352 5577 Fox: (07) 352 5109 A.C.N. **S Y D N E Y** Phone: (02) 899 5722 Fax: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fox: (03) 853 0730 **PERTH** Phone: (09) 249 2988 Fax: (09) 249 2942



#### ALS EP-067 : PESTICIDES

QC LOT No. : OCOPS246 MATRIX: Soil

1.20

ANALYST: J. Langford

	Blank	Spike	SPIKE QC RESULTS Control Limi					mits	
	Сопс	Level	SCS	DCS	Average	RPD	R	ec.	RPD
COMPOUND			Conc	Conc	Rec.		<u> </u>	1	
	mg/kg	j mg/kg	mg/kg	mg/kg	%	%	Low	High	%
EP-067A : ORGANO	CHLORINE	PESTICI	DES		· · · · · · · · · · · · · · · · · · ·	<del></del>			<del></del>
alpha-BHC	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>79</td><td>5</td><td>60</td><td>115</td><td>20</td></lor<>	0.20	0.16	0.15	79	5	60	115	20
beta & gamma-BHC	<lor< td=""><td>0.40</td><td>0.33</td><td>0.32</td><td>81</td><td>2</td><td>60</td><td>117</td><td>20</td></lor<>	0.40	0.33	0.32	81	2	60	117	20
delta-BHC	<lor< td=""><td>0.20</td><td>0.17</td><td>0.16</td><td>79</td><td>5</td><td>67</td><td>113</td><td>20</td></lor<>	0.20	0.17	0.16	79	5	67	113	20
Heptachlor	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>76</td><td>5</td><td>38</td><td>125</td><td>20</td></lor<>	0.20	0.16	0.15	76	5	38	125	20
Aldrin	<lor< td=""><td>0.20</td><td>0.16</td><td>0.19</td><td>86</td><td>17</td><td>53</td><td>116</td><td>20</td></lor<>	0.20	0.16	0.19	86	17	53	116	20
Heptachlor epoxide	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>76</td><td>7</td><td>62</td><td>114</td><td>20</td></lor<>	0.20	0.16	0.15	76	7	62	114	20
Endosulfan 1	<lor< td=""><td>0.20</td><td>_0.17</td><td>0.18</td><td>85</td><td>6</td><td>67</td><td>111</td><td>20</td></lor<>	0.20	_0.17	0.18	85	6	67	111	20
4,4'-DDE	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>75</td><td>6</td><td>68</td><td>114</td><td>20</td></lor<>	0.20	0.16	0.15	75	6	68	114	20
Dieldrin	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>75</td><td>5</td><td>67</td><td>113</td><td>20</td></lor<>	0.20	0.16	0.15	75	5	67	113	20
Endrin	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>77</td><td>6</td><td>41</td><td>129</td><td>20</td></lor<>	0.20	0.16	0.15	77	6	41	129	20
Endosulfan 2	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>76</td><td>5</td><td>68</td><td>112</td><td>20</td></lor<>	0.20	0.16	0.15	76	5	68	112	20
4,4'-DDD	<lor< td=""><td>0.20</td><td>0.16</td><td>0.14</td><td>73</td><td>9</td><td>67</td><td>111</td><td>20</td></lor<>	0.20	0.16	0.14	73	9	67	111	20
Endrin aldehyde	<lor< td=""><td>0.20</td><td>0.15</td><td>0.13</td><td>68</td><td>16</td><td>66</td><td>112</td><td>20</td></lor<>	0.20	0.15	0.13	68	16	66	112	20
Endosulfan sulfate	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>75</td><td>7</td><td>64</td><td>117</td><td>20</td></lor<>	0.20	0.16	0.15	75	7	64	117	20
4,4'-DDT	<lor< td=""><td>0.20</td><td>0.18</td><td>0.17</td><td>86</td><td>6</td><td>71</td><td>107</td><td>20</td></lor<>	0.20	0.18	0.17	86	6	71	107	20
EP-067B : ORGANO	PHOSPHOR	US PEST	TICIDES						
Dichlorvos	<lor< td=""><td>0.20</td><td>0.14</td><td>0.13</td><td>66</td><td>4</td><td>52</td><td>116</td><td>20</td></lor<>	0.20	0.14	0.13	66	4	52	116	20
Dimethoate	<lor< td=""><td>0.20</td><td>0.15</td><td>0.14</td><td>72</td><td>2</td><td>54</td><td>114</td><td>20</td></lor<>	0.20	0.15	0.14	72	2	54	114	20
Diazinon	<lor< td=""><td>0.20</td><td>0.14</td><td>0.13</td><td>67</td><td>4</td><td>53</td><td>117</td><td>20</td></lor<>	0.20	0.14	0.13	67	4	53	117	20
Chlorpyrifos methyl	<lor< td=""><td>0.20</td><td>0.13</td><td>0.13</td><td>64</td><td>5</td><td>63</td><td>115</td><td>20</td></lor<>	0.20	0.13	0.13	64	5	63	115	20
Malathion	<lor< td=""><td>0.20</td><td>0.14</td><td>0.13</td><td>65</td><td>6</td><td>62</td><td>116</td><td>20</td></lor<>	0.20	0.14	0.13	65	6	62	116	20
Fenthion	<lor< td=""><td>0.20</td><td>0.13</td><td>0.13</td><td>65</td><td>0</td><td>59</td><td>115</td><td>20</td></lor<>	0.20	0.13	0.13	65	0	59	115	20
Chlorpyrifos	<lor< td=""><td>0.20</td><td>0.13</td><td>0.12</td><td>63 •</td><td>6</td><td>65</td><td>112</td><td>20</td></lor<>	0.20	0.13	0.12	63 •	6	65	112	20
Pirimiphos ethyl	<lor< td=""><td>0.20</td><td>0.13</td><td>0.13</td><td>64</td><td>5</td><td>45</td><td>120</td><td>20</td></lor<>	0.20	0.13	0.13	64	5	45	120	20
Bromophos ethyl	<lor< td=""><td>0.20</td><td>N/A</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td></lor<>	0.20	N/A	N/A					
Prothiofos	<lor< td=""><td>0.20</td><td>0.14</td><td>0.14</td><td>68</td><td>6</td><td>65</td><td>113</td><td>20</td></lor<>	0.20	0.14	0.14	68	6	65	113	20
Ethion	<lor< td=""><td>0.20</td><td>0.13</td><td>0.12</td><td>61</td><td>8</td><td>52</td><td>123</td><td>20</td></lor<>	0.20	0.13	0.12	61	8	52	123	20

#### **COMMENTS** :

1) The control limits are based on ALS laboratory statistical data (Method QWI-ORG/06)

2) \* : Recovery or RPD falls outside of the recommended control limits.

## BATCH QUALITY CONTROL

### ALS EP-075 : SEMIVOLATILE SCAN

QC LOT No. : SVOCS145 MATRIX: Soil

#### ANALYST: L. Baker

	Blank	Spike		<b>QC SPIKE</b>	RESULTS		Cor	ntrol Li	mits
	Conc.	Level	SCS	DCS	Average				-
COMPOUND			Conc	Conc	Rec.	RPD	Reco	very	RPD
	mg/kg	mg/kg	mg/kg	mg/kg	%	%	Low	High	%
EP-075B : POLYAROMATIC HYDRO	CARBONS				<u> </u>				
Naphthalene	<lor< td=""><td>1.25</td><td>1.16</td><td>1.08</td><td>90</td><td>7</td><td>56</td><td>107</td><td>35</td></lor<>	1.25	1.16	1.08	90	7	56	107	35
2-Methylnaphthalene	<lor< td=""><td>1.25</td><td>1.19</td><td>1.18</td><td>95</td><td>0</td><td>49</td><td>113</td><td>35</td></lor<>	1.25	1.19	1.18	95	0	49	113	35
2-Chloronaphthalene	<lor< td=""><td>1.25</td><td>1.14</td><td>1.15</td><td>92</td><td>1</td><td>52</td><td>104</td><td>35</td></lor<>	1.25	1.14	1.15	92	1	52	104	35
Acenaphthalene	<lor< td=""><td>1.25</td><td>1.18</td><td>1.23</td><td>96</td><td>4</td><td>52</td><td>107</td><td>35</td></lor<>	1.25	1.18	1.23	96	4	52	107	35
Acenaphthene	<lor< td=""><td>1.25</td><td>1.20</td><td>1.24</td><td>98</td><td>3</td><td>_53</td><td>112</td><td>35</td></lor<>	1.25	1.20	1.24	98	3	_53	112	35
Fluorene	<lor< td=""><td>1.25</td><td>1.21</td><td>1.23</td><td>97</td><td>2</td><td>54</td><td>111</td><td>35</td></lor<>	1.25	1.21	1.23	97	2	54	111	35
Phenanthrone	<lor< td=""><td>1.25</td><td>1.34</td><td>1.27</td><td>104</td><td>5</td><td>56</td><td>115</td><td>35</td></lor<>	1.25	1.34	1.27	104	5	56	115	35
Anthracene	<lor< td=""><td>1.25</td><td>0.96</td><td>0.98</td><td>77</td><td>3</td><td>49</td><td>118</td><td>35</td></lor<>	1.25	0.96	0.98	77	3	49	118	35
Fluoranthrene	<lor< td=""><td>1.25</td><td>1.33</td><td>1.36</td><td>108</td><td>3</td><td>55</td><td>118</td><td>35</td></lor<>	1.25	1.33	1.36	108	3	55	118	35
Pyrene	<lor< td=""><td>1.25</td><td>1.33</td><td>1.30</td><td>105</td><td>3</td><td>55</td><td>120</td><td>35</td></lor<>	1.25	1.33	1.30	105	3	55	120	35
N-2-Fluorenylacetimide	<lor< td=""><td>1.25</td><td>1.22</td><td>1.24</td><td>99</td><td>2</td><td>29</td><td>111</td><td>35</td></lor<>	1.25	1.22	1.24	99	2	29	111	35
Benz(a)anthracene	<lor< td=""><td>1.25</td><td>1.23</td><td>1.36</td><td>103</td><td>10</td><td>54</td><td>118</td><td>35</td></lor<>	1.25	1.23	1.36	103	10	54	118	35
Chrysene	<lor< td=""><td>1.25</td><td>1.39</td><td>1.47</td><td>114</td><td>6</td><td>51</td><td>124</td><td>35</td></lor<>	1.25	1.39	1.47	114	6	51	124	35
Benzo(b) & (k) fluoranthene	<lor< td=""><td>2.50</td><td>2.35</td><td>2.46</td><td>96</td><td>4</td><td>53</td><td>123</td><td>35</td></lor<>	2.50	2.35	2.46	96	4	53	123	35
7,12-Dimethyl benz(a)anthracene	<lor< td=""><td>1.25</td><td>0.98</td><td>1.12</td><td>84</td><td>13</td><td>37</td><td>187</td><td>35</td></lor<>	1.25	0.98	1.12	84	13	37	187	35
Benzo(a)pyrene	<lor< td=""><td>1.25</td><td>0.85</td><td>1.04</td><td>75</td><td>20</td><td>44</td><td>124</td><td>35</td></lor<>	1.25	0.85	1.04	75	20	44	124	35
3-Methylchloanthrene	<lor< td=""><td>1.25</td><td>0.85</td><td>0.95</td><td>72</td><td>11</td><td>45</td><td>118</td><td>35</td></lor<>	1.25	0.85	0.95	72	11	45	118	35
Indeno(1,2,3-cd)pyrene	<lor< td=""><td>1.25</td><td>1.49</td><td>1.49</td><td>119</td><td>0</td><td>43</td><td>123</td><td>35</td></lor<>	1.25	1.49	1.49	119	0	43	123	35
Dibenz(a,h)anthracene	<lor< td=""><td>1.25</td><td>1.46</td><td>1.59</td><td>122</td><td>9</td><td>39</td><td>123</td><td>35</td></lor<>	1.25	1.46	1.59	122	9	39	123	35
Benzo(g,h,i)perylene	<lor< td=""><td>1.25</td><td>1.43</td><td>1.55</td><td>119</td><td>8</td><td>44</td><td>119</td><td>35</td></lor<>	1.25	1.43	1.55	119	8	44	119	35

#### COMMENTS :

1) The control limits are based on ALS laboratory stastical data (Method QWI-ORG/06).

2) \*: Recovery or RPD falls outside the recommended limits.

# Appendix L

.

-

Site Plan Showing Location of Trial Excavation Area



LEGEND	
	DEMOLISHED BUILDING
	COVERED WALKWAY
	TRIAL EXCAVATION AREA

### KEY TO BUILDINGS

1 2 3 4 5 6 7 8 9 10 11 2 13 4 15 16 7 8 9 10 11 2 13 4 15 16 7 8 9 21 22 3 4 5 6 7 8 9 10 11 2 13 4 15 16 7 8 9 20 12 23 4 5 6 7 8 9 10 10 0, 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Ward 1 Ward 2 Ward 3 Ward 4, Dibden Hou Ward 5, Robertson Ward 6, Anderson H Ward 7, Repatriation Ward 8, Apps House Ward 9, Davenport H Ward 10, Howard Ho Mortuary Boiler/Incinerator Ho Occupational Therap Garage/Garden Com Canteen Saiter Hall Administration Chapel Groundwater Pump Telecom Radio Towe Psychogeriatric Ware Mason House Litchfield House Industrial Therapy (I Linen Sorting Barnett House James Nash House	se House louse House Duse Duse Duse Duse Duse Duse Duse D
ST SHO	HOSPITAL WING LOCATION OF	CHECKED UP DRAWN JD
ECAV	ATION AREA	DATE 22.9.94
		ODAM/INC No.

# Appendix M

Photographic Record of Backhoe Excavation



ļ

I

Photo 1: The backhoe used in the trial excavation. Pieces of concrete are visible in the excavation material.



Photo 2: A piece of concrete present in the excavation material.



Photo 3: In the centre foreground, shows a large piece of concrete which could not be removed by the backhoe. It's volume was estimated to be at least 0.2m<sup>3</sup>.



Photo 4: Distinct rows where grass is growing well relative to other areas. Building rubble is thought to buried in trenches below these areas. The area of lush vegetation in the background may be the location of a large burial pit.



16178

### PUBLIC & ENVIRONMENTAL HEALTH SERVICE

In reply please quote:

Gilles Plains/200

Contact: Phone: Heather Hill 2266333



15th June 1995

Mr M. Harvey Manager, Industry Services Office of the Environment Protection Authority GPO Box 2607 ADELAIDE SA 5001

Dear Mr Harvey

### RE: Hillcrest Hospital, Fosters Road, Gilles Plains

Attached is our Site Assessment Report for your action. It recommends the removal of the underground fuel storage tanks and the underground pipe work. In addition, further general testing of the site is recommended especially areas of building rubble and unknown fill.

Yours sincerely

Dr Ian Calder Director Environmental Health Branch PUBLIC AND ENVIRONMENTAL HEALTH SERVICE

cc:

W:\PEH\_DIVN\PH113888.DOC

Facsimile No.: Within Australia (08) 226 6316 Outside Australia 61 8 226 6316

11-13 Hindmarsh Square, Adelaide, S.A. 5000 AUSTRALIA P.O. Box 6, Rundle Mall, S.A. 5000 AUSTRALIA

Telephone: (08) 226 6320

Data on site investigation were provided by Rust PPK in their report dated 2nd December 1994.

#### **SITE IDENTIFICATION** 1.

SAHC IDENTIFICATION:	Gilles Plains/200 SAHC 08/151/200
PROPERTY ADDRESS:	Fosters Road Gilles Plains
PROPERTY DESCRIPTION:	Hillcrest Hospital and Strathmont Centre carpark
TITLE REFERENCE:	CT 637/7 and CT 637/8 cancelled 9/6/1917 when land became the property of the South Australian State Government. There is no current Certificate of Title
LOCAL GOVERNMENT AUTHORITY:	Enfield City Council
ZONING:	Residential
CURRENT STATUS:	The administration building is still used as is the garage/gardening compound. All the other buildings are not used.
AREA:	Lot 103 of proposed division of Section 872 is 46.1 hectares and Section 855 is 2.3 hectares
<u>OWNERSHIP</u>	South Australian State Government

#### PARTY RESPONSIBLE FOR ASSESSMENT AND MANAGEMENT 3.

South Australian State Government

Public & Environmental Health Service

Ń

2.

Gilles Plains/200

2

SITE ASSESSMENT REPORT

4. SOIL CONSULTANT

**PPK Consultants** 

#### 5. PROPOSED USE

Residential development

#### 6. <u>SITE HISTORY</u>

In 1876 E. M. Baggot, a cereal crop and grazing farmer, bought the site including Section 855. The land was subsequently owned by a succession of farmers until 1917 when it was transferred to the State Government. In 1926, the construction of the hospital began. By 1959, there were ten wards and the administration building. In 1961, the central boiler was installed. Other buildings were added in 1968 and 1975. Steam was supplied to these buildings from the central boiler house, via underground insulated (possibly with asbestos)pipework running parallel with the covered walkways. New buildings continued to be built until 1989.

There was a farm on the property when the hospital began operation in 1929. It was possibly on the hospital paddock. This area has continued to be used for cereal crops and sheep grazing. Many other areas were used for market gardens and orchards.

The central boilers were fired with coke from 1961 to 1975. Coke ash from the boilers was buried to varying depths at different locations on the site. Building rubble was also buried at different locations following the demolition of some buildings. Bitumen paths were laid out and later covered with soil.

Two petrol bowsers and three underground storage tanks were installed west of the mortuary.

#### 7. <u>SITE INSPECTIONS</u>

Rust PPK personnel inspected the site on the 14th September 1994 and on the 23rd September 1994. SAHC personnel inspected the site on the 7th June 1995.

The site is bounded by Grand Junction Road to the north, by Fosters Road to the west, by a new housing development to the south and by the Strathmont Centre to the east. Proposed Lot 103 is occupied by Hillcrest Hospital. This area consists of accommodation and administration buildings, a boiler house and garage/garden compound. The northern portion is used for cultivating

Public & Environmental Health Service

Gilles Plains/200

3

cereal crops. Section 855 contains a bituminised car park. The site is fairly flat. Stormwater drains from the site at two locations, one of which is via a creek which runs through the hospital paddock.

#### 8. <u>SITE INVESTIGATION AND TESTING</u>

As a result of the initial site history and site investigation, thirteen sites were selected to investigate possible areas of contamination. The soil sampling was restricted to section 872.

Borehole cores from borehole locations 1B to 9B were recovered using truck mounted hydraulic push tube equipment. To avoid cross-contamination, all push tubes were steam cleaned between sample locations. Samples from locations 10D to 13D were extracted by hand using a hammer and dig stick. Three to four 150mm depth sub-samples were taken from each location and throughly mixed. Sample preservation techniques were employed to ensure that there was no deterioration of the samples.

Samples 1B to 6B were taken from an area reported as being used for the burial of coke ash and building rubble, and prior to that a market garden existed in the vicinity of 1B, 5B and 6B. Sample 7B was taken from an area reported as being used for the burial of coke ash and prior to that a market garden. Samples 8B and 9B were taken from an area reported as being used for the burial of coke ash. Samples 10D and 11D were taken from an area suspected of being a former orchard. Samples 12D and 13D were taken from the former farm: the hospital paddock.

Samples taken from sites reported to contain coke ash were tested for the presence of Polycyclic Aromatic Hydrocarbons (PAH), copper, lead, zinc and arsenic. Samples from sites reported to have been used as market gardens or orchards were also tested for organochlorine pesticides.

### 9. GROUNDWATER

No groundwater was struck in any of the previously drilled boreholes. There is anecdotal evidence of transient groundwater pumping for garden irrigation, ceased due to groundwater salinity. There was also a pump used to avoid ponding in the psycho-geriatric ward.

Gilles Plains/200

7

4

#### 10. <u>CONCLUSIONS</u>

The laboratory methods used for the testing were specified as were quality controls and recoveries.

In all samples of soil strata containing flecks of what appeared to be coke ash, concentrations of PAH and organochlorine pesticides were below the laboratory reporting limits and below the ANZECC/NHMRC health-based investigation guidelines

In the samples tested for selected metals, concentrations were below the recommended ANZECC/NHMRC health-based investigation guidelines. Some filled areas have not been assessed and a history has not been provided to indicate the filled areas are innocuous.

While not all orchards were tested, the results of those assessed did not indicate problems and it is reasonable to believe that other orchards on the site would have been used similarly and would give similar results.

#### 11. HEALTH MANAGEMENT REQUIREMENTS

It is necessary to further test several different locations on the site, in particular possible building rubble burial sites some of which have been market garden/orchard locations. Another filled area may be under the IDSC carpark: its filling status needs to be clarified. The former tranformer site should be tested for polychlorinated biphenyls (PCB). The underground fuel tanks should be emptied and removed. If there is olfactory or visual evidence of a fuel spill from the tanks, the soil should be tested for the presence of lead and total petroleum hydrocarbons.

The underground pipework should also be removed from the site. The cladding should be assessed for the presence of asbestos, and if it is present, appropriate safety measures should be taken during its removal. Although the chemical tests undertaken at this time have not revealed concentrations needing health management requirements, the results of further testing on untested areas are necessary before making a final decision on the possible extent of site contamination.

As with any assessment there is uncertainty arising from the sampling and assessment methodology. This has been considered in drafting the conclusions. It is recommended that this report be read in conjunction with the SAHC paper "Background to the Health Risk Assessment Report".

Public & Environmental Health Service

Gilles Plains/200

#### 10. <u>CONCLUSIONS</u>

The laboratory methods used for the testing were specified as were quality controls and recoveries.

In all samples of soil strata containing flecks of what appeared to be coke ash, concentrations of PAH and organochlorine pesticides were below the laboratory reporting limits and below the ANZECC/NHMRC health-based investigation guidelines

In the samples tested for selected metals, concentrations were below the recommended ANZECC/NHMRC health-based investigation guidelines. Some filled areas have not been assessed and a history has not been provided to indicate the filled areas are innocuous.

While not all orchards were tested, the results of those assessed did not indicate problems and it is reasonable to believe that other orchards on the site would have been used similarly and would give similar results.

#### 11. HEALTH MANAGEMENT REQUIREMENTS

It is necessary to further test several different locations on the site, in particular possible building rubble burial sites some of which have been market garden/orchard locations. Another filled area may be under the IDSC carpark: its filling status needs to be clarified. The former tranformer site should be tested for polychlorinated biphenyls (PCB). The underground fuel tanks should be emptied and removed. If there is olfactory or visual evidence of a fuel spill from the tanks, the soil should be tested for the presence of lead and total petroleum hydrocarbons.

The underground pipework should also be removed from the site. The cladding should be assessed for the presence of asbestos, and if it is present, appropriate safety measures should be taken during its removal.

Although the chemical tests undertaken at this time have not revealed concentrations needing health management requirements, the results of further testing on untested areas are necessary before making a final decision on the possible extent of site contamination.

As with any assessment there is uncertainty arising from the sampling and assessment methodology. This has been considered in drafting the conclusions. It is recommended that this report be read in conjunction with the SAHC paper "Background to the Health Risk Assessment Report".

Public & Environmental Health Service

Gilles Plains/200

In accordance with government policy, information on this site will be provided to the Department of Environment and Natural Resources for their records on soil quality.

Report prepared by

Report reviewed by

(Heather Hill)

Date <u>15-6-95</u>

(Dr A.J. Langley)

\_\_\_\_ Date \_\_\_\_\_ 16-6-95

W:\PEH\_DIVN\PH113888.DOC

Public & Environmental Health Service

Gilles Plains/200



### PUBLIC & ENVIRONMENTAL HEALTH SERVICE

In reply please quote:

### BACKGROUND TO THE HEALTH RISK ASSESSMENT REPORT

The attached health risk assessment report has been prepared by staff of the Environmental Health Branch utilising expertise in medicine, chemistry and toxicology.

Due care has been taken in the preparation of this assessment. Information supplied to the Environmental Health Branch has been accepted as true and correct and has been used in good faith.

As with any health risk assessment, uncertainties arise relating to the adequacy of toxicological exposure information, and site investigation data. Professional judgement has been used to assess the data and the uncertainties have been considered in appraising the information and establishing health risk management recommendations.

An assessment which does not require health management measures does not imply that there is no contamination or risk and does not represent a 'clearance'. Given the inherent uncertainties in the process, the Environmental Health Branch endeavours to assess the level of risk and the nature of health management interventions that would provide, in their opinion, an acceptable level of risk for occupants and users of the site. The risk assessments incorporate safety factors to address the inherent uncertainties in the assessment process. The levels of risk are generally taken to be those that relate to long term exposure.

There are always uncertainties arising from the practical limitations of the extent and nature of sampling and localised patches of contamination may be found with repeated sampling. If contamination is suspected or detected it must be reported to the Office of the Environment Protection Authority.

As a matter of policy, copies of any report prepared by the Public and Environmental Health Service may be made available to the relevant local government and the owner(s) of the property, even if the owner has not commissioned the preparation of the report.

The health risk assessment report is provided to the Office of the Environment Protection Authority (EPA) which has administrative responsibility for government management of contaminated land and the EPA will provide the official government advice on the management of the site.

The EPA may undertake a separate assessment where there are matters of specific environmental concern such as groundwater. The EPA will provide the final government direction on the management of the site.

Only the Minister for Environment and Natural Resources can approve the sale or purchase of contaminated land by Government departments or agencies.

Extracts from consultants' reports are shown in quotation marks and referenced. Where amendments are made to consultants' reports new material is presented in "square brackets" ie [....].

Facsimile: (08) 226 6316

# 337 epa 772/94 27 10 97

Further Investigation of Potential Contamination at **Hillcrest Hospital Fosters Road Gilles Plains, SA** 

### **Department of Environment** and Natural Resources

Save as: 16178 19950721

**EPA** 

Rece	eived	29 '	8 '	9	5	
Doc.	No.	05	95	23	67	
File	No.	EPF	<u>r/</u>	77/	199	14
Res	ponse		<i>i</i>	1		
Reti	um to	)				
То	Lac	Tlo	50			

**Rust PPK Pty Ltd** Environment & Infrastructure

100 North Terrace Adelaide SA 5000 PO Box 398 Adelaide SA 5001 Australia Telephone: (61 8) 212 5733 Facsimile: (61 8) 212 4686

21 July 1995 27G233A 95/515



A NATA Certified Quality Company

## Contents

Page Number

Exec	xecutive Summary	
1.	Introduction	1
2.	Scope of Works	
	<ul> <li>2.1 Buried Rubble and Uncompacted Fill</li> <li>2.2 Coke Ash</li> <li>2.3 Base Material Underlying Bitumen</li> <li>2.4 Internal White Ant Treatment</li> <li>2.5 Chemical Storage Buildings</li> <li>2.6 Sites of Former Orchards or Market Gardens</li> <li>2.7 Former Substation</li> <li>2.8 Depth of Foundations</li> </ul>	2 2 2 2 2 2 3 3 3 3 3
3.	<ul> <li>Works Undertaken</li> <li>3.1 Sampling Methodology</li> <li>3.2 Laboratory Used</li> <li>3.3 Buried Rubble and Uncompacted Fill</li> <li>3.4 Coke Ash</li> <li>3.5 Base Material Underlying Bitumen</li> <li>3.6 Internal White Ant Treatment</li> <li>3.7 Chemical Storage Building</li> <li>3.8 Sites of Former Orchards or Market Gardens</li> <li>3.9 Former Substation</li> <li>3.10 Depth of Foundations</li> </ul>	4 4 6 7 8 8 8 9 9
4.	Contamination Detected	10
5.	Discussion and Recommendations	11

### Contents

Continued

#### **Page Number**

### 6. Demolition and Remediation

6.1	Excavation and Backfilling of Garage/Garden Complex and the	
	Former Location of Ward 2	12
6.2	Removal of Bitumen from Investigation Area	12
6.3	Removal of Underground Storage Tanks	12
6.4	Asbestos Remediation	13
6.5	Demolition of Covered Walkways	13
6.6	Demolition of Building 17	13
6.7	Demolition of Buildings Within the Remediation Zone,	
	Excluding Building 17	13
6.8	Organochlorine Pesticide Investigation	14
6.9	Fibre Monitoring and Validation Sampling	14
6.10	Quality Control Inspection	14
6.11	Provisional Sum	14
6.12	Summary of Budget Estimates	14

7. Statement	of	Limitations
--------------	----	-------------

### Appendices

- Appendix A Site Plan (Test Pit and Sampling Locations)
- Appendix B Geotechnical Logs
- Appendix C Sample Transmittal Forms
- Appendix D Laboratory Reports
- Appendix E Summary of Analytical Results
- Appendix F Dynamic Cone Penetrometer Results Certificates
- Appendix G Proposed Area for Demolition Works
- Appendix H Asbestos Remediation Plan

ii

16

### Executive Summary

### Background

Rust PPK Pty Ltd was previously commissioned by the Resource Conservation and Management group of the Department of Environment and Natural Resources to investigate and report on the potential site contamination, environmental and other related issues arising from historical and current site activities on a 46.1 hectare section of the Hillcrest Hospital property and adjoining areas.

The resultant document, Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA (Document No 94/730 of 2 December 1994) made the following recommendations:

- Develop a program for further investigation, assessment and determination of possible remediation requirements, for the areas of the site which are subject to potential chemical contamination.
- Determine the probable extent of impact of buried rubble in the site on future building activities. This would include developing a program of test boreholes to delineate areas of the site which are subject to burial of building rubble. The depth of soil cover should also be determined.
- Determine the feasibility of relocating the groundwater pumping station currently on the subject site to a new location on the Hospital grounds near the psychogeriatric ward.
- Include underground pipework insulation in plans to remove asbestos containing materials from the site prior to demolition and building activities.

This report was formally assessed by Dr Andrew Langley and Heather Hill of the South Australian Health Commission. This assessment is documented in the Site Assessment Report (SAHC identification: Gilles Plains/200 08/151/200). Subsequently Rust PPK were invited by Gordon Heath of Heath Planning and Management to submit a proposal for consultancy and technical services that addressed the concerns of the South Australian Health Commission within an approximate boundary designated on a plan provided by Heath Planning and Management. These consultancy and technical services are listed below.

- Identify, investigate and document all contaminants within the Workshop, Boiler House and Walkway Zones of the former Hillcrest Hospital, including recommending an appropriate boundary within which to designate the works. Investigation of the walkways was to extent beyond the boundary defined.
- Document all works necessary for the complete removal of all contaminants, buildings, structures, pavements within the designated zone boundaries required to result in land suitable for redevelopment.

 Assist the Department of Environment and Natural Resources to undertake any activities necessary to implement the agreed demolition and remediation works within the agreed timescale and budget parameters.

The resulting proposal titled Site Contamination, Investigation, Demolition and Remediation Works - Former Hillcrest Site (Document No 95/341 of 23 May 1995) was submitted to Mr Peter Lawrence, Manager of the Property Services branch of the Department of Environment and Natural Resources. Acceptance of this proposal was confirmed in correspondence from Peter Lawrence on 7 June 1995.

### **Details of Investigations**

This report details the further investigation work undertaken.

An area of 2.7 hectares was defined for the scope of works of the further investigation. A total of twelve test pits were excavated on the site with the following objectives:

- Six test pits were excavated in the area of the garage/garden complex and the former location of Ward 2 to investigate the extent, nature and possible chemical contamination of the building rubble used as fill in these locations.
- Several test pits were excavated surrounding the boiler house to locate the areas where coke ash from the boiler house may have been used as fill or stockpiled and investigate the possible chemical contamination associated with the coke ash. These test pits were located so as to also provide information on underground pipework associated with the boiler house.
- A test pit was excavated adjacent to the rear wall of building 19, the food store, to determine the depth of the footings and to enable a sample to be collected from beneath the footings of an existing building on the site to test for organochlorine pesticides (OCPs) contamination.
- Several trenches were excavated within the investigation area to locate underground pipework. Where asbestos materials were associated with the pipework located it was attempted to define the extent of the pipework.

The fill material evident in the test pits excavated in the area of the garage/garden complex extended to a maximum depth of 0.95 metres. The average depth of the fill material was 0.7 metres. The fill intersected during test pit excavations in the former location of ward 2 extended to a maximum depth of 1.2 metres and had an average depth of 0.9 metres. Fragments of coke ash were encountered in test pit 3 in the garage garden complex and test pit 10 adjacent to the former location of ward 2. Samples were collected from the depth intervals where coke ash was evident and tested for polycyclic aromatic hydrocarbons (PAHs) and metals. Samples were also collected from test pit 2 in the garage garden complex and test pit 6 in the former location of ward 2 and analysed for PAHs and metals. No concentrations of contaminants were detected above further investigation levels (FILs) established by the South Australian Health Commission and the Australian and New Zealand Environment and Conservation Council.

Four test pits, designated 5, 7, 8 and 9 were excavated surrounding the boiler house. Fragments of coke ash were evident in test pit 7. Samples were collected from all four test pits and analysed for polycyclic aromatic hydrocarbons (PAHs) and metals. No concentrations of contaminants above FILs were detected. Underground pipes were located ad acent to test pit 5 to the south of the boiler house.

Test pit 12, excavated at the rear of building 19, the food store, indicated that the rear brick wall extended to a depth of 0.45 metres below which the foundations continued a further 0.25 metres. There was no evidence of piles associated with the foundation at this location. A sample was collected from immediately below the foundation and tested for organochlorine pesticides (OCPs). No concentrations of contaminants exceeding FILs were detected.

Trenching undertaken in the south-west corner of the site located 15 linear metres of disused steam pipework that was lagged with asbestos containing materials. This pipework extended beyond the investigation zone. Trenching to the north of this location (south-west of building 19) intersected asbestos cement pipework. The extent of this pipework was not defined due to live underground electrical services in the area.

Further samples were collected utilising a dig stick from several locations within the investigation area. Samples Bit 1 and Bit 2 were collected from beneath the bitumen to the west of the boiler house and south of the chemical storage building. Two further samples, Cp 1 and Cp 2, were collected from beneath the bitumen in the carpark east of the SACON workshops. These samples were analysed for polycyclic aromatic hydrocarbons (PAHs). No concentrations of contaminants exceeded FILs.

A sample was collected from beneath the bitumen immediately south of the chemical storage building and analysed for total petroleum hydrocarbons (TPH) and constituents, benzene, toluene, ethyl benzene and xylene (BTEX), organochlorine pesticides (OCPs), polycyclic aromatic hydrocarbons (PAHs) and metals to establish if soil contamination had occurred from the storage and handling of chemicals in the area. No concentrations of contaminants detected exceeded the FILs.

Two samples were collected from each of the two former market garden locations within the investigation area. Each pair of samples were composited prior to analysis for OCPs, arsenic and mercury. No contaminants above the FILs were encountered.

Two samples from beneath the former substation location, south of the boiler house, were collected and composited prior to analysis for polychlorinated biphenyls (PCBs). No contaminants were detected above the FILs.

The only concentration of contaminants that exceeded FILs were detected in a composite sample from beneath the former location of the occupational therapy building, south of the boiler house. Organochlorine pesticides were detected at a concentration of 5.3 mg/kg. The major constituents of the contamination detected were aldrin at 3.7 mg/kg and chlordane at 0.8 mg/kg. Organophosphate pesticides were also detected at a concentration of 0.8 mg/kg.

Verbal discussions were held with Dr Andrew Langley and Heather Hill of the South Australian Health commission to discuss the contamination detected and to ensure that the other concerns raised by the SAHC in their assessment report, previously referred to, and that were relevant to the investigation area, had been addressed. The SAHC indicated that the concentrations of the organochlorine pesticides encountered would not constitute a health risk for residential use, so long as the keeping of domestic fowls, in unsurfaced areas was not allowed. (There is a small possibility of bio-accumulation of organochlorine pesticides by domestic fowls.)

### **Demolition and Remediation**

The results of the investigation undertaken were utilised to formalise the works required to result in land suitable for redevelopment within the investigation zone.

Budget estimates were obtained for individual components of the works required and have been included in this report.

•	Excavation and backfilling of garage/garden complex:	\$64,000
•	Excavation and backfilling of former ward 2 location:	\$59,000
•	Removal of bitumen from investigation area:	\$32,500
•	Removal of underground storage tanks:	\$10,800
•	Remediation of asbestos cement materials in building 17:	\$25,000
•	Remediation of asbestos clad pipework within remediation zone:	\$1,800
•	Remediation of asbestos clad pipework from remediation zone	
	to building 24:	\$5,000
•	Remediation of ACMs in buildings in remediation zone,	
	excluding building 17:	\$7,000
•	Demolition of covered walkways and associated concrete:	\$23,000
•	Demolition of building 17, the boiler house, including backfill:	\$20,000
•	Demolition of buildings within the remediation zone,	
	excluding building 17:	\$60,000
•	Removal of asbestos gaskets from non asbestos clad	
	underground pipework:	\$4,000
•	Collection and analysis of two samples from beneath each slab	
	for organochlorine pesticides:	\$6,000
•	Fibre monitoring (conducted by Project Manager):	\$300/day
•	Validation sampling:	\$2,500
•	Remediation project management:	\$12,500
•	Provisional Sum:	\$30,000

It is anticipated that these works could be completed within three months of the contractor taking possession of the site. This time scale would allow the contractor to salvage suitable materials during the demolition works. These budget estimates include the salvage value of the materials.

## 1. Introduction

Rust PPK were invited by Gordon Heath of Heath Planning and Management to submit a proposal for the following consultancy and technical services within an approximate boundary designated on a plan provided by Heath Planning and Management:

- Identify, investigate and document all contaminants within the Workshop, Boiler House and Walkway Zones of the former Hillcrest Hospital, including recommending an appropriate boundary within which to designate the works. An approximate boundary was designated on a plan provided. Investigation of the walkways was to extent beyond the boundary defined.
- Document all works necessary for the complete removal of all contaminants, buildings, structures, pavements within the designated zone boundaries required to result in land suitable for residential development.
- Assist the Department of Environment and Natural Resources to undertake any activities necessary to implement the agreed demolition and remediation works within the agreed timescale and budget parameters.

The resulting proposal titled Site Contamination, Investigation, Demolition and Remediation Works - Former Hillcrest Site (Document No 95/341 of 23 May 1995) was submitted to Mr Peter Lawrence, Manager of the Property Services branch of the Department of Environment and Natural Resources. Acceptance of this proposal was confirmed in correspondence from Peter Lawrence on 7 June 1995.

This report documents the undertaking of the consultancy and technical services required. An audit of asbestos contamination has been completed as part of the environmental investigation and is detailed in the report Hillcrest Hospital Asbestos Remediation Plan (Document No 95/457 of 7 July 1995) included in Appendix H of this report.

### 2. Scope of Works

### 2.1 Buried Rubble and Uncompacted Fill

Trenching was undertaken in the areas indicated by anecdotal evidence to contain buried rubble and uncompacted fill with the following objectives:

- to identify the areas where buried rubble is present
- to determine areas where rubble should be removed
- to determine the extent of chemical contamination in buried rubble
- to determine the nature and extent of uncompacted fill
- to determine the consistency or relative density of the uncompacted fill material

### 2.2 Coke Ash

Trenching was undertaken to allow visual examination for the presence of coke ash. Chemical tests were carried out for Polycyclic Aromatic Hydrocarbons (PAHs) and metals on samples collected from locations were there was visual evidence of the presence of coke ash.

### 2.3 Base Material Underlying Bitumen

No testing was undertaken on the bitumen itself however samples were collected from the base material beneath the bitumen and analysed for polycyclic aromatic hydrocarbons (PAHs).

### 2.4 Internal White Ant Treatment

Soil samples were collected from beneath the foundations of a building on the site and beneath the former location of a building that had been demolished, and analysed for organochlorine pesticides (OCPs).

### 2.5 Chemical Storage Buildings

A soil sample was collected from beneath the bitumen at the front of the chemical storage building and analysed for benzene, toluene, ethyl benzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs) and metals.

### 2.6 Sites of Former Orchards or Market Gardens

Two samples were collected from each of the two former orchard and market garden sites within the investigation area. These samples were composited and analysed for organochlorine pesticides (OCPs), arsenic and mercury.

### 2.7 Former Substation

Two samples were collected from beneath the former location of a substation south of the boiler house. These samples were composited and analysed for polychlorinated biphenyls (PCBs).

### **2.8** Depth of Foundations

A test pit was excavated adjacent to an existing building on the site to obtain an indication of the depth of the foundations that would be encountered during demolition.

### 3. Works Undertaken

### 3.1 Sampling Methodology

Samples were collected from the side walls of the test pits. Samples were taken by first digging away the trench face and sampling the undisturbed "clean" material behind. A clean spatula was used to remove the soil which was then placed on a plastic sheet, mixed, shaped into a cone and a quarter of the cone removed to obtain a sample fully representative of the depth interval being sampled. The spatula was cleaned and rinsed using sulphamic acid and distilled water between the collection of the samples. The back hoe bucket used for the trenching was cleaned between test pits using high pressure cleaning equipment to avoid cross contamination of the test pits.

Samples were also collected using a dig stick in several locations on the site. The samples were fully representative of the depth interval being sampled. The dig stick was cleaned and rinsed between samples using sulphamic acid and distilled water to avoid cross contamination.

For each of the soil samples forwarded to the laboratory, sample preservation techniques were employed to ensure that there was no deteriation of the samples, such as by volitisation of contaminants, between sampling and analysis. Sample jars prior to and after sampling were maintained at approximately 4°C by use of polystyrene insulated containers and frozen "cooler" bricks. Sample containers were glass. A teflon disk inserted inside the container lid provided a gas tight seal and also ensured prevention of contamination from the plastic lid.

Samples were forwarded to the laboratory so as to be received within 24 hours or were placed in cool storage at  $4^{\circ}$ C. The laboratory advises that on arrival the samples were placed in cool storage at  $4^{\circ}$ C.

Sample transmittal forms accompanied the samples to the laboratory indicating sample identification, depths of the soil strata that the sample represented, the date sampled and the chemical analysis required. These were signed and returned by the laboratory as confirmation they had received the samples indicated.

### 3.2 Laboratory Used

Australian Government Analytical Laboratories 51-65 Clarke Street South Melbourne VIC 3205

### 3.3 Buried Rubble and Uncompacted Fill

Six test pits were excavated in the area of the garage/garden complex and the former location of ward 2. The locations of these test pits are indicated on the site plan contained in Appendix A of this report. The test pits were excavated to natural soil under

the full time supervision of a Rust PPK geotechnical engineer. The exposed soil and fill profile was logged in accordance with the visual-manual method set out in AS1726 - 1993 to provide a description of the nature and depths of any fill material. Pocket penetrometer readings were taken in all cohesive strata to provide information on their in-situ strength. The geotechnical logs are included in Appendix B of this report.

The exposed profiles were examined for visual or olfactory evidence of contamination, and environmental samples taken as required from the side walls of the test pits. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

Dynamic Cone Penetrometer (DCP) tests, as set out in AS1289.F3.2, were undertaken next to four of the test pits in order to correlate fill type and fill density. Dynamic Penetrometer Results are included as Appendix F.

### 3.3.1 Garage/Garden Complex

Three test pits were excavated in the area of the garage/garden complex to a maximum depth of 1.2 metres below ground level (mBGL). Fill was encountered to 0.95 mBGL in test pit 1 located to the south-east of the amenities facilities. The fill in test pit 2 and test pit 3 extended to 0.65 and 0.6 mBGL respectively. The geotechnical logs are included in Appendix B of this report.

The composition of the fill material varied from sandy silty gravel intersected in test pit 1 to concrete fragments with bitumen topping up to 600 mm diameter evident in test pit 2. Also contained in the fill detected in test pit 2 were fragments of old timber and bitumen. The fill in test pit 3 contained some black fragments, possibly coke ash, concrete fragments and a piece of metal.

#### Sample Analysis Undertaken

Samples were collected from test pit 2 and test pit 3 fully representative of the depth intervals 0.31 to 0.46 metres and 0.25 to 0.4 metres respectively and submitted for analysis for polynuclear aromatic hydrocarbons (PAHs) and metals.

#### Results

No concentrations of PAHs or metals exceeded the further investigation limits (FILs). Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

#### **Dynamic Cone Penetrometer Tests**

Dynamic Cone Penetrometer tests were undertaken adjacent to test pit 1 and test pit 3. The results indicate reasonable compaction of the fill, however it is likely that the results are distorted due to the large fragments of building rubble detected in the backfill. Dynamic Penetrometer Results certificates are included in Appendix F of this report.

### 3.3.2 Former Site of Ward 2

Three test pits were excavated in the former location of Ward 2. The maximum depth of excavation was 1.7 mBGL. Fill was intersected to a maximum depth of 1.2 mBGL in test pit 10, adjacent to the southern most footing of the former ward 2 location. Test pit 4 was located adjacent to the southern footing of the northern wing of the former ward 2 location. This footing was still evident on the surface. The footing extended to 1.0 mBGL above a gravel base and constituted the northern wall of the test pit. The southern wall of the test pit was logged. Test pit 6 located to the west of the entrance for the former ward 2, was excavated to 1.0 mBGL where the top of a concrete conduit, containing a steam pipe, was intersected.

The fill evident in test pit 4 was sandy silty clay that contained some bricks and brick fragments and extended to 0.7 mBGL. The fill detected in test pit 6 varied from silty clay to clayey silty gravel and contained fragments of coke ash. Test pit 10 detected fill material to a depth of 1.2 mBGL, as was previously indicated. The fill consisted of silty clay, clayey silt and contained bricks and brick fragments, broken glass, pieces of plastic, fragments of floor coverings and pieces of timber.

Test pit locations are indicated on a site plan contained in Appendix A of this report. The geotechnical logs are included in Appendix B of this report.

#### Sample Analysis Undertaken

Samples fully representative of the depth intervals 0.1 to 0.25 metres and 0.5 to 0.75 metres were collected from test pit 6 and test pit 10 respectively and submitted for analysis for PAHs and metals.

#### Results

No concentrations of PAHs or metals detected in the analysis undertaken exceeded the FILs. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

#### **Dynamic Cone Penetrometer Tests**

Dynamic Cone Penetrometer tests were undertaken adjacent to test pit 4 and test pit 10. The results indicate reasonable compaction of the fill, however it is likely that the results are distorted due to the large fragments of building rubble detected in the backfill. Dynamic Penetrometer Results certificates are included in Appendix F of this report.

### 3.4 Coke Ash

During the undertaking of site works Mr Howard Thiele, the head gardener, indicated that Mr Nick Boffa, a former gardener at the site, would be able to provide information regarding the areas where coke ash was used as fill on the site. Mr Thiele had been questioned previously as part of the site history but had not indicated Mr Boffa as a possible source of information. Mr Boffa indicated that two truck loads per week of coke ash were used as fill at locations over the whole of the site from 1967 to 1974,

when the boiler was converted to gas. He was unable to specify any exact locations or the size of the truck.

Test pits 5, 7, 8 and 9 were excavated in the area immediately surrounding the boiler house to locate areas where coke ash was used as fill material or was stockpiled. Visual evidence of coke ash was detected in test pit 7, to the east of the boiler house. There was no visual evidence of coke ash contamination in the other test pits. The geotechnical logs are included in Appendix B of this report.

The anecdotal evidence obtained from Mr Boffa indicates that substantial amounts of coke ash were used as fill material over the majority of the site. Visual evidence of coke ash fragments was noted in test pit 3 in the garage/garden complex, test pit 6 west of the entrance of the former ward 2, test pit 7 to the east of the boiler house and test pit 11 beneath the former location of the occupational therapy building, however no significant layers of coke ash were encountered.

#### Sample Analysis Undertaken

Samples from test pits 3, 6, 7 and 11 were collected from the depth at which visual evidence of coke ash was noted fully representative of the soil strata over a minimum depth interval of 0.15 metres. Samples were also collected from test pits 5,8 and 9 from depth intervals that visually appeared the most likely to contain contamination.

#### Results

No concentrations of PAHs were detected that exceeded the FILs. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

The investigation undertaken indicates that the concentrations of polycyclic aromatic hydrocarbons associated with the coke ash that was visually evident are below the FILs.

### **3.5 Base Material Underlying Bitumen**

No chemical testing was undertaken on the bitumen itself as the site remediation plan will provide for the removal from the site of all bitumen and disposal to a landfill site approved by the Environment Protection Authority to accept the bitumen.

Two samples were collected from beneath the bitumen west of the boiler and south of the chemical storage building and submitted for laboratory analysis for PAHs. A further two samples were collected from beneath the bitumen in the car park to the east of the SACON workshops and submitted for laboratory analysis for PAHs. Sampling locations are indicated on the site plan contained in Appendix A of this report.

No concentrations were obtained in either of the samples analysed that exceeded the FILs. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.
### **3.6** Internal White Ant Treatment

Two samples were collected from beneath the former location of the footings of the occupational therapy building that were fully representative of the surface soil strata from depth range 0 to 150 mm and were composited and analysed for organochlorine pesticides (OCPs). A sample was also collected from test pit 12, excavated adjacent to the footings of a building to the west of the boiler. The sample collected was fully representative of the soil strata from 0 - 150 mm beneath the footing. The sample was analysed for OCPs. Sampling and test pit locations are indicated on the site plan contained in Appendix A of this report. The geotechnical logs are included in Appendix B of this report.

#### Results

The analysis undertaken on the composite sample from the former location of the occupational therapy building detected OCPs at a concentration of 5.3 ppm exceeding the FILs. The major constituents of the OCPs detected were aldrin at 3.7 mg/Kg and chlordane 0.8 mg/Kg. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

## 3.7 Chemical Storage Building

The base of the chemical storage building was concrete. The storage building is raised and a concrete platform exists at the front of the building that was used for the loading and unloading of drums of chemicals off and on trucks. A sample was collected from beneath the bitumen immediately south of this which was considered the most likely place for any spills to have occurred that would not be contained by the concrete. Sampling locations are indicated on the site plan contained in Appendix A.

The sample was submitted for analysis for total petroleum hydrocarbons, BTEX, OCPs, PAHs and metals. No concentrations of contaminants above the FILs were detected. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

### **3.8** Sites of Former Orchards or Market Gardens

Two samples were collected from each of the former market garden areas with the investigation region. Sampling locations are indicated on a site plan contained in Appendix A. The two samples from each area were fully representative of the surface soil strata from the depth range 0 - 150 mm. The two samples from each former market garden location were composited prior to laboratory analysis for OCPs, arsenic and mercury. No contaminants above the FILs were detected by the analysis undertaken. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

#### **3.9** Former Substation

Two samples, fully representative of the soil strata from the depth range 0 - 150 mm, were collected from the site of the former substation south of the boiler house and submitted to a NATA registered laboratory to be composited and analysed for PCBs. No contaminants were detected above the FIL. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

### **3.10** Depth of Foundations

Test pit 12, previously referred to in section 3.4, was excavated adjacent to the rear wall of building 19, the food store, enabling the depth of the foundations at this location to be established. The brick wall continued to a depth of 0.45 metres below which a concrete foundation extended a further 0.25 metres. No piles were associated with the foundations in this location.

# 4. Contamination Detected

The only concentrations of contaminants detected that exceeded FILs were in the samples collected from the former location of the occupational therapy building, which had been demolished. Two samples were collected from this area and composited prior to analysis for organochlorine pesticides.

The analysis undertaken on the composite sample from the former location of the occupational therapy building detected OCPs at a concentration of 5.3 ppm exceeding the further investigation limit of 1.0 ppm. The major constituents of the OCPs detected were aldrin at 3.7 mg/Kg and chlordane 0.8 mg/Kg. Laboratory reports and a summary of analytical results are included in Appendix D and Appendix E of this report.

## 5. Discussion and Recommendations

The trenching in the area of the garage/garden complex and the former location of ward 2 intersected buried rubble and uncompacted fill to a maximum depth of 1.2 metres. If building is to occur in this area geotechnical considerations would require the excavation of the fill, backfilling with quarry material and compaction. No chemical contamination of the fill was detected by the sampling and analysis undertaken. Consequently excavation of the fill is not required if no building is to occur on these areas.

Anecdotal evidence suggested that there are areas where large amounts of coke ash were deposited, however none were located by the trenching undertaken in the area of investigation. Analysis undertaken on samples collected where small amounts of coke ash were visual evident indicated that only minor levels of polycyclic aromatic hydrocarbons (below FILs) were associated with the coke ash in these samples. No remediation of these areas will be required. However, if thick layers of coke ash are intersected during earthworks on the site, these should be evaluated at this time.

Organochlorine pesticide contamination was detected in a composite sample from beneath the former location of the occupational therapy building, recently demolished. Concentrations detected exceeded FILs. The levels detected were discussed with the SA Health Commission, who indicated that they would not constitute a health risk for residential development, except possibly in the extreme case of bio-accumulation by domestic fowls kept in the open in these areas. This is not likely to be approved by the relevant local authority. The concentrations detected therefore are not sufficient to necessitate the excavation and removal of the soil. A sample collected from beneath the footings of an existing building on the site did not contain organochlorine pesticides.

It is anticipated that the most feasible and cost affective method of dealing with any similar contamination that may exist under other buildings on the site is the assessment of the soil that remains after the demolition of each building and the removal of the associated slab. These samples should be fully representative of the surface to 150 mm depth interval and be analysed for organochlorine pesticides.

# 6. **Demolition and Remediation**

The results of the investigation undertaken were utilised to formalise the works required to result in land suitable for redevelopment. Budget estimates were obtained for individual components of the works required and have been included in section 6.12 of this report. Details are provided in sections 6.1 to 6.11.

# 6.1 Excavation and Backfilling of Garage/Garden Complex and the Former Location of Ward 2

The budget estimates to undertake excavation of the garage/garden complex and the former Ward 2 location were calculated by multiplying an estimated volume by cubic metre rates for excavation, disposal and backfilling. The volume was estimated using cross sections determined from the logs of the test pits and the immediate areas of the garage/garden complex and the former location of Ward 2. The region between these two locations was not included in this calculation.

### 6.2 **Removal of Bitumen from Investigation Area**

The cost for the removal of bitumen was estimated on a rate per square metre basis. The area of bitumen to be excavated included all bituminised regions of the investigation area. The cost for disposal as low level contaminated soil was calculated assuming 16 square metres of bitumen to the tonne and a per tonne disposal charge.

### 6.3 **Removal of Underground Storage Tanks**

The initial quote obtained for the removal of underground storage tanks (USTs), tabled in the Value Engineering Workshop conducted by Rust PPK on 3 July 1995, was for the removal of three USTs. Further investigation has indicated that a tank that was previously believed to have been removed due to the condition of the fill and dip points associated with the tank remains in-situ. As a result a revised quote has been included in this report.

It is necessary that investigations are undertaken concurrently with the removal of the USTs due to the potential for contamination to have occurred from any leaks in the tanks or the associated pipe work. The estimate included in this report allows for the following investigative measures to be undertaken:

- on-site supervision by a Rust PPK engineer during the tank removal and verification of tank condition
- collection and on-site analysis of head space samples for volatile organic compounds using a photoionization detector
- collection and laboratory analysis of two samples from beneath each tank to be analysed for total petroleum hydrocarbons (TPHs), benzene, ethylbenzene, toluene and xylene (BETX) and metals

- collection and laboratory analysis of a sample from beneath each bowser to be analysed for total petroleum hydrocarbons (TPHs), benzene, ethylbenzene, toluene and xylene (BETX) and metals
- Documentation and reporting

If these investigative measures indicate contamination, further investigation to meet the requirements of the South Australian Health Commission would be necessary. These could included further excavation and sampling of the soil surrounding the underground storage tanks, the collection of core samples from beneath and adjacent to the pits to delineate soil contamination or the drilling of groundwater monitoring bores to investigate soil and/or groundwater contamination depending on the degree and nature of the contamination detected. A provisional sum of \$10,000 is recommended to allow for these possibilities and has been included in the provisional sum for the complete works indicated in this report.

#### 6.4 Asbestos Remediation

Details of the asbestos remediation are contained in the Hillcrest Hospital Asbestos Remediation Plan in Appendix H.

### 6.5 Demolition of Covered Walkways

The budget estimate obtained for the demolition of the covered walkways and associated concrete allowed for the removal of concrete culverts associated with walkways where they extended beneath roads. The bitumen required to be excavated to undertake these operations would not be replaced, however backfilling and compaction with quarry material would be undertaken.

## 6.6 Demolition of Building 17

The budget estimate given for the demolition of building 17 (the boiler house) includes excavation and backfilling, however the removal of any building piles associated with the foundations were not included. The estimate was given assuming that the time period allowed for demolition works would be sufficient for the salvage of suitable materials to be undertaken.

## 6.7 Demolition of Buildings Within The Remediation Zone, Excluding Building 17

The budget estimate given for the demolition of the remaining buildings within the remediation zone allowed for the salvage of suitable materials.

## 6.8 Organochlorine Pesticide Investigation

It is recommended in section 5 of this report that two samples are collected from the soil immediately beneath each slab removed during demolition to be analysed for organochlorine pesticides. Concentrations of contaminants detected in these samples that exceed FILs may necessitate further sampling to delineate the contamination detected and may require additional remediation works.

## 6.9 Fibre Monitoring and Validation Sampling

During asbestos removal operations it is required by the SA Code of Practice for the Safe Removal of Asbestos that asbestos fibre concentrations in the air shall be measured at several locations outside the designated removal area. Such data are important in determining the positions of the barriers which contain the removal area and the effectiveness of the control procedures. Air monitoring is also required in decontamination areas. It is recommended that air monitoring is undertaken by the project manager, independent of the removal contractor.

## 6.10 Quality Control Inspection

At the completion of the scope of works required for asbestos remediation a quality control inspection is required to verify that the works required have been completed.

## 6.11 Provisional Sum

A provisional sum of \$30,000 has been suggested to allow for the potential variations that may result from extra works required as a result of contamination from underground storage tanks, possible OCP contamination of slabs beneath the soil, the removal of piles possibly associated with the foundations of the boiler house, and the excavation and removal of underground pipework not included in the scope of works.

## 6.12 Summary of Budget Estimates

Following are the budget estimates obtained for the different components of the works required to result in land suitable for residential development.

•	Excavation and backfilling of garage/garden complex:	\$64,000
•	Excavation and backfilling of former ward 2 location:	\$59,000
•	Removal of bitumen from investigation area:	\$32,500
٠	Removal of underground storage tanks:	\$10,800
•	Remediation of asbestos cement materials in building 17:	\$25,000
•	Remediation of asbestos clad pipework within remediation zone:	\$1,800
٠	Remediation of asbestos clad pipework from remediation zone	
	to building 24:	\$5,000

•	Remediation of ACMs in buildings in remediation zone,	
	excluding building 17:	\$7,000
•	Demolition of covered walkways and associated concrete:	\$23,000
•	Demolition of building 17, the boiler house, including backfill:	\$20,000
•	Demolition of buildings within the remediation zone,	
	excluding building 17:	\$60,000
•	Removal of asbestos gaskets from non asbestos clad	
	underground pipework:	\$4,000
•	Collection and analysis of two samples from beneath each slab	
	for organochlorine pesticides:	\$6,500
9	Fibre monitoring:	\$300/day
•	Validation sampling:	\$2,500
•	Project management of remediation works:	\$12,500
9	Provisional Sum:	\$30,000

It is anticipated that these works could be completed within three months of the contractor taking possession of the site. This time scale would allow the contractor to salvage suitable materials during the asbestos works. The contractor has considered the salvage value of the materials in making these quotes. The proposed boundaries within which to undertake these works are indicated on the site plan contained in Appendix G of this report.

# 7. Statement of Limitations

This report has been prepared by the Consultant with all reasonable skill, care and diligence in accordance with the terms of agreement with the Client, and taking account of the human and other resources utilised by agreement with the Client.

The data in the report was derived by applying the methodology described in subsequent sections of this report. To the best of the Consultant's knowledge, the information contained in the report is accurate at the date of issue. However there should be a recognition of the limitations of the site environmental assessment process. These are referred to, for example in Section 4 of ASTM Practice E 1527-94. Clause 4.5 states the following:

No environmental site assessment can wholly eliminate uncertainty regarding the potential for recognised environmental conditions in connection with a property. This site assessment is intended to reduce, but not eliminate, uncertainty regarding the potential for recognised environmental conditions in connection with a property, and both practices recognise limits of time and cost.

It should also be recognised that site conditions, including contaminant extent and concentrations, can change with time. This may be particularly relevant if the report is used after a protracted delay, such that further investigation of the site may be necessary.

In preparing this report, the Consultant has relied on and presumed accurate certain information provided by the Client or third parties. Unless otherwise stated in the report, the Consultant has not attempted to verify the accuracy or completeness of any such information.

The consultant has prepared this report for the Client in accordance with generally accepted consulting practice and the Consultant's Terms of Business. No other warranty, express or implied, is made as to the professional advice included in this report. The Consultant disclaims any responsibility in respect of any matters outside the scope of the terms of agreement with the Client.

This report has not been prepared for use by parties other than the Client. It may or may not contain sufficient information for purposes of other parties or for other uses. The Consultant accepts no responsibility to third parties to whom this report, or any part thereof, is made known.

A third party relies upon the report at its own risk.

In accordance with standard practice, the assessment carried out is site specific. Consequently, the assessment does not address environmental liabilities which may or may not pertain to other properties either currently or previously owned or operated by the Client or other off-site environmental liabilities.

# Appendix A

Site Plan (Test Pit and Sampling Locations)



LEGEND		
	DENOTES TRENCH LOCATION	
× ×	DENOTES SAMPLING LOCATION	
	DENOTES AREA OF INVESTIGATIO	N
٦	DENOTES EXISTING BUILDINGS	
<b>-</b> 1	DENOTES REMOVED BUILDINGS	
	DENOTES COVERED WALKWAY	

	SCALE 1:1000
AND SAMPLING	CHECKED ASM
CATIONS	JD JD
ST HOSPITAL	DATE 5.7.95
	ORAWING No.
STH.AUST., ADELAIDE 5000 TELEPHONE (08) 2125733	27G233A/01

# Appendix **B**

Geotechnical Logs

.

T.E.S.T.I.N.G. LABORATORY

# Test Pit Log

GE

Client:	Departm	ent of Environment A	R Natural Resources				Job I	No.:	270	5233A			
Project	Hillcrest	Hospital					Date	:	14	9/6/95			
	micros	riospitat					Logg	ed by:	•	BJH			
Drilling	rilling Method: Backhoe								Pit Location:				
Ground	roundwater Struck: Nil Groundwater Stands: -								1				
	Groundwater Status							<u></u>		·			
								ensi	ne. Pa)				
Depth		Soil Description					≳	e D o	e Pe	Ê			
(m)		Symbol				stur	tici.	sist	ket nete	th (			
		Noist Const					Plas	Rel	Poc	Dep			
<b> </b>													
0.0-	FILL. C	layey silty sand, dark g	rev brown, fine to med	ium		м	VL						
0.2	grained, I	fine roots.				ļ							
0.2-	EIII Si	ilty gravelly clay gravit	sh orange and brown		1	>PL	м						
0.35	some fine	e sand gravels to 15 mm	n.										
0.25		some fine sand gravels to 15 mm.					- -						
0.35-	FILL. Sandy silty gravel, blue grey, fine to medium sand, gravels to 30 mm, some orange sand.					1							
	gravels to 30 mm, some orange sand.							500					
0.95-	Silty sandy CLAY. Orange brown, fine to medium sand, CL <p. fine="" roots.<="" some="" td=""><td>  <pl< td=""><td>м</td><td>н</td><td>500+</td><td></td></pl<></td></p.>					<pl< td=""><td>м</td><td>н</td><td>500+</td><td></td></pl<>	м	н	500+				
	some fine roots.												
	END OF	TEST PIT 1.2 m											
						}	ļ	}					
			J							i			
							ļ	}					
							[						
					ļ								
		Diastiaitu	Consistency	Rolativo D	l <u>onsitu</u>	Plar	l	arks	l <u></u> j				
	e Content	MB = Non-plastic	VS = Very Soft		oose		i in citt						
	7 Jmid	T = Trace	S = Solt	L = Loose									
Da ≖ Da	т	VL = Very Low	F = Firm	M = Mediu	Im								
M = Mo	oist ol	L = Low M = Medium	St = Stiff VSt= Verv Stiff	D = Dense VD = Verv f	) ense								
PL = Pla	astic Limit	H = High	H = Hard										
	quid Limit	VH = Very High	Fb = Friable							,			
Pt = Pta	astic Index	EH = Extra High											

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

ERED MATERIALS TESTING CABOOR ATO ROUTE

# **Test Pit Log**

GEO-16

Client: Project:	Department of Environment & Hillcrest Hospital	k Natural Resources	- -			Job N Date:	No.:	27C 1	G233A 9/6/95
		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·			Pit Lo	catior	<u>.</u>	BIH
Groundwate	thod: Backhoe er Struck: Nil Grou	undwater Stands:							2
	, NII 0.00					, 	īť		<u> </u>
Depth		Soil Description		-	t e	ţy	tency/ e Dens	Pene er (kPa	Ê.
(m)			•	USC Symbo	Moistur Conten	Plastici	Consist Relativ	Pocket tromet	Depth (
	· · · · ·	· · · · · · · · · · ·							
0.0- 0.35	Bitumen.	:	-		-	•	•		
0.35- 0.2	FILL. Sandy silty gravel, cream sand, gravel to 40 mm, some blu	y yellow, fine to coarse le grey gravel to 30 mm	5 · 1.,		Da	Т			
0.2- 0.65	FILL. Silty gravelly clay, brown to medium sand, some gravel to with bitumen topping to 600 mm	n, dark brown, some fin 150 mm, concrete frag n, old timber fragments	e ments S to		.≈PL	L			
0.65- 0.8	Silty sandy CLAY. Orange brow	vn, fine to medium san	d:	CL	≤PL	M	н		
	END OF TEST PIT 0.8 m								
		<b>1</b>							~
		<b>-</b> .						:	
,						-			
	•		•						
Moisture Co D - Dry H = Humid Da = Damp M = Moist W = Wet PL = Plastic LL = Liquid L Pl = Plastic	FontentPlasticityNP = Non-plasticT = TraceVL = Very LowL = LowM = MediumLimitH = HighLimitVH = Very HighIndexFH = Extra High	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Relative D VL = Very L L = Loose M = Mediu D = Dense VD = Very D	ensity oose m Dense	Pla	n/Rem	arks	· · · · · · · · · · · · · · · · · · ·	

ζ.

٢.

REGISTERED MATERIALS TESTING TEDENABOR ATO REYER

# Test Pit Log

Client:	Departm	ent of Environment 8	k Natural Resources				Job N	<b>lo</b> .:	270	5233A
Project:	Hillcrest	Hospital					Date:	od by:	1	9/6/95
			·				Pitto	ocatior	<u>م</u>	BIH
Drilling M	lethod:	Backhoe	Inductor Stondor				1 // 20	Joanor		•
Groundw	arounuwater Status.						<u></u>		3	
Depth (m)			Soil Description	1	USC Symbol	Moisture Content	Plasticity	Consistency/ Relative Densi	Pocket Pene - trometer (kPa)	Depth (m)
0.0- 0.6	FILL. Si roots, son fragments	lty sandy clay, grey bro ne black fragments, pos to 100 mm, piece of n	own, fine sand, some fu sibly ash/coal, concrete netal at 0.45 m.	ne S		≈PL	М			
0.6- 0.75	Silty sand some fine	y CLAY. Orange brow roots.	vn, fine to medium san	d,	CL	>PL	L/M	Н	500+	0.7
	END OF	TEST PIT 0.75 m								
		·								
Moisture	e Content	Plasticity	Consistency	Relative D	ensity	Plai	n/Rem	arks		
D Dry H = Hun Da = Dan M = Moi W = Wet PL = Plas LL = Liqu P1 = Plas	nid np st tic Limit tic Limit tic Index	NP == Non-plastic T = Trace VL = Very Low L == Low M = Medium H = High VH = Very High EH = Extra High	VS = Very Solt $S = Solt$ $F = Firm$ $St = Stilf$ $VSt = Very Stiff$ $H = Hard$ $Fb = Friable$	VL = Very L L = Loose M = Mediu D = Dense VD = Very I	.oose im im Dense					

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

D MATERIALS TESTING BUDGED OR ATTOR Y

# Test Pit Log

,**1** 

GEO-16

Client: Project:	Departm Hillcrest	ent of Environment & Hospital	& Natural Resources	· ·	•		Job N Date: Logg	lo.: ed by:	270	6233A 9/6/95 BIH	
Drilling	Drilling Method: Backhoe Pit Location:										
Ground					· · · · ·			<u> </u>		4	
Depth (m)			Soil Description	י 	USC Symbol	Moisture Content	Plasticity	Consistency/ Relative Densit	Pocket Pene - trometer (kPa)	Depth (m)	
0.0- 0.7	FILL. Sa brown, so and off-w	andy silty clay, dark bro ome fine roots above 0. white sand, some bricks,	own over greyish orang 5 m, pockets of orange brick fragments.	e		≤PL over <pl< td=""><td>Ļм</td><td></td><td></td><td></td><td></td></pl<>	Ļм				
0.7- / 1.5	Silty. grav calcareou	elly, CLAY. Off-white s; some fine sand.	and orange brown, hig	shly	CĽ.	· <pľ< td=""><td>ĻМ</td><td>н</td><td>500+</td><td></td><td></td></pľ<>	ĻМ	н	500+		
. 1.5- 1.7	Silty CL/	Y. Orange brown and	l off-white, some fine s	and.	CL/ CH	<pl< td=""><td>M/H</td><td>Н</td><td>500+</td><td>•*</td><td>  .     .</td></pl<>	M/H	Н	500+	•*	.     .
Mojotu	END OF	TEST PIT 1.7 m	Consistence	Relative D	onsity	Plan	//Bem	arks		•	
Moistur D - Dry H = Hu	re Content y umid	Plasticity NP = Non-plastic T = Trace	Consistency VS = Very Solt S = Solt	Relative D VL = Very L L = Loose	ensity oose m	Plan	i/Rem	arks			
M = Ma M = Ma W = We PL = Pla LL = Lic PI = Pla	pist et astic Limit quid Limit astic Index	L = Low M = Medium H = High VH = Very High EH = Extra High	St = Still VSt= VeryStill H = Hard Fb = Friable	D = Dense VD = Very D	)ense						

٠,

REGISTERED MATERIALS TESTING STARDOR AND A TORY

# Test Pit Log

GE

Client:	Departm	ent of Environment	r Natural Persources				Job N	lo.:	270	3233A
Project:	Hillcrest	Hospital	e maturar resources				Date:		1	9/6/95
	microse	nospitat					Logg	ed by:		BJH
Drilling	illing Method: Backhoe P							catior	ייבי:	
Ground	Groundwater Struck: Nil Groundwater Stands:									5
							ity			
Darth								cy/ ens	ene kPa	
Depth			Soil Description	า	_	e te	ity	ten. /e D	t P∉ er(	Ē
(m)					U P O F	istu nter	stic	nsis Iativ	cke	pth
					S N S Y	ΣÖ	Pla	မီငိ	Po. tro	De
0.0-	FILL. Si	lty sandy clay, dark gre	y brown, fine to mediu	m.		≈PL	L/M			
0.4	sand, som	ne metal fragments, son	ne roots.							
0.4-	FILL. Si	ilty clay, mottled dark b	rown, light grey orange	2		≤PL	M/H			
0.75	brown, so	ome fine sand, calcareou	<b>IS</b> .						ļ	
0.75-	Silty CLA	AY. Greyish orange bro	own, trace fine sand.		СН	≤PL	Н	н	500+	
1.35										
	END OF	TEST PIT 1 35 m								
					}	}	}		ļ	
						1				
							1	Ì		
	ļ									
	1									
Moistu	re Content	Plasticity	Consistency	Relative D	ensity	Plai	n/Rem	arks		
D - Dr	у	NP = Non-plastic	VS = Very Soft	VL = Very L	.oose					
$H = H_{L}$	bimu ome	T = Trace	S = Soft F = Firm	L ≕ Loose M ≕ Mediu	រកា					
	oist	L = Low	St = Stiff	D = Dense	9	1				
W = W	et	M ≃ Medium y = Slice	VSt = Very Stilf	VD = Very I	Dense					
PL ⇒ Pk   LL ≍ Lie	astic Limit quid Limit	ra – ragn VH ≕ Very High	Fb = Friable							
P1 = P1	astic Index	EH = Extra High		l						

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

D MATERIALS TESTINGS SABOR ATO R.Y

# Test Pit Log

GEO-16

Client: Proiect:	Departm	ent of Environment &	k Natural Resources				Job N Date:	No.:	270	5233A 9/6/95
,,	Timeres(	nospital				•	Logg	ed by:		BIH
Drilling	Method	Backhoe	·				Pit Lo	ocation	n:	
Groundy	wator Struck	c Nil Ĝroj	undwater Stands	· .						6
				• •	<b></b>			िठा		
Death			• •					cy/ ensit	sne - kPa)	
Depin			Soil Description	1		e	_ ≿	e D e	P€ P€	Ê
(m)			•		p p	stur	E .	sist	ket	ţ)
	•		•		DSL FYS	Voi	las	Son	100 Loc	)ep
· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	- <u>4</u>	<u> </u>	20	┝━╙╴	04		
0.0- 0.1	FILL. Sa coarse sau	andy silty gravel, light and, gravel to 30 mm.	grey to blue grey, fine	<b>'O</b>		м	T.			
0.1- 0.25	FILL. Cl grey, son	layey silty gravel, mottl ne fine sand, gravel to 3	led orange brown and b 30 mm, some coke/ash.	lue S		M	VL			
0.25- 0.8	FILL. Si to 30 mm	lty clay, some fine to n a, some coke/ash fragme	nedium sand, some gravents to 200 mm	vel .		≥PL	Ļ,			
0. <b>8-</b> , 1.0	FILL. Si to coarse clay, pocl	lty sand, mottled yellow grained, some gravel to kets of calcareous silt.	w and orange brown, fu o 20 mm, pockets of sil	ne · ty		М	VL	-		
1.0	Top of co	oncrete conduit with ste	am pipe inside.						•	
	END OF	TEST PIT 1.0 m								
₿					1		}			
{		•	•							
		• •				]	· ·			
					•					
						ŀ	·			
· ·									,	
	•	•		· ·	·			ł		
	•	•								
				•						
	Contact	Olecticity	Consistency	Polotivo D				arke		l
Moisturi					00%	Fia	nnem	iai Nð		
H = Hu	mid	T = Trace	S = Soft	L = Loose						
Da = Da	mp .	VL = Very Low	F = Firm	M = Mediu	am .				۰.	
M = Mo	ist .		St = Stiff	D = Dense	B Donco -	1.1				
IW ≃We	etic Limit	m = meaium H = Hiah	$v_{OI} = very_{OIII}$ H = Hard	vu = veryl	Jense					
LL = Lio	uid Limit	VH = Very High	Fb = Friable	× '				· · ·		
PI = Pla	stic Index	EH = Extra High	· · ·							

7

7

MATERIALS. TESTING BURNER BORRATORY

Test Pit Log

യ

U

Client:	Departm	ent of Environment	Natural Decourace				Job N	<b>l</b> o.:	270	3233A
Project:	Hillcrest	Hospital	c Matural Resources				Date:		1	0/6/05
	interest						Logg	ed by:		BIH
Drilling	Method:	Backhoe					Pit Lo	catior	n:	
Ground	Groundwater Struck: Nil Groundwater Stands:									7
								Ę		·
Depth								cy/ ens	k Pa B	
			Soil Description	1	-	re Te	ity	ten /e D	t Pe er(	Ê
(111)					Q m	istu nter	stic	nsis Iativ	ckei	pth
					US Syi	νÕ	Pla	Ве Ве	tro T	De
0.0-	FILL. Cl	ayey silty sand, dark bi	rown, grey brown, fine	•		М	Т			
0.25	to coarse fragments	to 30 nm, fine roots.	50 mm, some brick some fragments of blac	S. K						
	ash/charce	oal to 20 mm.								
0.25-	FILL. Si	lty sandy clay orange b	rown, brown, fine to m	edium		≈PL	L/M			
0.45	sand, poc	kets of yellow/orange s	and, some gravel to 20	mm.			_,			
0.45-	Sandy sill	IV CLAY Orange brow	vn fine to medium san	đ		<p1< td=""><td>м</td><td>н</td><td>410</td><td>0.6</td></p1<>	м	н	410	0.6
0.75	oundy on		an, the to meature san	u.		112	141		410	0.0
0.75	Silty CLA	V Crasmy orongo he	own come fine and h	iahlu		- DI		ч	500+	
0.75-	calcareou	s.	own, some nine said, n	Iginy			L/1VI		500+	
					[					
	END OF	TEST PIT 0.8 m								
						ļ				
							ţ 			
į										
							]		·	
Moistur	e Content	Plasticity	Consistency	Relative D	ensity	Pla	n/Rem	arks	<u></u>	· · · ·
D - Dr	y	NP = Non-plastic	VS = Very Soft	VL = Very L	.oose					
$H = H_{L}$	umid Imp	T = Trace	S = Soft F = Firm	L = Loose M = Media	e Im					
M = M	oist	L = Low	St = Stilf	D = Dense	9					
W = W	et	M = Medium	VSt= Very Stiff	VD = Very (	Dense					1
PL ≅ Pla	astic Limit	H = High VH ≈ Verv High	H = Hard Fb = Friable							
PI = Pla	astic Index	EH = Extra High								

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733 L.A.B.O.R.A.T.O.R.Y

STERED MATERIALS TESTION G. A.B.O.R.A.T.O.R.Y

# Test Pit Log

GEO-16

Client: Project:	Department of Environment & Hillcrest Hospital	c Natural Resources		•	•	Job I Date Logg	No.: : ied by:	270	5233A 9/6/95 BJH
Drilling	Method: Backhoe	induistor Standa				.Pit L	ocation	י:	
Ground	water Struck: Nil Grou		-	1				، 	8
Depth (m)		Soil Description	٦	USC Symbol	Moisture Content	Plasticity	Consistency/ Relative Densit	Pocket Pene - trometer (kPa)	Depth (m)
0.0- 0.03 0.03-	Bitumen. FILL. Sandy silty gravel, creamy	y yellow, orange, fine	to		Da	T		•	
0.1- 0.4	FILL. Gravel, yellow orange bro to 150 mm.	own, quartzitic cobbles						•	•
0.4- 1.5	Silty CLAY. Dark grey brown, s calcareous silt below 1.2 m.	some fine sand, trace	•	СН	≈PL over . ≥PL	. H	VSt VSt	230 - 260	0.5 1.25
	END OF TEST PIT 1.5 m	·	•						
			. <sup>.</sup>	· ·			· · · · · · · · · · · · · · · · · · ·		
•					-			•	
					•				
Moistur D - Dr H = Hu Da = Da M - Mo W - We PL - Pla LL - Lic Pl = Pla	re ContentPlasticityy $NP = Non-plastic$ ymid $T = Trace$ ymp $VL = Very Low$ bist $L = Low$ et $M = Medium$ astic Limit $H = High$ yuid Limit $VH = Very High$ stic Index $EH = Extra High$	Consistency VS = Very Soft S = Soft F = Firm St = Stilf VSt = Very Stilf H = Hard Fb = Friable	Relative De VL = Very Lo L = Loose M = Medius D = Dense VD = Very D	ensity pose m ense	Plar	ı/Rem	arks		



# REGISTERED MATERIALS TESTING ABOOR ATO R. YES

# Test Pit Log

Gť

Client:	Departm	ent of Environment &	& Natural Resources				Jobi	No.:	270	233A	
Project:	roject: Hillcrest Hospital							Date:		19/6/95	
									Logged by:		
Drilling	Drilling Method: Backhoe										
Ground	water Struc	k: Nil Gro	undwater Stands:	-			1			9	
					<u> </u>	_ <u></u>	<u> </u>	<u>ि</u> ≳ा			
					<b> </b>			y/ ensi	Pa)		
Depth			Soil Descriptio	n			≥	e De	Pe X	Ê	
(m)						stur	ticit	sist ative	ket	ت چ	
					Syn	No.	Plas	2el	00	Cep	
<u></u> {			<u> </u>								
0.0-	FILL. C	layey silty sand, dark g	rey brown, fine to med	ium		м	VL				
0.2	grained, f	ine roots.									
0 2-	FILL Si	Ity gravelly clay, grevis	sh orange and brown.			>PL	м				
0.35	some fine	sand gravels to 15 mm	ū.								
0.35		andu siltu gravel blue s	rrev fine to medium se	nd	ļ	н	Т			1	
0.95	gravels to	30 mm, some orange	sand.	142,							
0.05	0.1	CLAY Order have	<i>fi f</i> i	L		-101		,,,	600.		
1.2	some fine	iy CLAT. Urange brow	wh, fine to mealum san	<b>a</b> ,		<rl< td=""><td>M</td><td>н</td><td>500+</td><td></td></rl<>	M	н	500+		
	END OF	TEST PIT 1.2 m								1	
j j											
						•					
					<b>]</b>		]				
Mointur	e Content	Plasticity	Consistency	Relative D	L ensity	Plar	L	arks			
		NP = Non-plastic	VS ≈ Verv Soft		OOSA		i i ent				
H ≞ Hu	mid	T = Trace	S = Soft	L = Loose							
Da = Da	mp	VL = Very Low	F ≈ Firm	M = Mediu	m						
M -= Mo 1 w - 14/∩	hist N	L ≕ Low M = Medium	St ≕ Still VSt≕ Verv Stiff		)ense						
** - **6   PL = Pla	stic Limit	H = High	H ≈ Hard								
LL = Liq	uid Limit	VH = Very High	Fb = Friable								
PI = Pla	stic Index	EH = Extra High	L	i		<u> </u>					

100 North Terraco, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

MATERIALS TESTINGCOLLABOR ALTO RUY

# **Test Pit Log**

GEO-16

Client: Project:	nt: Department of Environment & Natural Resources ect: Hillcrest Hospital								27G233A 19/6/95 ВЈН		
Drilling	Drilling Method: Backhoe										
Ground	water Struc	k: Nil Gro	undwater Stands:	-						10	
Depth (m)			Soil Description	ר	USC Symbol	Moisture Content	Plasticity	Consistency/ Retative Density	Pocket Pene - trometer (kPa)	Depth (m)	`
0.0- , 0.2	FILL. Si fine grav	ilty clay, orange brown, el, fine roots.	, some fine sand, some			≈PL	M/H				
. 0.2- 0.3	FILL. C medium	layey silty sand, dark g grained, fine roots.	rey brown, fine to	,		М	T/ VL				
0.3- 1.2	FILL. Rubble, mottled grey, brown, creamy, fine to coarse sand, gravel to 100 mm, bricks and brickHfragments, broken glass, pieces of plastic, fragments of floor covering, pieces of timber.H						Т				
1.2- 1.4	Silty CLAY. Orange brown and creamy, some fine sand, highly calcareous.					<pl< td=""><td>M/H</td><td>н</td><td>500+</td><td>1.3</td><td><b>*</b> .</td></pl<>	M/H	н	500+	1.3	<b>*</b> .
	END OF TEST PIT 1.4 m										
		•						- - -			
		•									
·	· ·										
Moisture ContentPlasticityConsistencyRelative DensityPlan/FDDryNP = Non-plasticVS = Very SoftVL = Very LoosePlan/FH = HumidT = TraceS = SoftL = LooseL = LooseDa = DampVL = Very LowF = FirmM = MediumM = MoistL = LowSt = StiffD = DenseW = WetM = MediumVSt= Very StiffVD = Very DensePL = Plastic LimitH = HighH = HardLL = Liquid LimitVH = Very HighFb = FriablePI = Plastic IndexEH = Extra HighFb = Friable				n/Rem	arks						



REGISTERED MATERIALS TILES TIM GUI BLANDOR ANTO RYPE

# Test Pit Log

S

Client:	Departme	ent of Environment &	Natural Resources		·		Jop N	lo.:	270	233A
Project	Hillcrest	Hospital					Date:		10	9/6/95
	· · · · · · · · · · · · · · · · · · ·								Logged by:	
Drilling	Drilling Mothod: Backhoe									
Cround	water Struck	Nil Grou	Indwater Stands:	_						
Ground				-				<u></u> >1		
Depth (m)			Soil Description						ocket Pene - rometer (kPa)	Jepth (m)
						20		0	<u> </u>	
0.0- 0.35	FILL. Silty sandy clay, dark brown, some dark grey brown, fine to medium sand, some gravel to 30 mm, some 5 fine bitumen/ash fragments to 30 mm, some glass fragments on surface. ▷									
0.35- 0.75	FILL. Silty clay, mottled creamy orange brown and dark ≥PL brown, some fine sand, moderately calcareous (probable disturbed natural).									
0.75- 1.0	Silty CLA fine sand.	Y. Orange brown, gre	yish orange brown, sor	ne	Сн	>PL	н	VSt	270	0.9
	END OF TEST PIT 1.0 m									
Moistur D - Dr H = Hu Da = Da M = Ma W = Wa PL = Pla LL = Lia Pl = Pla	re Content y umid amp oist et astic Lumit quid Limit astic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Relative C VL = Very I L = Loose M = Media D = Dens VD = Very	)ensity _oose e um e Dense	Pla	Plan/Remarks			

ERED

100 North Terrace, Adelaide S.A. 5000 Facsimile (08) 212 4686 Telephone (08) 212 5733

ELABOR ALTOR YES

# Test Pit Log

GEO-16

Client: Project:	Department of Environment & Natural Resources Hillcrest Hospital	Job No.: Date: Logged by:		27G233A 19/6/95 BJH			
Drilling I Groundy	Method: Backhoe water Struck: Nil Groundwater Stands: -	•	••	Pit Lo	catior	1:	12
Depth (m)	Soil Description	USC Symbol	Moisture Content	Plasticity	Consistency/ Relative Density	Pocket Pene - trometer (kPa)	Depth (m)
0.0- 0.5	FILL. Silty sandy clay, dark brown, grey brown, fine sand, some fine roots, some decomposed wood fibres to 40 mm, copper pipe at 250 mm.		>PL	L/M			
0.5- 0.7	Silty CLAY. Creamy orange brown, some fine sand, highly calcareous.	CL	>PL	М	S	30	0.6
<u>1</u>	END OF TEST PIT 0.7 m		•		•		•
			•				
			•	•			
						•	
$\begin{array}{rcl} Moisture\\ D & Dry\\ H &= Hul\\ Da &= Dae\\ M &= Mo\\ W &= We\\ PL &= Plae\\ LL &= Liq\\ Pl &= Plae\\ \end{array}$	e ContentPlasticityConsistencyRelative DmidT = TraceVS = Very SoftVL = Very ImpVL = Very LowF = FirmL = LooseistL = LowSt = StiffD = DenstM = MediumVSt = Very StiffVD = Very Istic LimitH = HighH = HardVD = Very Iuid LimitVH' = Very HighFb = FriableFriable	Density Loose Hum B Dense	Plar	n/Rem	arks ,		

ERIALS

S.T.I.N.G.

ΤE

M·A

T

# Appendix C

Sample Transmittal Forms



• • •





# Sample Transmittal and Testing

Order No .: Sender: Andrew Miller

## Job No .: 276233A Date: 20-6-95 Page | of )

**PROJECT:** 

1

\_\_\_\_

as

W

Faxed 21/6/95

Samples transferred from RUST PPK Pty. Ltd., 100 North Terrace, Adelaide to by Courier

Receiver to sign this form and fax to RUST PPK Pty. Ltd. immediately on receipt of samples.

Special Instructions: Analysis required by wed 28-6 awanged with David Loftus inas

Sample Identification Sample Depth Date Time Box No. **Tests Required** No. Sampled (m) Sampled 5312 Frangie 2 0.31-046 19-6 PAH, metals frange for PAH, metals 15313 - Sample 3 0-25-0.4 19-6 15314- Sample 6 0-1-025 19-6 15315-Sample 7 0-0-3 20-6 PAH, metals PAH, metals 15316 Sample 8 0,5-065 20-6 15317 - Sample 10 0.5-0.75 20-6 PAHI, metals PAH, Metals } Composite + Sample for PCB's 5318 552 0-0-15 20-6 0-0.45 20-0

Samples received at AGAL Vic. (Signed) ...... by....Olga Kya 21/0/91 (Date)  $1 - c_{M_{2}}$ (Time) env60 MLIL C. DLZ. C

r

 $\Delta <$ 

**RUST PPK Pty Ltd** 

ACN 058 381 507

100 North Terrace Adelaide, South Australia GPO Box 398, Adelaide SA 5001 Australia Telephone (08) 212 5733 Int Tel +61 8 212 5733 Facsimile (08) 212 4686

A NATA Certified Quality Company

Privled on recycled paper

ſ.





#### RUST PPK Pty Ltd

ACN 058 381 507

100 North Terrace Adetaide, South Australia GPO Box 398, Adetaide SA 5001 Australia Telephone (08) 212 5733 Int Tel +61 8 212 5733 Facsimile (08) 212 4686

A NATA Certified Quality Company

# Sample Transmittal and Testing

Order No.: Sender: Andrew Miller Job No.: 2762331 Date: 20-6-95 Page 2 of Z

## **PROJECT:**

env60

Samples transferred from RUST PPK Pty. Ltd., 100 North Terrace, Adelaide to by Courier

Receiver to sign this form and fax to RUST PPK Pty. Ltd. immediately on receipt of samples.

Special Instructions: Analysis required by Wed 28-6 as was anninged with David Loftus

1931	Sample No.	Depth (m)	Date Sampled	Time Sampled	Box No.	Tests Required
319	Bi+ 1 Bi+ 2	0-150	20-6-95, .20-6-95			3 Test for PAH's
5320 2	CPI	0-300 0-300	19-6-95 20-6-95			B Composite a test for PAHS
5321-	651	0-(50	20-6-95			BTEX, OCPS PAHS r metals
5302	mai	0-150 0-150	20-6-95 20-6-95			Composite à Test for OLPE ausenic, mercu
5323	maz may	0-150	20-6-95 20-6-95			Composite + Test tou OCPS, ausenic, mercur
		[				

Sample Identification

Samples received at . A GAL . VIC .... by ORGA Ryan O.R. (Signed) 21: 6195 (Date) gam (Time)



FAXED



# Sample Transmittal and Testing

Order No.: Sender: Anctieur Miller

ing		
Job No.:	274	23
Date: <u>7</u> Page 1 of	1-6-	- 95

## **PROJECT:**

Samples transferred from RUST PPK Pty. Ltd., 100 North Terrace, Adelaide to by Courier

Receiver to sign this form and fax to RUST PPK Pty. Ltd. immediately on receipt of samples.

Special Instructions	: Please returne año	Cijand Eig
23-6-95 0	amonged with	David ;
-		Lafters.

Box No. Sample Depth Date Time **Tests Required** Sampled No. (m) Sampled 15422 Kample 9 300-450 20-6 PAH & Michals PAH + MICTALS 15423 Sample 5 0-300 19-6 Phit + Melals 15424 Surple 11 0-300 70-6 15425 Scingite 12 (C. 3-(...) 20-6 CCPL Composition + NVA( (+- 15) VVA2 (0-154 15436 Metals: usfor poerious surgiles for 276233A by Penns no (Signed) 2 2 JUN 1995 (Date) 9an (Time) eny60 Metals- As CrGu Pb Zn P.S. ran aut af your Tans. ed on recycled peo

## **Sample Identification**

RUST PPK Pty Ltd

ACN 058 381 507

100 North Terrace Adelaide, South Australia GPO Box 398, Adelaide SA 5001 Australia Telephone (08) 212 5733 Int Tel +61 8 212 5733 Facsimile (08) 212 4686

A NATA Certified Quality Company

'3 A

.

# Appendix D

.

•

•

Laboratory Reports



An ISO 9001 Quality Systems Certified Organisatian

## **REPORT OF ANALYSIS**

Page 1/5

Client:	Rust PPK 100 North Terrace Adelaide 5000
Attention:	Andrew Miller
Sample Description:	Soil Job No 27G233A
Lab Registration Nos:	V95/15312to V95/15323
Date of Receipt:	21st June 1995

Samples submitted to AGAL on the above date have been analysed as received. The information below is provided as part of our commitment to the quality of the analytical results. Please contact the undersigned for any further details relating to this Report.

### **Methods of Analysis:**

The following methods of analysis were used for this work -

•	OC pesticides	AGAL(Vic) Method VL206 (GC determination)
•	PAH's	AGAL(Vic) Method VL219 (HPLC determination)
٠	BTEX & TPH - Soil	AGAL(Vic) Method VL228 (GC determination)

### **Quality Assurance:**

The following QA procedures were included with the analyses -

- Analysis of reagent blanks
- Analysis of recoveries

Results obtained for recoveries of selected analytes from water were as follows -

•	Acenaphthene	100%
•	PCB A1242	72%
•	Heptachlor	80%

#### **Results of Analysis:**

Analytical results appear in tabular form on the following page(s). Results for soil are expressed in mg/kg on a dry weight basis.

Signed:

Barrie Magor B.Sc.(Hons), Grad.Dip. App.Sci., MRACI for Regional Manager

File : 15312.DOC

Date:

29-6-95

An ISO 9001 Quality Systems Certilied Organisatian.

# **REPORT OF ANALYSIS**

(JA

**Client Reference No:** Limit of Sample 2 Sample 6 Sample 7 Sample 8 Sample 3 Reporting V95/15312 Lab Registration No: V95/15313 V95/15314 V95/15315 **V95/15316** PAH's: <0.1 <0.1 <0.1 Naphthalene < 0.1 < 0.1 0.1 < 0.1 <0.1 Acenaphthylene < 0.1 <0.1 < 0.1 0.1 Acenaphthene · < 0.1 < 0.1 < 0.1 0.1 < 0.1 < 0.1 Fluorene < 0.1 ′**<**0.1 <0.1 < 0.1 < 0.1 0.1 Phenanthrene 0.1 0.1 <0.1 <0.1 < 0.1 0.1 <0.1 Anthracene 0.1 <0.1 <0.1 < 0.1 0.1 Fluoranthene 0.1 < 0.1 < 0.1 < 0.1 < 0.1 <0.1 Pyrene 0.1 < 0.1 < 0.1 <0.1 <0.1 <0.1 Benzo(a)anthracene 0.1 < 0.1 <0.1 <0.1 <0.1 <0.1 Chrysene 0.1 <0.1 < 0.1 <0.1 < 0.1 <0.1 <0.1 Benzo(b)fluoranthene < 0.1 <0.1 0.1 <0.1 < 0.1 <0.1 Benzo(k)fluoranthene 0.1 0.1 <0.1 < 0.1 <0.1 <0.1 <0:1 < 0.1 Benzo(a)pyrene 0.1 0.1 < 0.1 < 0.1 <0.1 Dibenz(ah)anthracene 0.1 < 0.1 < 0.1 0.1 0.2<0.1 <0.1 Benzo(ghi)perylene 0.1 <0.1 0.1 Indeno(1,2,3-cd)pyrene 0.4 < 0.1 0.4 <0.1 0.1 <0.1 **Total PAH's** 0.2 0.5 0.3 0.6 0.1 0.1

2/33

Page 2/5



An ISO 9001 Quality Systems Certilied Organisation

## **REPORT OF ANALYSIS**

Page 4/5

Client:	Rust PPK 100 North Terrace Adelaide 5000
Attention:	Andrew Miller
Sample Description:	Soil Job No 27G233A
Lab Registration Nos:	V95/15312 V95/15323
Date of Receipt:	22nd June 1995

Samples submitted to AGAL on the above date have been analysed as received. The information below is provided as part of our commitment to the quality of the analytical results. Please contact the undersigned for any further details relating to this Report.

## **Methods of Analysis:**

The following methods of analysis were used for this work -

• Metals - Soil

AGAL(Vic) Method VL239 (ICP determination)

#### **Quality Assurance:**

The following QA procedures were included with the analyses -

- Analysis of reagent blanks
- Analysis of recoveries

Results obtained for recoveries of selected analytes from soil/water were as follows -

Lead 91%
Copper 96%

#### **Results of Analysis:**

Analytical results appear in tabular form on the following page. Results for soil are expressed in mg/kg on a dry weight basis.

Signed:

Roger Cromie Dip.App.Sci., Grad.Dip. App.Sci., MRACI for Regional Manager

Date:

30-6-95.

An ISO 9001 Quality Systems Certified Organisation

# **REPORT OF ANALYSIS**

÷Α

Limit of Detection	SAMPLE 2	SAMPLE 3	SAMPLE 6	SAMPLE 7	SAMPLE 8
	<b>V95/15312</b>	V95/15313	V95/15314	V95/15315	V95/15316
·					
5	(42)	6.2	6.2	7.3 7.3	7.5
10	(20	20	15	13 13	25
10	14	29	14	(68, 95)	15
10	19	· 20	10	60 73	<10
50	<50	64	<50	64 67	<50
	Limit of Detection 5 10 10 10 50	Limit of Detection         SAMPLE 2           5         42           10         20           10         14           10         19           50         <50	Limit of Detection         SAMPLE 2         SAMPLE 3           5         42         6.2           10         (20         20           10         14         29           10         19         20           50         <50	Limit of Detection         SAMPLE 2         SAMPLE 3         SAMPLE 6           V95/15312         V95/15313         V95/15314           5         42         6.2         6.2           10         20         20         15           10         14         29         14           10         19         20         10           50         <50	Limit of Detection         SAMPLE 2         SAMPLE 3         SAMPLE 6         SAMPLE 7           V95/15312         V95/15313         V95/15314         V95/15315           5         42         6.2         6.2         7.3         7.3           10         20         20         15         13         13           10         14         29         14         (68.95)           10         19         20         10         60         73           50         <50

	7	· ,	* .	•	MG3-MG4 V95/15323
Client Reference No: Lab Registration No:	Limit of Detection	SAMPLE 10 V95/15317	CS1 V95/15321	MG1- MG2 V95/15322	
Arsenic	5	<5	<5	<5	<5
Chromium	10	. 15	<10	no test	no test
Copper	10	11	<10	no test	no test
Lead	10	60	<10	no test	no test
Zinc	50	110	<50	no test	no test
Mercury	1	no test	no test	<1	<1

Results for soil are expressed in mg/kg on a dry weight basis.

Australian Government Analytical Labaratories . 51 - 65 Clorke Street Page 5/5

D/S
An ISO 9001 Quality Systems Certified Organisatian

### **REPORT OF ANALYSIS**

Page 1/4

1.16

Client:	Rust PPK
	100 North Terrace
	Adelaide 5000
Attention:	Andrew Miller
Sample Description:	Soil Job No 27G233A
Lab Registration Nos:	V95/15422 to V95/15426
Date of Receipt:	22nd June 1995

Samples submitted to AGAL on the above date have been analysed as received. The information below is provided as part of our commitment to the quality of the analytical results. Please contact the undersigned for any further details relating to this Report.

### **Methods of Analysis:**

The following methods of analysis were used for this work -

- OC pesticides
- PAH's

AGAL(Vic) Method VL206 (GC determination) AGAL(Vic) Method VL219 (HPLC determination)

#### **Quality Assurance:**

The following QA procedures were included with the analyses -

- Analysis of reagent blanks
- Analysis of recoveries

Results obtained for recoveries of selected analytes were as follows -

- Phenanthrene 85%
- Anthracene
- 82%

### **Results of Analysis:**

Analytical results appear in tabular form on the following page(s). Results for soil are expressed in mg/kg on a dry weight basis.

Signed:

Barrie Magor B.Sc.(Hons), Grad.Dip. App.Sci., MRACI for Regional Manager

File : 15422.DOC

Date:

29-6-95

An ISO 9001 Quality Systems Certified Organisation

### **REPORT OF ANALYSIS**

Page 2/4

Client Reference No:	Limit of	SAMPLE	SAMPLE	SAMPLE 11	SAMPLE	WA1-WA2
Lab Registration No:	Reporting	9 	ہ <u>V95/15423</u>	V95/15424	12 V95/15425	V95/15426
PAH'e						
Naphthalene	0.1	<01	<01	<0.1 <0.1	*	*
Acenaphthylene	0.1	<0.1	<0.1	<0.1 <0.1	*	, <b>*</b>
Acenaphthene	0.1	<0.1	<0.1	<0.1 <0.1	*	*
Fluorene	01	<0.1	<0.1	<0.1 <0.1	*	*
Phenanthrene	0.1	<0.1	0.1	0.1 0.2	*	*
Anthracene	0.1	<01	<0.1	<01 <0.1	*	*
Fluoranthene	0.1	<01	0.1	<0.1 0.2	*	*
Pyrene	0.1	<01	0.2	0.2 0.2	*	*
Benzo(a)anthracene	01	<01	0.2	02 0.2	*	*
Chrysene	0.1	<01	0.2	0.2 0.2	*	*
Benzo(b)fluoranthene	0.1	<0.1	< 0.1	<0.1 <0.1	*	*
Benzo(k)fluoranthene	0.1	<0.1	<0.1	<0.1 <0.1	*	*
Benzo(a)pyrene	0.1	<0.1	0.1	0.1 0.1	*	*
Dibenz(ah)anthracene	0.1	<0.1	< 0.1	<0.1 <0.1	*	*
Benzo(ghi)pervlene	0.1	<0.1	0.1	0.1 0.1	*	. *
Indeno(1.2.3-cd)pyrene	0.1	<0.1	< 0.1	<0.1 <0.1	*	*
Total PAH's	0.1	<0.1	1.0	0.9 1.2	*	*
Total OC Pesticides	0.2	. *	* .	*	<0.2	5.3
Total OP Pesticides	0.5	*	*	*	<0.5	0.8

\* indicates no test required.

Sample V95/15426 contains Aldrin at 3.7 mg/Kg and Chlordane at 0.8 mg/Kg, as well as smaller amounts of other OC and OP pesticides.

OC Pesticides screened for include HCB, BHC, Lindane, Heptachlor, Heptachlor epoxide, Aldrin, Dieldrin, Endrin, Chlorpyriphos, Total Chlordane, Total Endosulphan, Total DDT and Methoxychlor.

OP Pesticides screened for include Diclorvos, Mevinphos, Diazinon, Chlorpyriphos, Fenchlorvos, Parathion, Parathion-methyl, Fenitrothion, Chlorfenvinphos, Bromophos-ethyl, Ethion and Tetrachlorfenvinphos.



An ISO 9001 Quality Systems Certified Organisatian

### **REPORT OF ANALYSIS**

Page 3/4

ښت.

Client:	Rust PPK 100 North Terrace Adelaide 5000
Attention:	Andrew Miller
Sample Description:	Soil Job No 27G233A
Lab Registration Nos:	V95/15422 to V95/15426
Date of Receipt:	22nd June 1995

Samples submitted to AGAL on the above date have been analysed as received. The information below is provided as part of our commitment to the quality of the analytical results. Please contact the undersigned for any further details relating to this Report.

### **Methods of Analysis:**

The following methods of analysis were used for this work -

Metals - Soil

AGAL(Vic) Method VL239 (ICP determination)

### **Quality Assurance:**

The following QA procedures were included with the analyses -

- Analysis of reagent blanks
- Analysis of recoveries

Results obtained for recoveries of selected analytes from soil were as follows -

Lead 91%
Copper 96%

### **Results of Analysis:**

Analytical results appear in tabular form on the following page. Results for soil are expressed in mg/kg on a dry weight basis.

Signed:

C 0

Roger Cromie Dip.App.Sci., Grad.Dip. App.Sci., MRACI for Regional Manager

Date:

30 - 6 - 95

An ISO 9001 Quality Systems Certified Organisation

AGAL

## **REPORT OF ANALYSIS**

Page 4/4

Client Reference No:	Limit of Detection	SAMPLE 9	SAMPLE 5	SAMPLE 11	.•	
Lab Registration No:		V95/15422	V95/15423	V95/15424		
Metals:			•			
Arsenic	5	<5	9.9	5.2		
Chromium	10	20	21	21		
Copper	10	<10	29	17 .	· .	
Lead	10	<10	40	21	t	
Zinc	50	<50	56	<50		
•						

Results for soil are expressed in mg/kg on a dry weight basis.

Australian Government Analytical Laboratories 51 - 65 Clarke Street

# Appendix E

.

٩

J

Summary of Analytical Results

• .

### Soil Analytical Test Results (AGAL) Polycyclic Aromatic Hydrocarbons (PAH)

Sample	Limit of Reporting	Sample 2	Sample 3	Sample 5	Sample 6	Concentration Warr anting	Reference
Depth (m)	(LOR)	0.31-0.46	0.25-0.4	0-0.3	0.1-0.25	Further Investigation (IL)	
Polycyclic Aromatic Hydrocarbons (PAH):			_				
Naphthalene	0.1	<0.1	<0.1	<0.1	<0.1	5	2
Acenaphthylene	0.1	<0.1	<0.1	<0.1	<0.i		
Acenaphthene	0.1	<0.1	<0.1	<0.1	<0.1		
Fluorene	0.1	<0.1	<0.1	<0.1	<0.1		
Phenanthrene	0.1	0.1	<0.1	0.1	<0.1	10	2
Anthracene	0.1	<0.1	<0.1	1.0>	<0.1	10	2
Fluoranthrene	0.1	<0.1	<0.1	0.1	<0.1	10	2
Рутепе	0.1	<0.1	<0.1	0.2	<0.1	10	2
Benz(a)anthracene	0.1	<0.1	<0.1	0.2	<0.1		
Chrysene	0.1	<0.1	<0.1	0.2	<0.1		
Benzo(b)fluoranthene	0.1	<0.1	<0.1	<0.1	<0.1		
Benzo(k)fluoranthene	0.1	<0.1	<0.1	<0.1	0.1		
Benzo(a)pyrene	0.1	0.1	<0.1	0.1	<0.1	1	1
Dibenz(a,h)anthracene	0.1	<0.1	<0.1	<0.1	<0.1		
Benzo(g,h,i)perylene	0.1	<0.1	0.1	0.1	0.2		
Ideno(1,2,3,a,d)pyrene	0.1	<0.1	0.4	<0.1	<0.1		
Total PAHs	0.1	0.2	0.5	1.0	0.3	20	l

All soil results are expressed in mg/kg on a dry weight basis

# for leaded fuel only

IL = Investigation Level

*1	Denotes $> =$ and $< 2 \times IL$	*3	Denotes $> = 5$ and $< 10 \times IL$
*2	Denotes $> = 2$ and $< 5 \times IL$	*4	Denotes $> = 10 \times IL$

#### References

1. A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in S.A., South Australian Health Commission, January 1993.

2. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council, January 1992.

### Soil Analytical Test Results (AGAL) Polycyclic Aromatic Hydrocarbons (PAH)

Sample	Limit of Reporting	Sample 7	Sample 8	Sample 9	Sample 11.	Concentration Warranting	Reference
Depth (m)	(LOR)	0-0.3	0.5-0.65	0.3-0.45 <sub>.</sub>	0-0.3	Further Investigation (IL)	
Balvevalia Ammetia		<u>.</u>	• ,1	<u> </u>	· · · · ·		. •
Hydrocarbons (PAH):							
Naphthalene	0.1	<0.1	<0.1	<0.1	<0.1	5	2 -
Acenaphthylene	0.1	<0.1	<0.1	<0.1	<0.1		•
Acenaphthene	0.1	<0.1	<0.1	<0.1	<0.1	· ,	
Fluorene	. 0.1	<0.1	<0.1	<0.1	<0.1		e
Phenanthrene	0.1	<0.1	0.1	<0.1	0.1	10	2
Anthracene	0.1	0.1	<0.1	<0.1	<0.1	10	2
Fluoranthrene	0.1	<0.1	<0.1	<0,1	<0.1	10	2.
Pyrene /	0.1	<0.1	<0.1	<0.1	0.2	10	2
Benz(a)anthracene	0.1	<0.1	<0.1	<0.1	0.2	. 1	
Chrysene	0.1	<0.1	<0.1	<0.1	0.2	· •	
Benzo(b)fluoranthene	Ò.1	<0.1	<0.1	<0.1	<0.1		
Benzo(k)fluoranthene	0.1	<0.1	<0.1	<0.1	<0.1		
Benzo(a)pyrene	0.1	<0.1	<0.1	<0.1	0.1	1	1
Dibenz(a,h)anthracene	0.1	0.1	<0.1	<0.1	<0.1		
Benzo(g,h,i)perylene	0.1	<0.1	<0.1	<0.1	0.i		
Ideno(1,2,3,a,d)pyrene	0.1	0.4	<0.1	<0.1	<0.1		. *
Total PAHs	0.1	0.6	0.1	<0.1	0.9	<u>20</u>	1

All soil results are expressed in mg/kg on a dry weight basis

# for leaded fuel only

IL = Investigation Level

\*1 Denotes > = and < 2 x IL

\*2 Denotes > = 2 and  $< 5 \times IL$ 

Denotes > = 5 and  $< 10 \times IL$ Denotes  $> = 10 \times IL$ 

#### References

1. A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in S.A., South Australian Health Commission, January 1993.

\*3

4

2. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council, January 1992.

### Soil Analytical Test Results (AGAL) Metals

Sample	Limit of Reporting	Sample 2	Sample 3	Sample 5	Sample 6	Concentration Warranting	Reference
Depth (m)	(LOR)	0.31-0.46	0.25-0.4	0.25-0.4 0-0.3		Further Investigation (1L)	
Metals:							
Antimony	5					20	2
Arsenic	5	(42)	6.2	9.9	6.2	100 20	1
Cadmium	1	$\bigcirc$				20	1
Chromium	10	20	20	21	15	250	2
Copper	10	14	29	29	14	100	I
Lead	10	19	20	40	10	300	1
Manganese	10					500	2
Mercury	0.5					2	1
Nickel	10					100	2
Tin	10					50	2
Zinc	50	<50	64	56	<50	500	1

Sample	Limit of Reporting	Sample 7	Sample 8	Sample 9	Sample 11	Concentration Warranting	Reference
Depth (m)	(LOR)	0-0.3	0.5-0.65	0.5-0.65 0.3-0.45		Further Investigation (1L)	
Metals:							
Antimony	5					20	2
Arsenic	5	7.3	7.5	<5	5.2	100	1
Cadmium	1					20	1
Chromium	10	13	25	20	21	250	2
Copper	10	(68)	15	<10	17	100 60	1
Lead	10	60	<10	<10	21	300	1
Manganese	10					500	2
Mercury	0.5					2	1
Nickel	10					100	2
Tin	10					50	2
Zinc	50	64	<50	<50	<50	500	1

All concentrations expressed in mg/kg

IL	= Inv	estiga	tion	Level
----	-------	--------	------	-------

*1	Denotes $> =$ and $< 2 \times IL$	*3	Denotes $> = 5$ and $< 10 \times IL$
*2	Denotes $> = 2$ and $< 5 \times IL$	*4	Denotes $> = 10 \times IL$

References:

- 1. A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in SA, South Australian Health Commission, January 1993
- 2. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council, January 1992

### Soil Analytical Test Results (AGAL) Polycyclic Aromatic Hydrocarbons (PAH)

Sample	Limit of	BH1 & BH2	CP1 & CP2	CS1 ,	Sample 10	Concentration Womenting	Reference
Depth (m)	(LOR)	0-0.15	0-0.3 ·	0-0.15	0.5-0.75	Further Further Investigation (IL)	
Polycyclic Aromatic	•	•				•	
Hydrocarbons (PAH):							
Naphthalene ·	0.1	<0.1	· <0.1	<0.1	<0.1	5	2
Acenaphthylene	0.1	<0.1	<0.1	<0.1	<0.1		
Acenaphthene	0.1	<0.1	<0.1	<0.1	<0.1	. •	
Fluorene	0.1	<0.1	<0.1	<0.1	<0.1	· · ·	,
Phenanthrene	0.1	0.1	0.1	<0.1	· 0.1	10	2
Anthracene	0.1	<0,1	<0.1	<0.1	<0.1	- 10	2
Fluoranthrene	0.1	<0.1	<0.1	<0.1	0.5	10	2
Pyrene	0.1	<0.1	<0.1	<0.1	<0.1.	10	2
Benz(a)anthracene	0.1	<0.1	<0.1	<0.1	<0.1		
Chrysene	0.1	<0.1	<0.1	<0.1	<0.1		
Benzo(b)fluoranthene	0.1	0.1	0.1	<0, I	<0.1	-	
Benzo(k)fluoranthene	0.1	<0.1	<0.1	<0.1	<0.1	· ·	
Benzo(a)pyrene	0.1	0.2	0.2	<0.1	0.2	1	1
Dibenz(a,h)anthracene	0.1	<0.1	<0.1	<0.1	<0.1	•	
Benzo(g,h,i)perylene	0.1	<0.1	<0.1	<0.1	0.3		
Ideno(1,2,3,a,d)pyrene	0.1	<0.1	<0.1	<0.1	<0.1 ·	•	• •
Total PAHs	0.1	0.4	0.4	<0.1	1.1	20	. I

All soil results are expressed in mg/kg on a dry weight basis.

# for leaded fuel only

IL = Investigation Level

\*1 Denotes > = and < 2 x IL

\*2 Denotes > = 2 and  $< 5 \times IL$ 

Denotes > = 5 and  $< 10 \times IL$ Denotes  $> = 10 \times IL$ 

#### References

1. A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in S.A., South Australian Health Commission, January 1993.

\*3

\*4

2. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council, January 1992.

### Soil Analytical Test Results (AGAL) TPH, BTEX

Sample	Limit of Reporting	CSI	Concentration Reference Warranting		
Depth (m)	(LOR)	0-0.15	Further		
Total Petroleum			III ASSESSMENT		
	25	<25	ł		
C <sub>6</sub> -C <sub>9</sub>	25	<25	100   1		
$C_{15}-C_{28}$	25	<25	Ĵ		
C29-C36	25	<25	} 1,000 1		
Total TPH	100	<100	1,000 or 50#		
Monocyclic Aromatic					
Hydrocarbons (MAH):					
Benzene	0,5	<0.5	0.5 2		
Toluene	0.5	<0.5	3 2		
Ethyl Benzene	0.5	<0.5	5 2		
Xylene	0.5	<0.5	5 2		
Total BTEX	2.0	<2.0			

All soil results are expressed in mg/kg on a dry weight basis

# for leaded fuel only

References:

- 1. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council, January 1992
- 2. Dutch B Criteria

### Soil Analytical Test Results (AGAL) Metals

Sample	Limit of Reporting	Sample 10	CS1	MG1-MG2	MĠ3-MG4	Concentration Warranting	Reference
Depth (m)	(LOR)	0.5-0.75	0-0.15	0-0.15	0-0.15	Further Investigation (IL)	•••
Metals:						· · · ·	
Antimony	5		•	•	•	20	2
Arsenic	5	<5 <sup>,</sup>	<5	<5	<5	100	1
Cadmium	1		•			20	1
Chromium	10	15	<10			250	-2
Copper	10	. 11	<10	e		100	1
Lead	10	<b>60</b> °.	<10		•	300	1
Manganese	10					500	2
Mercury	0.5	· . ·	•	<1	<1	2	1
Nickel	10	<u>.</u>				100	2 ·
Tin	10					50	2
Zinc	50	110	<50			500	· 1

All concentrations expressed in mg/kg

IL = Investigation Level

\*1 Denotes > = and  $< 2 \times IL$ 

\*2 Denotes > = 2 and  $< 5 \times IL$ 

#### References: .

1. A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in SA, South Australian Health Commission, January 1993

\*∆

. . .

Denotes > = 5 and  $< 10 \times IL$ .

Denotes > = 10 x IL

2. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council, January 1992

### Soil Analytical Test Results (AGAL) OC Pesticides

Sample	Limit of	CSI	MG1 & MG2	MG3 & MG4	Concentration	
Depth (m)	Reporting (LOR)	0-0.15	0-0.15	0-0.15	Warranting Further Investigation (ANZECC)	
Organochlorine Pesticides	. <u>.</u>					
Total BHC/Dicloran	0.05				0.5	
Lindane	0.05				0.5	
Heptachlor	0.05				0.5	
Aldrin	0.05				0.5	
Chlorpyriphos	0.05				0.5	
Total Chlordane	0.05				0.5	
Heptachlor Epoxide	0.05				0.5	
Total Endosulphan	0.05				0.5	
(op-DDE) pp-DDE	0.05				0.5	
Dieldrin	0.05				0.5	
Endrin	0.05				0.5	
op-DDD pp-DDD	0.05				0.5	
op-DDT pp-DDT	0.05				0.5	
Methoxychlor	0.05				0.5	
Total OC's	0.2	<0.2	<0.2	<0.2	1.0	

Sample	Limit of Reporting	Sample 12	WAI & WA2	Concentration Warranting Further	
Depth (m)	(LOR)	0.8-0.95	0-0.15	Investigation (ANZECC)	
Organochlorine Pesticides					
Total BHC/Dicloran	0.05			0.5	
Lindane	0.05			0.5	
Heptachlor	0.05		6.5	0.5	
Aldrin	0.05		(3.7)	0.5	
Chlorpyriphos	0.05			0.5	
Total Chlordane	0.05		0.8	0.5	
Heptachlor Epoxide	0.05			0.5	
Total Endosulphan	0.05			0.5	
(op-DDE) pp-DDE	0.05			0.5	
Dieldrin	0.05			0.5	
Endrin	0.05			0.5	
op-DDD pp-DDD	0.05			0.5	
op-DDT pp-DDT	0.05			0.5	
Methoxychlor	0.05			0.5	
Total OC's	0.2	<0.2	(5.3)	1.0	

All soil results expressed in mg/kg on a dry weight basis.

IL = Investigation Level

\*1 Denotes > = and <  $2 \times 1L$ 

\*2 Denotes > = 2 and  $< 5 \times IL$ 

\*3 Denotes > = 5 and  $< 10 \times IL$ 

2

. сі г

\*4 Denotes > = 10 x IL

# Appendix F

Dynamic Cone Penetrometer Results Certificates



Unit 1, 8 Cord Street Dudley Park, S.A. 5008 Facsimile (08) 344 1567 Telephone (08) 344 1722

ynamic Penetrometer Results		Certificate No. 24678 Date 29:6: 95. Sheet J of.		
Client Depar Reso	rtment of Environment and Natural urces	Job No. 27G233A		
	crest Hospital Remediation	Tested by VES Checked by AJM		
Location Gillo	es Plains, SA			
Test Procedure:	AS1289.F3.2			
Test No.	i	2.		
Location, Surface, Details	arass surface adjucent to trench 1	adjacent to trench ?		
Lab. No.	80760	80761		
	Blows/100 m	m Penetration		
	0 5 10 15 20 25 30 0	) 5 10 15 20 25 30		
0. (E) ttdag 1. 1.				
Commente		······		

·...



GEO

Authorised Signature an the.

# Appendix G

Proposed Area for Demolition Works





LEGEND	
1000 A	DENOTES TRENCH LOCATION
(S1 ×	DENOTES SAMPLING LOCATION
	DENOTES PROPOSED AREA FOR DEMOLITION WORKS.
٦_	DENOTES EXISTING BUILDINGS
<u> </u>	DENOTES REMOVED BUILDINGS
_ <del></del> _	DENOTES COVERED WALKWAY

SCALE 1:1000
SITE PLAN
CHECKED
ASM
DRAWN
JD
HILLCREST HOSPITAL
DATE
5.7.95
CHECKED
CRAWING NO.
27G233A/01

# Appendix H

ſ

Ĺ

1

ſ

Asbestos Remediation Plan

Hillcrest Hospital Asbestos Remediation Plan

Ŷ

,

### Department of Environment and Natural Resources

Rust PPK Pty Ltd

Environment & Infrastructure

5 July 1995 27G233A 95/457 100 North Terrace Adelaide SA 5000 PO Box 398 Adelaide SA 5001 Australia Telephone: (61 8) 212 5733 Facsimile: (61 8) 212 4686

A NATA Certified Quality Company

### Contents

ļ,

.

ľ

### Page Number

1.	Introduction	1
2.	Location of ACMs Within the Proposed Remediation Zone	2
3.	Remediation Recommendations	5
4.	Approximate Remediation/Demolition Budgets	6
5.	Remediation/Demolition Project Options	7

### Appendices

Appendix APlanAppendix BPhotographsAppendix CSample Identifications

### 1. Introduction

Rust PPK conducted a site investigation of Hillcrest Hospital during June 1995. The purpose of the investigation was to determine the location of asbestos containing materials (ACMs) within the proposed remediation zone boundaries.

Backhoe excavations and examination of inspection pits were carried out to determine the extent of underground asbestos clad steam pipework fed from the disused boiler building.

Existing, available plans were examined to establish, as far as possible, the route of underground asbestos cement pipework. This information will be transferred to the project manager of any future remediation/development project.

Buildings within the proposed remediation zone boundaries were examined to confirm the findings of the SACON Asbestos Inspection Report, 1994.

# 2. Location of ACM's Within the Proposed Remediation Zone

### 2.1 Building 17

- Asbestos lagged pipework was found in several locations place throughout.
- Asbestos lagged pipework was found detached on the ground level west of the boilers.
- Woven asbestos material was found as loose rope, under four mounting straps adjacent water samplers, as junction box and fuse box seals, to several locations throughout the boilers and as door seals to the external chimney.
- Asbestos gaskets were found loose in several locations throughout and in place in pipework throughout.
- Two asbestos lagged vessels were found on the mezzanine floor north of the boiler.
- Vinyl tile floor covering were found in the switchroom area. These may contain asbestos.
- Asbestos cement sheeting was found as the ceiling of the northern external verandah.
- Asbestos cement and pipework lagging debris is noted in SACON's 1994 report as present in the underground coal storage hopper.

### 2.2 Building 14

• Asbestos cement was found as a splashboard on the north wall.

### 2.3 Building 18

- Asbestos cement was found as a welding bay screen.
- Possible asbestos insulation is present as hot water pipe chase within brickwork walls in one location.

### 2.4 Building 18A

- An asbestos cement hot water flue was found at the external south-west corner.
- Approximately 150 m<sup>2</sup> of vinyl tile floor coverings are present. This material may contain asbestos.
- Possible asbestos insulation is present as hot water pipe chase within a brickwork wall in one location.

### 2.5 Building 19

- External western wall cladding is asbestos cement backed pebbleboard infills (approximately 100 m<sup>2</sup>).
- Asbestos cement was found as toilet cubicle partitions, as an infill panel above a double door and as lining to an electrical junction box.
- Vinyl sheeting was found in several locations throughout. The backing of this material may contain asbestos.
- SACON's 1994 report states this building to be the former location of a boiler house. Further investigation of the site may be required during demolition.
- Asbestos insulation may be present as hot water pipe chasing within brickwork walls in three locations.

### 2.6 Building 25

- Vinyl sheeting in this building is not asbestos backed (refer samples 95/1598 and 95/1599).
- Asbestos cement was found as wall linings (approximately 20 m<sup>2</sup>).
- Vinyl tile floor coverings were found to the west of the building. These may contain asbestos (approximately 100 m<sup>2</sup>).
- A "Zelemite" electrical board was found.

### 2.7 Building 26

- Asbestos cement was found as external cladding to the north-west extension.
- A "Zelemite" electrical board was found.

Note: Building 26 is not to be included in any proposed demolition project.

### 2.8 Building 27

• Asbestos cement was found as west and east external gable ends.

### 2.9 Building 41

• Asbestos cement was found as internal wall and ceiling linings and as external eaves (approximately 70 m<sup>2</sup>).

### 2.10 Shed 5

• Asbestos lagging was found to hot water pipework (approximately 1 linear metre).

### 2.11 Underground Pipework

- Asbestos insulation was found as disused steam pipework lagging within and north of inspection pit D (refer plan and photographs 7 and 9). Approximately 15 linear metres of the pipework is present within the proposed remediation zone boundaries.
- Minor asbestos cement debris was found within inspection pit C (refer photograph 3, sample 95/1596).
- Asbestos cement pipework was found at excavation 4 (refer plan). Extent and route of underground asbestos cement pipework could not be safely verified due to underground live electrical services during the investigation.
- Asbestos gaskets were found within flanges and valves throughout underground steam pipework (refer sample 95/1596).

### **3. Remediation Recommendations**

### 3.1 Underground Pipework

- Remediation of buried asbestos clad steam pipework at inspection pit B and excavations 2 and 5 (approximately 15 linear metres are present within the proposed remediation zone). This asbestos clad pipework runs west to building 24 (approximately 200 metres from the proposed remediation zone). It is recommended that a remediation plan for the complete length of this pipework be considered.
- Asbestos cement pipework. It is recommended that existing plans detailing water supply, fire service and stormwater routes be verified following termination of electrical services.
- Asbestos containing gaskets within underground steam pipework to be removed.

### **3.2 Building 17** (former Boiler House)

- Remediation of all ACMs from this site by a fully licensed South Australian asbestos removal contractor.
- Remediation to occur prior to demolition.
- Discussions to be held with Department for Industrial Affairs prior to preparation of scope of works.
- Demolition of this structure to encompass backfill of site.

### 3.3 ACMs in Other Buildings Within Proposed Remediation Zone

- Remediation of all ACMs from this site by a fully licensed South Australian asbestos removal contractor.
- Investigation of possible hot water pipe chases prior to demolition.
- Demolition to encompass appropriate disposal of PCB capacitors from fluorescent lights and ceiling fans.

**Department of Environment and Natural Resources** 

## 4. Approximate Remediation/Demolition Budgets

		Approximate Budget
4.1	Remediation of ACMs in Building 17.	\$25,000
4.2	Remediation of underground asbestos clad pipework within remediation zone.	\$1,800
4.3	Remediation of underground asbestos clad pipework from remediation zone to Building 24 (approximately 200 linear metres).	\$5,000
4.4	Remediation of ACMs in buildings in remediation zone (excluding Building 17).	\$7,000 (includes PC for 6 hot water pipe chases)
4.5	Demolition of covered walkways and associated concrete.	\$23,000
4.6	Demolition of Building 17 (including backfill of site).	\$20,000
4.7	Demolition of buildings within remediation zone (excluding Building 17 and Building 16 - heritage).	\$60,000 (excludes piers)
4.8	Removal of asbestos gaskets from non-asbestos clad underground pipework (where accessible - approximately 20 flanges and valves).	\$4,000 (including removal of inspection pits)

i

### 5. Remediation/Demolition Project Options

Reductions in budget estimates may be achieved through combinations of the various phases of the remediation and demolition.

Three possible options are:

ł

- 5.1 All works undertaken a single project (excluding 4.3).
- 5.2 Sections 4.1, 4.2, 4.4 and 4.8 as a project. Sections 4.5, 4.6, 4.7 as a project.
- 5.3 Sections 4.1, 4.2, 4.3, 4.4, 4.8 as a project. Sections 4.5, 4.6, 4.7 as a project.

# Appendix A

-

Plan

.

Ŷ



TO BUILDING 24

# Appendix B

-

Photographs



I

Photo 1: Inspection Pit B - SMF (non-asbestos) insulation to pipework (indicated). Asbestos containing flange gasket (indicated).



Photo 2: Inspection Pit A - SMF (non-asbestos) insulation to pipework



Photo 3: Inspection Pit C - Electrical inspection pit. Minor asbestos cement debris.



Photo 4: Building 17 (Boiler House) - Asbestos cement spark guards and woven asbestos seal



Photo 5: Building 17 (Boiler House). Disused asbestos clad pipework.



Photo 6: Building 17 (Boiler House) - Loose asbestos containing gaskets


Photo 7: Excavation 2 - Asbestos clad concrete encased pipework.



Photo 8: Excavation 3 - SMF (non-asbestos) lagged pipework

#### Rust PPK Pty Ltd



Photo 9: Excavation 5 Asbestos clad concrete encased pipework. Showing Change in direction of pipework from north/south to east/west (refer plan).



Photo 10: Shed 5. Asbestos clad pipework (indicated)

# Appendix C

Sample Identifications

.

**RUST PPK Pty Ltd** 

ACN 058 381 507



100 North Terrace Adelaide, South Australia GPO Box 398, Adelaide SA 5001 Australia Telephone (08) 212 5733 Int Tel →61 & 212 5733 Facsimile (08) 212 4686

A NATA Certified Quality Company

# Sample Analysis Report

Date:	28/6/95	Page: 1 of 1	
Job/Report No.:	-27G233A	Key: Chrysotile: White Asbestos	
Location:	Hillcrest Hospital	Amosite: Brown/Grey Asbestos Crocidolite: Blue Asbestos	
Test Method:	Qualitative identification of asbestos types in bulk sa Microscopy including Dispersion Staining.	mples by Polarised Light	
RESULTS			
Laboratory ID No.: Sample: Description: Report:	95/1595 1 Inspection pit B - pipework flange gasket Chrysotile asbestos detected by Polarised Light Micro Staining.	oscopy including Dispersion	
Laboratory ID No.: Sample: Description: Report:	ry ID No.: 95/1596 2 on: Inspection pit C - loose fibre cement debris Chrysotile and Amosite asbestos detected by Polarised Light Microscopy including Dispersion Staining.		
Laboratory ID No.: Sample: Description: Report:	95/1597 3 Excavation 2 - Concrete encased pipework lagging Amosite asbestos detected by Polarised Light Micros	copy including Dispersion Staining.	
Laboratory ID No.: Sample: Description: Report:	95/1598 4 Building 25 - Storeroom floor, vinyl sheeting No asbestos detected by Polarised Light Microscopy	including Dispersion Staining.	
Laboratory 1D No.: Sample: Description: Report:	.aboratory ID No.:95/1599ample:5Description:Building 25 - East workshop, NE corner, vinyl sheetingReport:No asbestos detected by Polarised Light Microscopy including Dispersion Staining.		
Laboratory ID No.: Sample: Description: Report:	95/1600 6 Shed 5 - Hot water pipework insulation Amosite asbestos detected by Polarised Light Micros	copy including Dispersion Staining.	

Testing Officer:

Craig Walker

Laboratory Manager:

P. Anthey Marcosi

# 16178

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

# Hillcrest Hospital Stormwater Infrastructure Assessment

# JOHN BOTTING AND ASSOCIATES Consulting Engineers

25 May, 1995

Received	1	9 1	75	10 B 3 FEBRUAR
Doc. No.	05	95	23	60
File No.	ERA	17-	771	1994
Response	/	1	tträtta Francisco Pris	in the second second
Return to	an contract story	ind the state of the state	taananin wideele	in culture de la company d
TO M. I	HAR	K 7	************	haithteachdraichteachair a



## **1. INTRODUCTION**

In early May 1995, this office was commissioned by Heath Planning and Management (on behalf of the Department of Environment and Natural Resources) to undertake a preliminary assessment of the stormwater infrastructure at the Hillcrest Hospital site. The primary aim of the investigation was to provide an assessment of the likely impacts that stormwater management requirements may have on any future land divisions within the site.

The major tasks identified to be completed under this preliminary investigation were;

- Identify all of the stormwater drainage outlets from the Hillcrest Hospital site and determine the major catchment boundaries for each outlet.
- Determine the function and any need to retain the pump house that was located in the south east quadrant of the site.
- Determine the likely regional stormwater management strategy based on discussions with Enfield Council.
- Prepare a report of the investigation, including comments on the implications of the findings with respect to the possible future uses of the Hillcrest Hospital site.

# 2. SITE LOCATION AND TOPOGRAPHY

The Hillcrest Hospital site is bounded by Grand Junction Road (north), Strathmont Centre (east), Regent Gardens residential development (east and south) and Fosters Road (west).

The site is located on the top of a small hill. This means that except for a portion in the north east corner, no runoff is expected to enter the site from external properties. It is likely that a small part of the Strathmont Centre site may contribute some surface runoff to the north east corner of the Hillcrest Hospital site.

The majority of the Hillcrest Hospital site would contribute stormwater runoff into the Dry Creek catchment. A small section of the south west corner of the Hospital site may contribute surface runoff into the Torrens River catchment (via Fosters Road).

# 3. STORMWATER DRAINAGE SYSTEMS

### 3.1 General

A total of eight (8) separate stormwater drain outlets were identified from design plans. All drain outlet sizes and locations were confirmed with site investigations. For the purposes of this report, the drainage systems have been numbered 1 to 8, and have also been categorised by their immediate outfall destination. Figure 1 illustrates the location of the eight drainage systems and the approximate delineation of their catchment boundaries. It should be noted that these catchment boundaries were determined predominantly in relation to which buildings were directly connected to each drainage system. No detailed surface runoff assessment was carried out as part of this investigation.

Two of the stormwater drain outlets (1 & 2) discharged into the Regent Gardens residential development area. Three of the drain outlets (3, 4 & 5) discharged into a Council drain in Fosters Road. The remaining three drain outlets (6, 7 & 8) discharged into a well-defined depression and then through a culvert beneath Grand Junction Road to Dry Creek.

### 3.2 System #1

Drainage System #1 collects runoff from

- Pharmacy Building,
- part of the Canteen,
- Ward 10 Building
- part of the Ward 6 Building

At the time of this investigation, the outlet of the system consisted of a very shallow 450mm diameter reinforced concrete pipe (RCP) that discharged into an open paddock within the Regent Gardens residential development site. Discussions held with officers of the Enfield Council revealed that an allowance had been made for the eventual connection of this drain.

### 3.3 System #2

Drainage System #2 collects runoff only from

• part of the Ward 6 Building

This is piped directly to a new stormwater drain within the Regent Gardens site. Immediately prior to the boundary with Regent Gardens, a silt trap has been constructed from a 900mm diameter RCP. This silt trap will require regular cleaning, and hence access to this structure would need to be maintained in the future.



#### 3.4 System #3

Drainage System #3 collects runoff from

- Psychogeriatric Ward Block
- Psychogeriatric Assessment Unit

The outlet from this system consists of a 375mm diameter RCP that is connected into the back of a side entry pit on Fosters Road. Any future land division between the Psychogeriatric Buildings and Fosters Road would need to provide for the protection of this outlet alignment. An easement may be suitable for this purpose, but would be subject to Enfield Council approval.

### 3.5 System #4

Drainage System #4 collects runoff from the majority of the Hillcrest Hospital site. The major buildings include

- Ward 4
- Chapel
- Administration Building
- Ward 5
- Linen & Sewing Room
- Industrial Therapy Workshop
- Litchfield House
- Czechowicz House

The outlet from this large drainage system consists of a 525mm diameter RCP that connects into a Junction Box in the footpath on the eastern side of Fosters Road.

#### 3.6 System #5

Drainage System #5 collects runoff only from

• James Nash House

The outlet consists of a 375mm diameter RCP that discharges into the rear of a side entry pit on Fosters Road. Any future land division between James Nash House and Fosters Road would need to provide for the protection of this outlet alignment. An easement may be suitable for this purpose, but would be subject to Enfield Council approval.

#### 3.7 System #6

Drainage System #6 collects runoff only from

• part of Ward 1

The outlet for this small drainage system consists of a 300mm diameter pipe (probably earthenware) that discharges into the top end of a cut-off channel that runs in an easterly direction.

#### 3.8 System #7

Drainage System #7 collects runoff from

- part of Ward 1
- the Morgue Building

The outlet for this drainage system consists of a 300mm diameter earthenware pipe that discharges into the same cut-off channel as System #6.

#### 3.9 System #8

Drainage System #8 collects runoff from

- Salter Hall
- Staff Dining Building
- part of the Canteen
- the Kitchen

The outlet for this drainage system consists of a 375mm diameter RCP that connects into a Junction Box adjacent to the Strathmont Centre access road. It is presumed that this Junction Box also collects some runoff from a portion of the Strathmont Centre site. The Junction Box then discharges into the top end of an open channel that flows towards Grand Junction Road. The cut-off channel that collects runoff from Drainage Systems 6 and 7 also joins the open channel at this location.

## 4. PUMP HOUSE FUNCTION

The Pump House contained a large reinforced concrete sump that collected stormwater and shallow groundwater. A pump, controlled by float switches, lifts the water from the sump and discharges it into the top end of Drainage System #4.

The sources of water that contributed to the sump in the Pump House have either been removed or are totally ineffectual. Howard House, which has now been demolished, contributed all of its roof water to the Pump House. Also, a sub surface cut-off drain (referred to as a "French Drain" on the design drawings) surrounded Howard House to intercept shallow groundwater. This sub surface drain was also connected to the Pump House sump. A small diameter drainage system serviced a few very small inlets on the access road between the Pump House and the old Howard House carpark. These inlets were all found to be completely blocked with soil, and were considered unlikely to have ever been effectual.

The outlet alignment from the Pump House to the main drain of Drainage System #4 was traced during site investigations to the Junction Box adjacent to the Chapel. This alignment was completely at odds with documented plans. Subsequent independent plans obtained from Enfield Council agree totally with the results of the site investigations.

Claims that the Pump House serviced the basements of the Administration Building and the Psychogeriatric Ward Block could not be verified, and do not appear to be logical. No evidence was found on the plans sourced by Heath Planning and Management of any basement drains connected to the Pump House sump.

# Hillcrest Hospital Stormwater Infrastructure Assessment

Based on these findings, it is considered that the Pump House can be decommissioned now that Howard House has been demolished. As a matter of precaution, it may be prudent to conduct a brief site investigation of the basements of the Administration Building and the Psychogeriatric Ward Block to ensure that they do not somehow depend on the Pump House.

# 5. REGIONAL STORMWATER MANAGEMENT

Discussions were held with officers from Enfield Council on Monday 22 May 1995 regarding the likely regional stormwater requirements that would be relevant to the Hillcrest Hospital site. The following points summarise these discussions.

- Runoff from the site should be limited to match the existing state of development. That is, if additional impervious areas are constructed on the site, then on-site detention should be used to limit the runoff from the 1 in 100 year Average Recurrence Interval (ARI) event to match the expected runoff from the existing amount of impervious coverage.
- 2. Any low lying areas should provide protection against flooding of adjacent land owners up to at least the 1 in 100 year ARI standard.
- 3. Drainage infrastructure servicing more than one property should be located within public owned land. Council did not want to see a drainage system being utilised that was covered by a series of adjoining easements.
- 4. Council would seek to minimise its exposure to future maintenance of drainage structures. To this end, if multiple on-site detention structures were proposed, then these would need to be located on private property and maintained by the respective land owners.
- 5. The Council would not seek to inherit an old and convoluted drainage network.
- 6. Water quality improvement measures would be welcomed.

# 6. PROPOSED FUTURE STORMWATER STRATEGY

A proposed stormwater drainage strategy has been developed based on the dual objectives of providing the maximum flexibility in any future land division and also satisfying Enfield Council's stormwater management requirements. It is considered that to maximise the flexibility in any future land division, minimal reliance should be placed on the retention of the existing drainage systems, particularly Systems 4, 6, 7 and 8. This strategy also agrees with the Enfield Council's requirement of not taking over the majority of the drainage network in its present state.

# Hillcrest Hospital Stormwater Infrastructure Assessment

To achieve this overall strategy, the following conceptual works, shown on Figure 2, are recommended.

- Drainage System #1 should be replaced with a new System running in a northerly direction adjacent to the eastern boundary between the Hillcrest Hospital and Strathmont Centre sites. The existing outfall should be retained to provide an outlet for surface runoff only.
- Drainage System #2 should be retained to service the existing part of Ward 6. No additional connections should be allowed into this System. If Ward 6 is demolished in the future, then this Drainage System should only be used to collect surface runoff from this immediate corner of the Hospital site. Any future development in this area should drain to the new outlet (north-south) of Drainage System #1.
- Drainage System #3 should be retained to service the Psychogeriatric Buildings.
- Drainage System #4 should only be partially retained to service the western portion of the site.
- Drainage System #5 should be retained to service James Nash House.
- Drainage Systems 6, 7 & 8 should be replaced by a number of new north-south drainage systems that discharge into a common collector drain and then eventually into the existing section of open creek. The western most alignment of these new systems should be on the western side of Wards 1, 5 and 4. It may be possible to retain portions of the existing internal drainage network as feeder drains. This would be subject to approval by Enfield Council.
- Drainage of the area in the vicinity of the existing Pump House should be carefully designed to avoid the creation of any low spots adjacent to the boundary.
- Surface runoff from the very south west corner of the site should be allowed to continue to discharge onto Fosters Road and into the Torrens River catchment.

One of the important consequences of these works is that the majority of the site will then discharge to a common point, which is the culvert beneath Grand Junction Road. Therefore, there is an ideal opportunity to construct a water quality improvement feature immediately upstream of the culvert.

As can be seen from Figure 2, these works allow the retention of the Psychogeriatric Buildings, Litchfield House, James Nash House and the Industrial Therapy/Linen & Sewing Room Buildings. All of these buildings would be serviced by parts of the existing drainage systems. The Administration Building, Chapel and Morgue Buildings can be retained, but must be serviced by new drainage systems. With the provision of these new drainage systems, the remainder of the site should be capable of being subdivided with a considerable degree of flexibility.



Figure 2: HILLCREST HOSPITAL PROPOSED STORMWATER DRAINAGE STRATEGY

15 June, 1995

Mr Gordon Heath, Heath Planning and Management, 8 Woodcock Court, ST AGNES SA 5097

Dear Gordon,

## Re: Hillcrest Hospital Stormwater Infrastructure Assessment

As suggested, I have conducted an additional site inspection this morning of the basement areas of the Administration and Psychogeriatric Ward Block buildings. The purpose of this inspection was to ascertain whether the drainage of these basements depended in any way on the performance of the Pump House.

#### **Administration Building**

The basement area of the Administration Building has a small sump to collect any drainage water. The sump is serviced by a float level actuated small pump which lifts any water from the sump and discharges onto adjacent ground via a small diameter brass pipe.

### Psychogeriatric Ward Buildings

The basements of both the Ward Block and Assessment Block were extensively investigated. Each basement contains numerous sumps that collect any drainage water from within the basement area. Each sump has its own float level activated pump, which lifts the water from the sump into a high level PVC stormwater drainage system that is suspended from the underside of the building's flooring system. All of the PVC drainage systems were found to discharge into the perimeter drainage system which eventually connects into the Fosters Road drain. (Referred to as Drainage System #3 in my earlier report.)

Therefore, the Pump House may now be decommissioned with confidence. Should you require any further assistance in this matter, please do not hesitate to contact me.

Yours faithfully,

JOHN E. BOTTING B.E. (Hons.), M.I.E. Aust., Chartered Professional Engineer, (Australia).

#### 95.11

## 10165 SAR VOL 1

.... 17 W ۰. 11.



ò

ENGINEERS 

BC TONKIN ن A ک SS

CIVIL / STRUCTURAL / LOCAL GOVERNMENT / ENVIRONMENTAL / BUILDING SURVEYING / TRANSPORTATION 55 Queen Street Adelaide South Australia 5000 / Facsimile (08) 8223 5237 Telephone (08) 8223 5583 Email: reception@bctonkin.com.au .

. . . . . . .

5 canned 14/06/06

### **BROCK BARRETT PROJECT MARKETING**

LOTS 351 AND 352, DP48652 FORMER HILLCREST HOSPITAL SITE AUDIT REPORT VOLUME 1 OF 2 98.0295/1 23 JULY 1999

BC TONKIN & ASSOCIATES Consulting Engineers 55 Queen Street ADELAIDE SA 5000

ACN 007 860 586

Telephone:(08)82235583Facsimile:(08)82235237Email:reception@bctonkin.com.au

Received (C/8/2006
Doc. No. 05/06/2696
File No. 05/13847
Response / /
Return to
TO WENDY BOYCE.

# SITE DETAILS

Name of Auditor :	Mr Adrian Hall of BC Tonkin & Associates
Date of Appointment as an Accredited Environmental Auditor :	7 January 1997
Name of person making a request for a Site Audit Report :	Mr Wayne Gibbings Brock Barrett Project Marketing
Date of appointment as Auditor for this site :	11 May 1998
Date of notification of EPA :	13 May 1998
Address of the site being audited :	Lots 351 and 352, DP48652
Property Description :	Lots 351 and 352, DP48652 Hundred of Yatala County of Adelaide
Ownership :	Department for Environment, Heritage and Aboriginal Affairs
Local Government Authority :	City of Port Adelaide Enfield
Zoning :	Mixed Use (Oakden) (MU(O)) Map PadE/27
Previous Land Use:	Hillcrest Hospital
Current Land Use:	Vacant
Proposed Land Use:	25 Residential Allotments and Connecting Access Roadways

# CONTENTS

	Site Detai	ls	iii
(	Contents		iv
l	EXECUTIN	VE SUMMARY	VII
	Site	Audit Information	vii
	Audi	itor's Conclusions	viii
5	STATEME	INT OF LIMITATIONS	х
	1. INTF	RODUCTION	1
	1.1	General	1
	1.2	Site Identification	1
	1.3	Purpose of the Report	1
	1.4	Summary of Audit Activities	1
	2. SITE	INFORMATION	3
	2.1	Site Description and Condition	3
	2.2	Surrounding Land Use and Zoning	3
	2.3	Geology and Pedology	3
	2.4	Hydrogeology	3
:	3. SITE	HISTORY AND PRELIMINARY ESA	5
	3.1	General	5
	3.2	Sources of Information	5
	3.3	Site History Summary	5
	3.4	Potential Contamination Issues	6
	3.5	Preliminary ESA	6
4	4. ENVI	IRONMENTAL SITE ASSESSMENT	7
	4.1	General	7
	4.2	Scope of Works	7
	4.3	Methodology	7
	4.4	Site Soils Encountered	8
	4.5	Laboratory Analysis Programme 4.5.1 Soil Analysis 4.5.2 Analysing Laboratories	9 9 9
	4.6	Assessment Criteria	10
	4.7	Contamination Assessment 4.7.1 Square Acre 4.7.2 Building Footprint (Ward 6 Andersen House) 4.7.3 Underground Steam Pipes 4.7.4 Residential Allotments and Roadway	10 10 11 11
	4.8	Quality Assurance and Quality Control (QA/QC)	12
	4.9	Conclusions	13

٠.

5.	SITE F	REMEDIATION AND VALIDATION	14
	5.1	Reports	14
	5.2	Objective and Scope of Works	14
	5.3	Site Soils Encountered	14
	5.4	Proposed Allotments 4 and 6	15
	5.5	Ward 6 Building Footprint	15
	5.6	Ward 4 Building Footprint	16
	5.7	Uncontrolled Imported Fill Materials	17
	5.8	Clean Imported Fill	19
	5.9	Material Removed Off Site	20
	5.10	Analysing Laboratories	21
	5.11	Quality Assurance and Quality Control (QA/QC)	21
	5.12	Data Validation	22
	5.13	Conclusions	22
6.	AUDI	FOR ASSESSMENT OF RESULTS	23
	6.1	General	23
	6.2	Assessment Criteria	23
	6.3	Results for Soils Remaining on Site 6.3.1 Statistics	23 25
	6.4	Quality of Data 6.4.1 Laboratory QA/QC 6.4.2 Field and Report QA/QC 6.4.3 Summary	25 25 26 27
7.	RISK	EVALUATION	28
	7.1	Human and Ecological Receptors	28
	7.2	Exposure Concentrations	28
	7.3	Human Health Risks	28
	7.4	Environmental Risks	29
	7.5	Groundwater	29
	7.6	Off Site Effects	29
8.	AUDI	TOR'S CONCLUSIONS	30
	8.1	General	30
	8.2	Auditor's Conclusions	30
9.	REFE	RENCES	33

### FIGURES

.

Figure 1.1	Site Location Plan
Figure 1.2	Site Plan and Extent of Audit

Brock Barrett Project Marketing	Page	v
Lots 221 and 352 DP48652	File	SAR.doc
Site Audit Benert BCT Bef 98 0295/1	Date	23-Jul-99
Site Audit Neport, DCT Her Solocos, T		

Table 4.1	Laboratory Reports	9
Table 4.2	Square Acre Metal ESA Results Exceeding Criteria	10
Table 4.3	Ward 6 OCP ESA Results Exceeding Criteria	11
Table 4.4	Residential Allotments Metal ESA Results Exceeding Criteria	12
Table 5.1	Ward 6 OCP Round 1 Results above Detection Limits	15
Table 5.2	Ward 6 OCP Round 2 Results above Detection Limits	16
Table 5.3	Ward 4 OCP Round 1 Results above Detection Limits	16
Table 5.4	Ward 4 OCP Round 2 Results above Detection Limits	17
Table 5.5	Uncontrolled Fill Round 1 OCP Results Above Detection Limits	18
Table 5.6	Uncontrolled Fill Round 2 OCP Results Above Detection Limits	19
Table 5.7	Summary of Materials Removed Off Site	21
Table 5.8	Validation Laboratory Reports	21
Table 6.1	Soils Remaining on Site Laboratory Results : pH, Arsenic and Metals	23
Table 6.2	Soils Remaining on Site Laboratory Results : Organochlorine Pesticides	23
Table 6.3	Soils Remaining on Site Laboratory Results : Polycyclic Aromatic Hydrocarbons	23
Table 6.4	Soils on Site - Metals Exceeding Assessment Guidelines	24
Table 6.5	Soils on Site - OCPs Exceeding Detection Limits	24
Table 6.6	Soils on Site - PAHs Exceeding Assessment Guidelines	25

PPK Environment & Infrastructure Pty Ltd (1999g) Facsimile 16 July 1999

LTO Information (DP48652)

#### APPENDICES Volume 1

Appendix 1

Appendix 2

TABLES

Appendix 3	Site Photographs (July 1999)
Appendix 4	Development Plan Zoning Information
Appendix 5	Auditor Sample and Analysis Summaries
Appendix 6	Auditor Statistics
Appendix 7	Rust PPK Pty Ltd Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA, 94/730 27F358A, 2 December 1994.
Volume 2	
Appendix 8	PPK Environment & Infrastructure Pty Ltd (1999b) Environmental Site Assessment Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 98-597, 23 June 1999
Appendix 9	PPK Environment & Infrastructure Pty Ltd (1999c) Site Remediation and Validation Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 99-395, 25 June 1999
Appendix 10	PPK Environment & Infrastructure Pty Ltd (1999d) Facsimile 7 July 1999
Appendix 11	PPK Environment & Infrastructure Pty Ltd (1999e) Facsimile 12 July 1999
Appendix 12	PPK Environment & Infrastructure Pty Ltd (1999f) Facsimile 15 June 1999
Appendix 13	PPK Environment & Infrastructure Pty Ltd (1999a) Facsimile 9 June 1999

٠.

# EXECUTIVE SUMMARY

#### Site Audit Information

This Site Audit Report has been prepared for a proposed residential development, located in the southern portion of the former Hillcrest Hospital, north of Buckingham Street, Oakden (see Location Plan, Figure 1.1). This report follows the completion of a site history, environmental site assessments, and site remediation and validation undertaken by PPK Environment & Infrastructure Pty Ltd.

The report has been prepared in accordance with guidelines provided in the South Australian Environment Protection Authority (EPA) Special Bulletin No. 1, 20 October 1995, The Use of Environmental Auditors: Contaminated Land, and the Victorian Environment Protection Authority (Vic EPA) Guidelines for Environmental Auditors Contaminated Land, Issue of Certificates of Environmental Audit, WH 91/14, May 1992.

Summary information is set out as follows:

#### Name of Auditor

Mr Adrian Hall of BC Tonkin & Associates

Date of appointment as an Accredited Environmental Auditor under the Environment Protection Authority Act, 1970, Victoria

7 January 1997

Name of person making a request for a Site Audit Report Mr Wayne Gibbings, Brock Barrett Project Marketing

# Name of primary consultant undertaking site investigations

PPK Environment & Infrastructure Pty Ltd (PPK)

# Name of developer undertaking site remediation activities

GY Land Development Pty Ltd

#### Date of appointment as Auditor for this site

11 May 1998

Br Lo Date of notification of EPA 13 May 1998

#### Address of the site being audited

Allotments 351 and 352, Deposited Plan 48652.

#### Lands Title Information

The site comprises the land described in Allotments 351 and 352, Deposited Plan DP48652, Hundred of Yatala.

It is noted that the site is incorrectly identified throughout the following two PPK Environment & Infrastructure Pty Ltd site reports as Lots 351 and 352 in DP48052:

- PPK Environment & Infrastructure Pty Ltd (1999) Environmental Site Assessment Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 98-597, 23 June 1999
- PPK Environment & Infrastructure Pty Ltd (1999) Site Remediation and Validation Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 99-395, 25 June 1999

PPK Environment & Infrastructure acknowledged this error in a letter dated 16 July 1999, contained in Appendix 1 of this report.

Brock Barrett Project Marketing	Page	vii
Lots 351 and 352, DP48652	File	SAR.doc
Site Audit Report, BCT Ref 98.0295/1	Date	23-Jul-99

A copy of Deposited Plan 48652 obtained from the Lands Titles Office is included in Appendix 2 of this report.

#### Land Use Zoning

The land is zoned as Mixed Use (Oakden) (MU(O)) in Map PadE/27 of the Development Plan for the Port Adelaide Enfield (City).

#### Name of current site owner and occupier

Department of Environment, Heritage and Aboriginal Affairs (DEHAA), South Australia

#### **Documentation reviewed**

- Rust PPK Pty Ltd Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA, 94/730 27F358A, 2 December 1994.
- PPK Environment & Infrastructure Pty Ltd Facsimile 9 June 1999
- PPK Environment & Infrastructure Pty Ltd (1999) Environmental Site Assessment Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 98-597, 23 June 1999
- PPK Environment & Infrastructure Pty Ltd (1999) Site Remediation and Validation Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 99-395, 25 June 1999
- PPK Environment & Infrastructure Pty Ltd Facsimile 7 July 1999
- PPK Environment & Infrastructure Pty Ltd Facsimile 12 July 1999.

### Auditor's Conclusions

The conclusions of this Site Audit are set out as follows:

- 1. The studies conducted by PPK Environment & Infrastructure Pty Ltd were assessed by the Auditor as being adequate to determine the potential for site contamination.
- 2. The overall sampling frequency (ie. the test location spacing and the selection of samples) is considered by the Auditor to be acceptable. The analytical parameters are considered by the Auditor to be sufficient to adequately characterise the level of soil contamination on the site.
- 3. The remediation and validation works conducted by PPK were assessed by the Auditor as being adequate.
- 4. It is concluded that the remaining heavy metals contamination levels on this site do not pose unacceptable human health risks. It is also considered that heavy metals contamination levels on this site are such that they do not pose unacceptable risks to plants which have their root systems in, or which uptake nutrients from, the site soils, and that the heavy metal contamination levels also do not pose unacceptable risks to soil fauna such as earthworms.
- It is concluded that the remaining organochlorine pesticides (aldrin) levels on this site within the 5. central and access roadways constitute an unacceptable human health risk, unless access, and thus exposure, to the soils is restricted. It is concluded that the remaining organochlorine pesticides (aldrin) levels on this site on the remainder of the site (i.e. the residential allotments) do not pose unacceptable human health risks.
- 6. It is concluded that the remaining polycyclic aromatic hydrocarbon (benzo(a)pyrene) levels (maximum concentration 1.46 mg/kg) on this site do not pose unacceptable human health risks given the localised occurrences and depths and the 95% UCL below the acceptance criteria.
- 7. Notwithstanding the widespread presence of a thin layer of fill containing ash and charcoal at 0.5 m depth in the Square Acre, the Auditor is of the opinion that the material does not constitute an unacceptable health risk (based on the results of testing for PAHs), nor are thereunacceptable aesthetic implications (having regard to the depth, thickness and general appearance of the material).

Brock Barrett Project Marketing	Page	viii
Lots 351 and 352, DP48652	File	SAR.doc
Site Audit Report, BCT Ref 98.0295/1	Date	23-Jul-99

- Notwithstanding the limited documentation of QA/QC procedures employed by the consultant. the overall methodology is considered by the Auditor to be acceptable.
- 9. Contamination levels on the portion of the site representing the residential allotments are such that there are no unacceptable risks to plants which have their root systems in, or which uptake nutrients from, the site soils. The contamination levels also pose no unacceptable risks to soil fauna such as earthworms.
- 10. Groundwater information obtained from PIRSA and site investigations, indicates that the depth to the water table in the area is in excess of 12 m below the ground surface. Groundwater contamination is therefore not an issue at this site.
- 11. It is concluded that the potential for off site effects of contaminant migration from the site, eg. as a result of leaching of contaminants to the groundwater table, or stormwater runoff, is negligible.

On the basis of the above conclusions, the Auditor considers that in accordance with the South Australian Environment Protection Authority Special Bulletin No. 1, 20 October 1995, the condition of that portion of the site representing the residential allotments (as shown in Figure 1.2, Site Plan and Extent of Audit) is such that it is suitable for unrestricted residential use.

The Auditor also considers that the condition of that portion of the site representing the central and access roadways (as shown in Figure 1.2, Site Plan and Extent of Audit), is such that it is suitable only for use as access roadways, provided that the conditions as specified below are satisfied:

- The proposed development of the site is for 25 residential allotments with internal connecting 1. roadways, as shown in Figure 1.2. The proposed development as documented must be adhered to.
- 2. It is a requirement of this Audit that the Auditor be kept informed of any relevant site redevelopment activities, and that opportunity be given to the Auditor to ensure that the above conditions are adhered to.
- 3. If at any time in the future the site is to be redeveloped, then further site characterisation and/or remediation may be required. A new Audit Report will be required to be prepared for any other development proposal.

In accordance with South Australian Environment Protection Authority (EPA) Information Bulletin IS No. 8, November 1997, Assessment Procedure for Contaminated Sites, table on page 3, Stage 7, development or building approval by the relevant planning authority must include the Auditor's Conditions 1 to 3 above.

Signed:

F.M.D. Hall

AMD Hall, MIE Aust **Chartered Professional Engineer** Associate Director Environmental Auditor (Contaminated Land)

**BC TONKIN & ASSOCIATES** 

23 July 1999 Date:

ix

## STATEMENT OF LIMITATIONS

This Site Audit Report represents an Environmental Audit of certain information relating to the site described in **Lots 351 and 352, Deposited Plan DP48652**, identified for residential development. This information was obtained from the sources referenced in this Site Audit Report.

The Site Audit Report is based on site conditions at the time of issue of the report. The Auditor cannot control future activities on the site, nor impacts from off site, which may result in subsequent contamination of the site. The Auditor disclaims any obligations to update this report to take account of events taking place after the time of this Site Audit Report.

The Environmental Auditor makes no legal representations whatsoever concerning any matter including, but not limited to, ownership of any property or the interpretation of any law.

#### 1. INTRODUCTION

#### 1.1 General

Mr Adrian Hall of BC Tonkin & Associates has been appointed by Mr Wayne Gibbings, Project Manager, Brock Barrett Project Marketing, to act as the Environmental Auditor, appointed under the Environmental Protection Act (Victoria) for the proposed residential development of the southern portion of the former Hillcrest Hospital site, north of Buckingham Street, Oakden.

#### 1.2 Site Identification

The site comprises Allotments 351 and 352, Deposited Plan DP48652. The site location is shown in Figure 1.1. A site plan showing the proposed residential subdivision and extent of the Audit is given in Figure 1.2.

It is noted that the site is incorrectly identified throughout the following two PPK Environment & Infrastructure Pty Ltd (PPK) site reports as Lots 351 and 352 in DP48052:

- PPK Environment & Infrastructure Pty Ltd (1999) Environmental Site Assessment Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 98-597, 23 June 1999
- PPK Environment & Infrastructure Pty Ltd (1999) Site Remediation and Validation Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 99-395, 25 June 1999

PPK Environment & Infrastructure acknowledged this error in a letter dated 16 July 1999, contained in Appendix 1 of this report.

A copy of Deposited Plan 48652 obtained from the Lands Titles Office is included in Appendix 2 of this report.

The site comprises an approximate area of 2.07 hectares and occupies the southern portion of the former Hillcrest Hospital site.

#### 1.3 **Purpose of the Report**

The proposed development incorporates the construction of 25 medium density residential allotments serviced by a central roadway with a connecting access roadway extending from the existing Buckingham Street (see Figure 1.2).

The purpose of this report is to provide, in accordance with the EPA Special Bulletin No. 1 dated 20 October 1995, a Site Audit Report which

- specifies the current contamination status of the land, and
- identifies the types of land use or development which are not compromised by on-site contamination.

This Audit will therefore assess whether health and environmental risks from possible exposure to the soil at this site are acceptably low, and thus facilitate planning approvals for the proposed future use of the site.

#### **Summary of Audit Activities** 1.4

The Environmental Auditor was engaged on 11 May 1998, following historical investigations and preliminary environmental investigations of the Hillcrest Hospital site, but prior to an environmental assessment of the Audit site and subsequent remediation and validation.

1

The Auditor's role involved the following activities:

- advice on scope of works for environmental site assessment
- site inspections
- · request for the de-archiving of selected samples for additional analysis
- nominating acceptance criteria for the contaminants of concern (arsenic, benzo(a)pyrene and organochlorine pesticides)
- detailed inspection of test pits in the Square Acre, and advice that thin layer of fill containing ash and charcoal would not require remediation
- requiring validation sampling of uncontrolled fill materials imported onto the site without the knowledge of the consultant or the Auditor
- requiring validation sampling of imported fill materials for use as clean backfill
- review and assessment of the final reports
- obtaining clarification on issues identified during the review of the reports
- preparing and issuing this Site Audit Report.

Issues considered to be of major importance in establishing the condition of the site were as follows:

- characterisation of organochlorine pesticide (OCPs) levels in soils underneath the footprints of former site buildings (Ward 4 Dibden House and Ward 6 Andersen House)
- delineation of the extent of localised areas of soil heavy metal (arsenic, copper and zinc) contamination
- characterisation of polycyclic aromatic hydrocarbons (PAHs) levels in the site area identified as the Square Acre which had been historically used for the disposal of coke ash
- characterisation of materials used in the underground steam pipes connecting site buildings to the central boiler (off site)
- characterisation of OCP levels in uncontrolled fill materials brought onto the site without the knowledge of the consultant or the Auditor
- verification of the levels of OCPs in soils remaining on site following removal of the uncontrolled fill, to provide sufficient information to adequately characterise the current condition of the site.

Brock Barrett Project Marketing	Page
Lots 351 and 352, DP48652	File
Site Audit Report, BCT Ref 98.0295/1	Date





# 2. SITE INFORMATION

#### 2.1 Site Description and Condition

The site was portion of the former Hillcrest Hospital and comprised the accommodation buildings Ward 4 Dibden House and Ward 6 Andersen House. Both of these buildings were demolished by the end of 1998. The areas of site surrounding the former wards primarily comprised open, vacant portions of land with established trees, grasses and vegetation.

The site is currently vacant land located north of Buckingham Street, Oakden. The site is relatively flat., The proposed allotments have been identified on site and the central and connecting access roadways have been marked out and constructed.

Photographs of the site showing the connecting roadway and residential allotments, taken following substantial completion of site remediation works, are included in Appendix 3 of this Report.

#### 2.2 Surrounding Land Use and Zoning

The site is contained within a Mixed Use (Oakden) (MU(O)) zone in Map PadE/27 of the Development Plan for the City of Port Adelaide Enfield, dated 6 May 1999. Extracts of the relevant zoning information (Mixed Use (Oakden)) are included in Appendix 4.

Land surrounding the site is residential to the south and east. To the east is Fosters Road and north is land associated with the former Hillcrest Hospital.

#### 2.3 Geology and Pedology

The major soil type in the site area identified in the Soil Association Map of the Adelaide Region (Taylor et al, 1974) is red brown (RB8). PPK described the site soil conditions generally as topsoil overlying red to brown clay of high plasticity and low permeability; overlying a layer of clay soil with a high lime content either as earthy pockets or as cemented rubble or nodular fragments of alkaline pH, in turn overlying sandy clay grading into weathered sandstone or highly plastic grey and grey/green mottled clay, related to Hindmarsh Clay.

The 1980 SA Department of Mines and Energy 1:50,000 scale Preliminary Geological Map, Resources Series of the Adelaide Region (Adelaide 6628-III) indicates the geological strata at the site belongs to either the Keswick Clay (Qpk) or the Pooraka Formation groups (Q), both of Quaternary age. PPK described Keswick Clay as comprising stiff green or yellow brown silty clay of very high reactivity associated with the Black Earth type BE pedological group, with soils of the Pooraka Formation being typically reddish brown clays with variable amounts of silt and sand and some calcium carbonate content, correlated with Red Brown Earth types RB4 and RB8 in the area.

Borelogs recorded by PPK for the site are contained in Appendix E of the PPK ESA Report and Appendix 10 of this Audit Report.

#### 2.4 Hydrogeology

Primary Industries and Resources South Australia (PIRSA) well information available for the site area is summarised by the Auditor in Table 2.1.

PIRSA Bore	Section	Drilled	Drilling	Depth	Date	TDS	pН	Yield
No. (6528 38;		Depth (m)	Date	SWL	SWL	(mg/L)		(Gal/
6628 40)				(m)				hour)
9606 A	495	62.79	08/44	34.14	06/44	4,390	-	998
16185	873	80.50	12/92	14.00	12/92	1737	7	11878
16186	873	35.00	12/92	0	-	4396	6	-
16486	873	60.00	10/93	18.70	10/93	1448	6	13066
16899	872	64.00	03/98	31	03/98	2864	-	7917

#### Table 2.1PIRSA Geodata Summary

Notes:

SWL - Standing Water Level, TDS - Total Dissolved Solids, A - Abandoned

The PIRSA groundwater information for bores in the area can be summarised as follows:

- bores are known to exist in the site area
- shallow, unconfined, as well as deeper semi-confined and confined aquifers exist in the vicinity
  of the site
- regional standing groundwater levels range from approximately 0 m to in excess of 34 m depth
- groundwater in the area is of a quality ranging from 1,448 mg/L (Bore 16486 drilled to 64 m depth) to 4,396 mg/L (Bore No 16186 drilled to 35 m depth), with groundwater of lower TDS values being suitable for irrigation uses
- pH ranges from 6.0 to 7.0
- well yields range from 998 gallons/hour to 13,066 gallons/hour.

PPK reported a groundwater pump housed in a small brick building on the southern side of the Hillcrest Hospital site north of the Telecom tower (Rust PPK, 1994), suggesting the existence of shallow groundwater, howver PPK reported that groundwater was not encountered during the site investigations to a maximum 12 m depth.

# 3. SITE HISTORY AND PRELIMINARY ESA

#### 3.1 General

A site history and preliminary environmental site assessment (ESA) of the whole Hillcrest Hospital site was undertaken by PPK (then Rust PPK) in 1994, prior to appointment of the independent Environmental Auditor. An overview of the site history is provided in Section 3.1 of the following PPK report (ESA Report), included in Appendix 8:

• PPK Environment & Infrastructure Pty Ltd (1999b) Environmental Site Assessment Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 98-597, 23 June 1999

The preliminary investigations were originally detailed in the following PPK report (Preliminary Report), included in Appendix 7:

• Rust PPK Pty Ltd Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA, 94/730 27F358A, 2 December 1994.

#### 3.2 Sources of Information

PPK reported that their historical investigations included information obtained from the following sources:

- Lands Titles Information
- Mapland aerial photographs (1949, 1959, 1965, 1969, 1975, 1980, 1985, 1989, 1992 and 1993)
- conversation
- publications
- government departments including DELM, DME and DIA.

### 3.3 Site History Summary

The site history is summarised in Section 3.1 of the PPK ESA Report.

From the late nineteenth century until 1926 the Hillcrest Hospital site was used for agricultural purposes, primarily cereal crops and grazing. The land was acquired in 1917 by the State Government and dedicated for the development of the Northfield Mental Hospital (Hillcrest Hospital). Construction of site buildings including accommodation Wards 4 and 6 was undertaken progressively from 1926 to 1959. Wards 4 and 6 and connecting walkways had been built by 1949.

During its early operational period, some areas of the Hillcrest Hospital site were still in use for agricultural purposes to provide food crops for the hospital. PPK described an orchard apparent on the southern side of Ward 6 in 1959, extending between the southern boundary and the covered walkway.

A network of underground steam and return condensate pipes which linked the major buildings to the central boiler house (not located on the Audit site) was constructed. Two were located within the central portion of the site linking former Wards 4 and 6. The Hillcrest Hospital was closed in the early 1990s.

### **3.4** Potential Contamination Issues

PPK identified a number of possible factors relating to potential contamination on the Audit site:

- the possible presence of buried coke ash (containing PAHs and heavy metals eg arsenic, copper, lead and zinc) to a depth of 1.2 1.5 m in a grassed lawn area known as the 'Square Acre' located in the central north western portion of the Audit site to east of chapel and Ward 4. Coke had been originally used to fire the boilers previously located in the Central Boiler House on another portion of the Hillcrest Hospital. The central boiler house was built to provide steam to all site wards and buildings. PPK reported that the incomplete products of combustion, coke ash (cinders), were often used as a landscaping medium or as fill at different sites on the hospital grounds.
- the possible presence of asbestos (synthetic mineral fibres) in insulation materials associated with the underground steam pipe network beneath the site, located in the rafters of the covered walkways connecting the major buildings.
- the possible presence of organochlorine pesticides (OCPs) in the areas of the former Ward 4 and 6 buildings and other areas treated with pesticides for white, bull and black ants eg the northern side of the Square Acre where black and bull ant treatment occurred.
- the possible presence of metals in some areas of the site as a result of previous extensive market gardening activities through the use of fertilisers, and PAHs through the possible use of coke ash in these areas.

#### 3.5 Preliminary ESA

A preliminary ESA was undertaken by PPK in May 1995, targeting the potential contamination issues identified in the site history. This is summarised in Section 3.3 of the PPK ESA Report. A total of 3 surface and subsurface soil samples were recovered from the area of the Audit site and submitted for laboratory analysis.

Borehole 9b was located in an area where filling or landscaping activities using coke ash were reported to have occurred (Square Acre). Small flecks of ash were recorded in the PPK borelog to 0.95 m depth. The sample was analysed for PAHs.

Two boreholes were located on a former orchard area (between Wards 4 and 6). Surface samples 10d and 11d were sampled and analysed for heavy metals and arsenic. A composite sample prepared from 10d and 11d in the former orchard area was also analysed for PAHs.

PPK reported that analyte concentrations were below the respective further investigations levels and or laboratory detection levels for the proposed current and continued land use.

# 4. ENVIRONMENTAL SITE ASSESSMENT

#### 4.1 General

The results of the 1998 site investigations were summarised in the following PPK Report included in Appendix 8 (ESA Report):

• PPK Environment & Infrastructure Pty Ltd (1999b) Environmental Site Assessment Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 98-597, 23 June 1999.

Soil sampling was undertaken between 3 June 1998 and 16 July 1998.

#### 4.2 Scope of Works

PPK stated that the scope of works involved in the Environmental Site Assessment of the site comprised:

- Review of historical site usage
- · Review of local soils and groundwater characteristics
- · Test pitting and soil sampling at 67 locations
- Targeted boring and deep soil sampling to maximum depth of 12 m
- Laboratory analysis of selected soil samples
- Review and assessment of soil contaminant levels in accordance with proposed future land use.

### 4.3 Methodology

The sampling methodology was described in Section 5.2 of the PPK ESA Report. Sampling locations were grid based and included targeted test pitting and soil sampling. PPK stated that the programme was based on AS4482.1-1997 which recommended a minimum of 30 soil sampling points across the site, based on the site area.

PPK divided the site into four nominal assessment areas based on previous land use and proposed development requirements:

- 1. Area 1 former Square Acre with an approximate area of 250 m<sup>2</sup> in the northern central portion of the site. Sampling in this area comprised 9 borehole locations. Sampling locations within the Square Acre are identified as TPSA1 –TPSA9 and are shown on PPK Figure 02.
- 2. Area 2 the building footprint of Ward 6, Anderson House. Sampling in this area comprised 13 shallow test pits within the building footprint. Sampling locations within the former Ward 6 building footprint are identified as UB1 UB14 and are shown on PPK Figure 03.
- 3. Area 3 underground steam pipe backfill materials comprising 180 linear metres of the site where underground steam pipes were located. PPK reported that the trenches were backfilled with shallow sandy backfill materials overlying natural soils. Sampling in the trenches comprised 6 test pits adjacent to the east-west and north-south lengths of the steam pipe at approx 50 m linear intervals with additional samples collected based on field evidence. Sampling locations are identified as S1 S6 and are shown on PPK Figure 04.

4. Area 4 - residential allotments and connecting roadway (excluding areas 1 - 3) comprising the majority of the site. Sampling in these areas comprised 30 test pits with at least one test pit located within each proposed residential allotment and at approximately 50 m linear intervals within the central portion of the site proposed for the access roadway. In addition a single bore was drilled to 12 m depth in the northwestern site corner, to identify groundwater beneath the site. Sampling locations within the residential allotments are identified as TP3 - TP25 and within the proposed roadway as TPR1 - TPR7. An additional 10 test pits were subsequently excavated following initial soil analysis and identification of localised areas of heavy metal and PAH contamination at locations surrounding the original test pits on an approximate 5 m radius (TP3, TP4 and TP6). Additional testpits were TP3A-D, TP4A-C and TP6A-C. Sampling locations are shown on PPK Figure 02. The location of the 12 m bore (GW1) and test pit TPR7 are shown on an amended plan in Appendix 10.

PPK reported that drilling of the 12 m bore was undertaken using a pneumatic hammer and stainless steel push tubes to 4.2 m, and solid flight augers to 12 m depth. Soil cores extracted from the push tubes were transferred onto clean plastic core trays for logging and sampling, with soil samples collected from greater than 4.2 m depth collected directly from cuttings.

PPK reported that soil samples from boreholes were generally taken from 0-150 mm, 150-300 mm, 400-500 mm and 900-1000 mm below ground level from discrete fill layers, dependent on the soil profile with additional samples taken from the underlying undisturbed natural soil profile and where visual evidence of contamination was observed.

PPK reported that test pits were excavated using a 20 tonne excavator supplied by the developer. Soil samples were recovered by PPK from the undisturbed walls of test pits to a maximum depth of 1.5 m with deeper samples collected to a maximum depth of 1.85 m directly from the excavated soil within the central portion of the bucket.

PPK reported that soil samples were collected in 250 mL prechilled glass jars sealed with plastic lids immediately following collection, which were then labelled and transferred directly to chilled eskies. PPK reported that samples where repacked into eskies with fresh ice bricks and sealed for transport to nominated laboratory. Chain of custody forms are included in Appendix F of the PPK ESA Report.

PPK reported that to reduce cross contamination all equipment used to recover soil samples was decontaminated between sampling location using a sulphamic arid solution and rinsed with potable water.

#### 4.4 Site Soils Encountered

Site soils were described in Section 5.3 of the PPK ESA Report. Borelogs are contained within Appendix E of the PPK ESA Report.

Charcoal, ash or slag were identified at varying depths in 19 of the sampling locations across the site. PPK reported that bitumen was identified in three locations representing a buried former bitumen pavement.

Square Acre (Section 5.3.1): PPK reported that the composition of fill materials was fairly consistent with varying thickness from 0.55 m to a maximum of 1.0 m, with the exception of TPSA8 where sand was encountered as trench backfill around a deep stormwater pipe to a depth of 2.5 m. Fill materials were typically sandy and clayey topsoil over clayey and gravelly fill. Some charcoal and or slag fragments were encountered in most of the nine test pits (TPSA1 - TPSA8). In particular a thin layer of light grey fine grained material, representing ash to a coarse to fine dolomitic sand was identified in addition to bitumen, brick fragments and small concrete blocks. PPK reported that natural soils were as expected with the exception of the topsoil layer, comprising a creamy brown clay layer containing abundant lime as a powdery silt and underlying hard brown clay layer to maximum depth of excavation.

**Building Footprint (Section 5.3.2)**: PPK reported that fill comprising a 50 mm layer of cream brown silty sand with fine gravel, timber and brick fragments was typically encountered. At all locations, natural soil was encountered at 0.05 m depth except UB10 where a layer of silty sandy clay fill extended to 0.2m. Timber and brick fragments were identified at all locations. Natural soils comprised brown sandy clay topsoil overlying a thin layer (200 mm – 300 mm) of reddish brown clay over calcareous creamy brown silty clay to clayey silt.

**Underground Steam Pipe Backfill Materials (Section 5.3.3)**: PPK reported two distinct types of fill with the upper comprising homogenous materials consisting of orange brown and cream brown silty sandy clay to a typical depth of 0.3 - 0.55 m. Sand fractions with fine ash and charcoal were observed in three locations (SP1, SP2 and SP3). Underlying this was a layer of yellow sand used to backfill around the pipe. Sand backfill was identified to a depth of 0.45 - 0.85 m. The natural soil profile under the buildings was identified as consisting of brown silty sandy clay overlying brown to red brown silty clay.

**Residential Allotments and Roadway (Section 5.3.4)**: PPK reported that the thickness of fill varied to a maximum depth of 0.8 m, generally 0.2 - 0.3 m and typically comprised a sandy clay soil with some gravel. Occasional brick fragments, charcoal and slag were identified in 9 locations (TP3A, TP4, TP8, TP10, TP11, TP22, TP25, TPR5 and TPR7). Bitumen was encountered at 4 test pit locations (TP14, TPR3, TPR4 and TPR7). PPK described the natural soil profile under the building as brown sandy clay topsoil over a thin layer (200 – 300 mm) of reddish brown clay, over a cream brown clay layer containing abundant lime as a powdery silt, to a depth of 1 – 1.5 metres below ground level, underlain in turn by a hard brown clay to maximum excavation depth.

#### 4.5 Laboratory Analysis Programme

#### 4.5.1 Soil Analysis

Selected soil samples from the four identified areas were analysed for a range of the following:

- pH
- Metals (As, Cd, Cr total, Cu, Hg, Pb and Zn)
- Polycyclic aromatic hydrocarbons (PAHs)
- Organochlorine pesticides (OCPs)
- Total Petroleum hydrocarbons (TPH)
- Volatile Aromatic Compounds (VACs)
- Volatile Halogenated Compounds (VHCs).

Soil samples were taken over five days during June 1998.

#### 4.5.2 Analysing Laboratories

Soil laboratory analyses were undertaken by Amdel Environmental Laboratories Ltd (Amdel), NATA certified laboratories for the analyses undertaken, identified in Section 5.5 of the PPK ESA Report.

Chain of custody forms are included in Appendix F of the PPK ESA Report. A copy of the chain of custody for Amdel report 8A00719 signed by the analysing laboratory is included in Appendix 11.

The laboratory analytical reports are included in Appendix G of the PPK ESA Report, as identified in Table 4.1.

Analysing Laboratory	Report Number	Date Sampled	Date Received by Laboratory	Date Reported By Laboratory	NATA Status
AMDEL	8A00719	5, 9, 10,11/6/98	11/6/98	19/6/98	NATA Endorsed
AMDEL	8A00785	29/6/98	30/6/98	7/7/98	NATA Endorsed
AMDEL	8A00838	16/7/98	16/7/98	23/7/98	NATA Endorsed

#### Table 4.1Laboratory Reports

9

#### 4.6 Assessment Criteria

The laboratory soil analysis results were compared by PPK to the following criteria, discussed in Section 5.6 of the PPK ESA Report:

- SAHC HIL Health based investigation levels (SAHC 1993)
- ANZECC B, Environmental Investigation Levels (ANZECC/NH&MRC 1992)
- NEHF A Proposed Health Based Soil Guidelines Exposure Setting A (standard residential with garden accessible soil (home grown produce contributing less than 10% fruit and vegetable intake; no poultry): this category includes children's day care centres, preschools and primary schools (NEHF 1996).

The SAHC HIL and ANZECC Environmental investigation levels were referred to as the primary assessment criteria, with NEHF A used for a preliminary health risk assessment.

Where no criteria were specified in the above, reference was made to:

- Dutch C, Dutch Government Clean-up criteria (ANZEC/NH&MRC 1990)
- Dutch Intervention, Intervention Values and Target Values (MHSPE 1994).
- NSW EPA Threshold Investigation levels (NSW EPA 1994) for TPH assessment.

#### 4.7 Contamination Assessment

Contamination assessment was discussed in Section 5.7 of the PPK ESA Report. Laboratory analysis reports are contained in Appendix G of the PPK ESA Report.

The soil results of the investigations are summarised in the following sections. All results exceeding the primary assessment criteria are identified in Tables 4.2, 4.3 and 4.4.

PPK calculated means, standard deviations and 95% UCLs for metal results, included in Appendix H of the PPK ESA Report.

#### 4.7.1 Square Acre

The results of samples taken in this area were discussed in Section 5.7.1 of the PPK ESA Report. In general all heavy metals were below ANZECC Environmental Investigation criteria with the exception of copper (156/155 mg/kg, ANZECC B 60 mg/kg) in duplicate samples from location TPSA2 taken at 0.35 – 0.45 m depth (below ground level), see Table 4.2. All concentrations were below NEHF A criteria. Soil pH levels ranged from 6.5 – 8.5. Levels of OCPs, OPP, TPH, PAHs, VHC and VAC were below the relevant laboratory detection limits.

Table 4.2	Square	Acre Metal E	ESA Results	Exceeding	Criteria
-----------	--------	--------------	-------------	-----------	----------

Sample / Heavy Metal	Location	Arsenic	Copper	Zinc
DL (mg/kg)		5	5	5
TPSA2 350-450	SA	Nd	156 t	18
TPSA2 350-450D	SA	Nd	155 ‡	16

SA – Square Acre

Nd - results below the laboratory detection limits as indicated

t equal to or exceeding ANZECC environmental investigation criteria.
#### 4.7.2 Building Footprint (Ward 6 Andersen House)

The results of samples taken in this area were discussed in Section 5.7.2 of the PPK ESA Report. Soil samples from areas adjacent to the concrete footings of the former Ward 6 building were taken at the depth of the excavated surface to 0.2 m depth. OCPs (aldrin, dieldrin, DDE and DDT) were detected in 11 of the 14 sampling locations. Maximum concentrations of OCPs identified include aldrin (31.1 mg/kg, UB10), dieldrin (9.1 mg/kg, UB14), DDE (0.2 mg/kg, UB7) and DDT (0.8 mg/kg, UB7), see Table 4.3.

No other OCP compounds were identified above the laboratory detection limits. PPK reported that the pesticide contamination appeared to be restricted generally to the upper 0.2 m of the exposed soil profile. PPK reported that analysis of underlying soils (0.2 m below ground level) identified only one occurrence of OCPs exceeding the criteria, namely aldrin (1.3 mg/kg, UB12).

Sample / OCP	Location	Aldrin	Dieldrin	DDE	DDT
DL (mg/kg)		0.1	0.1	0.1	0.1
UB1-0.05 R	BF W6	Nd	0.2 ‡	Nd	nd
UB2-0.05 R	BF W6	Nd	0.1	Nd	Nd
UB6-0.05 R	BF W6	1.1 ±	1.2 ‡±	Nd	Nd
UB7-0.05 R	BF W6	3.3 ±	0.7 ‡±	0.2	0.8 ±
UB8-0.05 R	BF W6	1.1 ±	1.3 ‡±	Nd	0.2
UB9-0.05 R	BF W6	3.5 ±	1.4 ‡±	Nd	Nd
UB9-0.2 R	BF W6	0.2	Nd	Nd	Nd
UB10-0.05 R	BF W6	31.1 ±§	2.6 ‡±	Nd	0.1
UB11-0.05 R	BF W6	1.3 ±	0.7 ‡±	Nd	0.4
UB11-0.2 R	BF W6	0.3	Nd	Nd	Nd
UB12-0.05 R	BF W6	8.3 ±§	5.3 ‡±	0.1	0.7 ±
UB12-0.2 R	BF W6	1.3 ±	0.1	Nd	Nd
UB13-0.05 R	BF W6	8.8 ±§	1.7 ‡±	Nd	Nd
UB14-0.05 R	BF W6	7.0 ±§	9.1 ‡±	Nd	Nd
UB14-0.2 R	BF W6	0.5 ±	0.1	Nd	nd

 Table 4.3
 Ward 6 OCP ESA Results Exceeding Criteria

BF W6 - beneath footprint of Ward 6

Nd - results below the laboratory detection limits as indicated

t equal to or exceeding ANZECC environmental investigation criteria

§ sum of aldrin / dieldrin equal to or exceeding NEHF A

± equal to or exceeding Dutch C clean up criteria

R - indicates sample removed during site remediation (see Section 5).

ł

#### 4.7.3 Underground Steam Pipes

The results of samples taken in this area were discussed in Section 5.7.3 of the PPK ESA Report. All heavy metals were below ANZECC Environmental Investigation criteria and NEHF A criteria. Soil pH levels ranged from 8.2 - 8.7.

#### 4.7.4 Residential Allotments and Roadway

The results of samples taken in this area were discussed in Section 5.7.4 of the PPK ESA Report. In general heavy metals were below the ANZECC environmental investigation criteria with the exception of samples from five sampling locations (TP3, TP4, TP4C, TP6 and TP6A), in fill to 0.5 m depth with maximum concentrations of copper (595 mg/kg TP3), zinc (612 mg/kg TP6) and arsenic (200 mg/kg TP6), see Table 4.4. Soil acidity ranged from pH 7.9 – 8.6.

Sample / Heavy Metal	Location	Arsenic	Copper	Zinc
DL (mg/kg)		5	5	5
TP3 400-500	RA	8	<b>595</b> ‡	202 ‡
TP4 400-500 R	RA	<b>68</b> ‡	15	49
TP4C 0-0.15	RA	<b>26</b> ‡	12	48
TP6 250-400 R	RA	200 §	17	612 t
TP6A 0.15-0.3 R	RA	22 t	15	49

#### Table 4.4 Residential Allotments Metal ESA Results Exceeding Criteria

RA - residential allotment

Nd - results below the laboratory detection limits as indicated

‡ equal to or exceeding ANZECC environmental investigation criteria

§ equal to or exceeding NEHF A health based criteria

R - indicates sample removed during site remediation (see Section 5).

Levels of OCPs, OPP, VHC, VAC levels were at or below the relevant laboratory detection limits.

Levels of TPH were below the Dutch Investigation and NSW EPA criteria.

PAHs were identified in one location TP4 (in proposed allotment 4) with Total PAHs (53.2 mg/kg) and Benzo(a)pyrene (5.9 mg/kg) at 400 – 500 mm depth exceeding NEHF A health based criteria (1 mg/kg and 20 mg/kg respectively). The borelog for this location indicated occasional charcoal fragments within this soil layer. The results of PAHs in the additional test pits excavated to delineate the extent of PAH contamination (TP4A-C) were below the laboratory detection limits.

#### 4.8 Quality Assurance and Quality Control (QA/QC)

QA/QC sampling and analysis procedures undertaken during the field investigations were not described in detail in the PPK ESA Report. Sampling methodology is summarised in Section 5.8.

PPK reported that analysis of 10 field duplicates and three laboratory replicates was undertaken, and performed %RPD and %RSD calculations for all analytes. Review indicated that 13 field duplicates were analysed as blind field or intra-laboratory duplicates as follows:

- TP8 150-300d
- TP10 300-400d
- TP19 150-300d
- TP24 0-150d
- TP25 0-150d
- TPR1 900-1000d
- TPR2 0-150d
- TPR5 0-150d
- TPSA2 350-450d
- TPSA5 450-600d
- SP6 600-700d (not calculated)
- UB11/12 0.-0.05
- UB11/12 0.05-0.2.

The results of the data validation is included in Appendix I of the PPK ESA Report.

PPK stated that "the RPD and RSD values determined for all of the analytes of the duplicates, and the RPD and RSD values determined for each of the analytes of the replicates were all found to be generally within the acceptance criteria".

RPDs and RSD for Total OCPs exceeded the accepted range (30%). PPK attributed this to a reflection of the relatively low concentrations of analytes where small differences equate to large percentage differences. The RPDs calculated for the two sample depths from UB11/12 were 143% and 129%, with an RSD of 79%.

Brock Barrett Project Marketing
Lots 351 and 352, DP48652
Site Audit Report, BCT Ref 98.0295/1

PPK also reported that the elevated results "indicate the homogenous nature of the surficial soils within the building footprints, particularly given the degree of demolition undertaken, and the variability of spatial concentrations of OCPs where they had been applied".

It is observed that an RPD exceeding the accepted range was also recorded in TP10 for lead (107%).

#### 4.9 Conclusions

PPK made the following conclusions in Section 6 of the PPK ESA Report:

Square Acre (Section 6.1): PPK stated that the investigation programme identified "no evidence of any widespread surface or subsurface contaminants within former square acre fill areas, which would preclude the use of the site for the proposed development programme". The localised subsurface copper concentration of 156 mg/kg in TPSA 2 at 0.35 - 0.45 m below ground level was not considered to represent significant environmental or health risks for the proposed development.

Building Footprint (Section 6.2): Elevated concentrations of aldrin, DDE, DDT and dieldrin were identified in the building footprint of Ward 6. PPK stated that removal of concrete footings would involve the excavation of the surrounding soils to an approximate depth of 1 - 2.3 m below surrounding site construction level. PPK-stated that remediation of the OCP contaminated soils would be undertaken as part of final demolition. PPK anticipated that following remedial works "the concentrations of residual OCP compounds, within the former building footprint area, will not pose potential environmental and/or human health limitations for the proposed development programme". PPK recommended that the assessment and remediation procedures also be applied to the building footprint of Ward 4. No further remedial works were recommended in this area subject to satisfactory completion of the remediation and provided that no other issues were identified.

Underground Steam Pipe Backfill Materials (Section 6.3): PPK stated there was "no evidence of subsurface contaminants within the backfill materials or in the natural undisturbed soils surrounding the underground steam pipes within the site, which would preclude the use of the site for the proposed development programme". No further works were recommended provided that the nature of the fill materials within the trenches was generally consistent along the extent of the underground steam pipe and that no other issues were identified during the excavation and removal of the pipe line. PPK recommended that the trench be backfilled with clean fill as described in SA EPA TB No 5.

Residential Allotments and Roadway (Section 6.4): PPK stated there was "no evidence of any widespread surface or subsurface contaminants within the proposed residential allotments and the central roadway which would preclude the use of the site for the proposed development programme". PPK stated with regard to the localised subsurface concentrations of copper and zinc exceeding ANZECC EIL but below NEHF A at two locations within allotments 3 and 4, that the "potential environmental risks for future planting in terms of phytotoxic risks are low to negligible, and therefore no remedial actions are deemed necessary". PPK recommended minor remedial works to excavate and remove soils within a 5 metre radius from the original test pit (TP6) to address the elevated subsurface arsenic levels (200 mg/kg) exceeding NEHF A in allotment 6, representing potential human health and environmental concerns. This would also remove the maximum recorded zinc concentration (612 mg/kg). PPK also recommended minor remedial works to excavate and remove soils within a 5 metre radius from the original test pit (TP4) to address the elevated subsurface benzo(a)pyrene and Total PAH levels (5.9 mg/kg and 53.2 mg/kg respectively) exceeding NEHF A in allotment 4, representing potential human health and environmental concerns. This would also remove the recorded arsenic concentration (68 mg/kg). PPK stated "Based on the results and findings of the investigation programme and through the anticipated completion of the aforementioned scope of minor remedial works, it is considered that the residual concentrations of the remaining analytes identified within the proposed residential allotments and roadway will not pose potential environmental and/or human health limitations for the proposed development program however this is subject to approval and endorsement by the environmental auditor".

13

# 5. SITE REMEDIATION AND VALIDATION

#### 5.1 Reports

PPK Environment and Infrastructure Pty Ltd (PPK) undertook site remediation and validation documented in the following report (PPK Validation Report) included in Appendix 8:

• PPK Environment & Infrastructure Pty Ltd (1999c) Site Remediation and Validation Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site, 27K139A 99-395, 25 June 1999.

#### 5.2 Objective and Scope of Works

PPK stated the "objectives of the remediation and validation program were to recommend remedial actions where soil contamination had been identified, and to further validate that the observed residual contaminant levels were consistent with the criteria for the proposed future redevelopment of the site for residential use".

The works incorporating site remediation and validation included:

- excavation and removal of localised shallow soil contamination (PAHs) from allotment 4
- excavation and removal of localised shallow soil contamination (arsenic and zinc) from allotment 6
- bulk excavation and removal of upper sub surface soils beneath former buildings Ward 4 and 6
- investigation of uncontrolled imported fill
- excavation and removal of uncontrolled imported fill from the eastern and western building footprints
- validation of imported clean fill from Walkley Heights and Settlers Farm.

Remediation works were undertaken by Salisbury Earthmovers (SEM Civil) under the general supervision of PPK.

#### 5.3 Site Soils Encountered

Borelogs for the boreholes located underneath the roadway (VR1-4), and eastern (VEB1-6) and western building footprints (VWB1-6) were provided separately by PPK and are contained in Appendix 10 of this Report. These boreholes were drilled as part of the investigation of the uncontrolled fill that had been brought onto the site without the knowledge of the consultant or the environmental auditor.

The borelogs indicated that in the eastern area of the connecting access road, fill comprising silty sandy clay was present to a maximum depth of 1.2 metres. An average 0.2 metre thick layer of sandy gravel road base materials had been placed at the surface. Natural soils encountered were typically cream brown to yellow brown silty sandy clay, with some calcrete content.

The borelogs indicated that following placement of the uncontrolled fill in the eastern building footprint, fill comprising grey brown silty sandy clay was present to a maximum depth of 2.1 metres. Natural soils encountered were typically cream brown to yellow brown silty sandy clay, with some calcrete content.

The borelogs indicated that following placement of the uncontrolled fill in the western building footprint, fill comprising brown to red brown silty sandy clay was present to a maximum depth of 1.5 metres. Natural soils encountered were typically cream brown, yellow brown to red brown silty sandy clay, with some calcrete content.

Following a detailed inspection of test pits in the Square Acre, which revealed the widespread presence of a thin layer of fill containing ash and charcoal at 0.5 m depth in the Square Acre, the Auditor advised, based on the results of testing for PAHs and having regard to the depth, thickness and general appearance of the material, that the material does not constitute an unacceptable health risk nor has unacceptable aesthetic implications, and would not require remediation.

#### 5.4 **Proposed Allotments 4 and 6**

PPK reported in Section 4.3 that excavation and removal of soils to 0.5 m depth in a 5 metre radius of the initial test pit locations (TP4 and TP6) was undertaken. The extent of the excavations is shown in Figure 07 and the sampling locations in PPK Figure 09.

2 soil samples were collected from the base of each excavation and analysed for the contaminants of concern as follows:

- TP4: L4-A(H), L4-B(H) PAHs
- TP6: L6-A(H), L6-B(H) arsenic and zinc.

PPK reported that "The results of the laboratory analysis programme reported concentrations of all selected analytes below auditor's nominated acceptance criteria".

The excavated soil was stockpiled, sampled and analysed for classification for off site disposal (see Section 5.9).

#### 5.5 Ward 6 Building Footprint

PPK reported in Section 4.1.1 that sampling was undertaken of exposed soils at 16 locations (UB15 to UB30) following the demolition and partial removal of concrete footings within the western portion of Ward 6. The sampling locations are shown on PPK Figure 05. PPK reported that surface soil samples were recovered at varying depths but were in general 300 - 700 mm below ground level. All samples were analysed for OCPs. Two blind field duplicates were also analysed D1 (UB17) and D2 (UB23).

PPK reported that the "results of the laboratory analysis program reported concentrations of all OCP compounds below auditor's acceptance criteria, with the exception of elevated concentrations of aldrin and dieldrin generally reported in the central and northern wing of the former building footprint".

All OCPs were below the laboratory detection limits in all samples with the exception of samples from 5 locations as identified in Table 5.1. Aldrin, dieldrin, endrin and g-BHC were detected. The maximum concentrations of aldrin (850 mg/kg) and dieldrin (11 mg/kg) were reported in sample UB28, in the former northern wing.

Sample / OCP	Aldrin	Dieldrin	Endrin	g-BHC
DL (mg/kg)	0.1	0.1	0.1	0.1
UB22 R	2.0 ‡	0.3	Nd	nd
UB23 (PS) R	0.9 ‡	0.6 t	0.5 t	nd
D2 (BFD UB23) R	1.1:	0.6 t	Nd	nd
UB24 R	0.7 ‡	0.1	Nd	nd
UB25 R	2.6 ‡	1.0 t	Nd	nd
UB28 R	850 t	11 t	Nd	0.2

Table 5.1 Ward 6 OCP Round 1 Results above Detection Limits

Nd - results below the laboratory detection limits as indicated

t equal to or exceeding Auditor acceptance criteria

R – indicates sample removed during site remediation.

15

The footings were subsequently exhumed and surrounding soils excavated to an approximate depth of 1 metre below ground level. Following excavation, PPK undertook a second round of validation sampling at 7 locations (UB31 to UB36). Sampling locations are shown on PPK Figure 05. PPK stated that a survey showed all samples were approximately 1 - 1.2 m below ground level. All samples were analysed for OCPs.

PPK summarised the results in Table 4.2, with a calculated 95% UCL of 0.38 mg/kg for aldrin.

PPK reported that "the results of the laboratory analysis program reported concentrations of all OCP compounds generally below auditor's nominated acceptance criteria, with the 95% UCL for all contaminants of concern below the nominated criterion of 0.5 mg/kg".

All OCP compounds were below the laboratory detection limits with the exception of aldrin and dieldrin in all samples as identified in Table 5.2. The maximum concentrations of aldrin (0.6 mg/kg) slightly exceeding the acceptance criteria and dieldrin (0.1 mg/kg) below the acceptance criteria were reported in sample UB32, located in the former northern wing.

Sample / OCP	Aldrin	Dieldrin
DL	0.1	0.1
UB31.	. <b>0.1</b>	Nd
UB32	0.6 ‡	0.1
UB33	0.2	Nd
UB34	0.2	Nd
UB35	0.1	Nd
UB36	0.2	Nd
UB37	Nd	Nd

#### Table 5.2 Ward 6 OCP Round 2 Results above Detection Limits

Nd – results below the laboratory detection limits as indicated t equal to or exceeding Auditor acceptance criteria

The excavated soils were stockpiled, sampled and analysed for classification for off site disposal (see Section 5.9).

#### 5.6 Ward 4 Building Footprint

PPK reported in Section 4.2 that the footings and surrounding soils of Ward 4 were excavated to an approximate depth of 1 m below ground level. The sampling locations are shown in PPK Figure 06.

Following completion, PPK undertook validation sampling of the base of the excavation at 18 locations (UWB1 to UWB18). All samples were analysed for OCPs. PPK summarised the results in Table 4.2, with a calculated 95% UCL of 0.2 mg/kg for aldrin.

PPK reported that the "results of the laboratory analysis program reported concentrations of all OCP compounds below auditor's nominated acceptance criteria of 0.5 mg/kg".

Results of OCPs reported equal to or above the laboratory detection limits are summarised in Table 5.3. Where detected, concentrations of aldrin ranged to a maximum of 0.5 mg/kg and dieldrin of 0.1 mg/kg. All other OCPs were below the laboratory detection limits.

Table 5.3	Ward 4 OCP F	Round 1 Results	above De	etection Limits

Sample / OCP	Aldrin	Dieldrin
DL (mg/kg)	0.1	0.1
UWB1	0.1	Nd
UWB6	0.4	0.1
UWB7	0.5 t	Nd

Nd – results below the laboratory detection limits as indicated t equal to Auditor acceptance criteria Although not reported in the PPK Validation Report, it was verified that an additional 7 validation samples including one blind field duplicate (UWB19 to UWB25 and BD4) were collected at the base of the western building footprint and analysed for OCPs. This was confirmed by PPK in their facsimile dated 7 July 1999, included as Appendix 10. The locations of these samples are shown on the amended PPK Figure 06 contained in the facsimile. It was verified by PPK (Appendix 12) that sample BD4 was a duplicate sample of UWB25.

OCPs were below the laboratory detection limits in all samples with one exception. Sample UBW24 contained an aldrin level of 1.8 mg/kg exceeding the Auditor criteria and dieldrin at the laboratory detection limit (0.1 mg/kg). PPK commented in their facsimile that "this sample was located adjacent to the roadway reserve, at an approximate depth of 1.2 m, and was considered to represent a localised occurrence, which did not exceed the NEHF criteria. It was also considered that the depth and location of the soils would not lead to significant exposures".

Results of OCPs reported equal to or above the laboratory detection limits are summarised in Table 5.4.

Table 5.4 Ward 4 OCP Round 2 Results above Detec	tion Limits
--	-------------

Sample / OCP	Aldrin	Dieldrin
DL	0.1	0.1
UWB24	1.8 ‡	0.1
Nd - results below the lab	pratory detection lim	nits as indicated

t equal to or exceeding Auditor acceptance criteria

R - indicates sample removed during site remediation.

PPK stated in their facsimile (Appendix 10) "Statistical analysis of the complete data set of all soil samples collected from the base of the Western Building Footprint, UWB1 – UBW25 (assuming all results reported as <LOR were present at a value of 90% of the LOR value) indicated that the 95% UCL of the mean concentration for Aldrin was 0.33 mg/kg, which is less that the auditor's nominated criterion".

The excavated soils were stockpiled, sampled and analysed for classification for off site disposal (see Section 5.9).

## 5.7 Uncontrolled Imported Fill Materials

PPK reported in Sections 4.1.2 and 4.2.3 that approximately 6,500 tonnes of soil was brought onto site by the developer without the knowledge of the consultant or the auditor. PPK indicated that approximately 6000 tonnes was sourced from the adjacent Regent Gardens – Stage 18 residential development, and approximately 500 tonnes from the Campbelltown Council, from the 'boxing out' of new roadways. PPK reported that the uncontrolled imported fill was used to backfill several areas of the site including the eastern and western building footprints.

PPK undertook insitu validation sampling of the uncontrolled fill which incorporated drilling and soil sampling at:

- 6 locations within residential allotments Ward 6 (VEB1-6)
- 6 locations within residential allotments Ward 4 (VWB1-6)
- 4 locations within the access roadway (VR1-4).

Sampling locations are shown in PPK Figure 08. PPK reported that boreholes were extended to 0.5 m depth into natural soil. Relevant borelogs are included in Appendix 10. PPK reported that "soil samples were collected at varying depths, to provide a random collection of soil samples from which to analyse".

Samples were analysed for a range of the following:

- DН
- Metals (As, Cd, Cr total, Cu, Hg, Pb and Zn)
- Polycyclic aromatic hydrocarbons (PAHs)
- Organochlorine pesticides (OCPs)
- Total Petroleum hydrocarbons (TPH)
- BTEX
- Phenols
- cvanide
- Chlorinated hydrocarbons.

The results of metals and TPH were either below the relevant laboratory detection limits or the acceptance criteria. Soil acidity ranged from pH 8.6 and 8.7. Levels of cyanide, PAHs, chlorinated hydrocarbons, phenols and BTEX were all below the relevant laboratory detection limits.

Initially 4 samples from Ward 6 and 3 from Ward 4 were analysed for OCPs. Following the results, which indicated that a portion of the uncontrolled fill was contaminated with OCPs, with aldrin exceeding the acceptance criteria (maximum concentration of 2.0 mg/kg at two locations within Ward 6 VEB2 and the access roadway VR4), additional analysis was undertaken at the Auditor's request. A total of 10 samples from Ward 6, 4 samples from the roadway and 7 samples from Ward 4 were submitted for analysis.

PPK subsequently reported for Ward 6 that "the results of the additional analyses, indicated that the impacted soils were primarily confined to the central-northern portion of the former Ward 6". Based on this, PPK recommended the impacted materials be removed to the full depth of the imported fill materials.

PPK subsequently reported for Ward 4 that "the results of the laboratory analysis program reported concentrations of all OCP compounds below auditors nominated acceptance criteria".

Results of OCPs reported equal to or above the laboratory detection limits are summarised in Table 5.5.

Sample / OCP	Location	Aldrin	Dieldrin	Chlordane Trans	Chiordane Cis	Trans NonachIor
DL (mg/kg)		0.1	0.1	0.1	0.1	0.1
VEB2-a 0.4 R	W6	0.3	Nd	nd	nd	nd
VEB2-b 1.0 R	W6	2.0 ‡	0.2	nd	nd	nd
VEB-2C 1.6 R	W6	1.1 ‡	0.3	nd	nd	nd
VEB3-a 0.4 R	W6	0.2	nd	nd	nd	nd
VR1-a 0.7	AR	0.5 t	0.1	nd	nd	nd
VR4-a 0.45	AR	2.0 ‡	0.3	nd	nd	nd
VWB1-a 0.4	W4	0.4	0.1	0.1	0.1	0.1

#### Table 5.5 Uncontrolled Fill Round 1 OCP Results Above Detection Limits

W6 - located within the former Ward 6 building footprint

W4 - located within the former Ward 4 building footprint

AR - located within the central access road

Nd - results below the laboratory detection limits as indicated

t equal to or exceeding Auditor acceptance criteria

R - indicates sample removed during site remediation.

PPK reported that approximately 300 m<sup>3</sup> of fill was excavated and removed from the central and central northern portion of Ward 6. The excavation comprised two separate areas, with the major excavation to the north and a smaller excavation to the south of the central access roadway. Uncontrolled fill was not removed from the central access roadway with the Auditor's agreement, as the road base had already been prepared at this stage. The extent of the two excavations is shown in PPK Figure 11.

Brock Barrett Project Marketing	Page	18
Lots 351 and 352, DP48652	File	SAR.doc
Site Audit Report, BCT Ref 98.0295/1	Date	23-Jul-99

PPK reported in Section 4.1.5 that following the excavation, 21 validation samples were taken at 13 locations (prefixed SE-, LE- and BLEBNE). These locations are shown on PPK Figure 11. The samples were analysed for OCPs.

PPK reported that the results "indicated that a further portion of the imported fill material was impacted, with levels of aldrin reported which exceeded the environmental auditor's nominated criterion .. at an approximate depth of 0.8 metres".

Samples which contained levels of detected OCPs are identified in Table 5.6. Aldrin was detected in samples from 6 locations with concentrations ranging from 0.8 mg/kg to 2.0 mg/kg, representing soils taken from the eastern and western walls of the northern excavation and the southern, eastern and western walls of the southern excavation.

Table 5.6 **Uncontrolled Fill Round 2 OCP Results Above Detection Limits** 

Sample / OCP	Aldrin	Dieldrin
DL (mg/kg)	0.1	0.1
SESWB R	2.0 ‡	0.1
SEWWB R	2.0 ‡	0.1
SEEWB R	2.0 ‡	0.1
LEWWBA R	1.5 ‡	0.2
LEEWB R	1.3 t	0.1
· LENWS R · · · ·	• • • 0.8 ‡	0.2

Nd - results below the laboratory detection limits as indicated t equal to or exceeding Auditor acceptance criteria R - indicates sample removed during site remediation.

The full extent of uncontrolled fill in the eastern building footprint was subsequently removed. PPK reported in Section 4.1.6 that approximately 2,000 m<sup>3</sup> of uncontrolled contaminated fill materials within the building footprint of Ward 6 (present on residential allotments 15, 16, 21 and 22) were excavated and removed. The extent of the further excavation of uncontrolled fill from Ward 6 is shown in PPK Figure 12.

Following excavation, PPK took validation sampling at 17 locations, including 9 validation samples from the southern excavation (prefixed HB-, HS- and HW-) and 10 validation samples from the northern excavation (prefixed HNE-). Sampling locations are shown in PPK Figure 12. 19 samples were analysed for OCPs.

The laboratory results of OCPs for all final validation samples were below the laboratory detection limits.

PPK reported that "visual inspection of the excavations indicated that all of the imported fill materials had been removed from the former eastern building footprint, within the residential allotments. The results of the validation sampling program confirmed this, with all OCP concentrations below either the laboratory detection limit of reporting, or the auditor's nominated threshold criteria".

#### 5.8 **Clean Imported Fill**

PPK reported in Sections 4.1.9 and 4.3.2 that approximately 2000 m<sup>3</sup> of fill materials were imported from two separate locations to backfill the additional excavations of Ward 6 and excavations in proposed allotments 4 and 6. PPK reported that clean fill was sourced from 'boxing out' of roadways within the Walkley Heights development and the trimming of residential blocks within the Settler's Farm development, Paralowie.

Validation of stockpiles of imported fill from Walkley's Heights stored in stockpiles in the south eastern portion of site was undertaken. PPK indicated that visual inspection of the proposed backfill materials indicated that the "soils were natural soil sediments of the area consisting of slightly calcareous silty clay to silty sandy clay".

Brock Barrett Project Marketing	Page	19
Lots 351 and 352, DP48652	File	SAR.doc
Site Audit Report, BCT Ref 98.0295/1	Date	23-Jul-99

6 validation samples including one blind field duplicate (IMPF-1N, 2E, 3S, 4Wa, 4Wb, 5E) were taken by PPK from the stockpiled soil. The distribution of the samples is shown in a figure included in Appendix 10. The samples were analysed for a range of:

- pH
- metals
- OCPs
- OPPs.

PPK reported in Section 4.1.9 that the "results of the validation sampling indicated that the material at the Walkley Heights site was suitable for use as bulk fill on the Hillcrest site, with all analytical concentrations reported below either the laboratory level of reporting or the auditor's nominated acceptance criteria".

Levels of metals were either below the laboratory detection limits or the acceptance criteria. Soil acidity ranged from pH 9.1 - 10. Levels of mercury, OCPs and OPP were below the relevant laboratory detection limits.

PPK reported that validation of insitu soils at Settler's Farm was undertaken, at the extension of General Drive adjacent to the corner with Brion Drive. 7 validation samples including one duplicate (LOT 279, 282a, 282b, 284, 298, 303 and 3x) were taken. The location of the samples is shown in the plan included in Appendix 12. PPK reported this approximated a staggered sampling grid on each side of the central roadway, at an approximate 50 m linear interval, or an approximate 25-30 m grid based on the area.

The samples were analysed for a range of:

- pH
- metals
- OCP
- PAHs
- TPH.

Levels of metals were either below the laboratory detection limits or the acceptance criteria. Soil acidity ranged from pH 8.9 – 9.5. Levels of OCPs, PAHs and TPH were below the relevant laboratory detection limits.

PPK reported that the "results of the validation sampling and analysis program, at the Settlers Farm site, indicated that the soil was suitable for use as bulk backfill material for the site". This was confirmed by the Auditor.

#### 5.9 Material Removed Off Site

The removal of materials off site is documented by PPK in Sections 4.1.2, 4.1.8, 4.2.2 and 4.3.1 of the PPK Validation Report. Copies of waste disposal notices are included in Appendix H.

Materials removed included:

- excavated soil from allotment 4 and 6
- excavated soil from Ward 6
- removal of uncontrolled fill from Ward 6.

PPK reported that materials removed off site were classified as either:

- clean fill and transported to either Mobile Reclaimers, Dry Creek or the Wingfield Waste Depot
- intermediate landfill cover and transported to the Wingfield Waste Depot.

A summary of the removed quantities is shown in Table 5.7.

• •

Source	Dates	Tonnes	m <sup>3</sup>	Samples	Classification
Ward 6	2/10/98	252.48	140	VS1-6	Clean fill
	12/10/98	320	175		Clean fill
Uncontrolled fill Allotments 4 and 6		3548.98	2000	CleanSP1/1-3 L4-SP1(H), L4-SP2(H) and L6-SP(H))	Clean fill
Ward 4	19/10/98, 30/10/98	320	175	VSW1 – VSW8, VSW9-16	Clean fill
otal Removed Off Site		4441.46	2490		

#### Table 5.7 Summary of Materials Removed Off Site

#### 5.10 Analysing Laboratories

Soil laboratory analyses were undertaken by Amdel Environmental Laboratories Ltd (Amdel), NATA certified for the analysis undertaken.

Signed chain of custody forms are included in Appendix F of the PPK Validation Report. The laboratory analytical reports are included in Appendix G of the PPK Validation Report, and are identified in Table 5.8.

Table 5.8 Validation Laboratory Reports

Analysing	Report	Date	Date Received	Date Reported	NATA
Laboratory	Number	Sampled	by Laboratory	By Laboratory	Status
AMDEL	8A01046	2/10/98	5/10/98	9/10/99	NATA Endorsed
AMDEL	8A01046A	2/10/98	10/10/98	13/10/98	NATA Endorsed
AMDEL	8A01075	12/10/98	13/10/98	16/10/98	NATA Endorsed
AMDEL	8A01095	19/10/98	20/10/98	23/10/98	NATA Endorsed
AMDEL	8A01135	30/10/98	2/11/98	5/11/98	NATA Endorsed
AMDEL	9A00352	25/3/98	29/4/98	30/4/99	NATA Endorsed
AMDEL	9A00251	25/3/99	29/3/98	9/4/99	NATA Endorsed
AMDEL	9A00288 Rev 1	24/3/98	8/4/98	3/5/99	NATA Endorsed
AMDEL	9A00359	30/4/99	3/5/99	4/5/99	NATA Endorsed
AMDEL	9A00366	4/5/99	5/5/99	7/5/99	NATA Endorsed
AMDEL	9A00371	5/5/99	5/5/99	11/5/99	NATA Endorsed
AMDEL	9A00374	4/5/99	6/5/99	11/5/99	NATA Endorsed
AMDEL	9A00386	10/5/99	11/5/99	17/5/99	NATA Endorsed
AMDEL	9A00414	24/5/99	24/5/99	27/5/99	NATA Endorsed
AMDEL	9A00432	26/5/99	26/5/99	1/6/99	NATA Endorsed
AMDEL	9A00455	3/6/99	4/6/99	9/6/99	NATA Endorsed

#### 5.11 Quality Assurance and Quality Control (QA/QC)

PPK described QA/QC data validation in Section 4.4 of the PPK Validation Report. Sampling and decontamination procedures undertaken during the field investigations were not detailed in the report.

PPK reported that analysis of 17 blind field duplicates was undertaken, and that laboratory replicates were nominally undertaken at a rate of 1 in 20 samples.

Review indicated that the following field duplicates were analysed as blind field or intra-laboratory duplicates:

- UB23 / D2
- UB11/UB12
- UB17 / D1
- BLEBNEa / BLEBNEb
- VSW5 / BD3

- **WB11/BD2**
- UWB4/BD1
- IMPF4Wa / IMPF4Wb
- HB-EF1/HB-EF2
- HNE-NWB / B2.

Results for a sample labelled RB analysed for OCPs are included in Amdel laboratory report 8A01135. PPK verified this was a rinsate blank sample (Refer PPK facsimile dated 7 July 1999 in Appendix 10). In this facsimile PPK stated that "the sample RB indicates that the cleaning operations undertaken during the collection of soil samples was adequate to limit cross contamination of the soil samples collected". Although this sample is included on the relevant chain of custody form (sample date 30/10/09), no other documentation regarding this sample was provided.

#### 5.12 **Data Validation**

PPK reported that %RPD and %RSD were calculated for all of the duplicate analyses. A summary of the results for metals and OCPs are included in Appendix Q of the Validation Report.

It is observed that UWB21 is included in Appendix Q for RPD analysis. Duplicate samples are not identified by PPK. PPK subsequently confirmed that BD4 was a duplicate of sample UWB25. These samples are not included in this Appendix.

PPK stated the "RPD and RSD values determined for all of the duplicate analyses, and the RPD and RSD values determined for each of the replicate analyses were all found to be generally within the acceptance criteria", (maximum of 20% for laboratory replicates and 30% for field duplicates), with one exception being the RPD for spike recovery of methoxychlor in Amdel report 8A1075 (21%).

PPK concluded that "based on the reported laboratory RPDs and RSDs and the calculated field duplicate RPDs and RSDs, the data collected during the validation program is considered to be suitable for inclusion into the remediation/validation program, and conclusions made, based on this data, appear to be valid".

#### 5.13 Conclusions

PPK concluded "based on the validation program undertaken on both the open excavations and the imported fill materials used to backfill the excavations, both areas specifically targeted for remedial works are considered to comply with the requirements of the environmental auditor for the proposed residential development and use of the site".

22

# 6. AUDITOR ASSESSMENT OF RESULTS

#### 6.1 General

Examination of the precision and quality of the data from the PPK investigations was undertaken by the Auditor in order to provide an assessment of the current status of the site.

#### 6.2 Assessment Criteria

Selection of site specific assessment criteria can include the adoption of published criteria from regulatory authorities and from overseas publications, or the conduct of human health and ecological risk assessments.

For the purposes of this Site Audit Report, reference has been made to the following soil criteria:

- ANZECC HIL ANZECC/NH&MRC (1992) Proposed Health Investigation Levels
- ANZECC B ANZECC/NH&MRC (1992) Environmental Investigation Levels
- SAHC HIL Investigation levels contained in SAHC (1993)
- NEHF A National Environmental Health Forum (NEHF Settings A) proposed health based investigation level soil guidelines: exposure setting A standard residential with garden/accessible soil.

The ANZECC/NH&MRC (1992) Environmental Investigation Levels are based on threshold levels for phytotoxicity and uptake of contaminants which may result in impairment of plant growth or reproduction, or unacceptable residue levels. These levels represent conservative values that protect the most sensitive receptor in the environment (ie. plant life). In the absence of specified criteria, the ANZECC guidelines refer to appropriate Dutch B investigation levels.

The South Australian Health Commission (SAHC 1993) health based investigation levels correspond to the ANZECC health based investigation levels for lead, arsenic, cadmium, and PAHs.

The NEHF (1996) Proposed Health Based Soil Guidelines Exposure Setting A apply to 'standard' residential developments, with gardens and accessible soil. It is assumed that home-grown produce contributes less than 10% of fruit and vegetable intake, and there is no poultry. This category is designed to include children's day care centres, preschools and primary schools. A 70 year exposure period has been assumed, except for those contaminants for which exposures over a much shorter period during childhood are critical.

Auditor acceptance criteria for the contaminants of concern were nominated, based on the above criteria and independent risk analysis and taking into account the nature of the proposed redevelopment:

- Benzo(a)pyrene 1 mg/kg
- Arsenic 20 mg/kg
- Individual OCP compounds (eg aldrin, dieldrin) 0.5 mg/kg.

#### 6.3 **Results for Soils Remaining on Site**

A summary of the laboratory analysis results for the identified contaminants of concern (metals, OCPs and PAHs) for soils remaining on site following completion of site remediation and validation is provided in the following tables, classified according to location, prepared by the Auditor:

- Table 6.1 Soils Remaining on Site Laboratory Results : pH, Arsenic and Metals
- Table 6.2 Soils Remaining on Site Laboratory Results : Organochlorine Pesticides
- Table 6.3 Soils Remaining on Site Laboratory Results : Polycyclic Aromatic Hydrocarbons

Brock Barrett Project Marketing
Lots 351 and 352, DP48652
Site Audit Report, BCT Ref 98.0295/1

٠.

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S											· · ·	
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u> Sahc ніl</u>		<u>L6-A(H)</u>	<u>L6-B(H)</u>	<u>SP01-550</u>	<u>SP01-650</u>	<u>SP02-800</u>	<u>SP02-850</u>	<u>SP03-400</u>	<u>SP03-450</u>	<u>SP04-1300</u>	<u>SP04-1350</u>	<u>SP05-1000</u>	<u>ŞP05-1550</u>	<u>SP05-700</u>	<u>SP06-570</u>
QA\QC						1													
Lab Report						9A00414	9A00414	8a00838	8a00838	8a00838	8a00838	8a00838	8a00838						
Sample Depth								0.55-0.65	0.65-0.75	0.8-0.85	0.85-0.95	0.4-0.45	0.45-0.55	1.3-1.35	1.35-1.45	1-1.05	1.55-0.7	0.7-0.8	0.57-0.6
.pH (pH units)					0.1		-	8.4	-	-	8.4	8.2	-	-	8.3	8.2	8.6	-	-
Arsenic (mg/kg)	20	20	100	100	5	11	nd	nď	5	nd	11	nd	nd	nd	nd	18	nd	nd	nd
Cadmium (mg/kg)	3		20	20	1.5			nd	nd	nd	nd	nd	ndi	nd	nd	nd	nd	nd	nd
Chromium (mg/kg)	50				5	-	-	nd	8	nd	20	nd	17	nd	13	15	10	, nd	nd
Cobalt					5	-	-	-		-	-	-	-	-	-	-	-		-
Copper (mg/kg)	60		1000	100	5		-	nd	10	nd	16	nd	11	16	12	13	7	nd	nd
Lead (mg/kg)	300		300	300	5	-		nd	nd	nd	nd	nd	7	nd	6	13	6	nd	nd
Mercury (mg/kg)	1		15	2	0.05		-	nd	nd	nd	nd	nd	nď						
Nickel	60		600		5	· -			-	-	-	-	-	-		•	-	-	
Zinc (mg/kg)	200		7000	500	5	26	25	nd	9	nd	nd	nd	17	87	13	28	12	7	nd

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHFA

4 > SAHC HIL

L

1

1

1

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>SP06-600</u>	<u>SP06-600d</u>	<u>SP11-500</u>	<u>T3A-150</u>	<u>T3A-400</u>	<u>T3B-400</u>	<u>T3C-450</u>	<u>T3D-400</u>	<u> </u>	<u>T4B-150</u>	<u>T4C-000</u>	<u> T4C-400</u>	<u>TP03-150</u>	<u>TP03-400</u>
QA\QC						BFD	PS					1	1						1
Lab Report						8a00838	8a00838	8A01046	8a00838	8a00838	8a00838	8a00838	8a00838	8a00838	8a00838	8a00838	8a00838	8a00719	8a00719
Sample Depth						0.6-0.7	0.6-0.7		0.15-0.3	0.4-0.5	0.4-0.5	0.45-0.55	0.4-0.5	0.4-0.5	0.15-0.3		0.4-0.5	0.15-0.3	0.4-0.5
								·			,					•			<u> </u>
.pH (pH units)					0.1	8.6	8.7	-		-	-		-	-	.		-		.
Arsenic (mg/kg)	20	20	100	100	5	nd	nd	6	6	nd	nd	nd	nd	7	15	1 2 26	6	7	8
Cadmium (mg/kg)	3		20	20	1.5	nd	nd	nd	-	-	-	-	-	-		-		nd	nd
Chromium (mg/kg)	50				5	11	10	13	-	-		-	-	-				16	13
Cobalt					5			5	-	-		-	-					-	-
Copper (mg/kg)	60		1000	100	5	7	7	<sup>'</sup> 60	16	8	13	14	16	23	16	12	24	20	595
Lead (mg/kg)	300		300	300	5	6	5	25	-		-	-	-	-	-		-	29	71
Mercury (mg/kg)	1		15	2	0.05	nd	nd	nd	-	-	-	-		-	-		-	0.07	0.11
Nickel	60		600		5	-		52		-	-		-	-	-				-
Zinc (mg/kg)	200		7000	500	5	; 11	10	140	30	15	17	16	139	30	36	48	32	72	202

ì ł i 1

3 > NEHFA

4 > SAHC HIL

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD intertaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B Environmental Investigation Levels (ANZECC/NHMRC 1992) 2 > Auditor Criteria

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

.

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHF A	<u>Sahc Hil</u>		<u>TP05-200</u>	<u>TP05-550</u>	<u>TP07-1800</u>	<u>TP07-200</u>	<u>TP07-900</u>	<u>TP08-150</u>	<u>TP08-150d</u>	<u>TP08-1600</u>	<u>TP08-400</u>	<u>TP09-150</u>	<u>TP09-900</u>	<u>TP10-300</u>	<u>TP10-300d</u>	<u>TP10-600</u>
QAIQC						1					PS	BFD			.		PS	8FD	
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth						0.2-0.3	0.55-0.65	1.8-1.9	0.2-0.3	0.9-1	0.15-0.3	0.15-0.3	1.6-1.7	0.4-0.5	0.15-0.3	0.9-1	0.3-0,4	0.3-0.4	0.6-0.7
										· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·						<u> </u>	I	 
.pH (pH units)					0.1	.		-	-		-	-	-	-	-	-			-
Arsenic (mg/kg)	20	20	100	100	5	nd	nd	6	nd	5	nd	nd	5	nd	nd	5	nd	nd	nď
Cadmium (mg/kg)	3		20	20	1.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chromium (mg/kg)	50				5	10	21	8	16	6	15	16	8	27	26	7	12	12	12
Cobait					5	.	-	-		-	-				-	-	-	-	
Copper (mg/kg)	60		1000	100	5	9	17	8	12	6	15	15	5	18	15	7	19	18	17
Lead (mg/kg)	300		300	300	5	: 20	9	nd	20	nd	39	36	5	11	11	nd	146	44	35
Mercury (mg/kg)	1		15	2	0.05	√nd	nd	nd	nd	nd	0.07	nd	nd	0.08	0.08	nd	0.07	nd	nd
Nickel	60		600		5		-	-	-	-	-	-	-	-	-	-	•	-	.
Zinc (mg/kg)	200		7000	500	5	13	15	9	57	5	51	42	8	16	16	7	121	106	105

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

2 > Auditor Criteria 3 > NEHFA 4 > SAHC HIL

1 > ANZECC B

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHE A</u>	<u>Sahc Hil</u>		<u>TP11-250</u>	<u>TP11-400</u>	<u>TP12-000</u>	<u>TP12-900</u>	<u>TP13-100</u>	<u>TP13-1450</u>	<u>TP14-150</u>	<u>TP14-1900</u>	<u>TP14-400</u>	<u>TP15-000</u>	<u>TP15-900</u>	<u>TP16-150</u>	<u>TP16-900</u>	<u>TP17-15</u>
QAIQC						1													ļ
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth						0.25-0.35	0.4-0.5		0.9-1	0.1-0.2	1.45-1.55	0.15-0.25	1.9-2	0.4-0.5		0.9-0.1	0.15-0.3	0.9-1	0.15-0.3
.pH (pH units)					0.1	-	-	-		-	-	-	-		-	-	.	-	-
Arsenic (mg/kg)	20	20	100	100	5	5	nd	nď	nd	nd	6	11	5	nd	nd	6	nd	nd	nd
Cadmium (mg/kg)	3		20	20	1.5	nd	nd	nđ	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chromium (mg/kg)	50				5	10	20	11	6	17	8	11	9	27	8	7	9	6	nd
Cobalt					5	.	-	-				-	-	-	-		-	-	-
Copper (mg/kg)	60		1000	100	5	11	12	9	6	12	5	11	nd	13	6 .	nď	7	5	nd
Lead (mg/kg)	300		300	300	5	16	20	11	6	17	8	17	nd	11	13	nd	14	nd	nd
Mercury (mg/kg)	1		15	2	0.05	nd	0.06	0.05	nd	0.06	nd	nd	nd	0.09	nd	nđ	nd	0.06	0.08
Nickel	60		600		5	-	-	-	-	-	-	-	-	•	-	•		-	-
Zinc (mg/kg)	200	ļ	7000	500	5	15	11	11	5	30	6	35	5	16	16	58	24	nd	nd
						1													
						•													
						·													
						-													
						i													
						i													

#### . . . . . .

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5). 1 > ANZECC B Environmental Investigation Levels (ANZECC/NHMRC 1992) Brock Barrett Project Marketing 2 > Auditor Criteria Site specific criteria as recommended by the Environmental Auditor Lots 351 and 352, DP 48052 3 > NEHFA Standard residential (NEHF 1996) Job No: 98.0295/S, 22/07/99 4 > SAHC HIL Health Investigation Levels (SAHC 1993) Laboratory Results pH Arsenic and Metals

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>TP17-1700</u>	<u>TP18-150</u>	<u>TP18-1700</u>	<u>TP18-900</u>	<u>TP19-150</u>	<u>TP19-1500</u>	<u>TP19-150d</u>	<u>TP20-400</u>	<u>TP20-900</u>	<u>TP22-1400</u>	<u>TP22-300</u>	<u>TP22-500</u>	<u>TP23-000</u>	<u>TP23-900</u>
QAIQC			1							PS	1	BFD							1
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth						1.7-1.8	0.15-0.3	1.7-1.8	0.9-1	0.15-0.3	1.5-1.6	0.15-0.3	0.4-0.5	0.9-1	1.4-1.5	0.3-0.45	0.5-0.6		0.9-1
											<u>.</u>				·,				<u></u>
.pH (pH units)					0.1	· -	-	-		-	-	-	-				-	-	.
Arsenic (mg/kg)	20	20	100	100	5	nd	nd	6	nd	nd	nd	nd	nd	nd	5	nd	nd	5	nd
Cadmium (mg/kg)	3	1	20	20	1.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chromium (mg/kg)	50				5	10	16	9	17	17	12	17	19	15	8	11	33	13	8
Cobatt					5	-		-	-		-		-	•	-	-	-	-	-
Copper (mg/kg)	60		1000	100	5	8	11	nd	10	12	7	12	10	9	nd	11	16	17	7
Lead (mg/kg)	300		300	300	5	nd	10	nd	7	15	6	16	9	7	nd	36	11	26	nd
Mercury (mg/kg)	1		15	2	0.05	' nd	nd	nd	nd	nd	nd	nd	ndi	nd	nd	nd	nd	nd	nd .
Nickel	60		600		5	· -	-	-	-	-	-	-		-		-	-	-	-
Zinc (mg/kg)	200		7000	500	5	9	11	7	12	13	10	13	10	10	nd	27	19	42	7

#### \_ . . - - -. .

ŝ

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHFA 4 > SAHC HIL

.

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

f i

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S										·		
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHE A</u>	<u>Sahc Hil</u>		<u> TP24-000</u>	<u>TP24-000d</u>	<u>TP24-500</u>	<u>TP25-000</u>	TP25-000d	<u>TP25-1550</u>	<u>TP25-250</u>	<u>TPSA01-</u> <u>330</u>	<u>TPSA01-</u> <u>600</u>	<u>TPSA02-</u> <u>350</u>	<u>TPSA02-</u> 350d	<u>TPSA02-</u> 700	<u>TPSA03-</u> 000	<u>TPSA03-</u> 700
QA\QC						PS	BFD		PS	BFD					PS	BFD			
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth								0.5-0.6			1.55-1.65	0.25-0.4	0.33-0.37	0.6-0.75	0.35-0.45	0.35-0.45	0.7-0.8		0.7-0.85
										-									<u>.</u>
.pH (pH units)					0.1	-	-	-	-	-	-			•	-	-	-	-	
Arsenic (mg/kg)	20	20	100	100	5	_ nd	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd	nď	8	nd
Cadmium (mg/kg)	3		20	20	1.5	nđ	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chromium (mg/kg)	50				5	13	13	28	12	14	11	13	nd	11	nd	nd	15	12	15
Cobatt					5	-	-	-	-		-		-	-	-		-	-	-
Copper (mg/kg)	60		1000	100	5	12	12	17	13	15	9	13 .	21	11	156	, 155	15	12	14
Lead (mg/kg)	300		300	300	5	17	16	11	13	13	6	15	9	10	9	8	16	9	15
Mercury (mg/kg)	1		15	2	0.05	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	nd
Nickel	60		600		5		.	-	-			-	-	-	-	-		-	
Zinc (mg/kg)	200		7000	500	5	17	17	19	20	24	8	18 .	15	30	18	16	26	15	40

- -

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHFA 4 > SAHC HIL

÷

÷

i

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S									<b>.</b>			
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	SAHC HIL		1PSA04- 350	<u>TPSA04-</u> 700	<u>TPSA04-</u> 900	<u>TPSA05-</u> 200	<u>TP\$A05-</u> <u>450</u>	<u>TPSA05-</u> 450d	<u>TPSA06-</u> <u>350</u>	<u>TPSA06-</u> 700	<u>TPSA07-</u> <u>500</u>	<u>TPSA07-</u> 850	<u>TPSA08-</u> <u>150</u>	<u>TPSA08-</u> 900	<u>TPSA09-</u> 000	<u>1P\$A09-</u> 2150
QA\QC						1				PS	BFD	1							
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth						0.35-0.5	0.7-0.8	0.9-1	0.2-0.35	0.45-0.6	0.45-0.6	0.35-0.5	0.7-0.85	0.5-0.6	0.85-1	0.15-0.3	0.9-1		2.15-2.25
																	, 		<u> </u>
.pH (pH units)					0.1	-	-	-	-	.	-	-		-	-	-	-	-	.
Arsenic (mg/kg)	20	20	100	100	5	nd	5	nd	nd	9	10	6	nd	nď	nď	nd	nd	5	nd
Cadmium (mg/kg)	3		20	20	1.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chromium (mg/kg)	50				5	8	11	17	15	13	10	11	14	7	16	8	12	11	16
Cobalt					5	-		-	-	-	-	-	-	-	-	-	-	-	-
Copper (mg/kg)	60		1000	100	5	58	22	14	13	25	20	12	13	40	17	9	11	13	6
Lead (mg/kg)	300		300	300	5	, 11	9	11	10	13	16	15	17	9	17	10	13	10	7
Mercury (mg/kg)	1		15	2	0.05	nd	nđ	nd	nd	nd	nd	nd	nd	· nd	nd	nd	nď	nd	nd
Nickel	60		600		5	-		-	-	-	-	•	-		-	-	-	-	-
Zinc (mg/kg)	200		7000	500	5	: 19	12	16	20	31	37	29	40	19	24	13	27	18	12

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHF A

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

		MENT CR									•	 			NKIIN	& A5:		TES
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHF A	<u>Sahc Hil</u>	D.L.	WB1-a	З <u>Ү₩₿3-b</u>	<u>VWB4-a</u>										
QA\QC			1	1		1	1								1		1	
Lab Report						9A00251	9A00251	9A00251										
Sample Depth																		
	1	1	1	E I			1	ł	1		1	ı	,			1		,
Total Cyanide (mg/kg)		1	500	250	0.5	.	nd	-										
.pH						8.6	-	8.7										
Antimony (mg/kg)	20				. 5		nd	-										
Arsenic (mg/kg)	20	20	100	100	5	nd	nd	nd								r F		
Beryilium (mg/kg)			20		5	.	nd	-										
Cadmium (mg/kg)	3		20	20	1	nd	nd	nđ										
Chromium (mg/kg)	50				5	27	22	25										
Cobalt (mg/kg)					5	· -	nd	-										
Copper (mg/kg)	60		1000	100	5	<sup>'</sup> 15	13	13		•								
Lead (mg/kg)	300		300	300	5	12	12	10										
Mercury (mg/kg)	1		15	2	0.05	nd	nd	0.09										
Molybdenum (mg/kg)					5		nd											
Nickel (mg/kg)	60		600		5	; 12	8	10										
Selenium (mg/kg)	ł				5	· .	nd	-										
Tin (mg/kg)	50				5	.	nd	-										
Zinc (mg/kg)	200		7000	500	5	- 24	28	23										

# Table 6.1 Ward 4 Soil Laboratory Results: pH Arsenic and Metals

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

2 > Auditor Criteria

3 > NEHFA

4 > SAHC HIL

1 > ANZECC B Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

# Table 6.1 Settlers Farm Soil Laboratory Results: pH Arsenic and Metals

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S									
	<u>ANZECC B</u>	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>LOT 282a-</u> <u>1</u>	<u>LOT 2826-</u> 1	<u>LOT 284-1</u>	<u>LQT 298-1</u>	<u>LOT 303-1</u>	<u>LOT 3X-1</u>					
QAIQC						PS	BFD									
Lab Report					9A00455	9A00455	9A00455	9A00455	9A00455	9A00455	9A00455					
Sample Depth					0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	 				
· · · · · · · · · · · · · · · · · · ·																
.pH					9	9.3	9.2	9	8.9	9.5	9.4					
Arsenic	20	20	100	100	14	10	12	13	15	13	14					
Cadmium	3		20	20	0.25	0.25	0.25	0.25	0.25	0.25	0.25					
Chromium	50				43	39	40	45	45	39	44					
Copper	60		1000	100	32	32	31	33	33	30	32					
Lead	300		300	300	17	12	12	14	14	14	13					
Mercury	1		15	2	0.025	0.025	-	0.06	0.025	0.025	0.025					
Zinc	200		7000	500	38	31	31	32	34	36	36			l		

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5). 1 > ANZECC B 2 > Auditor Criteria 3 > NEHF A 4 > SAHC HIL Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993) Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/SF, 22/07/99 Laboratory Results pH Arsenic and Metals

#### BC TONKIN & ASSOCIATES

# Table 6.1 Walkley Heights Soil Laboratory Results: pH Arsenic and Metals

	ASSESS	SSESSMENT CRITERIA D.					s									
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>SAHC HIL</u>		IMPF-2E	IMPF-3S	<u>IMPF-4Wa</u>	IMPE-4Wb	<u>IMPF-5E</u>						
QA\QC						1		PS	BFD-4Wb							
Lab Report					9A00386	9A00386	9A00386	9A00386	9A00386	9A00386						
Sample Depth																
											_					
.pH					10	9.7	9.1	9.6	9.6	9.6						
Arsenic	20	20	100	100	5	6	2.5	6	6	2.5						
Cadmium	3		20	20	0.25	0.25	0.25	0.25	0.25	0.25						
Chromium	50				24	32	33	24	23	25			1			
Copper	60		1000	100	12	9	16	8	8	10						
Lead	300		300	300	9	8	15	9	9	10						
Mercury	1		.15	2	0.025	0.025	0.025	0.025	0.025	0.025						
Nickel	60		600		20	15	18	16	13	16						
Zinc	200		7000	500	25	24	27	23	19	19						

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD Interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5). 1 > ANZECC B 2 > Auditor Criteria 3 > NEHF A 4 > SAHC HIL

;

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993) Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/WH, 22/07/99 Laboratory Results pH Arsenic and Metals

#### BC TONKIN & ASSOCIATES

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>SP10-500</u>	<u>TPR01-200</u>	<u>TPR01-400</u>	<u>TPR01-900</u>	<u>TPR01-</u> 900d	<u>TPR02-000</u>	<u>TPR02-</u> 000d	<u>TPR02-400</u>	<u>TPR02-900</u>	<u>TPR03-060</u>	<u>19R03-</u> 1500	<u> 1PR03-400</u>	<u> TPR04-060</u>	<u>IPR04-40</u>
QA\QC									PS	BFD	PS	BFD				ł			
Lab Report						8A01046	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth	<u> </u>					<u> </u>	0.2-0.3	0.4-0.5	0.9-1	0.9-1			0.4-0.5	0.9-1	1.5-1.6	0.4-0.5	0.06-0.15	0.4-0.5	0.06-0.2
Total Cupulda (ma/ka)	1	l	500	250	0.5		l	l	l	l			Į				1	Į	l
Total Cyanide (ingrkg)			500	250	0.5		-	-	-	-		•		-			-		-
.pH						-	-	-	-	-	-	•	-	-	-	-	-	-	-
Antimony (mg/kg)	20				5	-	-	-	-	•	-	-	-	-		-	-	-	-
Arsenic (mg/kg)	20	20	100	100	5	11	nd	nd	nd	6	nď	nd	nd	6	nd	nd	nd	nd	nd
Beryllium (mg/kg)			20		5	-		-	-	-		-	-	-	-	-	-		
Cadmium (mg/kg)	3		20	20	1.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chromium (mg/kg)	50				5	· 17	20	29	11	11	13	14	30	8	ndi	15	29	nd	16
Cobalt (mg/kg) (mg/kg)					5	7	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (mg/kg)	60		1000	100	5	34	20	14	8	8	11	13	16	7	nd	8	16	nd	13
Lead (mg/kg)	300		300	300	5	24	34	11	6	5	15	16	11	nd	nd	7	11	nd	12
Mercury (mg/kg)	1		15	2	0.05	nd	nd	nd	nd	nd	nd	nď	0.06	nd	nd	nd	0.05	nd	nd
Molybdenum (mg/kg)				r	5		-	-		-	-	-	<u>.</u>	-	-	-		-	-
Nickel (mg/kg) (mg/kg)	60		600		5	42	-	-	-	-	-	•	-	-	-	-	.	-	-
Selenium (mg/kg)					5		-	-	-	-	-	-	-	-		-	-	-	-
Tin (mg/kg)	50			,	5		-	-		-		-	-	-	-	-	-	-	-
Zinc (mg/kg)	200		7000	500	5	190	160	18	9	8	23	25	20	7	5	13	17	nd	10

# . . . . . .

1

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interfaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

2 > Auditor Criteria 3 > NEHF A

1 > ANZECC B

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/R, 22/07/99 Laboratory Results pH Arsenic and Metals

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

### Table 6.1 Central and Access Roadways Soil Laboratory Results: pH Arsenic and Metals

BC TONKIN & ASSOCIATES

	ASSESS	ASSESSMENT CRITERIA			D.L.	RESULT	S											
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>SAHC HIL</u>		<u>TPR04-900</u>	<u>TPR05-000</u>	<u>TPR05-</u> 000d	<u>TPR05-150</u>	<u>TPR05-400</u>	<u>TPR07-</u> <u>1600</u>	<u>TPR07-300</u>	<u>TPR07-450</u>	<u>VR1-a</u>	<u>VR2-a</u>			
QAIQC					[	ļ	PS	BFD										ļ
Lab Report					1	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	9A00251	9A00251			
Sample Depth						0.9-1			0.15-0.3	0.4-0.5	1.6-1.7	0.3-0.45	0.45-0.6					<u> </u>
						-											1	
Total Cyanide (mg/kg)			500	250	0.5		-	-	-	-	-	-	-	nd	-		1	
.pH							-	-	-	-	-	-			9			
Antimony (mg/kg)	20				5	-		-	-	-	-	-	-	nđ	-			
Arsenic (mg/kg)	20	20	100	100	5	nd	7	7	6	nd	nd	7	nd	nd	nd			
Beryllium (mg/kg)			20		5	-	-		-	-	-	-	-	nd	-			
Cadmium (mg/kg)	3		20	20	1.5	nd	nd	nd	1.4	nd	nd	nd	nd	nd	nd			
Chromium (mg/kg)	50				5	15	10	10	16	19	11	13	17	24	23			
Cobalt (mg/kg) (mg/kg)					5		-	-	-	-	-		-	nd	-			,
Copper (mg/kg)	60		1000	100	5	11	16	16	15	13	8	11	13	11	30			
Lead (mg/kg)	300		300	300	5	8	24	24	21	13	5	27	9	8	6			
Mercury (mg/kg)	1		15	2	0.05	nd	nd	nď	nd	nd	nd	nđ	nd	nd	nd			
Molybdenum (mg/kg)					5		-		-		-		-	nd				
Nickel (mg/kg) (mg/kg)	60		600		5		-	-	-		-	-	-	10	6			
Selenium (mg/kg)					5			-	-			-		nd	.			
Tin (mg/kg)	50				5			-	-		-	-	-	nd	-			
Zinc (mg/kg)	200		7000	500	5	9	58	60	56	27	. 12	48	11	19	26		1	

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD Interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

_		
1	>	ANZECC B
2	>	Auditor Criteria
3	>	ŃEHF A
4	>	SAHC HIL

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Health Investigation Levels (SAHC 1993)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

.

### Table 6.2 Residential Allotments Soil Laboratory Results: Organochlorine Pesticides

BC TONKIN & ASSOCIATES

	ASSESS				D.L.	RESULT	S											
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>TP10-300</u>	<u>TP12-000</u>	<u>TP14-150</u>	<u>TP15-000</u>	<u>TP20-400</u>	<u>TP23-000</u>	<u>TPSA01-</u> <u>330</u>	<u>TPSA03-</u> 000	<u>TPSA03-</u> 700	<u>TPSA08-</u> 150	<u>tpsa09-</u> 000		
QAIQC						PS												
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719								
Sample Depth	<u> </u>					0.3-0.4		0.15-0.25		0.4-0.5		0.33-0.37		0.7-0.85	0.15-0.3			
	1	1	1	1	,		1	1	1	1	1	1	1	1	1	1		I
a-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd								
Aldrin (mg/kg)		0.5	10		0.1	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd		
Alpha-Chlordane (mg/kg)		0.5			0.1	nd	ndi	nd	nd	nd								
Alpha-Endosulfan (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd								
b-BHC (mg/kg)	Ì				0.1	nd	nd	ndi	nd	nd	nd	nd	nd	nd	nd	nd		
Beta-Endosulfan (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd								
Chlordane Cis		0.5	50		0.1		-			-	-	-	-	-	-	-		
Chlordane Trans		0.5			0.1	-		-	-	-	-		-	-	•	-		
d-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd								
DDD (mg/kg)					0.1	nd	nd	nd	nd	nd								
DDE (mg/kg)		0.5			0.1	<sup>1</sup> nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	nd		
DDT (mg/kg)		0.5	200		0.1	nd	nd	nd	nď	nd		1						
Dieldrin (mg/kg)	0.2	0.5	10		0.1	nd	nd	nd	nd	nď								
Endosulfan 1					0.1	·	-	-	-	-			-	-	•			
Endosulfan 2					0.1	· -	-			-	-		-	-	-	-		
Endosulfan sulphate (mg/kg)					0.1	nd	nd	nd	nd	nd								
Endrin (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd		
g-BHC					0.1	nd	nd	nd	nd	nd								
Gamma-Chlordane (mg/kg)		0.5			0.1	: nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd		
HCB (mg/kg)					0.1	'nd	nd	ndi	nd	nd	nd	nd	nd	nd	nd	nd		
Heptachlor (mg/kg)		0.5	10		0.1	nd	nd	nd	nd	nd								
Heptachlor epoxide (mg/kg)					0.1	nd	nd	nd	nd	nď								
All laboratory reports are NATA accre	edited unless so	ecifed as pre	liminary (P).		1	> ANZECC	B E	Invironmental	Investigation	Levels (ANZE	ECC/NHMRC	1992)					Brock Barre	ett Project Marketi

Al laboratory reports are NATA accreated unless specified as preliminary (r). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples, DL, primary laboratory laboratory detection limit.

SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

3 > NEHFA

Environmental Investigation Levels (ANZECC/NHMHC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99

Laboratory Results Organochlorine Pesticides

<sup>2 &</sup>gt; Auditor Criteria

	ASSESSI	MENT CR	ITERIA		D.L.	RESULT	s											 
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>SAHC HIL</u>		<u>TP10-300</u>	<u>TP12-000</u>	<u>TP14-150</u>	<u>TP15-000</u>	<u>TP20-400</u>	<u>TP23-000</u>	<u>TPSA01-</u> <u>330</u>	<u>TP\$A03-</u> 000	<u>TP\$A03-</u> 700	<u>TP\$A08-</u> 150	<u>TP\$A09-</u> 000		
QAIQC						PS												
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719								
Sample Depth			_			0.3-0.4		0.15-0.25		0.4-0.5		0.33-0.37		0.7-0.85	0.15-0.3			
																	•	
Methoxychlor (mg/kg)					0.1	nd	nd	nd	nd	nđ								
Oxychlordane (mg/kg)					0.1	nd	nd	nd	nd	nd								

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD intertaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHF A 4 > SAHC HIL

ł

1

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993) Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99 Laboratory Results Organochlorine Pesticides

Table 6.2 Ward 4	Soil Lab	orator	y Resi	ults: Oi	rganoc	chlorine	e Pesti	cides						В		NKIN	& ASS	SOCIA	TES
	ASSESS	MENT CR	ITERIA		D.L.	RESULT	s												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>BD1-1</u>	<u>BD2-1</u>	<u>BD4-1</u>	<u>UWB01-1</u>	<u>UWB02-1</u>	<u>UWB03-1</u>	<u>UWB04-1</u>	<u>UWB05-1</u>	<u>UWB06-1</u>	<u>UWB07-1</u>	<u>UWB08-1</u>	<u>UWB09-1</u>	<u>UWB10-1</u>	<u>UWB11-1</u>
QAIQC						BFD-UWB4	FD-UWB1	FD-UWB2				PS							PS
Lab Report						8a01095	8a01095	8a01135	8a01095										
Sample Depth																	,		
	1	1	1	1	I	1	]	1				1			1		1		
a-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd 2	nd	nd	nđ	nd
Aldrin (mg/kg)		0.5	10		0.2	nd	nd	nd	0.1	nd	nd	nd	nd	0.4	0.5	nd	nd	nđ	nd
b-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chlordane Cis (mg/kg)		0.5	50		0.1	nd	nd	nd	nd	nd	nd	nd	ndi	nd	nd	nd	nd	nd	nd
Chlordane Trans (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
d-BHC (mg/kg)					0.1	nd <sub>.</sub>	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD (mg/kg)					0.1	nd	nd	nd	nd	nđ	nd								
DDE (mg/kg)		0.5			0.1	, nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDT (mg/kg)		0.5	200		0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dieldrin (mg/kg)	0.2	0.5	10		0.2	nd	nd	nd	nđ	nd	nd	nd	nd	0.1	nd	nd	nd	nd	nd
Endosulfan 1 (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan 2 (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan sulphate (mg/kg)					0.1 ·	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endrin (mg/kg)		0.5			0.1	i nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
g-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HCB (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nđ	nd						
Heptachlor (mg/kg)		0.5	10		0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptachlor epoxide (mg/kg)					0.1	, nd	nd	nd	nd	nd	nd	nđ	nd						
Methoxychlor (mg/kg)					0.1	nd ،	nd	nd	nd	nd	nd	nd ·	nd						
Oxychlordane (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

#### .. . . . .

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD Intertaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria

3 > NEHFA

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/W4, 22/07/99

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

Laboratory Results Organochlorine Pesticides

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>UWB12-1</u>	<u>UWB13-1</u>	<u>UWB14-1</u>	<u>UWB15-1</u>	<u>UWB16-1</u>	<u>UWB17-1</u>	<u>UWB18-1</u>	<u>UWB19-1</u>	<u>UWB20-1</u>	<u>UWB21-1</u>	<u>UWB22-1</u>	<u>UWB23-1</u>	<u>UWB24-1</u>	<u>UWB25-1</u>
QA\QC					1										PS				
Lab Report						8a01095	8a01135												
Sample Depth				<u> </u>	[				ļ										ļ
PHC (malka)	1					<sub>nd</sub>	ad .	nd	nd	nd	nd	nd	ba	ba	nd	d nd	pd	nd	nd
a-one (mg/kg)					0.1						10							2	
Aldrin (mg/kg)		0.5	10		0.2	nd	) nd	1.8	nd										
b-BHC (mg/kg)					0.1	nd	nđ	nd	nď	nd	nd								
Chlordane Cis (mg/kg)		0.5	50		0.1	nd	nd	nd	nd	nđ	nd								
Chlordane Trans (mg/kg)		0.5			0.1	nd	nđ	nd	nd	ndi	nd								
d-BHC (mg/kg)					0.1	nd	nd	nd	nd	nď	nd								
DDD (mg/kg)					0.1	nd													
DDE (mg/kg)		0.5			0.1	` nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd
DDT (mg/kg)		0.5	200		0.1	nd													
Dieldrin (mg/kg)	0.2	0.5	10		0.2	nd	nđ	nd	nd	0.1	nd								
Endosulfan 1 (mg/kg)					0.1	, nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd
Endosulfan 2 (mg/kg)					0.1	nd													
Endosulfan sulphate (mg/kg)					0.1	nd	nd	ndi	nd	nd	nd	nđ	nd						
Endrin (mg/kg)		0.5			0.1	nd	nď	nd	nd	nd	nd	nd							
g-BHC (mg/kg)					0.1	nd	nđ												
HCB (mg/kg)					0.1	nd													
Heptachlor (mg/kg)		0.5	10		0.1	nd													
Heptachlor epoxide (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nđ	nd						
Methoxychlor (mg/kg)					0.1	nd													
								.	l .	.	.	.					Ι.		1 .

# All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Health Investigation Levels (SAHC 1993)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/W4, 22/07/99

Laboratory Results Organochlorine Pesticides

2 > Auditor Criteria 3 > NEHFA 4 > SAHC HIL

# Table 6.2 Ward 4 Soil Laboratory Results: Organochlorine Pesticides

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	s												
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHE A</u>	<u>Sahc Hil</u>		<u>VWB1-a</u>	<u>VWB2-a</u>	<u>VWB3-a</u>	<u>VWB3-b</u>	<u>VWB4-a</u>	<u>VWB5-a</u>	<u>VWB6-a</u>							
QAIQC					ļ	1			ļ										
Lab Report						9A00251	9A00288	9A00288	9A00251	9A00251	9A00352	9A00288							
Sample Depth																		<u> </u>	<u> </u>
		<b>、</b>					,			•	ı	ι	1	ŧ	(	ι	l	i	
a-BHC (mg/kg)					0.1	nd													
Aldrin (mg/kg)		0.5	10		0.2	0.4	nd	nd	nd	nď	nd	nd							
b-BHC (mg/kg)					0.1	nd													
Chlordane Cis (mg/kg)		0.5	50		0.1	0.1	nd	nd	nd	nd	nd	. nd							
Chlordane Trans (mg/kg)		0.5			0.1	0.1	nd	nd	nd	nd	nd	nd							
d-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nđ	nd				ł			
DDD (mg/kg)					0.1	; nd	nd	nd	nd	nd	nd	nd							
DDE (mg/kg)		0.5			0.1	nd	nd	nd	nd	ndi	nd	nd							ł
DDT (mg/kg)		0.5	200		0.1	nd													
Dieldrin (mg/kg)	0.2	0.5	10		0.2	0.1	nd	nd	nd	nd	nd	nd							
Endosulfan 1 (mg/kg)					0.1	nd	ndi	. nd	nd	nd	nd	nd							
Endosulfan 2 (mg/kg)					0.1	nd	nd	nd	nd	nď	nd	nd	i						
Endosulfan sulphate (mg/kg)					0.1	nd													
Endrin (mg/kg)		0.5			0.1	nd													
g-BHC (mg/kg)			ļ		0.1	nd	nd	nđ	nd	nd	nd	nd							
HCB (mg/kg)					0.1	nđ	nd	nd	nd	nd	nd	nđ	i t						}
Heptachlor (mg/kg)		0.5	10		0.1	nd							l						
Heptachlor epoxide (mg/kg)					0.1	, nd	nď	nd	nd	nd	nd	nd							
Methoxychlor (mg/kg)					0.1	nd	nd	nđ	nd	nd	nd	nd							
Oxychlordane (mg/kg)					0.1	ind	nđ	nd	nd	nđ	nd	nd							

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed.

SS no of composite subsamples. D.L. primary laboratory laboratory detection limit.

nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

3 > NEHFA 4 > SAHC HIL

1 > ANZECC B

2 > Auditor Criteria

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Health Investigation Levels (SAHC 1993)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

**Brock Barrett Project Marketing** Lots 351 and 352, DP 48052 Job No: 98.0295/W4, 22/07/99 Laboratory Results Organochlorine Pesticides

BC TONKIN & ASSOCIATES

### Table 6.2 Ward 6 Soil Laboratory Results: Organochlorine Pesticides

BC TONKIN & ASSOCIATES

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	<u>ANZECC B</u>	<u>Auditor</u> <u>Criteria</u>	<u>NEHE A</u>	<u>SAHC HIL</u>		<u>HB-EF1</u>	<u>HB-EF2</u>	HB-WF1	<u>HNE-NEB</u>	<u>HNE-NES</u>	<u>KNE-NWB</u>	<u>HNE-</u> NWB2	HNE-NWS	HNE-SAND	HNE-WB	<u>HNE-WS</u>	<u>HNEB-E</u>	HNEB-W	<u>HSE-B</u>
QA\QC					1	PS	BFD-EF2				PS	BFD-NWB2							
Lab Report						9A00414	9A00414	9A00414	9A00432	9A00432	9A00432	9A00432	9A00432	9A00432	9A00432	9A00432	9A00432	9A00432	9A00414
Sample Depth									<u> </u>										
											,								1
a-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ
Aldrin (mg/kg)		0.5	10		0.1	nd	nd	nd	nd	nď	nd	nd	nd	nď	nd	nd	nd	nd	nd
b-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chlordane Cis (mg/kg)		. 0.5	50		0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	nd	nd
Chlordane Trans (mg/kg)		0.5			0.1	nd	nd	nd	nd	nď	nd	nd	nď	กต่	nd	nd	nd	nd	nd
d-BHC (mg/kg)					0.1	nď	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDE (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd
DDT (mg/kg)		0.5	200		0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dieldrin (mg/kg)	0.2	0.5	10		0.1	nđ	nd	ndi	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan 1 (mg/kg)				i	0.1	, nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan 2 (mg/kg)					0.1	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan sulphate (mg/kg)					0.1	, nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endrin (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd
g-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	nd
HCB (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptachlor (mg/kg)		0.5	10		0.1	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptachior epoxide (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Methoxychlor (mg/kg)		ļ			0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd
Oxychlordane (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. 1 > ANZECC B 2 > Auditor Criteria

3 > NEHF A

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/W8, 22/07/99 Laboratory Results Organochlorine Pesticides

SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S											
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		HSE-S	<u>HSW-B</u>	<u>HSW-S</u>	<u>НW-В</u>	<u>HW-S</u>	<u>UB-31</u>	<u>UB-32</u>	<u>UB-33</u>	<u>UB-34</u>	<u>UB-35</u>	<u>UB-36</u>	<u>UB-37</u>	
QA\QC																		
Lab Report				Ì	ļ	9A00414	9A00414	9A00414	9A00414	9A00414	8a01075							
Sample Depth											1-1.2	1-1.2	1-1.2	1-1.2	1-1.2	1-1.2	1-1.2	
		1	1	1			1	1		1		,		1	1			
a-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Aldrin (mg/kg)		0.5	10		0.1	nd	nd	nd	nd	nd	0.1	2 0.6	0.2	0.2	0.1	0.2	nd	
b-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Chlordane Cis (mg/kg)		0.5	50		0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Chlordane Trans (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
d-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
DDD (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
DDE (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
DDT (mg/kg)		0.5	200		0.1	<sup>i</sup> nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	
Dieldrin (mg/kg)	0.2	0.5	10		0.1	nd	nd	nd	nd	nd	nd	0.1	nd	ndi	nd	ndi	nd	
Endosulfan 1 (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	
Endosulfan 2 (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Endosulfan sulphate (mg/kg)					0.1	t nd	nd	nd	nd	nd	nd	nd	nd	ndi	nd	nd	nd	
Endrin (mg/kg)		0.5			0.1	∍ nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
g-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
HCB (mg/kg)					0.1	nđ	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	
Heptachlor (mg/kg)		0.5	10		0.1	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	nd	
Heptachlor epoxide (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Methoxychlor (mg/kg)					0.1	· nd	nd	nd	nd	nđ	nd							
Oxychlordane (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	

#### Table 6.2 Ward 6 Soil Laboratory Results: Organochlorine Pesticides

TONKIN ... ASSOCIATES

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed.

SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHFA

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/W6, 22/07/99 Laboratory Results Organochlorine Pesticides

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

Standard residential (NEHF 1996)

	ASSESSMENT CRITERIA			D.L.	RESULT	'S			· · · · · ·									
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHF A	SAHC HIL		<u>LOT 282a-</u> 1	LOT 284-1	<u>LOT 298-1</u>	LOT 303-1	LOT 3X-1								
QAIQC		1		1		PS									1			
Lab Report	l.		· · ·		9A00455	9A00455	9A00455	9A00455	9A00455	9A00455		ĺ						
Sample Depth				<u> </u>	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4								
	1		1	t	1	1	1	1	1	f	1 1	1	1	1	1	1	1	ł
a-BHC					0.05	0.05	0.05	0.05	0.05	0.05								
Aldrin		0.5	10		0.05	0.05	0.05	0.05	0.05	0.05								
b-BHC					0.05	0.05	0.05	0.05	0.05	0.05								
Chlordane Cis		0.5	50		0.05	0.05	0.05	0.05	0.05	0.05		1						
Chlordane Trans		0.5			0.05	0.05	0.05	0.05	0.05	0.05						}		
d-BHC					0.05	0.05	0.05	0.05	0.05	.0.05								
DDD					0.05	0.05	0.05	0.05	0.05	0.05		1						
DDE		0.5			0.05	0.05	0.05	0.05	0.05	0.05								ł
DDT		0.5	200		0.05	0.05	0.05	0.05	0.05	0.05								
Dieldrin	0.2	0.5	10		0.05	0.05	0.05	0.05	0.05	0.05								
Endosulfan 1					0.05	0.05	0.05	0.05	0.05	0.05								
Endosulfan 2					0.05	0.05	0.05	0.05	0.05	0.05				Ì				1
Endosulfan sulphate					0.05	0.05	0.05	0.05	0.05	0.05							,	
Endrin		0.5			0.05	0.05	0.05	0.05	0.05	0.05								
g-BHC					0.05	0.05	0.05	0.05	0.05	0.05								
нсв					0.05	0.05	0.05	0.05	0.05	0.05	   							
Heptachlor		0.5	10		0.05	0.05	0.05	0.05	0.05	0.05								
Heptachlor epoxide					0.05	0.05	0.05	0.05	0.05	0.05					Į			
Methoxychlor					0.05	0.05	0.05	0.05	0.05	0.05								
Oxychlordane					0.05	0.05	0.05	0.05	0.05	0.05								
	1	1	1	1	1	1	1	1	1	1	1 I	1	1	1	1	1	1	1

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD Interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

٠

1 > ANZECC B 2 > Auditor Criteria

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/SF, 22/07/99 Laboratory Results Organochlorine Pesticides

3 > NEHF A 4 > SAHC HIL

Health Investigation Levels (SAHC 1993)

	ASSESS	MENT CR	ITERIA		D.L.	BESULT	S					· · ·							
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHF A	SAHC HIL		IMPF-2E	IMPF-3S	<u>IMPF-4Wa</u>	IMPF-4Wb	IMPF-5E									
QAIQC								PS	BFD-4Wb					ľ				1	
Lab Report					9A00386	9A00386	9A00386	9A00386	9A00386	9A00386									
Sample Depth																			
	i	I	1	1	1	t	1	1	1.	1	1	l	1	ł	I	F	I	I	ł
a-BHC					0.05	0.05	0.05	0.05	0.05	0.05									
Aldrin		0.5	10		0.05	0.05	0.05	0.05	0.05	0.05									
ь-внс					0.05	0.05	0.05	0.05	0.05	0.05									
Chlordane Cis		0.5	50		0.05	0.05	0.05	0.05	0.05	0.05									
Chlordane Trans		0.5			0.05	0.05	0.05	0.05	0.05	0.05									
d-BHC					0.05	0.05	0.05	0.05	0.05	0.05									
DDD					0.05	0.05	0.05	0.05	0.05	0.05									
DDE		0.5			0.05	0.05	0.05	0.05	0.05	0.05									
DDT		0.5	200		0.05	0.05	0.05	0.05	0.05	0.05									
Dichlorvos					0.25	0.25	0.25	0.25	0.25	0.25									
Dieldrin	0.2	0.5	10		0.05	-0.05	0.05	0.05	0.05	0.05									
Endosulfan 1					0.05	0.05	0.05	0.05	0.05	0.05									
Endosulfan 2					0.05	0.05	0.05	0.05	0.05	0.05									
Endosulfan sulphate					0.05	<sup>:</sup> 0.05	0.05	0.05	0.05	0.05									
Endrin		0.5			0.05	0.05	0.05	0.05	0.05	0.05									
g-BHC					0.05	0.05	0.05	0.05	0.05	0.05									
нсв					0.05	0.05	0.05	0.05	0.05	0.05									
Heptachlor		0.5	10		0.05	<b>'0.05</b>	0.05	0.05	0.05	0.05									
Heptachlor epoxide					0.05	0.05	0.05	0.05	0.05	0.05									
Methoxychlor					0.05	0.05	0.05	0.05	0.05	0.05									
Oxychlordane					0.05	0.05	0.05	0.05	0.05	0.05									

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, LD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/WH, 22/07/99 Laboratory Results Organochlorine Pesticides

# 3 > NEHFA

Standard residential (NEHF 1996)

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

<sup>1 &</sup>gt; ANZECC B 2 > Auditor Criteria

# Table 6.2 Central and Connecting Roadways Soil Laboratory Results: Organochlorine Pesticides

BC TONKIN & ASSOCIATES

	ASSESS		D.L.	RESULTS															
	<u>ANZECC B</u>	<u>Auditor</u> <u>Criteria</u>	NEHE A	<u>Sahc Hil</u>		<u>TPR02-000</u>	<u>TPR02-</u> 000d	TPR03-060	<u>TPR05-000</u>	<u>VR1-a</u>	<u>VR2-a</u>	<u>VR3-a</u>	<u>VR4-a</u>						
QAIQC						PS	BFD		PS										
Lab Report						8a00719	8a00719	8a00719	8a00719	9A00251	9A00251	9A00352	9A00352						
Sample Depth				<u> </u>		<u> </u>		1.5-1.6											
							1		1			1	1		1		,	1	1
a-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd						
Aldrin (mg/kg)		0.5	10		0.2	nd	nd	nd	nd	2 0.5	nd	nd	2						
Alpha-Chlordane		0.5			0.1	nd	nd	nd	nd	.	-		-						l.
Alpha-Endosulfan		0.5			0.1	nd	nd	nd	nd		· .	-	-						
b-BHC (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd						
Beta-Endosulfan		0.5			0.1	' nd	nd	nd	nd	-	-								
Chlordane Cis (mg/kg)		0.5	50		0.1	-	-	-	-	nđ	nd	nd	nd						
Chlordane Trans (mg/kg)		0.5			0.1	, -	-	-		nd	nd	nd	nđ						
d-BHC (mg/kg)					0.1	nd	nd	nd	nd	nđ	nd	nd	nď						
DDD (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd						
DDE (mg/kg)		0.5			0.1	nd	nd	nd	nd	nd	nď	nd	nd	•					
DDT (mg/kg)		0.5	200		0.1	nd	nd	nd	nđ	nd	nd	nd	nđ					Į	
Dieldrin (mg/kg)	0.2	0.5	10		0.2	nd	nď	nd	nd	0.1	nd	nd	0.3			ĺ			
Endosulfan 1 (mg/kg)					0.1	· · -		-	-	nd	nd	nd	nd						
Endosulfan 2 (mg/kg)					0.1		-	-	-	nd	nd	nd	nd						
Endosulfan sulphate (mg/kg)		1			0.1	nd	nd	nd	nd	nd	nd	nd	nd						
Endrin (mg/kg)		0.5			0.1	, nd	nd	nd	nd	nd	nd	nd	nd						
g-BHC (mg/kg)					0.1	nd	nd	ndi	nd	nd	nd	nd	nd						
Gamma-Chlordane		0.5			0.1	_ nd	nd	nd	nd	-	-	-	-						
HCB (mg/kg)					0.1	. nd	nd	nd	nd	nđ	nd	nd	nd						
Heptachlor (mg/kg)		0.5	10		0.1	· nd	nd	nd	nd	nd	nd	nd	nd						
Heptachlor epoxide (mg/kg)					0.1	nd	nd	nd	nd	nd	nd	nd	nd			1			
All laboratory reports are NATA ac	credited unless sp	ecifed as pre	liminary (P).		1	> ANZECC	B E	Environmental	Investigation	Levels (ANZI	ECC/NHMRC	1992)					Br	ock Barrett P	roject Marketing

PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5). 2 > Auditor Criteria

3 > NEHFA

4 > SAHC HIL

Health Investigation Levels (SAHC 1993)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Lots 351 and 352, DP 48052 Job No: 98.0295/R, 22/07/99

Laboratory Results Organochlorine Pesticides

	ASSESSMENT CRITERIA				D.L.	RESULT	SULTS										
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHE A	<u>Sahc Hil</u>		<u>TPR02-000</u>	<u>TPR02-</u> 000d	<u>TPR03-060</u>	<u>TPR05-000</u>	<u>VR1-a</u>	<u>VR2-</u> #	<u>VR3-a</u>	<u>VR4-a</u>				
QAIQC						PS	BFD		PS						·	1	
Lab Report						8a00719	8a00719	8a00719	8a00719	9A00251	9A00251	9A00352	9A00352				
Sample Depth								1.5-1.6									
Methoxychlor (mg/kg)					0.1	nď	nd	nd	nd	nd	nd	nd	nd				ŀ
Oxychlordane (mg/kg)					0.1	nd	nd	nd	nd	nđ	nd	nd	nd				

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHF A

4 > SAHC HIL

÷

1

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Jób No: 98.0295/R, 22/07/99 Laboratory Results Organochlorine Pesticides

~
	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S												
	<u>ANZEÇC B</u>	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	SAHC HIL		<u>L4-A(H)</u>	<u>L4-B(H)</u>	<u>SP11-500</u>	<u>T4A-400</u>	<u>T4B-150</u>	<u>T4C-000</u>	<u> T4C-400</u>	<u>TP03-150</u>	<u>TP03-400</u>	<u>TP05-200</u>	<u>TP05-550</u>	<u>TP07-1800</u>	<u>TP07-200</u>	<u>TP07-90</u>
QA\QC	1			1			[												
Lab Report			-			9A00414	9A00414	8A01046	8a00838	8a00838	8a00838	8a00838	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a0071
Sample Depth									0.4-0.5	0.15-0.3		0.4-0.5	0.15-0.3	0.4-0.5	0.2-0.3	0.55-0.65	1.8-1.9	0.2-0.3	0.9-1
A		1	1	1	1	1.	.	Ι.	.	.	.				1	ĺ .	1	I	]
Acenaphthene (mg/kg)					0.5	°nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	nd
Acenaphthylene					0.5	nd	nd	nď	nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd
Anthracene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(a)anthracene					0.5	nd	nd	nd .	nd	nd	nd	nd	nd	1.5	nd	nd	nd	nd	nd
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	nd	nd	nd	nd	nd	nd	nd	nd	2 3 4 1.3	nd	nd	nd	nd	nd
Benzo(b)&(k)fluoranthene (mg/kg)					1	nd	nd	nd	nd	nd	nd	nd	nd	2	ndi	nd	nd	nd	nd
Benzo(ghl)perylene (mg/kg)					0.5	; nd	nd	nd	nd	nd	nd	nd	nd	0.9	nd	nd	nd	nd	nd
Chrysene (mg/kg)					0.5	<sub>i</sub> nd	nd	nd	nd	nd	nd	nd	nd	1.3	nd	nd	nd	nd	nd
Dibenz(ah)anthracene					0.5	nd	nđ	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fluoranthene (mg/kg)					0.5	nđ	0.7	0.53	nd	nd	nd	nd	nd	3.1	nd	nd	nd	nd	nd
Fluorene (mg/kg)					0.5	nd	nď	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Indeno(123-cd)pyrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nđ	nd	1.1	nd	nd	nd	nd	nd
Naphthalene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phenanthrene (mg/kg)					0.5	nd	1	nd	nd	nd	nd	nd	nd	1.8	nd	nd	nď	nd	nd
Pyrene (mg/kg)					0.5	nd	0.7	0.59	nd	nd	nd	nd	nd	3	nd	nd	nd	nd	nd
Total PAHs (mg/kg)			20	20	0.5	nd	2.4	1.12	nd	nd	nd	nd	nd	16	nd	nd	nd	nd	nd
						1													

#### All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD Interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria Environmental Investigation Levels (ANZECC/NHMRC 1992)

Health Investigation Levels (SAHC 1993)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99

Laboratory Results Polycyclic Aromatic Hydrocarbons

). 3 > NEHF A 4 > SAHC HIL

# Table 6.3 Residential Allotments Soil Laboratory Results: Polycyclic Aromatic Hydrocarbons

#### BC TONKIN & ASSOCIATES

	ASSESS	MENT CR	ITERIA		Ð.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> Criteria	<u>NEHF A</u>	<u>SAHC HIL</u>		<u>TP08-150</u>	<u>TP08-150d</u>	<u>TP08-1600</u>	<u>TP08-400</u>	<u>TP09-150</u>	<u>TP09-900</u>	<u>TP10-300</u>	<u>TP10-300d</u>	<u>TP10-600</u>	<u>TP11-250</u>	<u>TP11-400</u>	<u>TP12-000</u>	<u>TP12-900</u>	<u>TP13-100</u>
QAIQC					1	PS	BFD					PS	BFD					{	
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth						0.15-0.3	0.15-0.3	1.6-1.7	0.4-0.5	0.15-0.3	0.9-1	0.3-0.4	0.3-0.4	0.6-0.7	0.25-0.35	0.4-0.5		0.9-1	0.1-0.2
					_														<u> </u>
Acenaphthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acenaphthylene					0.5	. nd	_ nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Anthracene (mg/kg)					0.5	nd	nd	nd	nď	nd	nđ	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(a)anthracene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nđ	nd	nd	nd
Benzo(b)&(k)fluoranthene (mg/kg)					1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(ghi)perylene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chrysene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď
Dibenz(ah)anthracene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fluoranthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ
Fluorene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Indeno(123-cd)pyrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Naphthalene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phenanthrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Pyrene (mg/kg)		· ·			0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd
Total PAHs (mg/kg)		İ	20	20	0.5	nd	nd	ndi	nđ	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nđ

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit.

nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B Environmental Investigation Levels (ANZECC/NHMRC 1992) 2 > Auditor Criteria

Site specific criteria as recommended by the Environmental Auditor

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99 Laboratory Results Polycyclic Aromatic Hydrocarbons

3 > NEHFA Standard residential (NEHF 1996)

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

							. 0.90							B			@ A55		
	ASSESS ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHFA	<u>Sahc Hil</u>	D.L.	HESULT <u>TP13-1450</u>	S <u>TP14-150</u>	<u>TP14-1900</u>	<u>TP14-400</u>	<u>TP15-000</u>	<u>TP15-900</u>	<u>TP16-150</u>	<u>TP16-900</u>	<u>TP17-150</u>	<u>TP17-1700</u>	<u>TP18-150</u>	<u>TP18-1700</u>	<u>TP18-900</u>	<u>TP19-150</u>
QAIQC																			PS
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth						1.45-1.55	0.15-0.25	1.9-2	0.4-0.5		0.9-0.1	0.15-0.3	0.9-1	0.15-0.3	1.7-1.8	0.15-0.3	1.7-1.8	0.9-1	0.15-0.3
	l	1	l		l		Į	ļ	t	Į	l	l	l	l	Į	Į	l	Į	Į
Acenaphthene (mg/kg)				1	0.5	nd	nd	nd	nđ	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd
Acenaphthylene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Anthracene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď
Benzo(a)anthracene					0.5	nd	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd	nd	nd
Benzo(a)pyrene (mg/kg)		1	1	1 1	0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(b)&(k)fluoranthene (mg/kg)					1	nd	nd	nđ	nd	nd	nd	nd	nd						
Benzo(ghi)perylene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chrysene (mg/kg)					0.5	_ nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dibenz(ah)anthracene					0.5	nd :	nd	nd	nď	nd	лd	nd	nd	nď	nd	nd	nd	nd	nd
Fluoranthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd
Fluorene (mg/kg)		ĺ			0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Indeno(123-cd)pyrene (mg/kg)		i			0.5	nd	nd	nd	nd	nd	nd	nd	nď	nď	nd	nd	nd	nd	nd
Naphthalene (mg/kg)					0.5	nd	nd	nď	nd	nd	nd	nđ	nd						
Phenanthrene (mg/kg)	i				0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Pyrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	nd	nd
Total PAHs (mg/kg)			20	20	0.5	nd	nd	nď	nd	nd	nd	nd	nd	nď	nd	nđ	nd	nd	nd

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria

. ł

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99 Laboratory Results Polycyclic Aromatic Hydrocarbons

- 3 > NEHFA Standard residential (NEHF 1996) 4 > SAHC HIL
  - Health Investigation Levels (SAHC 1993)

## Table 6.3 Residential Allotments Soil Laboratory Results: Polycyclic Aromatic Hydrocarbons

#### BC TONKIN & ASSOCIATES

	ASSESS	SSESSMENT CRITERIA			D.L.	RESULT	S												
	ANZECC B	<u>Auditor</u> Criteria	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>TP19-1500</u>	<u>TP19-150d</u>	<u>TP20-400</u>	<u>TP20-900</u>	<u>TP22-1400</u>	<u>TP22-300</u>	<u>TP22-500</u>	<u>TP23-000</u>	<u>TP23-900</u>	<u>TP24-000</u>	<u>TP24-000d</u>	<u>TP24-500</u>	<u>TP25-000</u>	<u>TP25-000d</u>
QAIQC						1	BFD				}				PS	BFD		PS	BFD
Lab Report	i	i			ĺ	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth				ľ		1.5-1.6	0.15-0.3	0.4-0.5	0.9-1	1.4-1.5	0.3-0.45	0.5-0.6		0.9-1			0.5-0.6		
Acenaphthene (mg/kg)					0.5	nd	nd	nd	nd	- nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd
Acenaphthylene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	nď	nd	nd	nď
Anthracene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd
Benzo(a)anthracene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(b)&(k)fluoranthene (mg/kg)					1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(ghi)perylene (mg/kg)					0.5	nd	nd	nd	nđ	nđ	nđ	nd	nd	nđ	nd	nd	nd	nd	nd
Chrysene (mg/kg)					0.5	nd	nd .	nd	nd	nd	nd	nd	nd	nd	лd	nd	nd	nd	nd
Dibenz(ah)anthracene					0.5	nd	nď	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fluoranthene (mg/kg)					0.5	nd	nd	nď	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď
Fluorene (mg/kg)					0.5	, nd	nď	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Indeno(123-cd)pyrene (mg/kg)					0.5	nd	nď	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Naphthalene (mg/kg)					0.5	nd	nd	) nđ	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd	nd
Phenanthrene (mg/kg)	}				0.5	- nđ	nd	nd	nd	nd	nd	nđ	nď	nď	nd	nd	nd	nd	nd
Pyrene (mg/kg)	}				0.5	nd	nd	nđ	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd	nd
Total PAHs (mg/kg)		1	20	20	0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

- 1 > ANZECC B
- 2 > Auditor Criteria
  - 3 > NEHFA
- Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99 Laboratory Results Polycyclic Aromatic Hydrocarbons

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

Table 6.3 Residen	tial Allo	tments	s Soil I	Labora	tory R	esults:	Polyc	yclic A	Aromat	ic Hyd	lrocart	ons		В	c TO	NKIN	& ASS	SOCIA	TES
<u></u>	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S							<b></b>					
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	SAHC HIL		<u>TP25-1550</u>	<u>TP25-250</u>	<u>TPSA01-</u> <u>330</u>	<u>TPSA01-</u> 600	<u>TPSA02-</u> 350	<u>TPSA02-</u> <u>350d</u>	<u>TPSA02-</u> 700	<u>TPSA03-</u> 000	<u>TPSA03-</u> <u>700</u>	<u>TPSA04-</u> <u>350</u>	<u>TPSA04-</u> 700	<u>1PSA04-</u> 900	<u>1PSA05-</u> 200	<u>1P\$A05-</u> <u>450</u>
QA\QC				-		1				PS	BFD								PS
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth						1.55-1.65	0.25-0.4	0.33-0.37	0.6-0.75	0.35-0.45	0.35-0.45	0.7-0.8		0.7-0.85	0.35-0.5	0.7-0.8	0.9-1	0.2-0.35	0.45-0.6
		1		1		1	1	i	1	1	1	1	I	I ·	1	1	1	1	
Acenaphthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd	nd	nd	nd
Acenaphthylene					0.5	ind	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Anthracene (mg/kg)					0.5	nd	nd	nd	nd	nd	· nd	nď	nd	nd	nd	nď	nd	nd	nd
Benzo(a)anthracene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd	nd	nd	nd	nd
Benzo(b)&(k)fluoranthene (mg/kg)					1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(ghi)perylene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chrysene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nď	nd
Dibenz(ah)anthracene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	ndi	nd	nd	nd	nd	nd
Fluoranthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	, nd	nd	nd	nd	nd	nd	nd	nd
Fluorene (mg/kg)					0.5	nd	nd	nd	nd	nd	ndi	nd	nd	nd	nd	nd	nd	nd	nd
Indeno(123-cd)pyrene (mg/kg)					0.5	nd	nd	nd	nd	nď	nd	nd	nd	nd	nđ	nd	nd	nd	nd
Naphthalene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phenanthrene (mg/kg)		· ·			0.5	. nd	nd	nd	nd	nd	nd	nd	nđ	nd	0.5	nd	nd	nd	nd
Pyrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď	nd
Total PAHs (mg/kg)			20	20	0.5	nd	nd	nđ	nd	nd	nd	nd	nd	nd	0.5	nd	nd	nd	nd

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD Interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria

3 > NEHFA

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99

4 > SAHC HIL

Health Investigation Levels (SAHC 1993)

Laboratory Results Polycyclic Aromatic Hydrocarbons

	ASSESS	MENT CR	ITERIA		D.L.	RESULT	S											
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHF A	<u>Sahc Hil</u>		<u>1PSA05-</u> 450d	<u>TPSA06-</u> <u>350</u>	<u>tpsa06-</u> 700	<u>TPSA07-</u> <u>500</u>	<u>TPSA07-</u> 850	<u>TPSA08-</u> 150	<u>TPSA08-</u> 900	<u>TP\$A09-</u> 000	<u>TPSA09-</u> 2150				
QAIQC						BFD				1								
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719				
Sample Depth						0.45-0.6	0.35-0.5	0.7-0.85	0.5-0.6	0.85-1	0.15-0.3	0.9-1		2.15-2.25		 	 	
	1	1	ł	1		1	1	1	1		1	1	1	1	1 1	I	1	1
Acenaphthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Acenaphthylene					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd			ĺ	ł
Anthracene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Benzo(a)anthracene					0.5	nd	nď	nd	nd	nd	nd	nd	nd	nd				
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Benzo(b)&(k)fluoranthene (mg/kg)					1	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Benzo(ghi)perylene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				ļ
Chrysene (mg/kg)					0.5	ndi	nd	nd	nd	nd	nd	nd	nd	nď				
Dibenz(ah)anthracene					0.5	nd	nd	nd	nd	nd	nd	nd	nđ	nd				
Fluoranthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Fluorene (mg/kg)					0.5	nd	nd	nd	nd	nđ	nd	nd	nd	nd				
Indeno(123-cd)pyrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Naphthalene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Phenanthrene (mg/kg)					0.5	nd	nď	nď	nd	nd	nd	nd	nd	nd				
Pyrene (mg/kg)	Į				0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd				
Total PAHs (mg/kg)			20	20	0.5	nd	nd	nď	nd	nd	nd	nd	nd	nd				

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria

3 > NEHFA

t 1

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/S, 22/07/99 Laboratory Results Polycyclic Aromatic Hydrocarbons

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

	ACCECC		ITEDIA		<b>D</b> I	DECULTO		 									
	ASSESS ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHF A	SAHC HIL	<b>D.</b> L.	RESULIS											
QA\QC			ł							ļ	t						
Lab Report																	
Sample Depth									1								
A	l				0.05	1						1		ł	1		1
Acenaphthene			ľ		0.25												
Acenaphthylene					0.25									ł			
Anthracene					0.25						Ì		1		]	]	
Benzo(a)anthracene					0.25				ć					,			
Benzo(a)pyrene		1	1	1	0.25								l l				
Benzo(b)&(k)fluoranthene					0.5												
Benzo(ghl)perylene					0.25										ĺ		
Chrysene					0.25	;											ļ
Dibenz(ah)anthracene					0.25											ļ	
Fluoranthene					0.25		1								1		
Fluorene					0.25			ĺ									
Indeno(123-cd)pyrene					0.25		,					¢		ľ			1
Naphthalene		ļ			0.25												
Phenanthrene					0.25			ĺ									
Pyrene					0.25										ł		
Total PAHs			20	20	0.25												

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHF A

4 > SAHC HIL

1

Environmental Investigation Levels (ANZECC/NHMRC 1992) Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996)

Health Investigation Levels (SAHC 1993)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/SF, 22/07/99 Laboratory Results Polycyclic Aromatic Hydrocarbons

BC TONKIN & ASSOCIATES

	ASSESS	SSESSMENT CRITERIA			D.L.	RESULT	S									
	ANZECC B	<u>Auditor</u> Criteria	<u>NEHF A</u>	SAHC HIL		<u>WB1-a</u>	<u>VWB3-b</u>	<u>VWB4-a</u>								
QA\QC					ļ			ļ				I				
Lab Report						9A00251	9A00251	9A00251								
Sample Depth						<u>}</u>										
														1	1	
Acenaphthene (mg/kg)					0.5	nd	nd	nd		,						
Acenaphthylene (mg/kg)					0.5	nd	nd	nd		ĺ					1	
Anthracene (mg/kg)					0.5	nd	nd	nd								
Benzo(a)anthracene (mg/kg)					0.5	nd	nd	nd								
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	nd	nd	nd								
Benzo(b)&(k)fluoranthene (mg/kg)		ļ			1	nd	nd	nd								
Benzo(ghi)perylene (mg/kg)					0.5	nd	nd	nd		¢.		-				
Chrysene (mg/kg)					0.5	. nd	nd	nd								
Dibenz(ah)anthracene (mg/kg)					0.5	nd	nd	nd								
Fluoranthene (mg/kg)					0.5	nd	nď	nd								
Fluorene (mg/kg)					0.5	nd	nd	nd						l		
Indeno(123-cd)pyrene (mg/kg)					0.5	nd	nd	nd								
Naphthalene (mg/kg)					0.5	ndi	nd	nd					ļ			
Phenanthrene (mg/kg)					0.5	nd	nd	nd								
Pyrene (mg/kg)					0.5	nd	nd	nd							ł	
Total PAHs (mg/kg)			20	20	0.5	nd	nd	nd								

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 5\ 3 > NEHF A Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor Standard residential (NEHF 1996) Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/W4, 22/07/98 Laboratory Results Polycyclic Aromatic Hydrocarbons

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

### Table 6.3 Central and Connecting Roadways Soil Laboratory Results: Polycyclic Aromatic **Hydrocarbons**

### BC TONKIN & ASSOCIATES

	ASSESS				D.L.	RESULT	S										1.82		
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	NEHE A	<u>Sahc Hil</u>		<u>SP10-500</u>	<u>TPR01-200</u>	<u>TPR01-400</u>	<u>TPR01-900</u>	<u>TPR01-</u> 900d	<u>TPR02-000</u>	<u>TPR02-</u> 000d	<u> TPR02-400</u>	<u>TPR02-900</u>	<u>TPR03-060</u>	<u>TPR03-</u> 1500	<u>TPR03-400</u>	<u>TPR04-060</u>	<u>TPR04-400</u>
QA\QC						1			PS	BFD	PS	BFD							
Lab Report						8A01046	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719
Sample Depth							0.2-0.3	0.4-0.5	0.9-1	0.9-1			0.4-0.5	0.9-1	1.5-1.6	0.4-0.5	0.06-0.15	0.4-0.5	0.06-0.2
Acenaphthene (mg/kg)			ſ		0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acenaphthylene (mg/kg) (mg/kg)					0.5	nd	nd	nd	' nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd
Anthracene (mg/kg)					0.5	· nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ
Benzo(a)anthracene (mg/kg) (mg/kg					0.5	1.41	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	<sup>2</sup> 3 4 1.46	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Benzo(b)&(k)fluoranthene (mg/kg)					1	2	nd	nđ	nđ	nd	nd	nd	ndi	nd	nd	nd	nd	nd	nd
Benzo(ghi)perylene (mg/kg)					0.5	0.68	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chrysene (mg/kg)					0.5	1.35	ndi	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nď
Dibenz(ah)anthracene (mg/kg) (mg/					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fluoranthene (mg/kg)					0.5	1.24	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fluorene (mg/kg)					0.5	nd	nđ	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd
Indeno(123-cd)pyrene (mg/kg)					0.5	0.56	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Naphthalene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	ndi	nd	nd	nd	nd
Phenanthrene (mg/kg)					0.5	0.67	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd	nd	nd	nd
Pyrene (mg/kg)					0.5	1.63	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd	nd
Total PAHs (mg/kg)			20	20	0.5	10.92	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ

All laboratory reports are NATA accredited unless specifed as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, - not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria 3 > NEHFA

1

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Site specific criteria as recommended by the Environmental Auditor

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/R, 22/07/99 Laboratory Results Polycyclic Aromatic Hydrocarbons

4 > SAHC HIL

Standard residential (NEHF 1996) Health Investigation Levels (SAHC 1993)

### Table 6.3 Central and Connecting Roadways Soil Laboratory Results: Polycyclic Aromatic Hydrocarbons

BC TONKIN & ASSOCIATES

	ASSESSI	SSESSMENT CRITERIA ZECC B Auditor NEHF A Criteria			D.L.	RESULT	s									·		
	ANZECC B	<u>Auditor</u> <u>Criteria</u>	<u>NEHF A</u>	<u>Sahc Hil</u>		<u>TPR04-900</u>	<u>TPR05-000</u>	<u>TPR05-</u> 000d	<u>TPR05-150</u>	<u>TPR05-400</u>	<u>TPR07-</u> <u>1600</u>	<u>TPR07-300</u>	<u> TPR07-450</u>	<u>VR1-a</u>	<u>VR2-a</u>			
QAIQC							PS	BFD										
Lab Report						8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	8a00719	9A00251	9A00251			
Sample Depth						0.9-1			0.15-0.3	0.4-0.5	1.6-1.7	0.3-0.45	0.45-0.6					
											· · · · · ·					,		
Acenaphthene (mg/kg)					0.5	nd	nd	nd	nd	nď	nd	nd	nđ	nd	nd			
Acenaphthylene (mg/kg) (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			
Anthracene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			
Benzo(a)anthracene (mg/kg) (mg/kg					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			
Benzo(a)pyrene (mg/kg)		1	1	1	0.5	nd	nd	nd	nd	nd	nd	nd	nđ	nd	nd			
Benzo(b)&(k)fluoranthene (mg/kg)					1	nd	nd	nd	nd	ndi	nd	nd	ndi	nd	nd			
Benzo(ghi)perylene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			
Chrysene (mg/kg)					0.5	nd	nd	nd	nd	nd	ndi	nđ	nd	nd	nd			
Dibenz(ah)anthracene (mg/kg) (mg/					0.5	· nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			
Fluoranthene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			
Fluorene (mg/kg)					0.5	nd	nd	nđ	nd	nd	nd	nd	nd	nd	nd			
Indeno(123-cd)pyrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nď	nd	nd			
Naphthalene (mg/kg)					0.5	nđ	nd	nd	nd	nd	nd	nd	nd	nđ	nd		1	
Phenanthrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nđ			
Pyrene (mg/kg)					0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			
Total PAHs (mg/kg)			20	20	0.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd			

All laboratory reports are NATA accredited unless specified as preliminary (P). PS primary sample, BFD blind field duplicate, ILD interlaboratory duplicate, -, not analysed. SS no of composite subsamples. D.L. primary laboratory laboratory detection limit. nd : below primary laboratory detection limit. Second laboratory detection limits specified (eg <5).

1 > ANZECC B 2 > Auditor Criteria

3 > NEHFA

Environmental Investigation Levels (ANZECC/NHMRC 1992)

Standard residential (NEHF 1996)

Site specific criteria as recommended by the Environmental Auditor

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/R, 22/07/99

4 > SAHC HIL Health Investigation Levels (SAHC 1993)

Laboratory Results Polycyclic Aromatic Hydrocarbons

nd

nd

nd

nd

0.1

24

Results of metals, OCP and PAHs are also discussed below. Results of all other contaminants were either below the laboratory detection limits and / or the assessment criteria.

#### Metals

The concentrations of metals in all samples remaining on site are either below all assessment criteria or below the laboratory detection limits, with the exception of the four samples identified in Table 6.4. Localised sub-surface concentrations of copper and zinc have been identified in three locations SP11, TP3 and TPSA2 at depths between 0.35 m and 0.5 m depth.

Given the concentration and localised nature of these exceedances, it is considered that the potential environmental risks in terms of phytotoxic risks are not significant.

Sample / Contaminant (mg/kg)	Location	Depth (m)	Copper	Zinc
SP11-1	Steam pipe	0.5	60 ±	140
TP3-400	Allotment 3	0.4-0.5	595 ±	202 ±
TPSA2-350	Square Acre	0.35-0.45 PS	156 ±	18
TPSA2-350d		0.35-0.45 BFD	155 ±	16

PS - Primary Sample, BFD - Blind field duplicate

± equals or exceeds ANZECC Environmental Investigation Level

#### Organochlorine Pesticides

The concentrations of OCPs in all samples remaining on site were below the laboratory detection limits, with the exception of the thirteen samples identified in Table 6.5. Five of these samples recorded OCP concentrations equal to or exceeding the Auditor acceptance criteria (0.5 mg/kg).

able 6.5	Solis on Site - C	ion Limits				
Sample / Contaminant	Location	Depth (m)	Aldrin	Dieldrin	Chlordane Cis	Chlordane Trans
DL			0.1	0.1	0.1	0.1
UB31	Ward 6	1-1.2	0.1	Nd	nd	nd
UB32	Footprint	1-1.2	0.6 ‡	0.1	nd	nd
UB33		1-1.2	0.2	Nd	nd	nd
UB34		1-1.2	0.2	Nd	nd	nd
UB35		1-1.2	0.1	Nd	nd	nd
UB36		1-1.2	0.2	Nd	nd	nd
VR1-a	Roadway	0.7	0.5 t	0.1	nd	nd
VR4-a		0.45	2.0 t	0.3 ±	nd	nd

1 - 1.2

1-1.2

1 - 1.2

1-1.2

0.4

- Eveneding Detection Li

Nd - results below the laboratory detection limits as indicated

Ward 4

Footprint

t equals or exceeds Auditor acceptance criteria

UWB1

UWB6

UWB7

UWB24

VWB1-a

± equals or exceeds ANZECC Environmental Investigation Level

The maximum concentrations of aldrin (2.0 mg/kg) and dieldrin (0.3 mg/kg) were recorded in sample VR4-a at 0.45 m depth underneath the roadway connecting the allotments. PPK commented that the aldrin concentration of 1.8 mg/kg recorded at UWB24, (Appendix 10) was located adjacent to the roadway reserve at an approximate depth of 1.2 m, and was considered to represent a localised occurrence, and did not exceed the NEHF criteria.

0.1

0.4

0.5 t

1.8 ‡

0.4

Nd

01

Nd

0.1

0.1

nd

nd

nd

nd

0.1

The remaining samples were located within the building footprints of the former Ward 4 (UWB7 and UWB24) and 6 buildings (UB32), representing samples of natural soils that were taken prior to the importation and subsequent removal of the uncontrolled contaminated fill materials.

#### Polycyclic Aromatic Hydrocarbons

The concentrations of PAHs in all samples remaining on site were below the laboratory detection limits, with the exception of the three samples identified in Table 6.6. Two of these samples recorded benzo(a)pyrene concentrations marginally exceeding the Auditor acceptance criteria (1.0 mg/kg).

Table 6.6	Soils on Site -	<b>PAHs Exceeding</b>	Assessment	Guidelines
-----------	-----------------	-----------------------	------------	------------

Sample / Contaminant	Location	Depth (m)	B(a)P	Total PAHs
DL (mg/kg)			0.1	0.1
SP10-1	Roadway	0.5	1.46 t	10.92
TP3-400	Allotment 3	0.4-0.5	1.3 ‡	16
TPSA4-350	Square Acre	0.35-0.5	Nd	0.5

B(a)P - benzo(a)pyrene

Nd - results below the laboratory detection limits as indicated

t equals or exceeds Auditor acceptance criteria

Given the concentration and localised nature of these exceedances, it is considered that the potential health and or environmental risks are not significant.

#### 6.3.1 Statistics

PPK performed statistical analyses on the results of the remaining soils for the validation of the Ward 4 and Ward 6 excavations:

- Ward 4 (western building footprint) aldrin 95% UCL 0.33 mg/kg
- Ward 6 (eastern building footprint) Aldrin 95% UCL 0.38 mg/kg.

Both 95% UCLs are below the acceptance criteria for individual OCPs (0.5 mg/kg).

The Auditor has also calculated summary statistics for metals, PAHs and OCPs for all soils remaining on site, for the residential allotments and central connecting access roadway which are included as Tables 1 and 2 respectively in Appendix 6 of this report.

Statistical analyses performed on the results of the site assessment, included arithmetic means, standard deviations and the 95% upper limit confidence limits (95% UCL,  $\alpha = 0.1$ , df =  $\infty$ ). Where sample results were recorded as below the laboratory detection limit, half the detection limit for each analyte was used in the calculation of the statistics.

The statistics indicate that the means and 95% UCLs for all analytes were below the acceptance and assessment criteria with the exception of aldrin in the central and connecting access roadways (0.82 mg/kg).

#### 6.4 Quality of Data

#### 6.4.1 Laboratory QA/QC

The analytical work for the soil testing was conducted by AMDEL, NATA accredited for the analytical methods undertaken.

A review the laboratory QA/QC results for analysis of blanks, recoveries and laboratory duplicates by the Auditor indicated:

- control blanks were below the laboratory detection limits
- matrix spikes were within the approximate range 70 to 130%
- RPDs calculated for laboratory repeats were less than 50%.

The laboratory QA/QC results indicate they are satisfactory for this Audit.

#### 6.4.2 Field and Report QA/QC

The sampling protocols and procedures, including decontamination and chain of custody, as documented in the PPK Report were considered to be generally in accordance with Australian Standard AS 4482.1-1997, although it is noted that the documentation and location of samples particularly field duplicates was not always made clear in either the ESA or the Validation Report. A number of issues for which clarification was sought by the Auditor are listed below.

- Samples omitted from the Validation Report include SP10 and SP11, were collected from the southern portion of the steam pipe trench and contained minor quantities of ash/ cinder type material at approximately 0.5 m depth, refer Tables 6.4 and 6.6 of this Report. Analysis indicated levels of benzo(a)pyrene (1.46 mg/kg) exceeding the acceptance criteria in SP10 and copper (60 mg/kg) equal to ANZECC B in SP11, as previously discussed. PPK subsequently reported (Appendix 10) that these materials were left in place within the roadway reserve and were considered to represent localised occurrences with limited exposure potential. The locations of these samples are shown on an amended figure included with this facsimile.
- As previously identified in Section 5.6, validation samples including one blind field duplicate (UWB19 to UWB25 and BD4) collected from the base of the western building footprint and analysed for OCPs, were omitted from the Validation Report. The locations of these samples are shown on the amended PPK Figure 06 contained in their facsimile (Appendix 10).
- Sample RB not documented in the Validation Report, was confirmed to be a rinsate sample by PPK (Appendix 10).
- Sample LENW-B collected from the base of the northern excavation following removal of contaminated uncontrolled fill was omitted from chain of custody forms (Appendix 10).
- The identify and location of the 6 Samples (prefixed IMPF) taken from the stockpiles of Walkley Heights materials were not documented in the Validation Report (Appendix 10).
- The identify of the samples of excavated stockpiles from allotments 4 and 6 was not documented in the Validation Report (Appendix 10).
- The identify and location of the 7 Samples (prefixed LOT) taken from Settlers Farm were not documented in the Validation Report (Appendix 10), locations shown in the amended plan provided in Appendix 12.
- The locations of deep bore GW1 and test pit TPR7 were omitted from site figures (Appendix 11).
- The chain of custody for Amdel laboratory report 8A00719 included in the ESA Report was not signed by the laboratory (provided in Appendix 11).
- It was verified by PPK (Appendix 12) that sample BD4 was a duplicate sample of UWB25
- Ommission of some samples from the ESA borelogs eg TP6 400-500d, TPR3 60-150d and TP20 400-500
- It is noted that there were five samples identified for UB11 and 6 for UB12 (including one duplicate) in the relevant chain of custody in the ESA Report. UB11 and UB12 are shown as duplicates on PPK Figure 03. Borelogs for these locations were not provided.

The RPDs calculated for the blind field duplicates are considered to be acceptable for the purposes of this Audit.

Brock Barrett Project Marketing	Page	26
Lots 351 and 352, DP48652	File	SAR.doc
Site Audit Report BCT Ref 98 0295/1	Date	23-Jul-99

ζ

#### 6.4.3 Summary

Notwithstanding the above comments, it is the Auditor's opinion that the data in the context of the field observations and the laboratory data obtained are valid and generally representative, and that the assessment results are sufficient to assist in forming an assessment of the contamination status of this site.

#### 7. **RISK EVALUATION**

#### 7.1 Human and Ecological Receptors

Having regard for the future residential use of the site, the categories of people who have the potential to experience exposure to the soils at this site would include:

- adult or child residents, visitors and trespassers exposed to surface soils
- construction or utility workers exposed to excavations at the site, whether associated with development of the ultimate end use of the site, or at subsequent times.

For the proposed use of the site, the exposure duration for all categories of human receptors must be consistent with a residential setting. Residential exposures represent the highest risk, ie. the lowest, or most stringent acceptance criteria. The child resident is the most sensitive receptor, and therefore the criteria designed to protect children will also protect the other categories of people listed above.

The main ecological receptors at this site would be:

- plants which have their roots in, or uptake nutrients from, surface soils in garden or landscaped areas
- soil fauna including earthworms.

#### 7.2 Exposure Concentrations

For this site the 95% UCLs on the statistics of the data for site soils have been adopted as the relevant exposure concentrations. However, it is also necessary to consider the maximum sample concentrations, as these give an indication of the probability of localised areas of unacceptably high contamination.

In order to evaluate risks, these concentrations are compared to the relevant site specific validation criteria, as discussed in Section 6.2.

#### 7.3 Human Health Risks

With reference to the statistics for soil samples remaining on site the 95% UCLs and maximum concentrations for metals, OCPs and PAHs are within the NEHF A (standard residential) and Auditor's risk-based criteria, with the exception of aldrin in the central and connecting access roadways (0.82 mg/kg).

The remaining maximum concentrations of aldrin (2.0 mg/kg) and dieldrin (0.3 mg/kg) were recorded in sample VR4-a at 0.45 m depth underneath the roadway connecting the allotments. An aldrin concentration of 1.8 mg/kg was recorded at UWB24 located adjacent to the roadway reserve at an approximate depth of 1.2 m. Therefore it is concluded that the remaining organochlorine pesticides (aldrin) levels on this site within the central and access roadways constitute an unacceptable human health risk, unless access, and thus exposure, to the soils is restricted. It is concluded that the remaining organochlorine pesticides (aldrin) levels on this site on the remainder of the site (i.e. the residential allotments) do not pose unacceptable human health risks.

28

The concentrations of benzo(a)pyrene in sample SP10 taken in the central roadway (1.46 mg/kg) marginally exceeds the NEHF A criterion (1 mg/kg). The concentrations of benzo(a)pyrene in sample TP3 from proposed residential allotment 3 (1.3 mg/kg) also marginally exceeds the NEHF A criterion. It is concluded that the remaining polycyclic aromatic hydrocarbon (benzo(a)pyrene) levels (maximum concentration 1.46 mg/kg) on this site do not pose unacceptable human health risks given the localised occurrences and depths and the 95% UCL below the acceptance criteria. Notwithstanding the widespread presence of a thin layer of fill containing ash and charcoal at 0.5 m depth in the Square Acre, the Auditor is of the opinion that the material does not constitute an unacceptable health risk (based on the results of testing for PAHs), nor are there unacceptable aesthetic implications (having regard to the depth, thickness and general appearance of the material).

Other results are either below the detection limits or the assessment criteria.

#### 7.4 Environmental Risks

With reference to the statistics, for soil samples remaining on site, the 95% UCLs for metals, OCPs and PAHs are below the ANZECC B assessment criteria. Other results are either below the detection limits or the assessment criteria.

Localised sub-surface concentrations of copper (60 – 595 mg/kg) and zinc (202 mg/kg) have been identified in three locations SP11, TP3 and TPSA2 at depths between 0.35 m and 0.5 m depth exceeding the ANZECC B environmental investigation levels (60 mg/kg and 200 mg/kg respectively). Given the concentration and localised nature of these exceedances, the potential environmental risks in terms of phytotoxic risks are considered to be insignificant.

The remaining maximum concentrations of aldrin (2.0 mg/kg) and dieldrin (0.3 mg/kg) were recorded in sample VR4-a at 0.45 m depth underneath the roadway connecting the allotments. An aldrin concentration of 1.8 mg/kg was recorded at UWB24 located adjacent to the roadway reserve at an approximate depth of 1.2 m. Therefore it is concluded that the remaining organochlorine pesticides (aldrin) levels on this site within the central and access roadways constitute an unacceptable environmental risk, unless access, and thus exposure, to the soils is restricted. It is concluded that the remaining organochlorine pesticides (aldrin) levels on the remaining organochlorine pesticides (aldrin) levels on the remaining organochlorine pesticides (aldrin) levels on the remainder of the site (i.e. the residential allotments) do not pose unacceptable environmental risks.

The concentrations of benzo(a)pyrene in sample SP10 taken in the central roadway (1.46 mg/kg) marginally exceeds Dutch B and Auditor risk-based criteria (1 mg/kg). The concentrations of benzo(a)pyrene in sample TP3 from proposed residential allotment 3 (1.3 mg/kg) also marginally exceeds these criteria. It is concluded that the remaining polycyclic aromatic hydrocarbon (benzo(a)pyrene) levels (maximum concentration 1.46 mg/kg) on this site do not pose unacceptable environmental risks given the localised occurrences and depths and the 95% UCL below the acceptance criteria. Notwithstanding the widespread presence of a thin layer of fill containing ash and charcoal at 0.5 m depth in the Square Acre, the Auditor is of the opinion that the material does not constitute an unacceptable environmental risk (based on the results of testing for PAHs).

#### 7.5 Groundwater

Groundwater information obtained from PIRSA and site investigations, indicates that the depth to the water table in the area is in excess of 12 m below the ground surface. PIRSA summary information also indicates groundwater quality in the site area to be suitable for irrigation. Therefore the groundwater quality at this site is unlikely to be an issue.

#### 7.6 Off Site Effects

The Auditor considers that the potential for off site effects of contaminant migration from the site, eg. as a result of leaching of contaminants to the groundwater table, or stormwater runoff, is negligible.

۰.

# 8. AUDITOR'S CONCLUSIONS

### 8.1 General

This Site Audit Report has been prepared for the site comprising the southern portion of the former Hillcrest Hospital described in Lots 351 and 352, Deposited Plan DP48652, located north of Buckingham Street, Oakden, as part of the redevelopment and sale of the property as 25 residential allotments and central and connecting access roadways.

This follows the completion of a preliminary environmental site assessment of the whole Hillcrest Hospital site in 1994, and detailed environmental site assessment in 1996, followed by site remediation and validation conducted between 1998 /1999 by PPK Environment & Infrastructure Pty Ltd.

In order to assess whether the environmental consultant's investigations have been satisfactory, the Auditor has to determine whether:

- the site history adequately defines the potential contaminants
- the sample density and testing frequency gives a representative picture of site conditions
- the selection of analytes adequately represents the potential site contamination
- the selection of acceptance criteria is appropriate.

In determining the condition of the site, the Auditor has to give consideration to defining the beneficial uses of the site. This includes issues relating to:

- the health and well being of humans, on or off the site
- environmental impacts to flora and fauna
- impacts of soil contamination on surface water and groundwater.

The EPA has indicated that the Site Audit Report should provide a concluding statement incorporating one of the following:

- the condition of the site is such that the site is suitable for unrestricted use
- the condition of the site is such that it is suitable only for certain stated uses; any conditions pertaining to the use of the site must be specified
- the condition of the site presents an unacceptable health and/or environmental risk, and is not suitable for any use unless remediated.

### 8.2 Auditor's Conclusions

The conclusions of this Site Audit are set out as follows:

- 1. The studies conducted by PPK Environment & Infrastructure Pty Ltd were assessed by the Auditor as being adequate to determine the potential for site contamination.
- 2. The overall sampling frequency (ie. the test location spacing and the selection of samples) is considered by the Auditor to be acceptable. The analytical parameters are considered by the Auditor to be sufficient to adequately characterise the level of soil contamination on the site.
- 3. The remediation and validation works conducted by PPK were assessed by the Auditor as being adequate.
- 4. It is concluded that the remaining heavy metals contamination levels on this site do not pose unacceptable human health risks. It is also considered that heavy metals contamination levels on this site are such that they do not pose unacceptable risks to plants which have their root systems in, or which uptake nutrients from, the site soils, and that the heavy metal contamination levels also do not pose unacceptable risks to soil fauna such as earthworms.

••

- 5. It is concluded that the remaining organochlorine pesticides (aldrin) levels on this site within the central and access roadways constitute an unacceptable human health risk, unless access, and thus exposure, to the soils is restricted. It is concluded that the remaining organochlorine pesticides (aldrin) levels on this site on the remainder of the site (i.e. the residential allotments) do not pose unacceptable human health risks.
- 6. It is concluded that the remaining polycyclic aromatic hydrocarbon (benzo(a)pyrene) levels (maximum concentration 1.46 mg/kg) on this site do not pose unacceptable human health risks given the localised occurrences and depths and the 95% UCL below the acceptance criteria.
- 7. Notwithstanding the widespread presence of a thin layer of fill containing ash and charcoal at 0.5 m depth in the Square Acre, the Auditor is of the opinion that the material does not constitute an unacceptable health risk (based on the results of testing for PAHs), nor are thereunacceptable aesthetic implications (having regard to the depth, thickness and general appearance of the material).
- 8. Notwithstanding the limited documentation of QA/QC procedures employed by the consultant. the overall methodology is considered by the Auditor to be acceptable.
- 9. Contamination levels on the portion of the site representing the residential allotments are such that there are no unacceptable risks to plants which have their root systems in, or which uptake nutrients from, the site soils. The contamination levels also pose no unacceptable risks to soil fauna such as earthworms.
- 10. Groundwater information obtained from PIRSA and site investigations, indicates that the depth to the water table in the area is in excess of 12 m below the ground surface. Groundwater contamination is therefore not an issue at this site.
- 11. It is concluded that the potential for off site effects of contaminant migration from the site, eg. as a result of leaching of contaminants to the groundwater table, or stormwater runoff, is negligible.

On the basis of the above conclusions, the Auditor considers that in accordance with the South Australian Environment Protection Authority Special Bulletin No. 1, 20 October 1995, the condition of that portion of the site representing the residential allotments (as shown in Figure 1.2, Site Plan and Extent of Audit) is such that it is suitable for unrestricted residential use.

The Auditor also considers that the condition of that portion of the site representing the central and access roadways (as shown in Figure 1.2, Site Plan and Extent of Audit), is such that it is suitable only for use as access roadways, provided that the conditions as specified below are satisfied:

- 1. The proposed development of the site is for 25 residential allotments with internal connecting roadways, as shown in Figure 1.2. The proposed development as documented must be adhered to.
- 2. It is a requirement of this Audit that the Auditor be kept informed of any relevant site redevelopment activities, and that opportunity be given to the Auditor to ensure that the above conditions are adhered to.
- 3. If at any time in the future the site is to be redeveloped, then further site characterisation and/or remediation may be required. A new Audit Report will be required to be prepared for any other development proposal.

31

In accordance with South Australian Environment Protection Authority (EPA) Information Bulletin IS No. 8, November 1997, Assessment Procedure for Contaminated Sites, table on page 3, Stage 7, development or building approval by the relevant planning authority must include the Auditor's Conditions 1 to 3 above.

Signed:

A.M.D. Kall

AMD Hall, MIE Aust Chartered Professional Engineer Associate Director Environmental Auditor (Contaminated Land)

**BC TONKIN & ASSOCIATES** 

Date: 23 July 1999

## 9. **REFERENCES**

ANZECC/NH&MRC (1992), Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council and National Health and Medical Research Council.

ANZEC/NH&MRC (1990), Draft Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australia and New Zealand Environment Council (ANZEC), National Health and Medical Research Council (NH&MRC), June 1990.

Australian Standards (1997) Guide to the sampling and investigation of potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds, AS 4482.1-1997.

Imray, P and A Langley (1996) *Health-Based Soil Investigation Levels*, National Environmental Health Forum (NEHF) Monographs, Soil Series No 1, SAHC.

MHSPE (9 May 1994) Intervention Values and Target Values - Soil Quality Standards, Ministry of Housing, Spatial Planning and the Environment, The Netherlands.

PPK Environment & Infrastructure Pty Ltd (1999a) Facsimile 9 June 1999

- PPK Environment & Infrastructure Pty Ltd (1999b) *Environmental Site Assessment Report Lots 351* and 352 DP 48652 Former Hillcrest Hospital Site, 27K139A 98-597, 23 June 1999
- PPK Environment & Infrastructure Pty Ltd (1999c) Site Remediation and Validation Report Lots 351 and 352 DP 48652 Former Hillcrest Hospital Site, 27K139A 99-395, 25 June 1999

PPK Environment & Infrastructure Pty Ltd (1999d) Facsimile 7 July 1999

PPK Environment & Infrastructure Pty Ltd (1999e) Facsimile 12 July 1999

PPK Environment & Infrastructure Pty Ltd (1999f) Facsimile 15 July 1999

PPK Environment & Infrastructure Pty Ltd (1999g) Facsimile 16 July 1999

Rust PPK Pty Ltd (1994) Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA, 94/730 27F358A, 2 December 1994.

- SAHC (1996) The Health Risk Assessment and Management of Contaminated Sites, Proceedings of the Third National Workshop on the Health Risk Assessment and Management of Contaminated Sites, Contaminated Sites Monograph Series No 5.
- SAHC (1993) A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in SA, Public and Environmental Health Service, January 1993.
- Taylor, J, B Thomson and R Shepherd (1974) *The Soils and Geology of the Adelaide Area*, Bulletin 46, Department of Mines Geological Survey of South Australia.

•

Appendix 1

# PPK Environment & Infrastructure Pty Ltd (1999g) Facsimile 16 July 1999

16/07 '99 10:17 PAA DI O 04004301

PPA PTI LTD

**幽いいと/いい**と

Our Reference 27K139A/JCR

16 July 1999

Mr Wayne Gibbings Brock Barrett Project Marketing 2<sup>nd</sup> Floor, 422 King William Street ADELAIDE SA 5000

Dear Wayne

#### Addenda to Report References 98-597 and 99-395

Further to our telephone conversation of 15<sup>th</sup> July 1999, I wish to confirm the following details:

Firstly, The PPK report reference 98-597, of 23 June 1999, entitled "Environmental Site Assessment Report Lots 351 and 352 DP 48052 Former Hillcrest Hospital Site" makes reference a deposited plan number 48052, whereas this should read deposited plan number 48652. This numerical error is present throughout the document, and within the document all references to DP48052 should be replaced with DP48652.

Secondly, The PPK report reference 99-395, of 25 June 1999, entitled "Site Remediation and Validation Report Lots 351 and 352 DP48052, Former Hillcrest Hospital Site" also makes reference a deposited plan number 48052, whereas this should read deposited plan number 48652. This numerical error is present throughout the document, and within the document all references to DP48052 should be replaced with DP48652.

We apologise for any inconvenience that this error may have caused, and ask that you append this letter to each of the reports, to prevent any future confusion this error may create.

Yours faithfully

**Jason Rollison** Environmental Consultant PPK Environment & Infrastructure Pty Ltd

cc. Mr Adrian Hall (BC Tonkin and Associates)

PPK Environment & Infrastructure Pty Ltd PPK House, 101 Pirie Street Adelaide SA 5000 GPO Box 398 Adelaide SA 5001 Australia Telephone 08 8405 4300 Int Tel + 61 8 8405 4300 Facsimile 08 8405 4301 Ermail ppkadel@ozemail.com.au

ACN 078 004 798 A NATA Cartilized Quelity Company Appendix 2

# LTO Information (DP48652)



D48652







ENLARGEMENT E2

357

NOT TO SCALE





ALEXANDER & SYMONDS PTY. LTD. IF KING WILLIAM ST. KENT TOWN PO. BOX 1000 KENT TOWN 5071 PHONE 8363 1600 FAX.8362 0099 REF : A 57896:00

FOSTERS

30

367

·163C

92.23 婃

NOT TO SCALE

PUELIC

(263

1<u>5</u>]

18

31.00

ROAD

A.C.N. 007 753 988



 $\mathbf{i}$ 

AS 2



Appendix 3

Site Photographs (July 1999)



1: View of site looking west towards site boundary and former Ward 4 area



2: View of site looking east from central roadway showing excavation of Ward 6 (at left).



3: View of central roadway looking west.

Appendix 4

# Development Plan Zoning Information



6 May 1999

### MIXED USE (OAKDEN) ZONE

#### Introduction

The objectives and principles of development control that follow apply in the Mixed Use (Oakden) Zone shown on Map PAdE/27. They are additional to those expressed for the whole of the council area.

The Mixed Use (Oakden) Zone contains the following areas, shown on Mixed Use (Oakden) Concept Plan Fig MU(O)/1:

- Institutions
- Recreation and Sporting Club
- Commercial

#### **OBJECTIVES**

- **Objective 1:** A zone accommodating recreational and sporting club facilities, short-term residential, commercial, office and institutional activities, community facilities and stormwater detention systems within areas designated for such use.
- **Objective 2:** Orderly and co-ordinated redevelopment which accords with defined policy area requirements and which encourages rehabilitation of existing buildings.
- **Objective 3:** A zone with a functional road and movement network linking with existing public roads ensuring efficient access to land.
- **Objective 4:** A zone containing a diverse range of land uses which are compatible with one another and the adjoining Residential (Comprehensive Development) Zone.

#### **PRINCIPLES OF DEVELOPMENT CONTROL**

- 1 Individual buildings should have a high standard of design, compatible with the:
  - (a) scale;
  - (b) built-form; and
  - (c) external materials

of existing buildings within the locality.

- 2 Development should not exceed two storeys in height except in that part of the Commercial Area 39a where development should not exceed three storeys in height.
- 3 Commercial development and short-term residential accommodation should primarily occur within existing buildings except in Commercial Area 39a shown on Mixed Use (Oakden) Concept Plan Fig MU(O)/1.
- 4 New roads and thoroughfares, including walkways and bicycle paths, should provide safe and convenient access and movement for vehicles and pedestrians within the zone, and to adjoining localities.
- 5 Development should be designed and located to retain existing mature trees.
- 6 Development within the Mixed Use (Oakden) Zone should be designed and located to avoid detrimental impact on the amenity of adjoining areas and the Residential (Comprehensive Development) Zone having particular regard to:
  - (a) noise pollution
  - (b) air pollution



6 May 1999

- (c) light overspill
- (d) overlooking
- (e) overshadowing
- 7 Development in the vicinity of Fosters Road should allow for detention devices required for stormwater management as shown on Mixed Use (Oakden) Concept Plan Fig MU(O)/1.
- 8 Landscaped buffers should be located on boundaries between the Mixed Use (Oakden) Zone and the Residential (Comprehensive Development) Zone and between defined areas within the Mixed Use (Oakden) Zone for privacy and visual screening in accord with Mixed Use (Oakden) Concept Plan Fig MU(O)/1.
- 9 Development of the Administration Building and Czechowicz House, marked on Mixed Use (Oakden) Concept Plan Fig MU(O)/1, should meet the development requirements for items of significance on the State Heritage Register.
- 10 Development within the zone should be undertaken in accordance with Mixed Use (Oakden) Concept Plan Fig MU(O)/1.
- 11 Only pedestrian access should be developed southward from the public road east of the Administration Building as shown on Mixed Use (Oakden) Concept Plan Fig MU(O)/1.
- 12 The following kinds of development are **non-complying** in the Mixed Use (Oakden) Zone:

Agistment and Holding of Stock Amusement Park Bank **Bowling Alley Builders Yard** Bus Depot Concert Hall Consulting Rooms with gross leasable area greater than 250 square metres except in Commercial Area 39a Demolition of State and Local Heritage Places listed in Tables PAdE/2 and PAdE/4 Dog Track Dwelling, except a Detached Dwelling, where ancillary to a non-residential use Drive-in Theatre **Electricity Generating Station Fuel Depot** General Industry Golf Driving Range Horse Keeping Hotel

Intensive Animal Keeping Junk Yard Major Public Service Depot Motel Motor Repair Station Offices with gross leasable floor area greater than 250 square metres - except in Commercial Area 39a Petrol Filling Station Post Office Prescribed Mining Operations **Refuse Destructor Retail Showroom Road Transport Terminal** Service Trade Premises Shop, or group of shops, with a gross leasable floor area greater than 100 square metres Show Ground Special Industry Timber Yard Warehouse

#### **Public Notification**

The following developments are listed as Category 1 within the Mixed Use (Oakden) Zone:-

- (a) The construction of, alteration or addition to, or change in use to:
  - (i) short-term residential accommodation;
  - (ii) convention centre;
  - (iii) commercial kitchen;

- (iv) recreation and sporting club building;
- (v) hospital; or
- (vi) community centre,

in existing buildings or new buildings up to two storeys.

- (b) The construction of or change in use to:
  - offices with a gross leasable floor area less than 1000 square metres in Commercial Area 39a; and
  - (ii) offices with a gross leasable floor area less than 250 square metres in Commercial Area 39b.
- (c) The construction of or change in use to:
  - (i) consulting rooms with a gross leasable floor area less than 1000 square metres in Commercial Area 39a; and
  - (ii) consulting rooms with a gross leasable floor area less than 250 square metres in Commercial Area 39b.
- (d) The construction of or change in use to a shop or group of shops with a gross leasable floor area less than 100 square metres.
- (e) The division of land which creates not more than four additional allotments.
- (f) A kind of development which, in the opinion of the relevant authority, is of a minor nature only and is unlikely to be the subject of reasonable objection from the owners or occupiers of land in the locality of the site of the development.
- (g) A kind of development classified as **non-complying** which comprises the alteration of, or addition to, a building which, in the opinion of the relevant authority, is of a minor nature only.
- (h) The construction of a building, including a dwelling to be used as ancillary to or in association with an existing building, which will facilitate the better enjoyment of the purpose for which the existing building is being used, and which constitutes, in the opinion of the relevant authority, development of a minor nature only.
- (i) The division of land by way of strata plan under the *Community Titles Act 1996* or the *Strata Titles Act 1988*.
- (j) The division of land (including for the construction of a road or thoroughfare) where the applicant proposes to use the land for a purpose which is, in the opinion of the relevant authority, consistent with the objective of the zone or area under the Development Plan, other than where the division will, in the opinion of the relevant authority, change the nature or function of an existing road.
- (k) Any development which comprises the construction of, or alteration of or addition to, a water or waste water (or water and waste water) treatment plant, or associated infrastructure, as part of a project for the provision, extension or improvement of public infrastructure, and which is undertaken on land owned by the Crown, a Minister of the Crown, or an agency or instrumentality of the Crown.
- (I) (1) Any development which comprises a special event if:
  - (i) the special event will not be held over more than three consecutive days; and

- (ii) in the opinion of the relevant authority, an event of a similar or greater size, or of a similar or greater impact on surrounding areas, has not been held on the same site (or substantially the same site) within six months immediately preceding the day or days on which the special event is proposed to occur.
- (2) In sub-clause (p)(1):

"special event" means a community, cultural, arts, entertainment, recreational, sporting or other similar event that is to be held over a limited period of time.

The following development is listed as **Category 2** within the Mixed Use (Oakden) Zone except where the development falls within the Category 1 list above:-

- (a) The construction of or change in use to an indoor recreation centre in Commercial Area 3a.
- (b) The alteration of, or change of use to, an existing building, comprising three storeys or more;
- (c) The division of land where the applicant proposes to use the land for a purpose which is, in the opinion of the relevant authority, consistent with the zone or area under the Development Plan and where the division will, in the opinion of the relevant authority, change the nature or function of an existing road; and
- (d) A building in a situation referred to in Category 1 above where the site of the proposed development is land adjacent to land in a Residential (Comprehensive Development) Zone.

#### Policy Area 37: Institutions Area

#### Introduction

The objectives and principles of development control that follow apply to that part of the Mixed Use (Oakden) Zone referred to as the Institutions Area shown on Mixed Use (Oakden) Concept Plan Fig MU(O)/1 and on Map PAdE/56. They are additional to those expressed for the whole of the Mixed Use (Oakden) Zone and for the council area as a whole.

#### OBJECTIVE

**Objective 1:** An area accommodating secure hospital and associated administrative and support buildings.

#### **PRINCIPLES OF DEVELOPMENT CONTROL**

- 1 Development undertaken in the Institutions Area should primarily be buildings and structures associated with the use of the land as secure hospitals.
- 2 Access/egress to the Institutions Area should be restricted to:
  - (a) a single access point on the east to west access road leading from Fosters Road into the James Nash House Complex; and
  - (b) a single access point located on Fosters Road for the Services to the Elderly Complex in accordance with Mixed Use (Oakden) Concept Plan Fig MU(O)/1.
- 3 Off-street parking space sufficient to accommodate the vehicles of users and visitors to the James Nash House Complex and the Services to the Elderly Complex should be provided within the Institutions Area.
- 4 New buildings should be designed and constructed of materials and be of a scale sympathetic with the overall character and built-form of the area.
- 5 New buildings, except outbuildings and ancillary uses, should be set-back 15 metres from Institution Area boundaries which adjoin the Residential (Comprehensive Development) Zone.
### Policy Area 38: Recreation and Sporting Club Area

#### Introduction

The objectives and principles of development control that follow apply to that part of the Mixed Use (Oakden) Zone referred to as the Recreation and Sporting Club Area on Mixed Use (Oakden) Concept Plan Fig MU(O)/1 and on Map PAdE/56. They are additional to those expressed for the whole of the Mixed Use (Oakden) Zone and for the council area as a whole.

#### OBJECTIVE

**Objective 1:** An area primarily accommodating recreational uses, sporting and associated training facilities, administrative uses and club rooms which do not impact on the viability of the Neighbourhood Centre (Northfield) Zone on the corner of Fosters Road and Folland Avenue at Northfield.

#### **PRINCIPLES OF DEVELOPMENT CONTROL**

- 1 Development undertaken within the Recreational and Sporting Club Area should be primarily sporting club facilities, recreational and associated training facilities, administrative uses, club rooms and hospitality uses.
- 2 Unrestricted views should be maintained between the north east section of Commercial Area 39b and the Recreation and Sporting Club Area.

### Policy Area 39: Commercial Area

#### Introduction

The objective and principles of development control that follow apply to that part of the Mixed Use (Oakden) Zone referred to as the Commercial Area, shown on Mixed Use (Oakden) Concept Plan Fig MU(O)/1 and on Map PAdE/56. They are additional to those expressed for the whole of the Mixed Use (Oakden) Zone and for the council area as a whole.

#### OBJECTIVE

**Objective 1:** An area accommodating commercial development in Area 39a with mixed commercial uses in existing buildings and short-term residential accommodation in Area 39b.

#### **PRINCIPLES OF DEVELOPMENT CONTROL**

- **1** Development in the Commercial Area should be:
  - (a) in Area 39a, commercial development, including gymnasium, fitness centre, office and consulting rooms, or similar use, which is compatible with the role of the Oakden Neighbourhood Centre and which complements adjoining development in the Mixed Use (Oakden) Zone.
  - (b) in Area 39b, short-term residential accommodation, commercial food preparation, consulting rooms, childcare facilities, offices, convention facilities and ancillary uses; such uses to be primarily within existing buildings.
- 2 Office development and consulting room development proposed in new buildings should not exceed, in total:
  - (a) 1000 square metres in Commercial Area 39a;
  - (b) 500 square metres in Commercial Area 39b.
- 3 Landscaped buffers with a minimum width of three metres should be located on the boundaries of the Commercial Area as shown on Mixed Use (Oakden) Concept Plan Fig MU(O)/1.

Appendix 5

Auditor Sample and Analysis Summaries

.

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA/ QC	рН	As	Sb	Ba	Be	Cd	Co	Cr	Cu	Pb	Mn	Hg	Mo	NI	Se	Ag	TI	Sn	Zn	BTEX	трн	PAHs	OCPs	OPP8	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
24/5/99	L4	A(H)	0.50									:															×							
24/5/99	L4	B(H)	0.50																								×							
24/5/99	L6	A(H)	0.50				x												-					×										
24/5/99	L6	8(H)	0.50				x																	×					-					
16/7/98	SP01	550	0.55	0.65		×	×				×		x	×	×		×							×										
16/7/98	SP01	650	0.65	0.75			×				×		x	×	×		x							x										
16/7/98	SP02	800	0.80	0.85			×	1			×	·	x	×	×		×							×										
16/7/98	SP02	850	0.85	0.95		×	×				×		x	×	x		x							x										
16/7/98	SP03	400	0.40	0.45		×	×	1			×		x	×	×		×		-					×										
16/7/98	SP03	450	0.45	0.55	· ·		×				×		x	×	×		×	_						x						[				
16/7/98	SP04	1300	1.30	1.35		1	×		<u> </u>		×		×	x	x		×							×				1					-	
16/7/98	SP04	1350	1.35	1.45		×	×				×		×	×	×		×							×										
16/7/98	SP05	1000	1.00	1.05		×	×				x	÷	x	x	x		x							×										
16/7/98	SP05	1550	1.55	0.70		×	×				x		x	×	x		×							×										
16/7/98	SP05	700	0.70	0.80			×				×		×	×	×		x							×										
16/7/98	SP06	570	0.57	0.60			×				×		×	×	×		×							×										
16/7/98	SP06	600	0.60	0.70	BFD	×	×				x		x	×	×		×							×										
16/7/98	SP06	600d	0.60	0.70	PS	×	×				×	;	x	×	×		×							×										
2/10/98	SP11	500	0.50				×				×	×	x	×	×		×		×					×			×							T
16/7/98	ТЗА	150	0.15	0.30			×							×										×	•									
16/7/98	ТЗА	400	0.40	0.50			×					:		×										×										
16/7/98	тзв	400	0.40	0.50			×					;		×										×										
16/7/98	тзс	450	0.45	0.55			×							×										×										
16/7/98	T3D	400	0.40	0.50			×					,		×										×										
16/7/98	T4A	400	0.40	0.50			×							×										×			×							
16/7/98	T4B	150	0.15	0.30		Ţ	×							×										×			×	ĺ						
16/7/98	T4C	000	0.00	0.15			×							×										x			×							
16/7/98	T4C	400	0.40	0.50			×		•					×							1			×			×							
10/6/98	TP03	150	0.15	0.30			×				×		×	×	×		×							×			×				1			
10/6/98	TP03	400	0.40	0.50			×	1			×		x	×	x		×							×			×	-						
10/6/98	TP05	200	0.20	0.30	1	1	×	-	1		×		x	×	×		×				1			×			×			1			-	
10/6/98	TP05	550	0.55	0.65			×				×		×	×	×		×							×			×							

Brock Barrett Project Marketing

Lots 351 and 352, DP 48052

Job No: 98.0295/S, 22/07/99

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA / QC	нq	As	Sb	Ba	Be	Cd	Co	Cr	Си	Pb	Mn	Hg	Мо	NI	Se	Ag	ті	Sn	Zn	BTEX	трн	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
10/6/98	TP07	1800	1.80	1.90			×				×		×	×	x		x							×			×						_	
10/6/98	TP07	200	0.20	0.30			×				×		x	x	×		×							×			×							L
10/6/98	TP07	900	0.90	1.00			x	1			x		x	×	x		x							×			<b>x</b> .							
10/6/98	TP08	150	0.15	0.30	PS		×				×		×	×	x		x							x			×							
10/6/98	TP08	150d	0.15	0.30	BFD		×				×		x	x	x		x							x			×							ļ
10/6/98	TP08	1600	1.60	1.70		1	×				x		x	×	x		x							×			×							
10/6/98	TP08	400	0.40	0.50			×				x		×	×	×		×							x			×	<u> </u>					ļ	ļ
10/6/98	TP09	150	0.15	0.30			×				×		x	×	x		×							×			×						-	
10/6/98	TP09	900	0.90	1.00			x		,		×		×	×	x		x							×			×							
10/6/98	TP10	300	0.30	0.40	PS		x				×		x	x	x		x							x		×	x	×				×		
10/6/98	TP10	300d	0.30	0.40	BFD		x				×		×	×	×		×					1		x			x							1
10/6/98	TP10	600	0.60	0.70			x				×		×	×	x		×							×			×					-		
10/6/98	TP11	250	0.25	0.35			×				×		×	×	×		,x							×	<u> </u>		×			L	Ì		<u> </u>	1
10/6/98	TP11	400	0.40	0.50			x				×		×	×	×		×						ļ	×			×				ļ		-	ļ
11/6/98	TP12	000	0.00	0.15			×				×		x	×	x		x							×			×	×						
11/6/98	TP12	900	0.90	1.00			×				×		×	×	×	<u> </u>	×							×			×		ļ				<u> </u>	1
11/6/98	TP13	100	0.10	0.20			×				×	, ,	×	×	×		×		ļ					×			×			L		<u> </u>	1	
11/6/98	TP13	1450	1.45	1.55		<u> </u>	×				×		x	×	×		×							×		ļ	×		 	L			<u> </u>	<u> </u>
11/6/98	TP14	150	0.15	0.25	<u> </u>		x				×	<u> </u>	×	×	×		×			<u> </u>				×		×	×	×	—		ļ	×	<u> </u>	<u> </u>
11/6/98	TP14	1900	1.90	2.00			×				×	ļ	×	×	×		×		ļ				<u> </u>	×		ļ	×		ļ	<u> </u>		ļ	<u> </u>	
11/6/98	TP14	400	0.40	0.50			×				×		×	×	×	<u> </u>	×							×		ļ	×		ļ			ļ		
5/6/98	TP15	000	0.00	0.15			×			<u> </u>	×		×	×	×		×							×			×	×				<u> </u>		<u> </u>
5/6/98	TP15	900	0.90	0.10			×		ļ	ļ	×	<u> </u>	×	×	×		×		ļ					×			×.		ļ	<u> </u>			<b>_</b>	<u> </u>
5/6/98	TP16	150	0.15	0.30			×				×	<u> </u>	×	×	×		×							×			×			<u>}</u>				<u> </u>
5/6/98	TP16	900	0.90	1.00		<u> </u>	×		<u> </u>	ļ	×	-	×	×	×		×	<u> </u>						×			×		ļ	ļ			<u> </u>	<u> </u>
5/6/98	TP17	150	0.15	0.30	<u> </u>	<u> </u>	×		<b> </b>	<u> </u>	×	· ·	×	×	×	<u> </u>	×				Ì			×			×		<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
5/6/98	TP17	1700	1.70	1.80	<u> </u>		×				×		×	×	×		×	ļ	ļ	ļ		ļ	<u> </u>	×	<u> </u>	ļ	×	<u> </u>	<u> </u>				ļ	<u> </u>
5/6/98	TP18	150	0.15	0.30			×				×	· ·	×	×	×		×		ļ					×		ļ	×		ļ	<u> </u>			<u> </u>	
5/6/98	TP18	1700	1.70	1.80		ļ	×		ļ	ļ	×	ļ	×	×	×	ļ	×	ļ	ļ		<u> </u>			×		<b> </b>	×			<u> </u>	ļ	<u> </u>	<u> </u>	<u> </u>
5/6/98	TP18	900	0.90	1.00			×		<u> </u>		×		×	×	x		×							×	<u> </u>	ļ	×		ļ	<u> </u>	ļ			<u> </u>
5/6/98	TP19	150	0.15	0.30	PS		x				×		×	×	×		×		ļ			_		×			×			 	<u> </u>	<u> </u>	<u> </u>	<u> </u>
5/6/98	TP19	1500	1.50	1.60			×		<u> </u>		x		×	×	×		×							×	<u> </u>		×		ļ				<u> </u>	

Т

Brock Barrett Project Marketing

Lots 351 and 352, DP 48052

Job No: 98.0295/S, 22/07/99

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA / QC	рН	As	Sb	Ba	Be	Cd	Co	Cr	Cu	РЬ	Mn	Hg	Мо	NI	Se	Ag	ТІ	Sn	Zn	BTEX	трн	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
5/6/98	TP19	150d	0.15	0.30	BFD	Γ	×				x		×	x	x		x		_					×			x							
5/6/98	TP20	400	0.40	0.50			×				x		x	×	×		×							×		×	x	x				×		
5/6/98	TP20	900	0.90	1.00			×				×		×	×	×		×							×			×							
9/6/98	TP22	1400	1.40	1.50			×				x		×	x	x		×							×			x							
9/6/98	TP22	300	0.30	0.45			x				×	•	x	×	x		x							×			×							
9/6/98	TP22	500	0.50	0.60			×				x		×	x	x		×							×			x							
9/6/98	TP23	000	0.00	0.15			×				×		×	×	x		. <b>x</b>							×			×	×						
9/6/98	TP23	900	0.90	1.00			×				×		×	×	x		x							×			×		[					
9-10/6/98	TP24	000	0.00	0.15	PS		x				×		x	×	×		×							×			x							
9-10/6/98	TP24	000d	0.00	0.15	BFD		x				×		x	×	×		x							x			x							
9-10/6/98	TP24	500	0.50	0.60			×				×		x	×	×		×							x			×							
10/6/98	TP25	000	0.00	0.15	PS		×				×		x	×	×		×							x			×							
10/6/98	TP25	000d	0.00	0.15	BFD		x				×		x	x	×		×							×			×							
10/6/98	TP25	1550	1.55	1.65			x				×		×	×	×		×							×			Χ.							
10/6/98	TP25	250	0.25	0.40			×				×		x	x	×		×							×			×		]					
5/6/98	TPSA01	330	0.33	0.37	-		×				×		x	×	×		x							×		×	×	×				x		
5/6/98	TPSA01	600	0.60	0.75			x				x		×	×	×		×							×			×		<u> </u>					
5/6/98	TPSA02	350	0.35	0.45	PS		x				×		×	×	×		×					<u> </u>		×			×							
5/6/98	TPSA02	350d	0.35	0.45	BFD		×				×		×	×	×		×							×			×							
5/6/98	TPSA02	700	0.70	0.80			×				×		×	×	×		×							×			×							
5/6/98	TPSA03	000	0.00	0.15			×			[	×		×	×	×		×					I		x			×	×						
5/6/98	TPSA03	700	0.70	0.85			×				×		×	×	×		×			İ				×		×	×	×				×		
5/6/98	TPSA04	350	0.35	0.50			x				×		×	x	x		×							×			×							
5/6/98	TPSA04	700	0.70	0.80			×			[	×	!	×	×	×		×							<b>x</b> .			×							
5/6/98	TPSA04	900	0.90	1.00			×				×		×	×	×		×	 						×			x		İ	[				
9/6/98	TPSA05	200	0.20	0.35			×				x		×	×	x		×							×			×							
9/6/98	TPSA05	450	0.45	0.60	PS		x				x		x	x	x		x							×			×							
9/6/98	TPSA05	450d	0.45	0.60	BFD		x				x		x	x	x		×							×			×							
9/6/98	TPSA06	350	0.35	0.50			×				×		x	x	×		x							x			x							
9/6/98	TPSA06	700	0.70	0.85			×				×		×	×	×		x					[·		×			x							
9/6/98	TPSA07	500	0.50	0.60		1	×				×		×	×	×		×							×		1	x			1		1		
9/6/98	TPSA07	850	0.85	1.00			×				x		×	×	x		x					1		×			×							

Brock Barrett Project Marketing

Lots 351 and 352, DP 48052

Job No: 98.0295/S, 22/07/99

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA / QC	рH	As	Sb	Ba	Be	Cd	Co	Cr	Cu	Pb	Mn	Hg	Мо	NI	Se	Ag	TI	Sn	Zn	BTEX	трн	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
9/6/98	TPSA08	150	0.15	0.30			x	Γ			x		x	x	×		x							×			x	×						
9/6/98	TPSA08	900	0.90	1.00			×				x		x	x	×		x							×			×							<u> </u>
9/6/98	TPSA09	000	0.00	0.15			×				x		x	x	x		x							×			×	×						
9/6/98	TPSA09	2150	2.15	2.25			x				×		×	x	×		×							×			×							
Total Numb	er of Sample	es 100		Samp	le Numbers:	8	98	0	0	0	87	1	87	96	87	0	87	0	1	0	0	0	0	98	0	5	79	11	0	0	0	5	0	0
Analysing La	ield Duplicat	tes (Primai tes (Primai	ry Sample	es): 8	Number c	nd held	Field D	uplicate	- Interia	B N	y aupik lumber	of Inter	aborato	ates nu ory Dup	licates:	0		ampies	in a cor	nposite.									<u> </u>					
Laboratory:	AMDEL		Lat	poratory R	Report: 8a008	838		1	Report	Date: 2	3/07/98		Nata	Endors	ed: 🖌	2																		
Laboratory:	AMDEL		Lat	ooratory F	Report: 8a007	719			Report	Date: 1	9/06/98		Nata	Endors	ed: 🖌																			
Laboratory:	AMDEL		Lat	poratory R	Report: 8A01	046			Report	Date: 9	/10/98		Nata	Endors	ed: 👿																			
Laboratory:	AMDEL		Lat	poratory F	Report: 9A00	414			Report	Date: 2	7/05/99		Nata	Endors	ed: 🖌																			
												÷.																						

•

## Soils Remaining on Site - Ward 4 Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA/ QC	рH	As	Sb	Ba	Be	Cd	Co	Cr	Cu	Pb	Mn	Hg	Мо	NI	Sə	Ag	וד	Sn	Zn	BTEX	трн	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
19/10/98	BD1	1	1.00		BFD-UWB4																							x						
19/10/98	8D2	1	1.00		BFD- UWB11																							×						1
30/10/98	BD4	1	1.00		BFD- UWB25																							×						
19/10/98	UWB01	1	1.00				<b>_</b>	1																	[			×						
19/10/98	UWB02	1	1.00																									×						
19/10/98	UWB03	1	1.00																									×						
19/10/98	UWB04	1	1.00		PS																							×						
19/10/98	UWB05	1	1.00																									×						
19/10/98	UWB06	1	1.00																									x						
19/10/98	UWB07	1	1.00																									×						1
19/10/98	UWB08	1	1.00					[																				x						
19/10/98	UWB09		1.00																									x						
19/10/98	UWB10	1	1.00																									×				}		T
19/10/98	UWB11	1	1.00		PS							<u> </u>																×						
19/10/98	UWB12	1	1.00																									x						T
19/10/98	UWB13	1	1.00																									x						
19/10/98	UWB14	1	1.00																									×		1				1
19/10/98	UWB15	1	1.00																									×						
19/10/98	UWB16	1	1.00									i																×						
19/10/98	UWB17	1	1.00																									×						
19/10/98	UWB18	1	1.00																									×						
30/10/98	UWB19	1	1.00																									x						
30/10/98	UWB20	1	1.00									1																×						
30/10/98	UWB21	1	1.00		PS				L	<u> </u>											L	[						×						
30/10/98	UWB22	1	1.00									1																×						
30/10/98	UWB23	1	1.00				1												ĺ									x						
30/10/98	UWB24	1	1.20																	[								x						
30/10/98	UWB25	1	1.00																									x						1
24/3/99	VWB1	a	0.40			x	×				x	·	×	×	×		×		×					×	×	×	x	×						
24/3/99	VWB2	a	0.15									<b>.</b>		1		1												×						1
24/3/99	VWB3	a	0.30		1	1			1		1	<u> </u>		1	1	1	<u> </u>					1	1	1		1		×					1	1
												· · · · ·					·	<u> </u>			L					4 <u></u>	·	·		· · · · · · · · · · · · · · · · · · ·	·	· · · · · · · · · · · · · · · · · · ·	4 <u> </u>	4

## Soils Remaining on Site - Ward 4 Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA/ QC	рН	As	Sb	Ba	Be	Cd	Co	Cr	Cu	Pb	Mn	Hg	Мо	Ni	Se	Ag	ТІ	Sn	Zn	BTEX	ТРН	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
24/3/99	VWB3	b	0.60			[	×	x		x	x	×	x	x	x		x	×	x	×			×	x	×	×	x	×					x	
24/3/99	VWB4	a	0.20			×	×				x		x	×	×		x		×					x	×	x	x	×					<u> </u>	
24/3/99	VWB5	a	0.35											····									<u> </u>			1	<u> </u>	×	†				<u> </u>	
24/3/99	VWB6	a	0.40																									×						<u> </u>
Total Numbe	VWB6       a       0.40       x         er of Samples 35       Sample Numbers:       2       3       1       0       1       3       3       3       3       1															0	0	1	0															
Number of F	ield Duplica	tes (Prima	ary Sampl	les): 3	Number	of Blind	Field D	uplicate	IS: 5	3 I 	lumber	of Inter	iaborato	ory Dup	licates:	0							,					·						
Laboratory:	AMDEL		Lat	boratory F	Report: 9A00	288		I	Report I	Date: 3	/05/99		Nata	Endors	ed: 🔽																			
Laboratory:	AMDEL		Lat	boratory F	Report: 9A00	352		i	Report I	Date: 3	0/04/99		Nata	Endors	ed: 🔽	3																		
Laboratory:	AMDEL		Lat	boratory F	Report: 9A00	251		I	Report	Date: 9	/04/99		Nata	Endors	ed: 🖌																			
Laboratory:	AMDEL		Lat	boratory F	Report: 8a01	095		1	Report	Date: 2	3/10/98	:	Nata	Endors	ed: 💽																			
Laboratory:	AMDEL		Lat	boratory F	Report: 8a01	135		I	Report	Date: 5	/11/98		Nata	Endors	ed: 🚺																			

## Soils Remaining on Site - Ward 6 Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA/ QC	рН	As	Sb	Ba	Be	Cd	Co	Cr	Cu	РЬ	Mn	Hg	Мо	NI	Se	Ag	Т	Sn	Zn	BTEX	трн	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
24/5/99	НВ	EF1	0.80		PS															1								x						
24/5/99	нв	EF2	0.80		BFD-EF2							·																×						[
24/5/99	нв	WF1	0.80																									×						
26/5/99	HNE	NEB	0.80																[									×						[
26/5/99	HNE	NES	0.00	0.15																								×						
26/5/99	HNE	NWB	0.80		PS																							×						
26/5/99	HNE	NWB2	0.80		BFD-NWB2											1						1						×						
26/5/99	HNE	NWS	0.00	0.15																		1						×				· ·		
26/5/99	HNE	SAND																										×						
26/5/99	HNE	WB	0.80																									×						
26/5/99	HNE	ws	0.00	0.15																								x						
26/5/99	HNEB	E	0.80																									x						
26/5/99	HNEB	w	0.80																									x						
24/5/99	HSE	В	0.80																									×						
24/5/99	HSE	S	0.00	0.15																								x						
24/5/99	HSW	В	0.80									:									<u> </u>							x						[
24/5/99	HSW	S	0.00	0.15								;																×	1					
24/5/99	нw	В	0.80									1																×						
24/5/99	нм	S	0.00	0.15								1																×						
12/10/98	UB	31	1.00	1.20								:																x						
12/10/98	UB	32	1.00	1.20								1															{	x						
12/10/98	UB	33	1.00	1.20																								x						
12/10/98	UB	34	1.00	1.20																								×						
12/10/98	UB	35	1.00	1.20																								x						
12/10/98	UB	36	1.00	1.20								;																x						
12/10/98	UB	37	1.00	1.20			1										1		1									x						

.

## Soils Remaining on Site - Ward 6 Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA / QC	рH	As	Sb	Ba	Be	Cd	Co	Cr	Cu	Pb	Mn	Hg	Мо	NI	Se	Ag	וד	Sn	Zn	BTEX	ТРН	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
Total Numb	er of Sample	is 26		Samp	le Numbers:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0
PS : priman	sample, F(	D : field du	plicate (r	not analys	ed), BFD : bl	ind field	duplica	ate, ILD	- interla	aborator	ry duplic	ate, St	S - indic	ates nu	mber o	f discret	te subs	amples	in a co	mposite	•													
Number of F	ield Duplicat	tes (Primar	y Sampl	es): 2	Number	of Blind	Field D	uplicate	s: 2	2 N	lumber	of Inter	laborato	bry Dup	icates:	0																		
Analysing La	boratory De	tails					_									_																		
Laboratory:	AMDEL		Lat	boratory F	leport: 9A00	432		I	Report I	Date: 1,	/06/99		Nata	Endorse	ed: 👿	3																		
Laboratory:	AMDEL		Lai	boratory F	leport: 9A00	414		I	Report i	Date: 2	7/05/99		Nata	Endorse	ed: 👿																			
Laboratory:	AMDEL		Lat	boratory F	leport: 8a01	075		l	Report I	Date: 1	6/10/98		Nata	Endorse	ed: 👿																			

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/W6, 22/07/99 Sample and Analysis Summary Solis Remaining on Site - Ward 6

### Soils Remaining on Site - Settlers Farm Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA / QC	pН	As	Sb	Ba	Be	Cd	Co	Cr	Cu	РЬ	Mn	Hg	Mo	NI	Se	Ag	ТІ	Sn	Zn	BTEX	ТРН	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
9/06/99	LOT 279	1	0.30	0.40		x	x				×	•	x	x	×		x							x				×						
9/06/99	LOT 282a	1	0.30	0.40	PS	x	x				x		x	×	×		x							x				×						
9/06/99	LOT 282b	1	0.30	0.40	BFD	×	×				×		x	×	×									x										
9/06/99	LOT 284	1	0.30	0.40		×	×				×		x	x	×		x							×				×						
9/06/99	LOT 298	1	0.30	0.40		×	×				×		×	x	×		x							×				×						
9/06/99	LOT 303	1	0.30	0.40		×	×				×		x	×	×		×							×		x	x	×				-		
9/06/99	LOT 3X	1	0.30	0.40		×	×				X.		x	x	x		x							×				×						
Total Numb	er of Sample	es 7		Samp	le Numbers:	7	7	0	0	0	7	0	7	7	7	0	6	0	0	0	0	0	0	7	0	1	1	6	0	0	0	0	0	0

PS: primary sample, FD: field duplicate (not analysed), BFD: blind field duplicate, ILD - interlaboratory duplicate, SS - indicates number of discrete subsamples in a composite.

Report Date: 9/06/99

Number of Field Duplicates (Primary Samples): 1 Number of Blind Field Duplicates: 1 Number of Interlaboratory Duplicates: 0

Analysing Laboratory Details

Laboratory: AMDEL

Laboratory Report: 9A00455

Nata Endorsed: 🖌

t

### Soils Remaining on Site - Walkley Heights Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA / QC	рH	As	Sb	Ba	Be	Cd	Co	Cr	Cu	Pb	Mn	Hg	Mo	NI	Se	Ag	TI	Sn	Zn	BTEX	ТРН	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
17/05/99	IMPF	1N				x	x				×		×	x	x		x		x					×				x	×					
17/05/99	IMPF	2E				×	×				×		x	x	x		x		x					x				x	×					
17/05/99	IMPF	35				×	×				×		x	x	×		x		x					×				×	x					
17/05/99	IMPF	4Wa			PS	x	x				×		x	x	x		x		x					×				×	×					
17/05/99	IMPF	4Wb			BFD-4Wb	x	x				×	. *	x	x	x		x		x					×				×	×					
17/05/99	IMPF	5E		1		×	×				×		x	x	x		x		x					×				×	×					·
Total Numbe	er of Sample	es 6		Samp	le Numbers:	6	6	0	0	0	6	0	6	6	6	0	6	0	6	0	0	0	0	6	0	0	0	6	6	0	0	0	0	0
PS : primary Number of F	sample, F	D : field du tes (Prima	uplicate (i iry Sampl	not analys es): 1	ed), BFD : bli Number (	nd field	i duplica Field D	ate, ILC Duplicate	) - interl es:	aborato	ry duplic Number	cate, S	S - Indic	ates nu	imber o licates:	f discre 0	e subs	amples	in a co	mposite			<u> </u>	<u></u>	•		<u>.</u>	•	· · · ·					
		•														•																		

Analysing Laboratory Details

.

Laboratory: AMDEL

•

Laboratory Report: 9A00386 Report Date: 17/05/99

Nata Endorsed: 😿

## Soils Remaining on Site - Central and Access Roadways Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA/ QC	pН	As	Sb	Ba	Be	Cd	Co	Cr	Cu	РЬ	Mn	Hg	Mo	Ni	Se	Ag	TI	Sn	Zn	BTEX	трн	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
2/10/98	SP10	500	0.50				x				×	×	×	×	×		×		<b>, x</b>					×			×							
9/6/98	TPR01	200	0.20	0.30			x				×	-	×	x	x		x							×			×							
9/6/98	TPR01	400	0.40	0.50			×	[			×	:	×	x	x		×	_						×			×							
9/6/98	TPR01	900	0.90	1.00	PS		×				×		×	x	×		x	_						x			×							
9/6/98	TPR01	900d	0.90	1.00	BFD		×				x		x	x	x		x	_						x			×							
9/6/98	TPR02	000	0.00	0.15	PS		×				x		x	x	x		×							x			x	×						
9/6/98	TPR02	000d	0.00	0.15	BFD	_	×				x		x	×	x	•	×							x			x	×						
9/6/98	TPR02	400	0.40	0.50			x				x		×	×	x		×							×			×							
9/6/98	TPR02	900	0.90	1.00			x				x		x	×	x		×							×			×						· ·	
9/6/98	TPR03	060	1.50	1.60			×				×		×	×	×		×							×			x	×						
9/6/98	TPR03	1500	0.40	0.50			×				×		x	×	x		×							x			×			L				
9/6/98	TPR03	400	0.06	0.15			×				×		×	×	×		×							×	 	 	×	ļ	 					ļ
10/6/98	TPR04	060	0.40	0.50			×				×		×	×	×		×							×			×					-	+	
10/6/98	TPR04	400	0.06	0.20			×				×		×	x	×		×			 				×	ļ		×	ļ			·	Ļ	<u> </u>	ļ
10/6/98	TPR04	900	0.90	1.00			×			 	×		×	×	×		×							×			×						ļ	
10/6/98	TPR05	000	0.00	0.15	PS		×				×		×	×	×		×			ļ			ļ	×		×	×	×		ļ		×	<u> </u>	ļ
10/6/98	TPR05	000d	0.00	0.15	BFD	<u> </u>	×		<u> </u>		×		×	×	×	<u> </u>	×		<u> </u>	ļ		<u> </u>	<u> </u>	×			×	<u> </u>	ļ	<u> </u>			<u> </u>	<b> </b>
10/6/98	TPR05	150	0.15	0.30			×		<u> </u>		×		×	×	×		×			ļ		ļ		×		ļ	×		<u> </u>				<u> </u>	
10/6/98	TPR05	400	0.40	0.50			×				×		×	x	×		×	 						×			×	1	 	<u> </u>			+	
5/6/98	TPR07	1600	1.60	1.70			×				×	<u> </u>	×	×	×		×		_		· ·		<u> </u>	×		ļ	×	<u> </u>						<u> </u>
5/6/98	TPR07	300	0.30	0.45	· ·	ļ	×	ļ			×		×	×	×		×			ļ	ļ			×		ļ	×	ļ	<u> </u>				<u> </u>	
5/6/98	TPR07	450	0.45	0.60	<u> </u>		×	ļ	<u> </u>	<u> </u>	×		×	×	×		×							×	<u> </u>	. 	×			<b></b>	ļ			
24/3/99	VR1	a	0.70	<u> </u>			×	×	<u> </u>	×	×	×	×	×	×		×	×	×	×	<u> </u>		×	×	×	×	×	×		ļ			×	<u> </u>
24/3/99	VR2	a	0.20	ļ	<b></b>	×	×				×		×	×	×		×	<u> </u>	×					×	×	×	×	×					<u> </u>	
24/3/99	VR3	a	0.20		ļ							·			<u> </u>		<u> </u>	ļ			<u> </u>			_	<u> </u>		ļ	×			<u> </u>			
24/3/99	VR4	a	0.45	ļ	ļ	1		ļ		1									_	ļ								×						l

.

## Soils Remaining on Site - Central and Access Roadways Sample and Analysis Summary

### BC TONKIN & ASSOCIATES

Date	Location No	Sample No	Min Depth	Max Depth	QA / ` QC	pH	As	Sb	Ba	Be	Cd	Co	Cr	Cu	Pb	Mn	Hg	Mo	Ni	Se	Ag	ТІ	Sn	Zn	BTEX	трн	PAHs	OCPs	OPPs	VACs	VHCs	Tot Phen	Tot Cyan	Triaz
Total Numb	er of Sample	əs 26	•	Samp	le Numbers:	1	24	1	0	1	24	2	24	24	24	0	24	1	3	1	0	0	1	24	2	3	24	8	0	0	0	1	1	0
PS : primar Number of F	y sample, Fi ield Duplica	D : field du tes (Prima	iplicate (i ry Sampl	not analys es): 3	ed), BFD : bl Number	ind field of Blind	duplica Field D	ute, ILD	) - interla os: 3	iborator 3 N	ry duplic lumber	cate, S of Inter	S - indic laborato	ates nu ory Dup	umber o	of discre 0	ete subs	amples	in a co	mposite														
Analysing L	aboratory De	etails																																
Laboratory:	AMDEL		La	boratory R	leport: 8a00	719			Report [	Date: 1	9/06/98		Nata I	Endors	ed: 🖌																			
Laboratory:	AMDEL		La	boratory P	leport: 8A01	046	•		Report [	Date: 9	/10/98		Nata I	Endors	ed: 💽																			
Laboratory:	AMDEL		La	boratory F	leport: 9A00	251			Report (	Date: 9	/04/99		Nata I	Endors	ed: 🖌																			

Appendix 6

# Auditor Statistics

### **Central and Connecting Access Roadways Statistics: Summary**

### BC TONKIN & ASSOCIATES

		Arithmetic			_		Standard	Confidence			Assessment C	riteria	
Contaminant	Count	Mean	Min		Max		Deviation	Limit (+/-)	95% UCL	ANZECC B	Auditor Criteri	NEHF A	SAHC HIL
Benzo(a)pyrene	24	0.30	0.25	•	1.46		0.25	0.10	0.40		1	1	1
Aldrin	8	0.35	0.05	•	2		0.69	0.47	0.82		0.5	10	
DDD	8	0.05	0.05	•	0.05	٠	0.00	0.00	0.05				
DDE	8	0.05	0.05	•	0.05	٠	0.00	0.00	0.05		0.5		
Dieldrin	8	0.09	0.05	•	0.3		0.09	0.06	0.15	0.2	0.5	10	
Arsenic	24	3.85	2.5	•	11		2.34	0.94	4.79	20	20	100	100
Copper	24	13.21	2.5	•	34		7.20	2.88	16.09	60		1000	100
Zinc	24	34.73	2.5	•	190		46.59	18.64	53.37	200		7000	500

Note: Statistics have been calculated assuming non detect values to be half of the laboratory detection limit. \* Indicates a non detect value (shown as half of the relevant detection limit.)

 Min Depth (m)
 ANZECC B
 Environmental Investigation Levels (ANZECC/NHMRC 1992)

 Max Depth (m)
 Auditor Criteria
 Site specific criteria as recommended by the Environmental Auditor

 Soil Type
 NEHF A
 Standard residential (NEHF 1996)

 SAHC HIL
 Health Investigation Levels (SAHC 1993)

Brock Barrett Project Marketing Lots 351 and 352, DP 48052 Job No: 98.0295/R, 23/07/99 Statistics: Summary, Central and Connecting Access Roadways

## Soils Remaining on Site (Residential Allotments and Imported Fill) Statistics: Summary

### BC TONKIN & ASSOCIATES

		Arithmetic				Standard	d Confidence	9		Assessment (	Criterla	
Contaminant	Count	Mean	Min		Max	Deviation	n Llmit (+/-)	95% UCL	ANZECC B	Auditor Criteri	NEHF A	SAHC HIL
Benzo(a)pyrene	83	0.26	0.25	. •	1.3	0.12	0.02	0.29		1	1	1
Aldrin	84	0.10	0.05	•	1.8	0.21	0.05	0.14		0.5	10	
DDD	84	0.05	0.05	• .	0.05	• 0.00	0.00	0.05				
DDE	84	0.05	0.05	•	0.05	• 0.00	0.00	0.05		0.5		
Dieldrin	84	0.05	0.05	•	0.1	0.01	0.00	0.05	0.2	0.5	10	
Arsenic	114	4.70	2.5	•	26	4.00	0.73	5.43	20	20	100	100
Copper	112	21.64	2.5	•	595	58.61	10.86	32.50	60		1000	100
Zinc	114	27.06	2.5	•	202	30.33	5.57	32.63	200		7000	500

Note: Statistics have been calculated assuming non detect values to be half of the laboratory detection limit. \* Indicates a non detect value (shown as half of the relevant detection limit.)

Min Depth (m)	ANZECC B	Environmental Investigation Levels (ANZECC/NHMRC 1992)	Brock Barrett Project Marketing
Max Depth (m)	Auditor Criteria	Site specific criteria as recommended by the Environmental Auditor	Lots 351 and 352, DP 48052
Soil Type	NEHF A	Standard residential (NEHF 1996)	Job No: 98.0295/S, 22/07/99
	SAHC HIL	Health Investigation Levels (SAHC 1993)	Statistics: Summary, Soils Remaining on Site (Residential Allotments and Imported Fill)

Appendix 7

Rust PPK Pty Ltd (1994) Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA, 94/730 27F358A, 2 December 1994.

1.1.1

· · · Luteld E~86041

Department of Environment and Natural Resources

71

Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA

### RUST PPK Pty Ltd Environment & Infrastructure

100 North Terrace Adelaide SA 5000 Australia Telephone: (08) 212 5733 Facsimile: (08) 212 4686

94/730 27F358A 2 December, 1994



Environment & Infrastructure

52.55

D North Terrace
 Acelaide, South Australia
 GPO Box 398, Acelaide
 SA 5001 Australia
 Telephone (08) 212 5733
 Int Tel -61 8 212 5733
 Facsimile (08) 212 4686

VATA Corolled Quality Correary

. . .

Inited on recycled paper

RUST PPK Pty Ltd ACN 058 381 507

#### Our Ref: 2710/2904/27F358A

3.1

2 December, 1994

Manager - Property Services Department of Environment & Natural Resources Resource Conservation and Management Group Treasury Building 144 King William Street ADELAIDE SA 5000

Attention: Mr. Peter Lawrence

Dear Sir,

## Re: Report of Potential Environmental Issues and Preliminary Testing at Hillcrest Hospital, Fosters Road, Gilles Plains, SA

We are pleased to provide our report on the titled subject. The report includes both the earlier draft site history report and subsequent preliminary test work.

We would welcome any comments you may have. Please do not hesitate to contact the undersigned if you wish to discuss any aspect of the report or if you require further assistance.

Yours faithfully,

Kes YA

LES GRAY, Senior Consultant

L

## Table of Contents

### **Executive Overview**

 $\langle \hat{} \rangle$ 

ŗ

L

1.	Introd	uction

- 1.1 Overview
- 1.2 Sampling and Testing Program

### 2. Background Information

- 2.1 Property/Address
- 2.2 Owner
- 2.3 Party Responsible for Assessment
- 2.4 Environmental Consultants
- 2.5 Proposed Land Use
- 2.6 Land
- 2.7 Operator of Site

3. Site Description

### 4. Site Inspection

- 4.1 Topography
- 4.2 Local Geographical Features of Relevance
- 4.3 Local Soil Types
- 4.4 Evidence of Possible Contamination and Other Potential Liabilities

### 5. History of Site

5.1	Overview	-	· -	 -		12
5.2	Sources of Information and Verification of Informa	ation				16
5.3	Maps Detailing Historical Uses					22
54	History of Adjacent Land Use					22

Page No.

i

1

2

3

3

3

3

3

3

4

5

6

6

6

7

### 6. Summary of Potentially Contaminated Areas

6.1	General	24
6.2	Areas Possibly Contaminated with Coke Ash	24
6.3	Areas Where Burial of Building Rubble Has Occurred	24
6.4	An External Underground Pipework Insulated with Material	
	Which May Contain Asbestos	25
6.5	Underground Fuel Storage Tanks	25
6.6	Sites Formerly Occupied by Market Gardens or Orchards	25
6.7	Areas of Landscaping with Unknown Sources of Fill	26
6.8	Areas of Potential Contamination from Miscellaneous Sources	26
6.9	Other Sources of Possible Contamination	26

## Table of Contents Continued

ومرادية وال

a destruction of

SALEAN V

A NEW Y

L

:

i

····

7.	Other Potential Liabilities	s P
	<ul> <li>7.1 Telecom Radio Tower</li> <li>7.2 Groundwater Pumps</li> <li>7.3 Uncompacted Soil</li> </ul>	27 28 29
8.	Testing	
	<ul> <li>8.1 Drilling and Soil Sampling Methodology</li> <li>8.2 Sampling Locations</li> <li>8.3 Sample Depths</li> <li>8.4 Laboratory Used</li> <li>8.5 Analytes</li> </ul>	30 31 32 33 33
9.	Results	 35
10.	Discussion of Results	37
11.	Trial Backhoe Excavation of Buried Building Rubble	
	<ul> <li>11.1 Methodology</li> <li>11.2 Location of Excavation Area</li> <li>11.3 Depth of Excavation</li> <li>11.4 Anecdotal Evidence</li> <li>11.5 Results of Trial Excavation</li> </ul>	 39 39 39 40 40
12.	Statement of Limitations	41

.

Page No.

## Appendices

i

j

the second state

Autoria

hereit

**Tritcanu** 

نسأ

APPENDIX A	Locality Map - Hillcrest Hospital
APPENDIX B	Site Plan, October 1994 Site Plan, 1988
APPENDIX C	Aerial Photograph
APPENDIX D	Photographic Record of Site Inspection
APPENDIX E	Former Certificates of Title
APPENDIX F	Previous Borehole Logs from the Department of Mines and Energy
APPENDIX G	Site Plans Showing Potentially Contaminated Areas and Other Potential Liabilities
APPENDIX H	Site Plans Showing Sampling Locations
APPENDIX I	Field Work and Sample Details
APPENDIX J	Borehole Logs and Explanatory Notes
APPENDIX K	Laboratory Methodology and Quality Assurance; Laboratory Analytical Reports
APPENDIX L	Site Plan Showing Location of Trial Excavation Area

APPENDIX M Photographic Record of Backhoe Excavation

## Abbreviations of Terms Used

IT	Industrial Therapy
IDSC	Intellectual Disability Services Council
PAH	Polycyclic Aromatic Hydrocarbon
TPH	Total Petroleum Hydrocarbon
PCB	Polychlorinated Biphenyls

## Executive Overview

GILLES PLAINS, SA

## Background to this Report

RUST PPK Pty Ltd was commissioned by the Resource Conservation and Management Group of the Department of Environment and Natural Resources to investigate and report on the potential site contamination, environmental and other related issues arising from historical and current site activities on a 46.1 hectare section of the Hillcrest Hospital property, Fosters Road, Gilles Plains and a 2.3 hectare adjoining area used by the IDSC (Intellectual Disability Services Council) Strathmont Centre. The work was carried out in two steps. Initially a review was carried out of historical, site inspection and anecdotal information. This was followed by a limited sampling and testing program and trial backhoe excavation to test information regarding the presence of buried building rubble. The purpose of the report is to fulfil the disclosure objectives of the current owner, the South Australian State Government, pending sale negotiations for the site.

### Limited Sampling and Testing Program

A limited sampling and testing program was designed on the basis of information obtained from site history research, detailed in subsequent sections.

Eighteen samples were taken from a total of thirteen locations across the site and none revealed evidence of unacceptable concentrations of the contaminants for which analytical tests were conducted.

A total of eleven of the locations were tested for contaminants usually associated with coke ash disposal. Six of these were on an approximate 20 metre triangular grid east of Litchfield House in an area of suspected coke ash disposal. Other sample locations were in lawned areas as follows:

- in a suspected former market garden area south of the Industrial Therapy Building,
- in a suspected ash disposal area south of the Boiler House and in a further suspected ash disposal area on the "Square Acre".

A further sample was taken from the suspected former orchard area in the south-east corner of the site. The absence of significant concentrations of these contaminants suggests that there were negligible quantities of coke ash in the samples. It will be appreciated that single samples cannot be taken as representative of an entire area and it remains a possibility that high concentrations of coke ash are present elsewhere either inside or outside the broad areas suggested from anecdotal information.

A total of four samples were tested for organochlorine pesticides and metals possibly associated with relevant cropping and orchard activities and again concentrations were within acceptable limits. Tests were conducted on samples from a former market garden area east of Litchfield House, from a former market garden area south of the Industrial Therapy building, from a former orchard area in the south-east corner of the site and from the Hospital Paddock at the northern end of the site. These preliminary results for the former cropping and orchard areas are encouraging however are insufficient to discount the possible presence of such contaminants from untested locations on the site where there is evidence of cropping and/or orchard activities. HEPOHI OF POIENING ENTRUMENTAL ISSUES AND FREIMINANT TESTING AT HILLCREST HOSPITAL FOSTERS ROAD, GILLES PLAINS, SA

Six boreholes drilled in an approximate 20 metre triangular grid pattern east of Litchfield House failed to find any evidence of the burial of building rubble. It will be appreciated that the anecdotal information indicated a large area in which such burial may have occurred and only a small part of this area was tested.

### Trial Backhoe Excavation of Buried Building Rubble

Excavations were dug to a depth of approximately 1.5 metres in a location immediately south of the fenceline which separates the Hospital Paddock from the remainder of the site.

Buried building rubble was unearthed confirming anecdotal evidence. The rubble had a soil coverage of approximately 0.3 metres and extended to a depth greater than 1.7 metres. The backhoe was unable in the time available to dislodge one large piece of concrete. In this small area there was no evidence of chemical contaminants.

However there are reports of up to 50 burial trenches in this area of the site alone, some of which may contain different materials. The presence of this rubble could impact on housing development costs in localised areas of the site.

### Current Status on the Site

ſ

It is proposed that the site be used for residential development in an expansion of the substantial area of single storey residential development which has occurred in the past 1 to 2 years to the immediate south and south-east of the site.

Parts of the Hillcrest Hospital property will not be sold including some of the more recently constructed buildings such as James Nash House (1989) Mason House (1980) and the Psychogeriatric Ward (1975). Many of the functions and activities formerly carried out at Hillcrest will be transferred to other sites. Relocation of the patients and staff was well underway at the time of publication of this report.

Some former accommodation wards have been demolished in the recent past while some others are vacant at present. Two buildings on the site have been granted heritage listing, namely the mortuary building and the administration block.

The northern portion of the Hillcrest property, referred to as the "Hospital Paddock" is used by the Department of Primary Industries for the cultivation of cereal crops.

The IDSC property included in the subject site is currently used by IDSC as a carpark.

### History Overview

Prior to 1926 the subject site was used primarily for growing cereal crops and perhaps some grazing. The land was acquired by the State Government in 1917 and dedicated for "Northfield Mental Hospital", later to become Hillcrest Hospital. Construction of buildings was undertaken progressively from 1926. By 1959 ten accommodation wards, the administration building and assorted services buildings were present on the site. Subsequent construction included a central boiler house (1961), the Industrial Therapy Workshop (1968), the Linen Sorting Building (1968), additional accommodation wards and sheds in the garage/garden complex. The current IDSC property was bituminised between 1970 and 1975.

Several areas of the subject site have been used for market garden and orchard activities. Approximate dates and locations have been obtained for these activities.

# Summary of Potentially Contaminated Areas

ITAL, FOSTERS ROAD

The sources of potential contamination and related potential liabilities encountered during the investigation of this site fell into the following categories:

- Areas possibly contaminated with coke ash.
- Areas where suspected burial of building rubble has occurred.
- An external underground pipe network insulated with materials which may contain asbestos.
- Areas of potential contamination from miscellaneous sources.
- Sites formerly occupied by market gardens or orchards.
- Sites of landscaping with unknown sources of fill.
- Related geotechnical issues.

TESTING AT HILLCREST

Each of the above types of contamination or related potential liability, is perceived as posing a potential risk to future redevelopment of the site - either through the impact on the health of future occupants or through the possible effects on future building development.

### Areas Possibly Contaminated with Coke Ash

Prior to 1961, hospital wards and other major buildings contained individual boilers for the purpose of heating. Subsequently in 1961 Central Boiler Plant was installed which supplied heating steam to all buildings.

Until 1975, a solid fuel, coke was used to fire the boilers. The incomplete product of combustion, coke ash was disposed of in different parts of the site for the purpose of landscaping, as a source of landfill or for creating pathways.

Areas where coke ash has been buried cannot be identified visually, since the areas were covered with top soil and grassed, leaving no visible evidence.

Coke ash contains Polycyclic Aromatic Hydrocarbons (PAHs) some of which are suspected to be carcinogenic.

Since the coke ash may have only minimal soil cover health risks may arise for future site occupants as a result of earthworks building and other site activities.

### Areas Where Burial of Building Rubble Has Occurred

It was common practice over many years to dispose of building rubble by burial on the site. This rubble includes demolition materials from former site buildings and is also understood to include offsite sources of demolition materials originating from former Hampstead Hospital buildings and other Some of the burial areas could contain chemical contamination which could arise from buried metallic components, buried bitumen rubble (possibly containing polycyclic aromatic hydrocarbons) and buried asbestos containing materials. The existence or otherwise of potential health risks would depend upon concentrations of contaminants and the presence or otherwise of exposure paths.

External Underground Pipework Insulated With Material Which May Contain Asbestos

When the Central Boiler House was installed in 1961, an underground network of steam and return condensate pipes which linked the major buildings to the Boiler House was also established. These pipes are insulated with materials which is likely to contain asbestos.

These pipes are most likely not laid in trenches, but are buried under soil and gravel. The small sections of pipes and insulation were observed in several access service pits. It appears likely that the full network of steam and condensate pipes, which are now redundant, is still present underground.

Earthworks and building activities on the site could result in disturbance or exposure of the possible asbestos with subsequent potential health risks arising from potential inhalation of asbestos fibres.

### Underground Fuel Storage Tanks

An estimated four in total underground fuel storage tanks are present on the site. These include the following:

- an estimated three tanks located west of the mortuary
- one tank located in the garage/garden complex.

Soil contamination could have occurred in the event of surface spillage or from any leakage from the tanks or associated pipelines.

### Sites Formerly Occupied by Market Gardens or Orchards

The hospital grounds were used extensively for market gardening and orchards in the past. Aerial photography and anecdotal information enabled an approximate determination of the areas of the site and the periods of these activities.

Possible chemical contaminants associated with these activities include organochlorine contained in some pesticides used prior to the 1960s and metallic chemical compounds used on orchards in the past.

The Hospital Paddock at the northern end of the property has been used for cropping purposes since at least 1949. Prior to the 1960s organochlorine pesticides may have been used. Information is available on the range of chemical substances used since the early 1960s.

### Areas of Landscaping with Unknown Sources of Fill

The category of areas were noted during the site inspection as being "raised" areas, however there is no information regarding the landscaping medium or the landfill.

### Areas of Potential Contamination from Miscellaneous Sources

This category covers numerous types of contamination, such as:

- Spot treatment for white ants, black ants and bull ants (pesticides used in the past contained organochlorines which are toxic and break down very slowly).
- The site of a former substation which may have contained Polychlorinated Biphenyls (PCBs) in its transformer oil. The transformer oil could have leaked into the soil. PCBs are harmful to human health.
- Bituminised areas including former roadways, paths and a carpark have been covered over, but may be uncovered in future earthworks building activities and subsequent site activities. This bitumen may contain PAHs and potential health risks may arise.

### Other Sources of Possible Contamination

- Additives may have been added to boiler feed water to prevent scaling and limit maintenance problems arising from poor water quality. Some such additives if used in the past may have been toxic, hence leakage through condensate return pipes into the soil structure may have caused slight contamination.
  - Most bitumen roads on the site are older than 15 years and possibly may contain PAHs.

#### Uncompacted Soil

The geotechnical implications of the presence of uncompacted soil on parts of the site will require consideration in the design of building development for the site. This uncompacted soil arises primarily from the on-site burial of building rubble and the partial demolition of the foundations of former buildings.

#### Shallow Groundwater

A groundwater pumping station on the site is operated for the purpose of preventing the ingress of groundwater to the basement of the psychogeriatric ward. As utilisation of this ward is to contain, it will also be necessary to continue future operation of the pumping station.

Due to recent essential site administrative changes in preparation for sale of the subject site responsibility for operation of the pumping station was transferred recently to Glenside/Hillcrest Building Services Department located at Glenside.

RUST PPK Ptv Ltd

### Telecom Radio Tower

Extensive enquiries were made to determine the possible need to specify a separation distance between residential housing and the Telecom radio tower installation on the site. This installation was constructed approximately 2 years ago for the purpose of receiving and transmitting mobile radio signals. The installation comprises a brick building with towers on top and a small wire mesh fenced enclosure.

In the end, the enquiries indicated that the separation distance is likely to be governed almost as much by visual, planning and access considerations as by any environmental requirement for a buffer distance separation. However, for reasons discussed below, it is recommended that prudence be applied, and that a separation distance be specified. At present we are unable to make a firm recommendation on distance, however we would suggest that S-10 metres may be sufficient, subject to further investigation, and subject also to knowledge of the height of the adjacent residential buildings.

### Heritage Listed Buildings

Two buildings on the site have been granted heritage listing, namely the mortuary building and the administration block. It is understood that Enfield Council is currently undertaking assessment of the heritage value of some other buildings on the site.

Sec.

### **Recommendations**

The following recommendations are made:

- Develop a program for further investigation, assessment and determination of possible remediation requirements, for the areas of the site which are subject to potential chemical contamination.
- Determine the probable extent of impact of buried rubble in the site on future building activities. This would include developing a program of test boreholes to delineate areas of the site which are subject to burial of building rubble. The depth of soil cover should also be determined.
- Determine the feasibility of relocating the groundwater pumping station currently on the subject site to a new location on the Hospital grounds near the psychogeriatric ward. This should be part of a strategy to ensure that future liabilities do not arise in the event of any dilapidation of buildings on the subject site as a result of changes in moisture content of the reactive clay soils.
  - Include underground pipework insulation in plans to remove asbestos containing materials from the site prior to demolition and building activities.

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES TESTING AT HILLCREST HOSPITAL FOSTERS ROA GILLES PLAINS, SA

## 1. Introduction

## 1.1 Overview

i

RUST PPK Pty Ltd was commissioned by the Resource Conservation and Management Group of the Department of Environment and Natural Resources to investigate and report on the potential site contamination, environmental and other related issues arising from historical and current site activities on a major section of the Hillcrest Hospital property, Fosters Road, Gilles Plains and a small adjoining area used by the IDSC (Intellectual Disability Services Council) Strathmont Centre. The work was carried out in two steps. Initially a review was carried out of historical, site inspection and anecdotal information and a draft report was produced. Subsequently RUST PPK was commissioned to carry out a limited program of sampling and testing. The scope of work for this program is included in Section 1.2 of this report. The results of this program are presented in this report together with site history information which includes all the contents of the earlier draft report. The purpose of the report is to fulfil the disclosure objectives of the current owner, the South Australian State Government, pending sale negotiations for the site.

The original perceived issues included the presence of an underground fuel tank and bitumen roadways.

Subsequent investigations revealed a number of additional sources of potential soil contamination including the following:

- The operation on the site of a boiler which, prior to conversion to gas firing, used solid fuel, apparently coke, and produced a solid waste residue.
- The widespread disposal of boiler waste residue around the Hillcrest Hospital site. Disposal areas were subsequently covered with topsoil and grassed leaving no evidence of disposal areas.
- The burial at unmarked locations on the site of possibly bitumen or asbestos contaminated rubble.

Client approval was also obtained for the assessment of a number of additional issues not strictly related to soil contamination, but which are relevant to the client's broad objective of disclosure of any potential site liabilities. The issues included the following:

- The on-site burial of rubble, whether clean or contaminated, at unmarked locations. Some of this rubble includes very large concrete and masonry blocks which could pose significant obstacles for earthmoving equipment during subsequent site development.
- Uncompacted fill material has been placed to depths of several metres over a significant area on part of the site.
- The purpose, operation and management of a groundwater pump on the site.
- The presence on the site of underground asbestos lagged pipes.

GILLES PLAINS, SA

• The presence of additional underground fuel tanks; two containing leaded petrol and the other containing unleaded petrol.

Following completion of the review of all the above issues, a draft report was produced including all relevant site history information.

### 1.2 Sampling and Testing Program

The draft report was reviewed with Mr Peter Lawrence and a preliminary sampling and testing program was designed in accordance with the discussions. The objective was to provide preliminary information for the South Australian Health Commission so that it could advise on an overall assessment program for the site.

The following components were included in the preliminary program:

- (a) Six boreholes in the carpark are to the east of Litchfield House. These were tested for possible coke ash contaminants and market garden contaminants
- (b) In an area of the site where rubble burial was suspected, backhoe excavation was carried out to determine the depth and physical nature of any buried rubble. Observations were made of possible contaminants in the rubble including asbestos, bitumen and metals. An area of 3 m x 5 m, located approximately 5.2 m south of the Hospital Paddock fenceline, was investigated using this method.
- (c) One borehole in each of three other locations where coke ash was suspected (one of these is also a former market garden). Testing will be similar to (a).
- (d) Two boreholes in a former orchard area (between ward nos. 4 and 6). These were tested for contaminants which may have resulted from chemical treatment and ash disposal.
- (e) Two boreholes in the "Hospital Paddock". Tests were carried out for some of the contaminants which may have arisen from chemical treatment activities.

Where necessary, multiple samples were taken from individual boreholes. This was carried out in boreholes located south of the Industrial Therapy Building and on the Square Acre.

The above program provided relatively intense testing in one location, plus a preliminary investigation of selected other areas.

K Pty Ltd

REPORT OF POTENTIAL ENVIRONMENTIAL ISSUES AND PRELIMINARY TESTING AT HILCREST HOSPITAL, FOSTERS ROAD, GULES PLAINS, SA

## 2. Background Information

### 2.1 Property/Address

Fosters Road, Gilles Plains.

### 2.2 Owner

The site is Crown Land with management and control vested in the South Australian State Government and the South Australian Health Commission.

- 24

## 2.3 Party Responsible for Assessment

Department of Environment and Natural Resources Resource Management Division Treasury Building 144 King William Street ADELAIDE SA 5000

Attention: Mr. Peter Lawrence

### 2.4 Environmental Consultants

RUST PPK Pty Ltd 100 North Terrace ADELAIDE SA 5000

### 2.5 Proposed Land Use

Residential - adults and children.

### 2.6 Land

It has been proposed to divide Section 872 into Lots 100, 101, 102 and 103. The site can then be described by:

- Lot 103 of proposed division of Section 872 which contains 46.1 ha.
- Section 855 which contains 2.3 ha.

Both are situated in the Hundred of Yatala, County of Adelaide.

Throughout this report, Lot 103 of proposed division of Section 872 will be referred to as "proposed Lot 103".

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AN TESTING AT HILLCREST HOSPITAL, FOSTERS, ROAD, GILLES PLAINS, SA ANARY

#### Operator of Site 2.7

## The South Australian Health Commission.

ي. د در موجو .

ł

Á.

Department of Environment & Natural Resources

1đ

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PRELIMINA TESTING AT HILLCREST HOSPITAL FOSTERS ROAD

**RUST PPK Ptv Ltd.** 

## 3. Site Description

The site is generally bounded by Grand Junction Road to the north, by Fosters Road to the west, by a new housing development to the south and by the IDSC (Intellectual Disability Services Council) Strathmont Centre to the east. Refer to the locality map in Appendix A and the current site plan in Appendix B, drawing 27F306A/01/O.

Proposed Lot 103 contains roughly 46.1 ha, and is occupied by Hillcrest Hospital as shown on the current site plan in Appendix B. The bulk of this area contains buildings required for the accommodation and care of patients and for purposes of administration. Other buildings which were of importance in this assessment were the boiler house and the garage/garden compound.

Appendix B contains the site plan of Hillcrest Hospital buildings as they were in 1988, which was provided by Mr Sven Karlsson, Administration Officer, Hospital Services.

The northern portion of proposed Lot 103, referred to as the "Hospital Paddock" is used by the Department of Primary Industries, formerly the Department of Agriculture, for the purpose of cultivating cereal crops at the request of Hillcrest Hospital. This agricultural area can be seen clearly in the aerial photograph shown in Appendix C.

Section 855 contains 2.3 ha and is used by the neighbouring IDSC Strathmont Centre. It contains a carpark area.

Please note that all maps show north as pointing to the top of page.

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PRELIM NART TESTING AT HELICREST HOSPITAL, FOSTERS ROAD, GILLES PLAINS, SA

RUST PPK Pty Ltd

## 4. Site Inspection

### 4.1 Topography

The site is fairly flat.

Stormwater drains from the site at two locations. One location is behind Ward 1 (Anderson House) on the eastern side of the property, as shown in photograph 15 in Appendix D. Housing is likely to be built very close to this storm water outlet, however a drain has been recently placed near the outlet.

Storm water also exits the property, via a creek which runs through the hospital paddock in a north-westerly direction. The storm water from this outlet joins a creek on the opposite side of Grand Junction Road. The creek which runs through the "hospital paddock" is usually dry but flows during periods of rain. It can be seen clearly in the aerial photograph which is in Appendix C.

### 4.2 Local Geographical Features of Relevance

On the southern side of the property north of the Telecom tower a small brick building houses a groundwater pump. Its location is shown on the current site plan in Appendix B, drawing 27F306A/01/O.

The presence of this groundwater pump suggests the existence of shallow groundwater.

Further information about the groundwater pump is given in Section 7.2.

### 4.3 Local Soil Types

Published information suggests that the near surface geological strata at the site belong to either the Keswick Clay or the Pooraka Formation groups, which are both of Quaternary age. Keswick Clay comprises stiff green or yellow brown silty clay of very high reactivity, and is associated with the Black Earth type BE pedeological group. Soils of the Pooraka Formation are typically reddish brown clays with variable amounts of silt and sand, and some calcium carbonate content. They are correlated with Red Brown Earth types RB4 and RB8 in the region of the study.

Copies of logs of earlier boreholes in the site were obtained from the Department of Mines and Energy. Reference to these previous borelogs contained in Appendix F for the site shows that the soil profile varies somewhat, but resembles an RB8 pedeological classification. It generally comprises successive high plasticity, calcareous clay layers of brown, red brown and white colouration to a depth of approximately 1.5 m. Underlying these layers is a highly plastic mottled grey, brown and yellow clay which extends to 4-5 m depth. The profile then grades to a clayey sand representing weathered sandstone.

The extensive depth of reactive clay present at the site means that very large surface soil movements will occur with changes in moisture content. The significant concentrations of

Department of Environment & Natural Resources

6

calcareous silt at some locations within the uppermost part of the profile may lead to settlement and loss of strength of these foundation soils should the silt become wetted.

No groundwater was struck in any of the previous boreholes for the site that were available, though shallow water tables may occur if infiltrating surface water perches on the relatively impermeable clay layers near to the surface.

# 4.4 Evidence of Possible Contamination and Other Potential Liabilities

This section will outline the potential types of contamination which were observed and that which was not visually apparent, but reported by employees, past and present who guided the co-authors around the property.

### 4.4.1 The Central Boiler House - Coke Ash

The central boiler house was built to provide steam to all the wards and to the administration building, for the purposes of heating.

Originally, the boilers were coke fired. Later they were changed to gas fired operation and stopped functioning 3-4 years ago. In the period that the boiler house was coke fired, incomplete products of combustion, coke ash, sometimes referred to as cinders, were often used as a landscaping medium or as land fill at different sites on the hospital grounds. Coke ash was disposed of in this method due to the high cost of transporting the waste to the Wingfield dump and the high cost of bringing a cleaner source of fill onto the site.

Areas within the hospital site where coke ash is believed to have been buried are shown in Appendix G, drawing number 27F306A/02/O. This map has been drawn based on anecdotal evidence given at the site visit.

Coke ash contains high levels of PAHs, Polycyclic Aromatic Hydrocarbons some of which are suspected to be carcinogenic when ingested or absorbed through the skin.

An incinerator is also located in the same building as the central boilers. It is thought to have burnt mainly paper rubbish. Incomplete products of combustion from the incinerator would also have contained PAHs but no information on landscaping using the incinerator ashes was reported. Photographs showing areas suspected of being contaminated with coke ash are shown in Appendix D.

- Photograph 1 shows "square acre" which is a grassed lawn to the east of the chapel and Ward 4. Coke ash has possibly been buried to a depth of 1.2-1.5 metres at this location.
- Photograph 1a shows the lawns to the south of the IT workshop which are possibly contaminated with coke ash to an unknown depth.
- Photograph 2 shows the central boiler house.
- Photograph 3 shows concrete bunding around an oil storage area the incinerator was perhaps oil fired.
(E.,

Note: Drawing 27F306A/02/O in Appendix G shows the locations where the above photographs were taken.

# 4.4.2 The Central Boiler House - Underground Piping Insulated With Materials Possibly Containing Asbestos

The presence of underground piping insulated with materials possibly containing asbestos was suggested at the site visit, but the positions of such piping was not known at the initial site inspection. On the second site visit however, underground piping insulated with materials which may contain asbestos was uncovered and photographed. In some areas outer piping had deteriorated exposing the insulation.

The steam and condensate pipes in use until 3-4 years ago, are located in the rafters of covered walkways connecting major buildings. The insulation is probably not asbestos, but most likely synthetic mineral fibre.

### 4.4.3 Diesel Bowser and Associated Garage/Garden Compound

The diesel bowser and associated underground storage tank is located to the eastern side of the garage/garden compound. The underground tank has a capacity of 4500 L and roughly 1500 L remain in the tank (September 14, 1994), according to Mr Howard Thiele, the head gardener. The diesel bowser is shown in photograph 5, Appendix D. It can be seen that the area in front of the bowser has not been concreted and spillage onto the bare earth has occurred. In addition, leakage may have occurred from the underground tank into the soil. Diesel contains PAHs and TPHs (Total Petroleum Hydrocarbons).

On the western side of the vehicle maintenance shed (the largest shed on the garage/garden compound), old batteries and service oil have been stored. This is shown in photograph 6 in Appendix D. Although the area is concreted, the tap situated above the batteries could spread any leakage onto the grass. Battery acid contains PCBs (Polychlorinated Biphenyls).

### 4.4.4 Old Substation

وريد وليسو فر مدين

Generally, substations older than 20 years are regarded as possibly containing PCBs in their transformer oil. All substations on the site are less than 15 years old except for one which was located on the southern side of the central boiler house. The substation has since been removed, but transformer oil may have leaked into the soil while it was in service. Refer to photograph 7 in Appendix D. The former location of the substation is shown on a site plan in Appendix G, drawing 27F306A/05/O.

### 4.4.5 Burial of Bitumen Carpark and Road

Photograph 8 shows the lawn to the south of Salter Hall. A bitumen carpark was originally on this site and is believed to have been not removed, but was covered with soil, some 12 years ago.

An old bitumen roadway on the eastern end of the oval was also covered with a fill of unknown origin.

and the second second

. Tarren de de la

Drawing 27F306A/05/0 in Appendix G shows the locations where burial of the bitumen carpark and roadway have occurred.

### 4.4.6

### Black Ant, White Ant and Bull Ant Treatment · .

The occupational therapy building is timber framed and formerly it was used as a school. It has been treated for white ants in the past. Photograph 9 shows a location on the northern side of the "square acre" lawn where black and bull ant treatment has occurred. Suspected locations of white ant, black ant and bull ant treatment are shown on the site plan in Appendix G, drawing 27F306A/05/O.

- 567

Insecticides used to eradicate ants and in particular white ants, in the past contained organochlorines which are very toxic and take long lengths of time to breakdown.

#### 4.4.7 Areas Contaminated with Building Salvage

Areas where building salvage is believed to have been used as landfill, are shown in Appendix G, drawing number 27F306A/03/O. This map has been drawn based on anecdotal evidence given at the site visits by Mr Howard Thiele and Mr Frank Rogers, the present and former gardeners. Some of this anecdotal evidence was verified by inspection of aerial photography.

Wards 2, 3 and 9 have been demolished. Anecdotal evidence indicates that the foundations of the buildings to a depth of 2 m were removed, crushed and then returned as backfill. This may cause subsidence in the soil at a later date and may pose limitations for building in the future.

Materials containing asbestos were removed from Wards 2, 3 and 9 prior to demolition so there is little chance that the land these buildings occupied is contaminated with asbestos. (Based on information derived from the Survey Report of Hillcrest Hospital for the Presence of Asbestos, published by SACON in 1990.)

> e.e.s

Photograph 10 in Appendix D shows the former site occupied by Ward 3 and an old bitumen pave way which may contain PAHs. Overt signs of building rubble at the surface are not present.

It was indicated that the garage/garden compound was landscaped with building salvage from the south-eastern corner of the Hampstead Hospital. This occurred sometime between 1970 and 1975. The building rubble is thought to have consisted mainly of 12 ft x 12 ft concrete slabs. It is not known if this building salvage contained asbestos.

A section of land to the north of the former Ward 3 has been filled with large concrete pieces, the quantity of which was estimated to be approximately 1,000 tonnes. About 50 trenches running north-south each approximately 3.5 metres deep and 1 metre wide were dug and the concrete pieces were buried in this way. Photograph 11 shows the site where this activity occurred. (Specified location and quantity based on anecdotal information received from Mr Frank Rogers.)

Building rubble has also been buried on land to the north of James Nash House. In this instance brick, concrete and other rubble from the construction of the psychogeniatric unit were buried (based on anecdotal evidence). This is possibly the cause of soil subsidence reported in the area - in one incident "a tractor fell into a hole" which had appeared; in other incidents, tools have disappeared into cracks which appear. The gardeners have tackled the situation by filling in cracks and holes that appear with clean fill. Photograph 12 shows the site where this activity occurred.

The land which is now occupied by Litchfield House and a carpark, was previously used to bury approximately 1,000 pieces of concrete curbing on top of this was added 250 mm of coke ash from the boiler then 6 cm of soil was placed over the coke ash. Litchfield House has been built on piles possibly due to the soil instability associated with areas filled with building salvage. (Details of the type and quantity of landfill are based on anecdotal information received from Mr Frank Rogers.)

Ward 8 has a small amount of landscaping on its nonhern side. According to Mr Howard Thiele rocks lie under the slope which has been created.

There is a large pile of assorted waste in the vicinity of James Nash House. Its location is shown on drawing 27F306A/05/O in Appendix G. The waste is comprised of soil mixed with building salvage and large slabs of concrete and bitumen. Refer to photograph 13.

Soil subsidence was reported to have occurred on a former market gardening area to the south of James Nash House (anecdotal evidence from Mr Frank Rogers), but burial of building rubble wasn't reported (see Drawing 27F306A/08/0).

### 4.4.8 Weed Killers/Pesticides/Insecticides

It was reported by Mr Howard Thiele that Zero and Round-up have been used over the last 15 years. Prior to that, soil sterilants were used but were confined to spot areas.

Herbicides have been applied around the edges of buildings, signs and pavements from a tank transported by tractor.

1944 1 Star

3.0

### 4.4.9 Heritage Listed Buildings

station -

Two buildings on the site have been granted heritage listing, namely the mortuary building located north of the boiler house and the administration block. The mortuary is a small building now used as a paint workshop. It is surrounded by old bitumen which may be contaminated with PAHs. See photograph 14 in Appendix D.

### 4.4.10 IDSC Strathmont Carpark/Dumping Area

Section 855 (see drawing number 27F306A/01/O in Appendix G) is occupied by IDSC (Intellectual Disability Service Council). It is primarily used as a carpark by nearby workshop employees and other IDSC staff. The gravelled carpark is located on the southeastern corner of Section 855.

A 300 L overhead diesel storage tank is located on the western side of Section 855. Some local spillage has occurred onto the exposed earth. This is shown in photographs 16 and 17.

192

- 18 A C

Building rubble, garden clippings and soil have been dumped in piles, north of the carpark, but are apparently removed periodically. One such pile is shown in photograph 18.

The foundations of a small concrete building have been left in the ground and are shown in photograph 19.

### 4.4.11 Petrol Bowsers and Associated Underground Storage Tanks

Two petrol bowsers are located in a westerly direction from the mortuary building. One of the bowsers dispenses leaded petrol and the other dispenses unleaded petrol.

The fill point for the underground storage tank associated with the unleaded petrol bowser is located approximately 28.5 m west and 6.5 m south from the south-western corner of the mortuary. Two other fill points were located approximately 2.4 m and 5.3 m respectively, west of the unleaded petrol fill point. Hence a total of three filling point were apparent, suggesting that three underground storage tanks are present.

It is not known how long the tanks have been in place.

The petrol bowsers are shown in photograph 25 and the fill point for the unleaded petrol underground storage tank is shown in photograph 26. The location of the petrol bowsers is shown on drawing 27F306A/05/O contained in Appendix G.

### 4.4.12 Chemical Storage Building

A chemical storage building exists and is located approximately 35.5 m west from the southwestern corner of the mortuary. It is a small brick structure, with raised wooden slats over a hard surface. It could not be ascertained if the surface was sealed with concrete. The storage building contained paint thinners, wood lacquer and mineral turps.

If the structure is not concrete lined, contamination of the soil could possibly have occurred in the past in the event of spillage. The approximate location of the chemical storage building is shown on drawing 27F306A/05/O contained in Appendix G.

PK Pty Ltd

# 5. History of Site

# 5.1 Overview

REPORT OF POTENTIAL ENVIRO TESTING AT HILLCREST HOSPI GILLES PLAINS, SA

### 5.1.1 Current Site Activities

Staff and patients are preparing to leave those buildings on the area of the site which is to be sold and rezoned, hence the wards are all gradually becoming disused. The garage/gardening compound is still fully utilised, as is the administration building. The SACON workshops, electrical workshops and hospital workshops are all redundant buildings.

Although only the administration building and the former mortuary have received State Heritage classification, the Enfield Council is currently undertaking investigation of the site and may decide to protect some of the buildings which are of unusual "H" shape construction. Ward 1 is of particular interest in this respect.

The Department of Primary Industries continues to farm the northern part of proposed Lot 103, the Hospital Paddock.

Section 855 is used as a carpark by IDSC workshop employees. Dumping of garden and building waste is apparent at the northern part of this section.

### 5.1.2 Buildings and Underground Pipework

Prior to 1926 the site of Hillcrest Hospital (including Section 855 now occupied by IDSC Strathmont) was used mainly for growing cereal crops and perhaps some grazing. Up until 1926 the site was known as Williams Farm. Construction of Wards 1 and 5 began in 1926 and was completed by 1929.

By 1949, Wards 1, 2, 3, 4, 5, 6 and 7 and the administration building had been completed as had the covered walkways which connected the buildings.

By 1959, Wards 8, 9 and 10 had been completed. Aerial photography shows that by 1959, the groundwater pump had also been installed.

In 1961 the central boiler was installed. Underground steam and condensate pipes ran parallel with the covered walkways. These pipes are highly likely to be insulated with materials containing asbestos.

In 1968, the Industrial Therapy (IT) Workshop was built and by 1975 the Linen Sorting Building was built. Steam was used in the IT workshop for some kind of steam cleaning, while in the Linen Sorting building, steam was probably used for heating or perhaps for ironing presses. Steam was supplied to these buildings from the central boiler house, via underground asbestos insulated pipework. About 18-20 years ago, underground external steam and condensate piping was made redundant when piping was run through the rafters of the covered walkways connecting the buildings - with the exception of Wards 9 and 10, the IT Workshop and the Linen Sorting Building which weren't connected by covered walkways. There is no evidence to suggest that any of the underground pipework insulated with materials possibly containing asbestos, has been removed. Drawing 27F306A/04/0 in Appendix G shows the locations where steam and condensate piping lagged with asbestos containing materials may be buried.

Photograph 20 in Appendix D shows steam and condensate piping between Anderson House (Ward 5) and Howard House (Ward 10). The third newer looking pipe maybe a gas line running through the same trench. Deterioration of outer pipes has exposed the insulation material which possibly contains asbestos.

Photographs 21 to 24 show sections of steam and condensate piping in the vicinity of the IT workshop and linen sorting building. Again, deterioration of outer pipes has exposed the insulation material which may contain asbestos. The locations where these photographs were taken are shown on Drawing 27F306A/04/O.

Between 1970 and 1975, aerial photography confirms that the garage/garden compound was landscaped and that one shed had been built. Litchfield House and Mason House had been built by 1975. Section 855 contained one large shed and a smaller shed surrounded by bitumen in the south-west corner by 1975.

By 1981, all the main sheds had been built on the garage/garden complex and foundations had been laid for the Psychogeriatric Ward which was built on piles possibly because bore tests revealed that the soil was highly expansive (these two buildings are not part of the property we are investigating). The sheds on Section 855 were moved north so that they no longer occupied this section.

By 1989 James Nash House had been built. (This building is not actually part of the property we are investigating.) The repatriation ward (Ward 7), to the south of the former occupational therapy building, was demolished in 1988. Building salvage from this demolition was removed from the site and clean garden loam is thought to have been used as backfill (anecdotal evidence from Mr Frank Rogers). Today the site is used as a picnic area with trees and lawn.

The overhead diesel storage facility and carpark as it appears today were in place on Section 855 by 1989.

and the second of the second second second second second second second second second second second second second

RUST PPK Pty Ltd

Wards 2 and 3 were demolished in 1991 and Ward 9 was demolished in 1993.<sup>37</sup> The foundations of these buildings were dug out to two metres, crushed then returned as backfill (anecdotal evidence supplied by Mr David Palmer and Mr Sven Karlsson).

A Telecom Radio Tower was built, south of the groundwater pump by 1992.

### 5.1.3 Farming Activity

When the hospital first began operation in 1929, great importance was placed on the hospital being able to provide a significant portion if its food requirements. Hence in 1929 £1,000 was spent on horses, cows, seed and implements for the purposes of stocking a farm on the hospital grounds. Averil G. Holt, historian who wrote the jubilee history of Hillcrest Hospital makes reference to this farm a few times revealing that at one time pigs were farmed.

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PRELIMINARY TESTING AT HILLCREST HOSPITAL, FOSTERS ROAD, GILLES PLAINS, SA

However she fails to identify where the farm actually was on the property. It is possible that "the farm" that she refers to, was the area now termed "the Hospital Paddock" (see site plan, Drawing 27F306A/01/O in Appendix B).

### The Hospital Paddock

By the early 60s, there was less pressure on hospitals to be self-sufficient in supplying food and therapy for patients changed from farming pursuits to indoor activities. This saw the farm at the top of the site near Grand Junction Road deteriorate and according to Mr Allan Fishley from the Department of Primary Industries, from the early 1960s the farm has been tended by the Department of Primary Industries.

#### Since late 1960s:

Logs of activities on the Hospital Paddock have been kept since the late 1960s. The field since then has been used to plant cereal crops, with sheep grazing on stubble only at the end of harvest. No chemical dipping of sheep was done on this property and chemical fertilisers, pesticides and insecticides were all prepared for use outside the hospital property before being used on the paddock. (The Department of Agriculture own land to the west and south of the hospital.)

**建筑**工作家

### According to the activity log:

Fertilisers used on the paddock since the late 1960s include:

- 2:1 (Nitrogen: Phosphate) Super
- Super Phosphate
- Super Ammonia
- Urea.

Pesticides and insecticides used on the paddock since the late 1960s include:

Sec. 20

	· ·	• •		 Sec. 1	a managerer i signer	dis 31 <sup>0</sup>
٠	MCPA			'2 '2		<i></i>

- Borox
- Tordon D
- Amine
- Propon
- Rogor
- 2.4-D
- Treflan
- Simizine
- Gromoxone
- Regione
- Avadex
- 2,4 D Ester (LV)
- Gleam
- Diuron
- Ally
- //шј
- Hoegrass.

Department of Environment & Natural Resources

PPK Ptv Ltd

According to Roge: Taylor from the Department of Primary Industries, none of the above named pesticides/insecticides contain organochlorines. Rogor is an organophosphate insecticide, however it biodegrades rapidly.

### Prior to the late 1960s

The creek running through the Hospital Paddock, may have been sprayed for mosquitoes in the past (but not since the late 1960s).

Due to the constant farming activities on the hospital paddock and possible animal farming, there is potential for possible contamination.

#### Market Gardening

1

Examination of aerial photography dating back to 1949 has revealed intensive market gardening. Please see Appendix G drawing 27F306A/06/0 for locations of different types of farming carried out and the dates that they were practised.

Areas where orchards have been in the past may be contaminated with copper sulfate. Other areas used for general farming of vegetables or cereals may be contaminated with organochlorine pesticides.

### 5.1.4 Areas Contaminated with Coke-ash and Building Rubble

#### Coke Ash

Each ward, prior to the early 1960s, had its own ideal boiler to provide heating. Patients would be responsible for replenishing coke in the boilers and for removing ash. Ash from these individual boilers was used to make the hospital paths, according to historian Ms Averil G. Holt. Unfortunately she gives no indication as to where these paths were located.

The Central Boilers were installed in 1961. They were fired with coke until 1975 when they were converted to gas fired operation. Between 1961 and 1975, coke ash from the boilers (i.e. solid waste residue) was buried to varying depths at different locations on the site. Drawing 27F306A/02/O in Appendix G gives locations where the coke ash has been buried based on anecdotal evidence. The anecdotal evidence received came from people who had been employed on the site no earlier than 1973, hence other areas may be contaminated which they have no knowledge of.

In all cases of coke ash burial, disposal areas were subsequently covered with topsoil and grassed leaving no evidence of contamination.

#### Building Rubble

Section 4.4.7 outlines the anecdotal evidence received relating to the disposal of building nubble. Areas contaminated with building nubble are summarised in Drawing 27F306A/03/O, which is based largely on anecdotal evidence.

PPK Pty Ltd

Aerial photography dating from 1949, allowed approximations to be made of the dates when burial of building rubble on some areas occurred. In other cases it was not possible to confirm anecdotal information through inspection of aerial photography.

Areas which were confirmed through aerial photography of containing buried waste were:

- The area north of Ward 3 and James Nash House (refer to Drawing 27F306A/03/O in Appendix G).
- The garage/garden compound (refer to Drawing 27F306A/03/O).
- The area to the south of James Nash House, between the James Nash carpark and Barnett House where soil subsidence has been reported to have occurred (refer to Drawing 27F306A/08/O in Appendix G).

Statistics and Lar

### 5.1.5 Leaded and Unleaded Petrol Underground Storage Tanks

Two petrol bowsers and three underground storage tanks were installed at an unknown date, west of the mortuary. The approximate location of the underground storage tanks is shown in Drawing 27F306A/05/O contained in Appendix G.

Enquiries were made to the Department of Industrial Affairs and the following conclusions were made regarding the location, volume and type of fluid held for each of the tanks:

- One underground tank for the storage of unleaded petrol is located approximately 28.5 m west and 6.5 m south from the south-western corner of the mortuary. The tank has a volume of approximately 4,850 l. It is suspected that the tank is empty, and it may have contained leaded petrol in the past.
- A second underground tank, for the storage of leaded petrol, is located approximately 30.9 m west and 6.5 m south from the south-western corner of the mortuary. The tank has a volume of approximately 5,370 l and has been abandoned, (ie no longer services either of the bowsers), suggesting that it may be empty.
- A third underground tank, for the storage of leaded petrol, is located approximately 33.8 m west and 6.5 m south from the south-western corner of the mortuary. The tank has a volume of approximately 4,850 l and it is not known whether it contains any petrol at the present time.

### 5.2 Sources of Information and Verification of Information

### 5.2.1 Visits to Site

Two formal visits were made to Hillcrest Hospital. The first visit, on the 14 September, the co-authors spoke to Mr Sven Karlsson, the administration officer of hospital services and were guided around the hospital grounds by Mr Howard Thiele, the head gardener. On the second visit to the site conducted on the 23 September, a former gardener Mr Frank Rogers gave a tour of the site. On both of these occasions photographs were taken.

The IDSC Strathmont carpark site (Section 855) was also visited on the 23 September. The co-author spoke to Mr Frank Moyle of IDSC General Services. Photographs were also taken on this occasion.

# 5.2.2 Conversations

Due to the lack of documented records, the anecdotal information that the above named people provided was used as the basis, for initially locating contaminated areas or possibly contaminated areas. Follow up phone calls were made and the following people were able to confirm or clarify some information derived from the site visits:

- Ms Evonne Reynolds State Heritage
- Mr Wayne Ashton Building Services for Glenside/Hillcrest Hospitals
- Mr Dave Palmer former SACON employee at Hillcrest Hospital
- Mr Allan Fishley Department of Agriculture responsible for the Hospital Paddock
- Mr Robert Taylor Department of Agriculture
- Ms Christal Neuhofer Department of Environment and Natural Resources.

Other people were also consulted but could not provide any useful information.

### 5.2.3 Publications

The following publications were able to provide some information:

• Survey Report of Hillcrest Hospital for Presence of Asbestos (Produced by the SACON Asbestos Liaison Unit, Printed September 1990)

Site plans and photographs appearing in Appendix A of the above publication provided information regarding locations of underground pipework insulated with materials which may contain asbestos.

Sandara - Sandara - Sandara - Sandara - Sandara - Sandara - Sandara - Sandara - Sandara - Sandara - Sandara - S

 Hillcrest Hospital - The Fist 50 Years, Commemorating the Golden Jubilee of Northfield Mental Hospital (1992-1964) (Written by Averil G. Holt, Published 1979)

This publication gave the years in which certain buildings were built. An early photograph of a section of the covered walkway - showing no sign of steam and condensate pipework in its roof space - confirmed the anecdotal evidence that steam and condensate piping associated with the central boiler house was originally buried underground.

. . . . .

### 5.2.4 Government Departments

• Land Titles Office

For full details, refer below to Section 5.2.5.

### Department of Environment & Land Management

Anecdotal evidence relating to the land history prior to 1898 was received from Sarah Poulton, historian.

### Department of Mines & Energy

ENVIRONMENTAL ISSUES AND PRELI

REPORT OF POTENTIAL

GILLES PLAINS SA

TESTING AT HILLCREST HOSPITAL FOSTERS ROAD.

Information was sought from this department regarding the groundwater pump located on the hospital site and any geological features of relevance within the vicinity of the pump. Borelogs were obtained and are included in Appendix F.

### Mapland, Department of Environment & Natural Resources

Aerial photographs from 1949 were examined to confirm or clarify anecdotal evidence. The photos revealed:

when buildings and other structures were built or destroyed

A. 1. 26.25

- areas of the hospital that have been used for farming purposes in the past
- history of adjacent land use.

For details, refer below to Section 5.2.6.

Department for Industrial Affairs

A plan drawing showing the locations of the leaded and unleaded petrol storage tanks was obtained.

### 5.2.5 History of Ownership

The history of ownership below relates to both sections 855 and proposed Lot 103.

- Prior to 1898, various cereal crop and grazing farmers occupied the land. They included Edward Meade Baggot in 1876 and Hart & Walters in 1881 (based on anecdotal evidence as outlined in Section 5.2.4).
- 30 June 1898, the site was transferred to Johnny Williams of Daisy Hills near Oakbank farms.
  - 26 May 1917, the title was transferred to Sarah Hannah Williams and William McEwen of Adelaide Auctioneers.
- 9 June 1917, the title was transferred to William Alfred Augustus West of Adelaide, then on the same day transferred to the Crown (State Government) when the land was dedicated for "Nonthfield Mental Hospital".
- The land is still classified as Crown Land.

### Title Reference

Copies of two Certificates of Title have been obtained from the Lands Title Office and are contained in Appendix E. They are:

1

• Certificate of Title, Volume 637 Folio 7

•

• Certificate of Title, Volume 637 Folio 8.

Both Certificates were cancelled on 9 June 1917 when the land became the property of the Crown (South Australian State Government). There is no current Certificate of Title.

### 5.2.6 Aerial Photography Examined

Aerial photographs of the Hillcrest Hospital site taken over the following years were examined:

 $\{ (x_i,y_i) \} \in \{ (x_i,y_i) \}$ 

a manifest a contract a contract of

. they are in

•	10 January, 1949	- Survey 7
•	3 January, 1959	- Survey 326
•	13 April, 1965	- Survey 811
•	1 April, 1969	- Survey 1157
•	20 June, 1975	- Survey 1833
•	13 January, 1980	- Survey 2651
•	18 February, 1985	- Survey 3220
•	28 September, 1989	- Survey 4108
•	25 February, 1992	- Survey 4499
•	19 September, 1993	- Survey 4704

A summary is given of the features noted in each photograph.

#### 10 January, 1949

Wards 1, 2, 3, 4, 5, 6, 7 and the administration building had been built. Covered walkways connecting these buildings had also been built.

.. ......

- The Hospital Paddock was used for growing some kind of crop. The stormwater outlet through the paddock was more towards Fosters Road, to the west of Ward 3.
- Extensive market gardening was also carried out on the rest of the property. The entire area west of Wards 3, 1 and 5 up to Fosters Road contained many small plots of different crops. Land that is now occupied by the top section of Ward 10 and the garage/garden compound was used as an orchard.
- The sports oval could be seen.
- Surrounding land to the south of the hospital site appeared to be vacant. Land to the north, east and west of the site was used for agricultural purposes (crops).
- Section 855 was used for agricultural purposes, but really just an extension of the hospital paddock.

### 3 January, 1959

GILLES PLAINS. SA

• Wards 8, 9 and 10 had been built. The groundwater pump to the east of Ward 8 was also in place. The covered walkway had been extended to Ward 8.

RUST PPK Pty Ltd

- The Hospital Paddock was still used for agricultural cropping purposes. The stormwater drainage through the paddock had now moved to a position adjacent to Ward 3, with the water flowing in a north-easterly direction.
- An orchard existed on the northern side of Ward 3. The area of land to the west of Wards 3, 1 and 5 used for market gardening had shrunk, with no gardening plots in the immediate vicinity of wards. An orchard was apparent between Wards 2 and 10 and extended on to the southern side of Ward 10. An orchard was also apparent on the southern side of Ward 6, extending to the southern boundary, and up to the covered walkway. Crops of some kind had also been planted to the immediate east of Ward 8.
- Surrounding land use was markedly agricultural, but land to the south remained vacant. ETSA had begun its operations on the opposite side of Fosters Road, adjacent to the Hospital Paddock.

# 13 April, 1965

\* 12 .

- The Boiler House had been built. SACON workshops had appeared. The Occupational Therapy building had been built as had three small sheds to the east of Ward 2. Barnett House, a hospital residence had been built.
- The Hospital Paddock was used for agricultural purposes (cropping) with stormwater travelling its current course through the property, but coming to rest in a dam on the opposite side of Grand Junction Road rather than joining a creek further north as it does today.
- The extent or market gardening had been reduced, with what appears to be orchards to the west of Ward 1, the north of Ward 3, between Wards 2 and 10, and between Wards 10 and 6. The orchard to the south of Ward 2 seems to be declining, with the number of trees fewer than before.
- The oval in all previous photographs and in this one, was smaller in size than it is currently, and a roundabout existed at its northern end, with a two-way bitumen road only on its southern side.
- The Department of Agriculture had constructed a building and carpark on the opposite side of Fosters Road, adjacent to the oval.

### 1 April, 1969

- The Industrial Therapy (IT) Workshop had been built.
- Building of the Intellectual Disability Service Council (IDSC) Strathmont Centre had commenced.

The flow of stormwater through the Hospital Paddock joined the creek on the opposite side of Grand Junction Road as it does today.

**RUST PPK Pty Ltd** 

• All market gardening, except for a small area on the western side of Ward 1 seemed to be declining.

### 20 June, 1975

- Section 855 had two sheds built on it, as well as a small building all on the eastern side of the section. Bitumen appeared to be laid around these structures.
- Leitchfield House had been built, and the land immediately east appeared to glisten, probably because bitumen for the carpark had just been laid. The Linen Sorting building had also been built.
- The new Psychogeriatric Ward had been built (however this is not part of the site we are reviewing).
- Building of the garage/garden compound had begun, with one small shed in place. This area did look as though it had been filled, since the earth was quite bare.

### 13 January, 1980

- Foundations for Mason House were being laid (however this is not part of the site we are reviewing).
- The garage/garden compound had been completed.
- The sheds on Section 855 had been moved east, so that were no longer built on the section.
- Land to the north of Ward 3 looked bare, implying burial of waste has occurred (confirming anecdotal evidence).

### 18 February, 1985

- Market gardening was confined to the area between the Linen Sorting building and Barnett House on Fosters Road. Mason House had been completed.
- Bare patches of earth running from the northern side of Ward 3, along the Hospital Paddock fence line towards Fosters Road were apparent. This suggests that some burial may have occurred and would explain the anecdotal evidence received relating to subsidence in the area.
- Some building had commenced on the opposite side of Grand Junction Road.

# 28 September, 1989

- James Nash House had been built.
- The Repatriation Ward, Ward 7 had been demolished.
- Site of the former market garden between Barnet House residence and the James Nash carpark, appeared bare suggesting burial had taken place which would explain the anecdotal evidence received relating to subsidence in the area.
- The overhead diesel storage facility on Section 855 was in place as was the carpark. The fire station, north of Section 855 had also been built.
- Numerous small experimental agricultural plots had been established by the Department of Agriculture on the western side of Posters Road.

### 25 February, 1992

- The Telecom Radio Tower had been built south of the groundwater pump.
- Wards 2 and 3 had been demolished.

### 19 September, 1993

- Ward 9 had been demolished.
- The rubbish heap photographed (Photograph No. 13) in James Nash House was clearly visible.

4.6

Site of the former market garden between Barnet House residence and James Nash carpark appeared to be recovering (i.e. grass growing back over bare earth).

# 5.3 Maps Detailing Historical Uses

Maps detailing historical use of land are given in Appendix G. They are:

- Drawing 27F306A/02/O possible areas contaminated with coke ash.
- Drawing 27F306A/03/O areas of suspected burial of building rubble.
- Drawing 27F306A/04/O external underground pipework insulated with materials which may contain asbestos.
- Drawing 27F306A/05/O areas of potential contamination from miscellaneous sources.
- Drawing 27F306A/06/O sites formerly occupied by market gardens or orchards.
- Drawing 27F306A/07/O sites of landscaping with unknown sources of fill.
- Drawing 27F306A/08/O geotechnical issues.

Information presented in these drawings is discussed in detail in Section 6.

Department of Environment & Natural Resources

100

# 5.4 History of Adjacent Land Use

REPORT OF POTENTIAL ENVRONMENTAL ISSUES AND

TESTING AT HILLCREST HOSPITAL FOSTERS ROAD.

GILLES PLAINS SA

Aerial photography has been examined, dating from 1949 to the present.

- In 1949 land to the north, east and west of the investigated site, was used for agricultural cropping activity. Land to the south appeared to be vacant.
- By 1959, ETSA transmission towers had been built opposite the hospital paddock at the intersection of Fosters Road and Grand Junction Road. Apart from this change the adjacent land use remained as it was in 1949.
- By 1965 the Department of Agriculture had constructed a large building and associated carpark roughly opposite the hospital oval on the western side of Fosters Road.
- By 1970 noticeable agricultural activity was in progress to the south of the hospital. The aerial photo showed evidence of some cultivation and 5 sheds had been erected suggesting chemical storage or animal farming.

Construction of the IDSC Strathmont Training Centre to the east of the hospital had also begun by 1970.

• By 1989 a womens rehabilitation centre had been built north of the hospital paddock on the northern side of Grand Junction Road. North of Section 855 a fire station had also been built.

The Department of Agriculture had established many small experimental cropping plots south of the ETSA transmission towers.

In the last year, residential development has begun on the southerm and south-eastern sides of the property.

a state and the state

Department of Environment & Natural Resources

PK Ptv Ltd

# 6. Summary of Potentially Contaminated Areas

## 6.1 General

GILLES PLAINS, SA

The sources of contamination and related potential liabilities encountered during the investigation of this site fell into the following categories:

- Areas possibly contaminated with coke ash."
- Areas where suspected burial of building rubble has occurred.
- An external underground pipe network insulated with materials which may contain asbestos.
- Areas of potential contamination from miscellaneous sources.
- Sites formerly occupied by market gardens or orchards.
- Sites of landscaping with unknown sources of fill.
- Related geotechnical issues.

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PRELIMINARY

-āz

TESTING AT HILLCREST HOSPITAL FOSTERS ROAD

Each of the above types of contamination or related potential liability, is perceived as posing a potential risk to future redevelopment of the site - either through the impact on the health of future occupants or through the impeding effects on future building development.

# 6.2 Areas Possibly Contaminated with Coke Ash

Prior to 1961, hospital wards and other major buildings contained individual boilers for the purpose of heating. Then in 1961 Central Boilers were installed which supplied heating steam to all buildings.

Until 1975, a solid fuel, coke was used to fire the boilers. The incomplete product of combustion, coke ash was used in different areas for the purpose of landscaping, as a source of landfill or for creating pathways.

Coke ash contains Polycyclic Aromatic Hydrocarbons (PAHs) some of which are suspected to be carcinogenic.

Areas where coke ash has been buried can't be identified visually, since areas were covered with top soil and grassed, leaving no evidence.

Drawing 27F306A/02/O in Appendix G shows areas where burial of coke ash is suspected, based on anecdotal evidence.

# 6.3 Areas Where Burial of Building Rubble Has Occurred

Building rubble buried around the hospital includes:

- the foundations of former buildings which have been reworked into the soil after demolition; and
- foreign sources of building salvage, in which case burial has been a means of disposal.

This type of contaminant implies building limitations, as far as earth works and future subsidence are concerned. Soil subsidence has been reported to have occurred in two buried disposal areas.

Areas containing building salvage may also be chemically contaminated in cases where bitumen rubble (possibly containing PAHs) was used as landfill or where asbestos insulation is included in the building rubble. Asbestos fibres, when inhaled increase the risk of particular respiratory diseases which may be terminal.

Drawing 27F306A/03/O in Appendix G shows areas where suspected burial of building rubble has occurred, based on anecdotal evidence, some of which has been confirmed by aerial photography.

# 6.4 An External Underground Pipework Insulated With Material Which May Contain Asbestos

When the Central Boiler House was installed in 1961, an underground network of steam and return condensate pipes which linked the major buildings to the Boiler House was also established. These pipes are insulated with a material which is likely to contain asbestos.

These pipes are most likely not laid in trenches, but are buried under soil and gravel. There is no evidence to suggest that these steam and condensate pipes which are now redundant, have been removed.

Drawing 27F306A/04/O in Appendix G shows the external underground pipework insulated with material which may contain asbestos.

### 6.5

# 5 Underground Fuel Storage Tanks

7.0

An estimated four in total underground fuel storage tanks are present on the site. There are two locations. Possible sources of contamination at these locations are as follows:

- Leakage of diesel into the soil via surface spillage or underground storage tank, located in the garage/garden complex. Diesel contains Total Petroleum Hydrocarbons (TPHs) and PAH, both of which may be harmful to human health.
- Leakage of leaded and unleaded petrol into the soil via an estimated three underground storage tanks, located west of the mortuary. Both leaded and unleaded petrol contain TPHs and monocyclic aromatic hydrocarbons (MAH) in particular benzene, toluene, ethyl benzene and xylene (BTEX group). In addition leaded petrol contains lead. Each of these substances may be harmful to human health.

# 6.6 Sites Formerly Occupied by Market Gardens or Orchards

The hospital grounds were used extensively for market gardening and orchards in the past. Aerial photography was used to determine which areas on the hospital were and when. This information is shown on Drawing 27F306A/06/O.

' PPK Ptv LLd

Possible chemical contaminants associated with these activities include organochlorine contained in some pesticides used prior to the 1960s and copper sulfate used on orchards in the past.

**RUST PPK Pty Ltd** 

The Hospital Paddock at the northern end of the property has been used for cropping purposes since at least 1949. Prior to the 1960s organochlorine pesticides may have been used, but they probably haven't been used since the late 1960s.

# 6.7 Areas of Landscaping with Unknown Sources of Fill

The category of areas were noted during the site inspection as being "raised" areas, however there is no information regarding the landscaping medium or the landfill.

Drawing 27F306A/07/O in Appendix G shows areas of landscaping with unknown sources of fill.

# 6.8 Areas of Potential Contamination from Miscellaneous Sources

This category of contamination covers smaller, more confined types of contamination, such as:

- Spot treatment for white ants, black ants and bull ants (pesticides used in the past contain organochlorines which are toxic and break down very slowly).
- The site of a former substation which may have contained Polychlorinated Biphenyls (PCBs) in its transformer oil. The transformer oil could have leaked into the soil.
- Buried bituminised areas. Bitumen older than about 15 years may contain PAHs. Bituminised areas that have been covered over, may pose difficulty to future earthworks.

Drawing 27F306A/05/O in Appendix G gives the locations of these smaller areas of possible contamination.

### 6.9

# Other Sources of Possible Contamination

- Additives may have been added to boiler feed water to prevent scaling and limit maintenance problems arising from poor water quality. Some such additives if used in the past may have been toxic, hence leakage through condensate return pipes into the soil structure may have caused slight contamination.
- Most bitumen roads on the site are older than 15 years and possibly may contain PAHs.

26

# 7. Other Potential Liabilities

# 7.1 Telecom Radio Tower

# 7.1.1 Summary

( )

Extensive enquiries were made to determine the possible need to specify a separation distance between residential housing and the Telecom radio tower installation on the site. This installation was constructed approximately 2 years ago for the purpose of receiving and transmitting mobile radio signals. The installation comprises a brick building with towers on top and a small wire mesh fenced enclosure.

In the end, the enquiries indicated that the separation distance is likely to be governed almost as much by visual, planning and access considerations as by any environmental requirement for a buffer distance separation. However, for reasons discussed below, it is recommended that prudence be applied, and that a separation distance be specified. At present we are unable to make a firm recommendation on distance, however we would suggest that 5-10 metres may be sufficient, subject to further investigation, and subject also to knowledge of the height of the adjacent residential buildings.

### 7.1.2 Radio Frequency Radiation

Maximum exposure levels of radio-frequency radiation are specified in Australian Standard A S2772.1-1990. This standard is in compliance with international standards which recognise the potential health effects of excessive radiation. The office of the Environment Protection Authority (EPA) advised that, based on information provided to them by operators of mobile telephone towers, it was expected that radiation levels would be much lower than those specified in the standard. It was also pointed out that Commonwealth, rather than State, legislation applies to these operators. At the suggestion of the EPA, enquiries were made with the Radiation Protection Branch of the South Australian Heath Commission. Advice was received that the radiation is not likely to be a hazard, however further enquiries could be made with the operators.

Advice from Telecom is that the Australian Standard radiation levels could be reached two metres in front of the disks, and possibly further away in the event of malfunctions. At ground level, the radiation intensity is orders of magnitude less than in the standard intensity. However Telecom would recommend a small but unspecified buffer, based on the doctrine of prudent avoidance.

### 7.1.3 Noise

The EPA is unaware of any potential noise emissions. Telecom confirms that noise emissions will be minimal, resulting only from the operation of dual 1.5 KW motors on airconditioning plant.

**RUST PPK Ptv 1 td** 

### 7.1.4 Other Factors

Telecom will require access for a mobile crane or cherry-picker for tower maintenance.

### 7.2 Groundwater Pumps

The groundwater pumps were installed some time between 1949 and 1959 on the lawned area east of Ward 8, and north of the Telecom Tower. The pumps are enclosed in a small brick building (refer to Drawing 27F306A/08/O in Appendix G).

Mr Howard Thiele, the present gardener and Mr Dave Palmer, a former maintenance employee at the hospital, believed that the pumps were installed due to water flooding the basement lift area in the administration building, and in the basement area of the psychogeriatric ward (which is built on piles) (see Drawing 27F306A/08/O). This apparently occurred during periods of heavy rain. Mr Frank Rogers, a former gardener at the hospital, believed the pumps were installed for the purpose of obtaining irrigation water. However the water brought to the surface proved unsuitable due to high salinity.

Shallow groundwater drawn by the pumps, joins other sources of stormwater and exits the site via the stormwater runoff behind Ward 6, Anderson House (see Drawing 27F306A/01/O). There is a small possibility that the groundwater is contaminated with PAHs (Polycyclic Aromatic Hydrocarbons), since the burial of coke ash may have occurred in the past in the nearby "Square Acre".

Maintenance of the pumps is now the responsibility of the Glenside/Hillcrest Building Services Department located at Glenside Hospital. Mr Wayne Ashton of the Building Services Department, is concerned that if the pumps are destroyed during redevelopment, the basement of the psychogeriatric ward may flood.

The pumps operate automatically employing a float mechanism and require regular maintenance checks, especially after periods of heavy rain, when mechanical parts may become blocked with mud.

The pumps were replaced in 1993.

1.1

N.

This drainage well and associated pumping is not registered with the Department of Mines and Energy. It is a legal requirement that any well sunk deeper than 2.5 m be declared. The depth of this well has not been ascertained. The depth should be checked and if it is deeper than 2.5 m, a permit is required and can be obtained from Ms Christal Neuhofer at the Department of Environment and Natural Resources.

In light of verbal evidence received, indicating the possible presence of shallow groundwater - it is recommended that the sump pump be retained and that access be kept available for maintenance requirements.

**PPK Pty Ltd** 

# 7.3 Uncompacted Soil

Areas where building rubble is suspected to have been buried or areas of landscaping with unknown sources of fill are potentially sites where soil subsidence may occur. These areas are discussed in Sections 6.3 and 6.7. Site plans detailing these area can be found in Appendix G. They are:

- 27F306A/03/O
- 27F306A/07/O
- 27F306A/08/O.

JST PPK Pty Ltd

ب بنين .

# 8. Testing

# 8.1 Drilling and Soil Sampling Methodology

A qualified geotechnical engineer and a qualified chemical engineer from the Adelaide office of RUST PPK supervised the drilling work and recovery of the soil samples for testing and geotechnical logging. Soil sampling was restricted to Section 872.

Details of sampling locations and depths are provided below in Sections 8.2 and 8.3 of this report. Sampling locations are shown on the site plans contained in Appendix H. In summary, there were a total of thirteen sampling locations. Borehole depths ranged from one to two metres at the sample locations 1B to 9B inclusive. Sample depths at locations 10D to 13D inclusive were 150 mm.

Borehole cores from bore hole locations 1B to 9B were recovered using truck mounted hydraulic push tube equipment. At each borehole location, duplicate borehole cores were recovered, one for sampling and one retained for geotechnical logging. To avoid cross-contamination, all push tubes were steam cleaned between sample locations. On completion of drilling activities, all soil from borehole cores was removed from the site and holes were backfilled with a clean source of fill.

Samples from locations 10D to 13D inclusive were extracted by hand using a hammer and dig stick. Three to four 150 mm depth sub-samples were taken from each location and thoroughly mixed, to ensure that enough soil was received for sampling.

Immediately after extraction, the first borehole core recovered from the sample locations 1B to 9B inclusive was sub-sampled for laboratory chemical analysis. The core was placed in a steam cleaned core tray and sub samples extracted were thoroughly representative of discrete nominated depth intervals. Details of these depth intervals for individual samples are included in the Field Work and Sample Details in Appendix I.

Soil samples to be forwarded to the laboratory'were given unique sample numbers which are also included in Appendix I together with further details of field work carried out including date, the identification of sampling personnel and the actual soil strata depth for individual samples.

For each of the soil sub-samples forwarded to the laboratory, sample preservation techniques were employed to ensure that there was no deterioration of the samples, such as by volatilisation of contaminants, between sampling and analysis. Sample jars prior to and after sampling were maintained at approximately 4°C by use of polystyrene insulated containers and frozen "cooler" bricks. Sample containers were glass. A teflon disk inserted inside the container lid provides a gas tight seal and also ensures prevention of contamination from the plastic lid.

All samples taken were forwarded to the laboratory. The samples were received by the analytical laboratory within 24 hours of sampling by RUST PPK. The laboratory advises that on arrival the samples were placed in cool storage at 4°C.

Documentation regarding samples despatched to the laboratory and chemical testing required are included on the sample submission forms. These documents formed a chain of custody

1. 199

record between RUST PPK and the laboratory. On receipt of the samples, the laboratory confirmed their arrival to RUST PPK.

· · ·

The second borehole core recovered at each location was placed in a core tray which had been previously steam cleaned. On completion of the field work, all intact borehole cores in core trays were forwarded to RUST PPKs Adelaide office.

Upon arrival, geotechnical logs were completed in accordance with AS1726 Geotechnical Site Investigation Code. The borehole logs and explanatory notes are contained in Appendix J. Soil cores were retained for one month at 24°C, although the cores tend to dry out and high vapour pressure (low boiling point) contaminants may volatilise during storage.

# 8.2 Sampling Locations

An underground services detector was used to ensure that services including power, water, sewer, stormwater, telephone and gas were avoided.

Sampling locations are shown on the Site Plans, in Appendix H. The sampling locations have been referenced to buildings which it is understood will not be demolished under the current proposal for future redevelopment of the site.

The sampling locations in this testing program were located in the following areas:

- East of Litchfield House. Six borehole locations, (numbers 1B to 6B inclusive) were established with approximately 20 metre spacings on an approximately triangular grid pattern. Borehole locations 1B to 3B inclusive were taken through a bituminised surface, approximately 75 m east from the eastern facing wall of Litchfield House. Borehole locations 4B to 6B inclusive were taken through lawned areas approximately 60 m east from the eastern facing wall of Litchfield House. (See Drawing number 27F358A/10/O in Appendix H). This area was reported as being used for the burial of coke ash and building rubble, and prior to that a market garden existed in the vicinity of borehole locations 1B, 5B and 6B.
- Borehole location 7B was on the lawned area south of the Industrial Therapy Building, approximately 127 m east from the eastern facing wall of Litchfield House. (See Drawing 27F358A/10/O in Appendix H.) This area was reported as being used for the burial of coke ash, and prior to that a market garden existed in this location.
- Borehole location 8B was approximately 41 m south and 70 m east from the south western corner of the old mortuary building. (See Drawing 27F358A/11/O in Appendix H). This area was reported as being used for the burial of coke ash.
- Borehole location 9B was approximately 33 m south and 46 m east from the south eastern corner of the Administration Building, in the lawned area known as Square Acre. (See Drawing 27F358A/12/O in Appendix H). This area was reported as being used for the burial of coke ash.
- Location numbers 10D and 11D where samples were extracted by hand with a digstick and hammer, were located approximately 116 m south from the south eastern corner of the Administration Building. (See Drawing 27F358A/12/O in Appendix H).

TESTING AT HILLCREST HOSPITAL, FOSTERS ROAD, GILLES PLAINS, SA HUSI PPK PTY LID

- 22

,

This area was suspected of being used as a former orchard. Coke ash may also have been used as a fertiliser.

• Location numbers 12D and 13D where samples were also extracted by hand with a dig-stick and hammer, were located in the area known as the Hospital Paddock. Location 12D was in the centre of the paddock and the location 13D was on the western side of the storm water runoff area passing through the field, which was dry on the day of sampling. (See drawing 27F358A/13/O in Appendix H). The Hospital Paddock is a cropping area.

# 8.3 Sample Depths

Anecdotal evidence had been received relating to landscaping or filling activities in the vicinity of borehole locations B1 to B9 inclusive. In all cases the depth of contamination was unknown. For this reason it was envisaged that boreholes would be dug to a depth of 1 m, the core examined for signs of contamination and if contamination was visually apparent at a depth of 1 m below the surface, further drilling would be carried out to determine the depth of contamination.

Boreholes 1B to 3B inclusive were to be dug to a depth of 1 m after the 50 mm thick layer of bitumen at the surface had been removed.

At each of the locations B1 to B9 inclusive, samples were taken of one or two different soil strata based on visual examination for the presence of contaminants.

The depth of samples taken from locations 10D to 13D inclusive was fully representative of the depth range 0 to 150 mm.

Following inspection of the borehole cores, a total of 16 samples were selected for laboratory analysis, as specified in Appendix I. These samples comprised the following:

- One sample from each of the borehole cores obtained from locations 1B to 9B inclusive, based on visual inspection of the borehole cores for strata containing flecks of what appeared to be coke ash.
- An additional sample was taken from the borehole core at location 7B. 300 mm of soil strata below the strata containing flecks of what appeared to be coke ash was also sampled.
- An additional sample was also taken from the borehole core at the location 9B. 350 mm of soil strata above the soil strata containing flecks of coke ash, was found to contain bitumen and was hence also sampled.
- A composite sample made by combining equal volumes of samples obtained from locations 1B and 6B, then mixing these thoroughly. The samples from 1B and 6B were taken from the strata containing flecks of what appeared to be coke ash.
- A composite sample was made by combining equal volumes of samples obtained from locations 10D and 11D, then mixing these thoroughly.

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PRELIM NANT TESTING AT HILLCREST HOSPITAL, FOSTERS ROAD, GILLES PLAINS, SA

HUSI PPK Pty Ltd . . .

• A composite sample was made by combining equal volumes of samples obtained from locations 12D and 13D, then mixing these thoroughly.

# 8.4 Laboratory Used

Australian Laboratory Services 32 Shand Street Stafford Qld 4053

# 8.5 Analytes

### 8.5.1 Polycyclic Aromatic Hydrocarbons (PAH), Selected Heavy Metals and Arsenic

Mr Howard Thiele, the head gardener on the site and Mr Frank Rogers a former gardener on the site, gave anecdotal evidence relating to the locations where filling and landscaping activities had occurred on the site in the past. According to this anecdotal evidence, one of the fill materials used in the past was coke ash which originated from the Boiler House situated on the site.

Coke ash contains high PAH levels and may also contain heavy metals and arsenic. The heavy metals which were selected as analytes in this sampling program were lead, copper and zinc.

Sampling locations 1B to 9B inclusive on the site, were located in areas where filling or landscaping activities using coke ash, were reported to have occurred in the past by the above named. Hence a sample was taken from the strata which appeared to contain coke ash at each of these locations, and was tested for the presence of PAHs, selected heavy metals and arsenic. In all cases, small flecks of what appeared to be ash, within a matrix of soil characterised this strata which was sampled.

Coke ash may have been used as a fertiliser in the past on former market gardening, orchard, or crop growing areas. Hence samples obtained from locations 10D to 13D inclusive were tested for the presence of selected heavy metals and arsenic. A composite sample made up from samples obtained from locations 10D and 11D, in a former orchard area, was also tested for the presence of PAHs.

### 8.5.2 Organochlorine Pesticides

In the past organochlorine pesticides may have been used on areas used for farming purposes.

Based on aerial photography, areas which appeared to have been used as market gardens or orchards in the past could be identified. Sample locations 10D and 11D were on an area which, prior to 1965 appeared to be used as an orchard. Sample locations 12D and 13D were taken from the Hospital Paddock which since the early 1960s has been used for growing \_ cereal crops, and prior to then was most likely used as a market garden. Hence a composite sample from locations 10D and 11D and another composite sample from locations 12D and 13D were tested for organochlorine pesticides.

.1

-t.

<u>,</u>

÷ ••

Based on aerial photography the area in the vicinity of sample locations 1B, 5B and 6B may have been used as an orchard area prior to 1965 and before any filling activity occurred. A composite sample from locations 1B and 6B was taken and tested for organochlorine pesticides.

The area in the vicinity of location 7B was used as a market garden prior to 1959 and before any filling activity had occurred. Hence the 300 mm of strata below the strata containing coke ash was sampled and tested for organochlorine pesticides.

Department of Environment & Natural Resources

٠.

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PRELIMINARY TESTING AT HALLCREST HOSPITAL, FOSTERS ROAD, Street Status, SA

11

# 9. **Results**

1

Laboratory analytical reports are contained in Appendix K of this report. The analytical results received have been compared to readily available criteria for further investigation and are summarised in Table 1 below.

All the samples tested for polycyclic aromatic hydrocarbons (PAH's) and organochlorine pesticides, returned results which were below the laboratory reporting limits and were also below the concentrations for further investigation.

All the samples tested for selected heavy metals and arsenic returned results which were above the laboratory reporting limits but below the concentrations for further investigation.

# TABLE 1Range of Results Obtained

Analytes	Number of Samples	Range of Actual Results	Further Investigation	Source
	Tested	(mg/kg)	Limit (mg/kg)	
Polycyclic Aromatic Hydrocarbons (PAH)	11	2017 - 2017 1	- 	
Naphthalene		<0.5	5	2
2-Methylnaphthalene		<0.5		
2-Chloronaphthalene	. i	<0.5		
Acenaphthylene		<0.5		
Acenaphthene		<0.5		
Fluorene		<0.5		
Phenanthrene		<0.5	10.	2
Anthracene		<0.5	10	2
Fluoranthene		<0.5	10	2
Рутепе		<0.5	10	2
N-2-Fluorenylacetamide		<0.5		
Benz(a)anthracene		< 0.5		
Chrysene		<0.5		
Benzo(b) & (k)fluoranthene		<1		
7.12-Dimethylbenz(a)anthracene		<0.5	4 - C	
Benzo(a)pyrene		<0.5	1	1
3-Methylcholanthrene		<0.5		
Indeno(1.2.3-cd)pyrene		<0.5		
Dibenz(a,h)anthracene		<0.5		
Benzo(g.h.i)perylene		<0.5		
Organochlorine Pesticide (OCP)	4			
alpha-BHC		<0.05	0.5	3
beta- & gamma-BHC		<0.1	0.5	3
delta-BHC		<0.05	0.5	3
Heptachlor		< 0.05	0.5	3
Aldrin		<0.05	0.5	3
Hentachlor enoxide		<0.05	05	2
Fodosulfan 1		<0.05	0.5	2
4 4'-DDE		<0.05	0.5	2
Dieldrin		<0.05	0.2	2
-Postrin		-0 M	04	2
Endosulfan 2		<0.05	05	2
44'DDD		<0.05	05	2
Endrin aldehyde		×0.02	20	2
Endoculfan sulfate		<0.05	0.5	3
4.4'-DDT		<0.2	0.5	3
Theorem Maria la	14			
Come	14	7.26	100	
		1-30	100	
		8-03	300	
<u> </u>		14-124	UUC	1
Arsenic	14	2-10	100	1

Information Sources:

L

- 1. SAHC (1993). A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in South Australia, Public & Environmental Health Service, South Australian Health Commission, Adelaide.
- 2. ANZECC (1992). Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council, Canberra.
- 3. Dutch B Criteria for Contaminants in Soils (Parther Investigation Levels).

Department of Environment & Natural Resources

36

# 10. Discussion of Results

The results received indicated that contaminant levels fall below further investigation limits for the depth ranges sampled, at locations on the site tested.

### Coke Ash

. . ·

1

In all samples of soil strata containing flecks of what appeared to be coke ash, concentrations of polycyclic aromatic hydrocarbons (PAHs), selected heavy metal and arsenic were below guideline values for further investigation. These samples were generally taken from strata visually assessed to contain what appeared to be traces of coke ash, from each of the borehole cores recovered at locations 1B to 9B and a composite from locations 10D and 11D.

Six of the samples (locations 1B to 6B) were taken in an area east of Litchfield House in an approximately triangular grid pattern with approximately 20 metre spacings between sampling locations. While this was an area where substantial coke ash disposal had been reported, this was not confirmed by chemical analysis.

Similarly no chemical evidence of substantial ash disposal was found in a total of five samples taken from the following locations:

- a single sample from the lawned area south of the Industrial Therapy Building (location 7B);
- a single sample from the lawned area south of the Boiler House (location 8B);
- two samples from different soil strata at a single location in the "Square Acre" south-east of the Administration Building;
- a single composite taken from the suspected former orchard area in the south-east corner of the site.

### Pesticides

In the four samples tested for organochlorine pesticides, concentrations were lower than guideline values for further investigation. The four samples included:

- Two composite samples representative of the depth range 0-150 mm from the surface. One sample was made by combining sub-samples from locations 10D and 11D, a former suspected orchard area in the south-eastern corner of the site. The other sample was made by combining sub-samples from locations 12D and 13D, in a cropping area in the Hospital Paddock at the northern end of the site.
- One sample taken from strata underlying fill material, representative of the depth range 0.4-0.7 m a suspected former market garden area in the lawned area south of the Industrial Therapy Building (location 7B).

• A composite sample combined from sub-samples of strata identified as fill at locations 1B and 6B, a former suspected market garden area east of Litchfield House. The sub-sample from location 1B was representative of the depth range 0.2-0.35 m and the sub-sample from location 6B was representative of the depth range 0.3-0.45 m.

### Rubble Burial

No evidence of buried rubble was found in six boreholes drilled down to natural soil in locations on an approximately 20 metre triangular grid east of Litchfield House. The fill depth ranged from 0.3 to 0.7 metres.

While rubble was not located, it is probable that rubble is located elsewhere within the large area identified from anecdotal information as being used for the burial of building rubble in the past.

Some brick fragments and bitumen were apparent in the bore core recovered from location 9 in the area known as Square Acre. Bitumen was particularly concentrated at a depth range of 0.45-0.75 m at this location. Burial of building rubble had not been reported in this area.

### General

None of the eighteen samples tested revealed evidence of unacceptable contamination. These results are based on a limited preliminary sampling and testing program and will assist with the design of a more comprehensive soil testing program for the site. REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PREJIMINARY TESTING AT HILLCREST HOSPITAL FOSTERS ROAD. GILLES PLAINS, SA

 $\frac{1}{si}$ 

# 11. Trial Backhoe Excavation of Buried Building Rubble

# 11.1 Methodology

In an area of the site where rubble burial was suspected, backhoe excavation was carried out to determine the depth and physical nature of the buried rubble. Observations were to be made of possible contaminants in the rubble including asbestos, bitumen and metals.

An area chosen for investigation was based on the anecdotal evidence that large pieces of concrete had been buried. The depth of the area excavated was not to exceed 1.5 m due to safety considerations. Details of the area sampled and the sample depth are given below in Sections 11.2 and 11.3 respectively.

The excavated soil and cavity were inspected for signs of contamination and to determine the depth of any buried rubble. Photographs were also taken.

The excavated material was then returned to the cavity and the area was compacted as far as practicable by driving the backhoe over it many times.

The backhoe is shown in photograph 1 contained in Appendix M. A 0.3 metre wide bucket was used.

# 11.2 Location of Excavation Area

An area of approximately 3 m x 5 m was excavated. This was located approximately 7.2 m south of the fenceline, which separates the Hospital Paddock from the remainder of the site.

Drawing 27F358A/14/O contained in Appendix L shows the location of this area more clearly. An underground services detector was used to ensure that services including power, water, sewer, stormwater, telephone and gas were avoided.

This area was chosen for trial excavation because anecdotal evidence relating to burial activity on the site had been received and also because of the low probability of encountering underground services.

### 11.3 Depth of Excavation

Soil and building rubble were excavated to a depth of approximately 1.5 m, however a large piece of concrete having a volume of at least 0.2 m<sup>3</sup> was encountered at a depth of 1.2 m.

This piece of concrete could not be broken by the backhoe, however the backhoe continued to dig to one side of the concrete piece in an attempt to ascertain its size. Hence in this way the maximum depth in the excavation area was 1.7 m.

Department of Environment & Natural Resources



# 11.4 Anecdotal Evidence

According to Mr Frank Rogers a former gardener on the site, up to approximately 50 trenches running north-south each approximately 3.5 m deep and 1 m wide were dug on land to the north of the former Ward 3 and filled with large concrete pieces. The area over which this activity is thought to have occurred is shown more clearly on drawing 27F306A/03/O in Appendix G.

The location described in Section 11.2 was chosen for trial excavation based on the above anecdotal information. Hence it was decided to excavate across the chosen site in an east-west direction to maximise the probability of encountering the reported building rubble.

# 11.5 Results of Trial Excavation

The area was excavated to a depth of between 1.2 and 1.7 m. Large pieces of concrete were visible in the excavation soil as well as a small quantity of steel reinforcement rods and old bricks. No bitumen, or materials containing asbestos were observed.

Photographs 1 to 4 contained in Appendix M show examples of the large pieces of concrete in the excavation soil. The backhoe in some cases broke up pieces of concrete before removing them so that the concrete contained in the excavation material, may be smaller in size than that which exists below the surface.

Photograph 3 shows the largest piece of concrete encountered during the trial excavation which the backhoe could not remove. Its volume was approximated as at least 0.2 m<sup>3</sup>.

The trial excavation confirmed anecdotal evidence received relating to the burial of large concrete pieces buried in trenches running north-south. By examination of the surface it was apparent that grass appeared to be growing well in distinct rows running north-south. It was found that these areas had been filled with building rubble and covered over with a thin layer of imported topsoil. The rows of greener grass running north-south are shown in photograph 4. It can also be seen from photograph 4, that a large area of very lush grass exists to the west of the excavation area. This may possibly be the location of a large burial pit.

REPORT OF POTENTIAL ENVIRONMENTAL ISSUES AND PRELIMINARY TESTING AT HILLCREST HOSPITAL FOSTERS ROAD. GILLES PLAINS, SA

# 12. Statement of Limitations

The principal purpose of this investigation and report has been to assess the physical characteristics of the site with respect to the presence or absence in the environment of hazardous materials, substances, contaminants or pollutants, as defined in applicable State and Commonwealth environmental legislation. The precise scope of work is detailed in this report, and was agreed with the Department of Environment and Natural Resources, recognising time and budgetary constraints.

RUST PPK Pty Ltd derived the data in this report primarily from visual inspections, examinations of readily - available records, interviews with individuals with knowledge of the site. Whilst to the best of our knowledge the information contained in this report is accurate at the date of issue, subsurface conditions, including contaminant extent and concentrations, can change with time. This should be recognised if the report is used after a protracted delay, such that further investigation of the site may be necessary.

In preparing this report, RUST PPK Pty Ltd has relied upon and presumed accurate certain information provided by the Client or third parties. Unless otherwise stated in the report, RUST PPK Pty Ltd has not attempted to verify the accuracy or completeness of any such information.

There are always some variations in subsurface conditions across a site which cannot be fully defined by investigation. Hence it is unlikely that the specific information presented in this report will represent the extremes of conditions that exist within the site.

RUST PPK Pty Ltd have prepared this report for the Department of Environment and Natural Resources, in accordance with generally accepted consulting practice and the RUST PPK Pty Ltd Terms of Business. No other warranty, express or implied, is made as to the professional advice included in this report. This report has not been prepared for use by parties other than the Department of Environment and Natural Resources. It may not contain sufficient information for purposes of other parties or for other uses.

# Appendix A

۴r

L.

. . . . . .

# Locality Map - Hillcrest Hospital

.

•



HILLOREST HOSPITAL Location Map

**RUST PPK Pty Ltd** it y
## Appendix B

HAR CAR

:::::

5

ſ

A CONTRACTOR

्ये

÷.

Site Plan, October 1994 Site Plan, 1988

- Faith

.....



. .

. .

1

.....



HILLCREST HOSPITAL Site Plan, 1988









**RUST PPK Pty Ltd** 

Photo 1: "Square Acre" (looking west towards the chapel and Ward 4) is possibly landscaped with coke ash



Photo 1a: Lawns to the south of the industrial Therapy (IT) Workshop are possibly landscaped with coke ash



Photo 2: The Central Boiler House. Lawns to the south of the Boiler House are possibly landscaped with coke ash



: 7

. :

Photo 3: Western wall of Boiler House/Incinerator building. Shows concrete bunding around an old oil storage area. The incinerator may have been oil fired



1

5-74

اجتير

**RUST PPK Pty Ltd** 

Photo 5: Diesel bowser and underground fuel storage tank on the eastern side of the Garage/Garden complex



Photo 6: Old batteries and service oil stored outside against the western wall of the vehicle maintenance shed



Photo 7: Area previously occupied by old substation may have contained PCB's in the transformer oil



Photo 8: Lawn on the southern side of Hall. Old carpark, possibly bitumen, may be buried underneath



<u>ب</u>\_1

Photo 9: Possible location of white ant treatment at the northern edge of "Square Acre"



Photo 10: Site which was occupied by Ward 3. An old bitumen pathway remains, possibly contaminated with PAH's



Photo 11: Building rubble is understood to have been used as landfill in this area which lies to the north of Ward 3 (now demolished)



Photo 12: Looking west between Section 100 and the hospital paddock. Soil subsidence has occurred in this area due to the burial of building salvage over 10 years ago



.

Photo 13: Waste heap to the east of Section 100, near the hospital paddock. Contains large slabs of concrete and bitumen



Photo 14: The Mortuary, now a paint workshop is Heritage Listed



Photo 15: Stormwater drainage from behind Ward 6 on castern side of property



Photo 16: Overhead diesel storage tank located on western side of section 855



{

...

57

3

Photo 17: Local spillage onto bare earth from overhead storage tank, Section 855

RUST



Photo 18: Waste heap north of carpark on section 855



.

Photo 19: Old foundations of a small concrete building on western side of section 855



Photo 20: Redundant underground steam and condensate piping between Anderson House (Ward 5) and Howard House (Ward 10). Deteriorated outer pipe casings reveal possible asbestos insulation



2

Photo 21: Redundant steam and condensate piping at the south western corner of the Industrial Therapy (IT) Workshop. Deteriorated outer pipe casings reveal possible asbestos insulation



Photo 22: Redundant steam and condensate piping at the southern side of the IT Workshop. Again, deteriorated outer pipe casings reveal possible asbestos insulation



. ..[

Photo 23: Redundant steam and condensate piping between two expansion bends on the eastern side of the IT Workshop. Scattered debris from outer pipe casing may contain asbestos



Photo 24: Redundant steam and condensate piping between Linen Sorting Room and IT Workshop. Deteriorated outer pipe casings reveal possible asbestos insulation

۰,



Fill points for the unleaded petrol underground storage tank located west from the mortuary. Photo 26:

# Appendix E

.



Surverant to Alemorandum of Thensfor A. 329 308. Johnny Lamo & Daisy Tillo near Galbank Farmer is the proprietor of an estate in fee simple subject nevertheless to such incumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in hat SECTION of land nitrated in the Hundred of Yatala \_\_ County of Adelande 496 containing one hundred and thirty four acres and one road or Presente and bounded as appears in the plan in the margin hereof which said Section \_\_\_\_\_ delineated in the public map of the said \_\_ fundre &\_\_\_ - deposited in the office of the Surveyor-General In witness whereof I have hereunto signed my name and affixed my seal this Huntreth day of \_\_\_\_\_\_ 1898 Signed the 18in the presence of Norgageno 329309 from williams\_la\_fames\_ Harbey & arthur Young Har Ł. hi Helcher Ferr registration the -at 12. 30por l'inplug DISCHARGE OF THE MASMORTGAGE 4027 15 Q THEREON, PRODUCED, FOR REGISTRATION .96 THE ..... ...... DAY OF ..... 499 mA Edward EP. REQ GEHL to, Application A 674 ursuant 495 Warah, Hauval Aflliams of 4 10 down Menry Milliamis of Pelou 500 4 iller Aut William 16 Owen of foilaid dailier, Au MOPRIETOR OF IN ESTATE IN FEE EMPIE IN THE WIT UND AS THE EXECUTION MAMED IN THE WILL DA May affair on pill Struct high data is 25 DAY OF MARCH ? 200 THE SEOVE JHE ... NAMED Johning Williams AS APPEARS BY MODATE DATED THE A Alum Bin - OA SPACE DATED THE 1916 DAY OF ... TRATION THE 26 DAY OF May



BUSITALia +Register Book \_ Foho Jusovant lo Mormorindum of Transier A: 329308. Mullamo of Daisy Silis near Calbank ohnnu armer is the proprietor of an estate in fee simple. subject nevertheless to such incumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in Those Sections of land reluated in the Hundred of yalata bounty of -Idelaide Nod 497 containing one hundred and thirty four acres or thereabouts and 498 containing one hundred and thirty lour acres one rood and twenty our terches on thenabouts and bounded as appears in the plan in the margin hered. Subject revertheless to ai-Fight of Way and Essment grand by Memorandum of Transfer A. 323979 to the -Boinmissioner of Walkworks and his successors and assign. over portion of the said Section 1999 marked Easement" in the said blan which said Section Jac- delinested in the public map of the said Hundred deposited in the office of the Surveyor-General In witness whereof I have hereunto signed my name and affixed my seal this than theth day of 30-Signed the day of. 1898 in the presence of Registrar-General. Korigage no 329309 from Williams 10 James Harvey and Che artheir Young Harvey and the Hercher Penn produced for reg-tration the 5 day func 1898 at 2.3 (Including they property) ..... Sep Key 497. DISCHARGE OF THE MORTGAGE No 3 9 30 9 BY RECEIPT ENDORSED THEREON, PRODUCED FOR REGISTRATION DAY OF THE ..... 496 atteduar DEP. REG. OSHL

Surrugat to Application Noyuga 15.9.1994 Sarah Hannah Willien of Fills Mario Widan Henry Hilliens of Illane Deling 3 Maijo. ٠. 3 and All alle fur to Ewen Tot Idela auit X λ. to CLEFK and wizuh MOMETOS OF AN ESTATE IN FEE SIMPLE IN THE WITHIN ST AND AS THE EXTENSE ATTO ANTES IN THE WITHIN ST AND AS THE EXTENSE ATTO MALE AND AS THE EXTENSE MALE AND AS THE EXTE . . . . •••••••• -- - ++ . . LELA PLATED THE PLATED 1 27477 116 1. Mary Al HQ -- 5/4-26 ...... Jack 1 74 . . . . . . . . ! rausfer and the second Sara illis Neury ing i.a.m. Audi Toen illique. red August Helas el there (ir ln -Auce for regulation the q dau 11.36 23 Blackwell . . . • • . . . . ley them - Linky west and structure the Aur A aus 4:0 and I form wataring 1 1.14 Teorse . -. C 1kt here 5 estate in p wither . . . . Sai Louger used to converg site at Chings . . . . . Nie alstra ÷, 26 Que Monill within land having Cancelled - the reverter to the brown vide ET o 4269 1 . 1962 Vain Dy Rey Ben s. - . - ` • ₽, 1 1.00 . : . . مەزئىيىر ì -----1 . <u>t</u> . 1 2.57 ••• . . ÷ 114 70.0 2.41 (M. 1) (M. 1.2) , · +1-5 s . s. A STREET. · . . . . a. C. : . . . . . 5 and the state of the state of the  $\cdot$ .... . 12 18 TA TANY .j 5. Constant of States 1:--. . . and the second second second second second second second second second second second second second second second 33 1 .....

HP YATALA Sections 496. 497. 498 and part of 499 containing 497. 1. 4 were repurchased for a mental Hospital @ £ 34. 17. b. per acre and hansferred to this majesty Hing Genge the Fifth 9. b. 1917 vide 6. S. O. 271/17 and 6. of Titles Tol. 635 Fo. 7 & 8. Vol 611 Fo. 34. abs 8/12/24 all to be dedicated for northfield Mental Hospital J. G. A. Resumption & Rededication Gaz. 12.963 Vide PA94/5. 3040 3039 313 320 Resubdi Waterworks Easement Vide p. 153 13t ac Certificate of Title Vol 635 Folio 8 2060 319 - Certificate of Title Vol. 611 Folio 3 Certificate of Title 50 ac : 3 PT: 299 Vol 635 Folio 7 318 317 503 500 🗝 For Original Survey Vide page 9. SCALE Sir. 60 ...... X. C.C.C. 25/17 Sections 496, 497, 498, and portions of section 499, KET.S.A. Isolink easonent containing 497. 1. 4 were transferred to the Crown, Vide DL SOCA/co the date of registration of the transfer being 9th June 1917. The Titles are in the name of His Mojesty King George the Fifth

.

.

• •

.

-

Appendix F

Borehole Logs

SHEET No. 6628





HILLCREST HOSPITAL, MULTI-PURPOSE HALL

BORE LOGS	Note: In all six bores the
	clay is highly leached-low
	salt content; conductivity
	0.2-0.7 mho, typical values
	below 0.6 m being 0.2 - 0.3 mho.
_	

### Bore 1 6628 390 EW 11/13

0 - 0.35 m	FILL - imported garden loam
0.35 - 0.65m	CLAY, red-brown; high plasticity, blocky structure
	wswp, friable (CH)
0.65-1.1 m	SILTY CLAY to CLAYEY SILT, pale brown, highly
	calcareous; wswp, friable (ML-CL)
1.1 - 1.7m	CLAY, brown, calcareous; small highly calcareous
	silt nockets decreasing with denth. high plasticity
	sub-blocky to granular structure, wew frisble ((4)
<b>17</b> -25 m	CLAY group and brown mattlad calcarouse, bigh
1.7 6.3 11	blacticity blacky atministration variable to 2.2 m
	prasticity, brocky structure; wswp, mable to 2.2 m;
2 5 7 5	wswp, nara below 2.2 m (CH)
2.5-3.5 m	CLAY, red-brown, slightly sandy; trace of yellow
	sandstone fragments at 2.9 m; wswp, hard (CH)
3.5 - 4.3m	CLAYEY M-F SAND, red; moist, dense - probable
	decomposed sandstone (SC)
4.3 -	SANDSTONE, too hard to peretrate.
(end)	
Bore 2 6	628 390 EL VITIL
0 - C.25 m	FILL - garden loan over old bitumen on crushed
0.25-0.5m	CLAY, red-brown; high plasticity, blocky structure;
	wswp, friable (CH)
0.5 - 1.1 m	CLAY, pale brown, calcareous, with approx, 50%
	highly calcareous clayey silt in discrete seams and
	pockets: wswp. friable (CH & ML-CL)
1.1-2.9m	CLAY, light brown to 2.3 m and red-brown below 2.3m.
	with approx. 10% earthy lime in scattered nockets.
•	high plasticity blocky structure: wswp friable (CH)
2.9-3.75m	SANDY CLAY stratified with CLAYEY M SAND
<b>D</b> .J <b>D</b> ./JM	red-brown red and vellow mottled: medium plasticity:
	wewn to 3.1 m. wewn below 3.1m (SC)
3 75-1 5m	Core lost
(and)	
(end)	
Poro 7	
bore 5	6628 390 60 11715
0 0 25 -	FILL imported coulor loss
0 - 0.25 m	FILL - imported garden lorm
0.25-0.55 m	LLAY, red-brown; high plasticity, blocky structure;
	wswp, friable (CH)
0.55-2.2m	CLAY, pale-brown, highly calcareous, with approx. 208
	pockets of earthy lime; high plasticity, structure
	indistrict; wswp, friable (Cil+ML-CL)
2.2-3.75m	SANDY CLAY to CLAYEY M. SAND, red-brown; root casts
	tilled with f. sand; medium-high plasticity, blocky
	structure; wswp, friable (SC)
3.75 m -	Cemented sand, too hard to penetrate.
(end)	•

1. N. 1979 - T

1

#### 6628 390 EW 11716 Bore 4

0 - 0.15 m 0.15 - 0.3 m 0.3 - 0.62 m 0.62 - 1.15m	FILL - garden loam over bitumen cap. SILTY CLAY, brown; wswp, friable (CL-CH) CLAY, red-brown; high plasticity, sub-blocky structure; wswp, friable; large tree roots (CH) CLAY, pale brown and brown mottled, highly cacareous
1.15-1.75m	approx. 50% pockets of earthy lime; wswp, friable (CH + ML-CL) CLAY, brown, slightly calcareous; approx. 10% pockets of earthy lime; high plasticity, granular structure; wswp, friable (CH)
1.75-2.5m	CLAY, light brown calcareous; high plasticity, blocky structure: wswp. hard (CH)
2.5-2.8m	SANDY CLAY, red-brown; sandy high plasticity, blocky structure: wswp. hard (SC-CH)
2.8-3.5m (end)	SANDY CLAY, yellow and red-brown mottled, high plasticity, structure indistinct; wswp, hard(SC)

Bore No.1 contains

Note: / the only trace of Keswick Clay in this group of bores. Have we found its boundary? Or is the other soil just an island patch?

HILLCREST HOSPITAL FOSTERS ROAD, GILLES PLAINS

6628 390 EW 11717

A - Series

SAMPLED 19th March 1981

LOCATION Salter Hall S-E corner of main hall 600 mm from South wall 900 mm from stage

0 - 0150 Concrete slab

0150 - 0590 Compacted fill

0590 - 0750 Moist red brown criy>PL

0750 - 1500 Dry, friable clayer marl, brown and pink. Becoming more clayer from 1500

1500 - 3500

3500 - 4900

moister with depth - fissures filled with darker clay and some pockets of sand and black silty specks at 0270. Becoming sandier with depth - (the sand is orange) small pockets of grey sandy clay.

Stiff, red brown, highly structured clay>PL

- with some pockets of marl. Becoming slightly

Orangish brown clayey sand with large pockets of orange sand. Some red and yellow staining at 4000 - becoming moister.

> ENDED HOLE IN YELLOW AND FAWN SAND WITH RED STAINING AT 4900

> > 金田市というのでは、「「「「「「「「「「「「「」」」」」

#### HILLCREST HOSPITAL FOSTERS ROAD, GILLES PLAINS



6628 390 EW 11718

A - Series

SAMPLED 19th March 1981

LOCATION

Salter Hall S-W corner of main hall 600 mm from South wall & 600 mm from West wall

- 0 0150
- 0150 0590 Compacted fill

0590 - 0890 Red brown slightly moist clay=PL

Concrete slab

- 0890 1450 Very dry, powdery pink marl some nodules with pockets of stiff, very dry clay. Becoming clayier with depth.
- 1450 2700 Dry, reddish brown marly clay friable with large pockets of highly structured clay.
- 2700 3150 Stiff, red brown, highly structured clay≯PL - some small pockets of marl still evident -Becoming slightly moister with depth. (unable to retrieve 3000 mm sample)
- 3150 4200 Becoming sandy with pockets of greyish green sandy clay, very highly structured, with some black mottling. - Colour change to red brown from 3400.

4200 - 4900

Pockets of fine fawn sand in brown, yellow and grey slightly clayey coarse sand.

ENDED HOLE IN SAME AT 4900



HILLCREST HOSPITAL - ASSESSMENT AND PSYCHOGERIATRIC UNITS

6528 390 EM 11709

-----

HORE LOGS

- 0 0.3 m CLAY, brown and red; high plasticity, granular structure; W > Wp, friable (CH).
- 0.3 1.0 m CLAYEY SILT to SILTY CLAY, pale brown, highly calcareous, gritty;  $W > V_P$ , loose and friable (ML CL).
- 1.0 4.5 m CLAY, grey brown and yellow mottled; high plasticity, blocky structure with slickensides;  $\mathcal{U} \approx Np$ , stiff to 1.5 m and here below 1.5 m (CH).
- 4.5 5.0  $\pi$  SANDY CLAY, grey & red mottled, with thin seams of white fine sand; W > Wp, very stiff (CH SC).

## 5.0 - 5.5 m CIAY, grey, with small patches of red fine sand; $W \ll W$ p, hard (CH0.

5.5 - 5.75 mCLAYEY FINE SAND, grey yellow & red; dry, weakly<br/>(end)CLAYEY FINE SAND, grey yellow & red; dry, weakly<br/>cemented - v. weak (decomposed) SANDSTONE.

Water not cut.

1.....

Bore l

HILLCREST HOSPITAL - ASSESSMENT & PSYCHOCERIATRIC UNITS		
	BORE LOGS	
Bore 5		
0 - 0.2 m	FILL - dk. brown clay and gravel.	
0.2 - 0.5 m	CLAY, red-brown; high plasticity, granular structure; W > Np, friable (CH).	
0.5 - 1.2 m	CLAYEY SILT to SILTY CLAY, pale brown and white, highly calcareous; W >> Wp, soft (ML - CL).	
1.2 – 4.15 m	CLAY, grey brown & yellow mottled; off-white highly calcareous patches to 1.5 m; high plasticity, blocky structure with slickensides; $\mathcal{W} \gtrsim \mathcal{W}p$ , hard (CH).	
4.15 - 4.55 (end)	CLAYEY FINE SAND, grey yellow & red; dry weakly cemented - very weak SANDSTONE. Moderately weathered at 4.55 m - unable to sample.	

.

Water not cut.

. . .

ļ

.

ē •

57

2.2

.

.

HILLCREST HOSPITAL - ASSESSMENT & PSYCHOGERIATRIC UNITS

### BORE LOGS

en see te Status and the second second second second second second second second second second second second second second Status and the second second second second second second second second second second second second second second

### 6628 390 ww 11711

THE SEALES THE

Eore 7	
0 - 0.5 m	SILTY CLAY, brown; $W \approx Wp$ , friable (CL - CH).
0.5 - 1.45 m	SILTY CLAY, pale brown & white, highly calcareous; W > Wp, firm (CL - CH).
1.45 - 5.2 m	CLAY, grey S brown mottled; small sand pockets below 4.0 m; high plasticity, blocky structure with slickensides; W さ Wp, very stiff to hard (CH).
5.2 - 5.7 m (end)	CLAYEY FINE SAND, grey yellow & red; dry,weakly cemented with strongly cemented seams - very weak SANDSTONE with moderately weathered seams.

Water not cut.

2 Her

; >
HILLCREST HOSPITAL - ASSESSMENT & PSYCHOGERIATRIC UNITS

U

 $\bigcirc$ 

BCRE LOGS

····

6628 390 EW 11712

Bore 9	
0 - 0.4 m	SILTY CLAY, brown; $W < W_D$ , friable (CL - CH).
0.4 - 1.2 m (approx.)	SILTY CLAY, pale brown & white, highly calcareous; W Np, friable; very weak crust at 0.65 m (CL - CH). Merges with the next layer.
1.2 - 5.6 m	CLAY, grey & brown mottled, with highly calcareous pace as to 2.8 m; high plasticity, blocky structure, $W \ll Wp$ , very stiff to hard (CH).
5.C - 6.1 m	SANDY CLAY, yellow brown & red mottled; W << Wp, hard (CH - SC).
6.1 - 6.3 m (end)	CLAYEY FINE SAND, grey brown & red; dry, very weakly cemented - very weak (decomposed) SANDSTONE.
Water not cut.	



# Appendix G

.

ĺ

Site Plans Showing Potentially Contaminated Areas and Other Potential Liabilities















# Appendix H

 $\left( \begin{array}{c} \end{array} \right)$ 

Site Plans Showing Sampling Locations





#### NOTES:

- 1. NORTH EASTERN CORNER OF LICHFIELD HOUSE HAS BEEN TAKEN AS A REFERENCE POINT (ORIGIN)
- 2. SAMPLES 1, 2 AND 3 WERE TAKEN FROM THE BITUMEN SECTION OF THE CARPARK.
- 3. SAMPLES 4, 5 AND 6 WERE TAKEN FROM A GRASSED SECTION OF LAND WITHIN THE CAR PARK.





AT A CONTRACT OF A CONTRACT WITH A DIRECT

ł



A 27 17 71 CN C.1. WHEL LITTLE

.

:

3.1

5



### Appendix I

-

#### Field Work and Sample Details

#### Field Work and Sample Details

#### I1. Field Work Notes

• 🐢

;

<u>r</u>=

¢ B

: ત્રં

Sampling Date:	28 October, 1994
Samplers:	Uma Preston (Chemical Engineer)
	Brenton Harris (Geotechnical Engineer)
Drilling Contractor:	K&W Drilling

#### 12. Sample Details

Sample No	Location No	Sample Depth (metres)	Soil Comments	Selected for Analysis
1	1B	0.2-0.35	FILL. Some flecks of ash	Analysis
2	2B	0.3-0.43	FILL. Some flecks of ash	Analysis
3	3B	0.25-0.40	FILL. Some flecks of ash.	Analysis
4a	4B	0.30-0.45	FILL. Some fine gravel	Analysis
5b	5B	0.33-0.50	FILL. Some bitumen fragments and ash	Analysis
6	6B	0.3-0.45	FILL. Some flecks of ash	Analysis
7a	7B	0.17-0.40	FILL. Bitumen fragments and some ash	Analysis
7b	7B	0.40-0.70	SILTY CLAY.	Analysis
8	8B	0.20-0.50	FILL. Some ash fragments	Analysis
9a	9B	0.40-0.75	FILL. Some bitumen and some ash	Analysis
9b	9B	0.75-0.95	FILL. Flecks of ash	Analysis
10	10D	0-0.15	· ·	Analysis
11	11D	0-0.15		Analysis
12	12D	0-0.15		Analysis
13	13D	0-0.15		Analysis
14	Composite of	0-0.15		Analysis
	Samples 12 and 13			
15	Composite of	0-0.15		Analysis
	Samples 10 and 11			
16	Composite of	N/A		Analysis
	Samples 1 and 6			ll

Notes:

• Suffix "B" after location number implies that borehole cores were recovered using truck mounted hydraulic push tube equipment.

• Suffix "D" after location number implies that sampling was carried out by hand with dig stick and hammer.

### Appendix J

( )

;--

Borehole Logs and Explanatory Notes



Forsimile (08) 212 4686 Telephone (08) 212 5733

N.A.T.A. REGISTERED MATERIALS TESTING LABORATORY

# Borehole Log

. .

ġ t

17

1

X

6

- Participant

NAMES I

	Client: Project:	Department of Environment & Natural Resources Hillcrest Hospital Complex							No. ed by cked b	27F 28/1 y P	358A 0/94 BJH FWL
	Drilling	Method: H	lydraulic Push Tube	& Hydraulic Hamme	r			Bore	Local	ion:	
	Ground	water Struc	ck: Nil Gro	oundwater Stands:-							1
	Depth (m)		Soil Des	scription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.05	Bitumen.									
	0.05- 0.2	FILL. Sandy silty gravel, pale greyish yellow, fine to coarse sand, gravel to 20 mm.									
	0.2- 0.3	FILL. Sar fine to me	FILL. Sandy silty clay, grey brown, greyish orange brown, fine to medium sand, some flecks of ash.								
	0.3- 0.4	Silty CLAY. Orange brown, some fine sand. CL/ CH						м/н	Fb		
	0.4- 1.0	Clayey gra fine sand,	welly SILT. Creamy b calcrete fragments to 1	orown over off-white, so 5 mm, highly calcareou	ome Is.	ML	н.	VL			
	1.0- 1.55	Silty CLA calcareous.	Y. Off-white and brow	vn, some fine sand, high	aly	CL over CL/ CH	<pl< td=""><td>M over M/H</td><td>Fb/ H</td><td></td><td></td></pl<>	M over M/H	Fb/ H		
	1.55- 2.4	Silty CLA sand.	Y. Brown, some grey	green mottling, some fi	ne	СН	≤PL	Н	н	500+	
		END OF BOREHOLE 2.4 m									
3EO-12			-								
Ċ	Moisturi D = Dry H = Hui Da = Dai M = Mo W = We PL = Pla LL = Liq PI = Pla	e Content , mid mp ist t stic Limit uid Limit stic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	Consistency VS = Very Soft S = Soft F = Firm SI = Stiff VSI = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks			[]	1	

# 

Focsimile (08) 212 4686 Telephone (08) 212 5733

N.A.T.A. REGISTERED MATERIALS TESTING LABORATORY

# Borehole Log

:

	Client: Project:	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex							No. ed by cked b	27F 28/1 y P	27F358A 28/10/94 BJH PTWL	
	Drilling	Method: H	ydraulic Push Tube	& Hydraulic Hamme	r			Bore	Locat	ion:		
	Ground	water Struc	k: Nil Gro	oundwater Stands:-							2	
	Depth (m)		Soil Des	cription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)	
	0.0- 0.05	Bitumen.	Bitumen.									
	0.05- 0.3	FILL. San coarse sand	FILL. Sandy silty gravel, pale greyish yellow, fine to coarse sand, gravel to 20 mm.									
	0.3- 0.45	FILL. San some fleck	FILL. Sandy silty clay, grey brown, fine to medium sand, some flecks of ash.									
	0.45- 0.55	Silty CLA	Silty CLAY. Orange brown, some fine sand. CL/ CH <pl< td=""><td>Fb</td><td></td><td></td></pl<>						Fb			
	0.55- 0.9	Silty CLA highly calc	Y/Clayey SILT. Crean careous.	ny brown, some fine sa	nd,	CL/ ML	<p∐ H</p∐ 	L/ VL				
	0.9- 1.1	Silty CLA highly calc	Y. Brown, creamy bro careous.	wn, some fine sand,	•	CL/ CH	<pl< td=""><td>М/Н</td><td>H/ Fb</td><td></td><td></td></pl<>	М/Н	H/ Fb			
		END OF I	BOREHOLE 1.1 m									
2	• .											
3EO-1			-									
Ċ	Moistur D = Dry H = Hu Da = Da M = Mo W = We PL = Pla LL = Liq Pl = Pla	Moisture ContentPlasticityConsistencyPlan/RemarksD = DryNP = Non-plasticVS = Very SoftH = HumidT = TraceS = SoftDa = DampVL = Very LowF = FirmM = MoistL = LowSt = StillW = WetM = MediumVSI = Very StillPL = Plastic LimitH = HighH = HardL = Liquid LimitVH = Very HighFb = Friable					L		·			



Focsimile (08) 212 4655 Telephone (08) 212 5733

N.A.T.A. REGISTERED MATERIALS TESTING LABORATORY

# Borehole Log

É

	Client: Project:	Client: Department of Environment & Natural Resources Department of Environment & Natural Resources C							Job No. Date Tested by Checked by		58A 0/94 BJH FWL
	Drilling	Method: A	uger, Hydraulic Pust	n Tube & Hydraulic I	lammer			Bore	Locat	ion:	
	Ground	water Struc	k: Nil Gro	oundwater Stands:-						3	3
	Depth (m)		. Soil Des	cription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.05	Bitumen.	Bitumen.								
	0.05- 0.25	FILL. San coarse sand	FILL. Sandy silty gravel, pale greyish yellow, fine to coarse sand, gravel to 20 mm.							-	
	0.25- 0.4	FILL. Silt of ash.	FILL. Silty sandy clay, brown, fine sand, some flecks of ash.					L			
	0.4- 0.6	Silty CLA	Silty CLAY. Orange brown, some fine sand.					н	Fb		
	0.6- 0.95	Silty CLA highly calc	Silty CLAY/Clayey SILT. Creamy brown, some fine sand, highly calcareous.					L/ VL			
	0.95- 1.1	Silty CLA calcareous.	Y. Creamy brown, sor	ne fine sand, highly		CL	<pl< td=""><td>Ļм</td><td>Fb</td><td></td><td></td></pl<>	Ļм	Fb		
		END OF E	END OF BOREHOLE 1.1 m								
GEO-12			-								
	Moistur D = Dry H = Hu Da = Da M = Mc W = We PL = Pla LL = Liq PI = Pla	isture Content Plasticity = Dry Plasticity = Humid T NP Non-plastic T Damp VL Very Low = Moist L Low = Wet M M Medium = Plastic Limit H High = Liquid Limit VH Very High = Plastic Index EH = Extra High		Consistency VS = Very Soft S = Soft F = Firm St = Stift VSt = Very Stift H = Hard Fb = Friable	Plan/Rema	rks					

### N.A.T.A.REGISTERED MATERIALS TESTING LABORATORY

łacsimite (08) 212 4000

Telephone (08) 212 5733

# Borehole Log

: JEWS

Client: Project:	Client: Department of Environment & Natural Resources Project: Hillcrest Hospital Complex								27F3 28/1 y P	858A 0/94 BJH FWL	
Drilling Ground	Method: H water Struc	ydraulic Push Tube k: Nil Gro	& Hydraulic Hamme	r			Bore	Bore Location: 4			
Depth (m)	•	Soil Des	scription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)	
0.0- 0.2	FILL. Silt slightly mi	y sand, grey brown, fin caceous, some fine roc			Н	T					
0.2- 0.35	FILL. Silt calcareous,	y clay, grey brown, so pockets of sand, some			<pl< td=""><td>м</td><td></td><td></td><td></td></pl<>	м					
0.35- 0.45	FILL. San coarse sand	dy silty clay, greyish y I, some fine gravel.			<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L					
0.45- 0.55	FILL. Silt of ash.	FILL. Silty sandy clay, brown, fine sand, some flecks of ash.									
0.55- 0.7	Silty CLA	Silty CLAY. Brown, orange brown, some fine sand.				<pl< td=""><td>н</td><td>Fb</td><td></td><td></td></pl<>	н	Fb			
0.7- 0.95	Silty CLA fine sand, 1	Y/Clayey SILT. Crean highly calcareous.	ny, creamy brown, som	e	CL/ ML	<pl <br="">H</pl>	Ц VL				
0.95- 1.1	Silty CLA calcareous.	Y. Creamy brown, sor	ne fine sand, highly	•	CL	<pl< td=""><td>ĻМ</td><td>FЪ</td><td></td><td></td></pl<>	ĻМ	FЪ			
	end of e	OREHOLE 1.1 m									
		-					-				
Moisturi D = Dry H = Hu Da = Dai M = Mo W = We PL = Pla LL = Lig Pl = Pla	Aoisture ContentPlasticityConsistency0 = DryNP = Non-plasticVS = Very Solt1 = HumidT = TraceS = Solt0a = DampVL = Very LowF = FirmA = MoistL = LowSt = StiftV = WetM = MediumVSt = Very StillH = Plastic LimitH = HighH = HardL = Liquid LimitVH = Very HighFb = FriableI = Plastic IndexEH = Extra HighFb = Friable			Plan/Rema	rks				<b>I</b>		



#### N.A.T.A.REGISTERED MATERIALS TESTING LABORATORY

\_

## Borehole Log

1000

C LUID TRUE

	Client: Project:	Department of Environment & Natural Resources Hillcrest Hospital Complex							Job No. Date Tested by Checked by		358A 10/94 BJH TWL
	Drilling	Method: H	lydraulic Push Tube	& Hydraulic Hamm	er			Bore	Locat	ion:	
:	Ground	water Struc	k: Nil Gro	oundwater Stands:-						·	5
	Depth (m)		Soil Des	scription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.2	FILL. Silt some grave	FILL. Silty sandy, grey brown, fine to medium grained, some gravel to 30 mm, some fine roots.					VL			
	0.2- 0.5	FILL. Cla some fine to 40 mm,	FILL. Clayey silty gravel, mottled grey brown and black, some fine to medium sand, gravel and bitumen fragments to 40 mm, some ash, some roots.								
	0.5- 0.7	FILL. Silty sandy clay, grey brown, fine sand, some flecks of ash.					<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L			
	0.7- 0.9	Silty sandy CLAY. Grey brown, fine sand.					<pl< td=""><td>Ļм</td><td>Fb</td><td></td><td></td></pl<>	Ļм	Fb		
	0.9- 1.1	Silty CLA	Silty CLAY. Orange brown, some fine sand.				<pl< td=""><td>н</td><td>H/ Fb</td><td></td><td></td></pl<>	н	H/ Fb		
		END OF BOREHOLE 1.1 m									
2											
EO-1			"								
9	Moistur D = Dry H = Hu Da = Da M = Mo W = We PL = Pla LL = Liq	e Content mid mp ist t stic Limit uid Limit	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High	Consistency VS = Very Solt S = Solt F = Firm St = Stilf VSt = Very Stilf H = Hard Fb = Friable	Plan/Rema	irks	<b>.</b>			<b>J</b>	
	PI = Pla	stic Index	EH = Extra High		<u> </u>		····				



### Borehole Log

Client: Project	Client: Department of Environment & Natural Resources							No. ed by	27F 28/1	358A 10/94 BJH	
					<u> </u>		Checked by PIWL				
Drilling	Method: H	Iydraulic Push Tube	& Hydraulic Hamme	r .			Bore	Locat	ion:	c	
Ground	iwater Struc	Gr Gr	oundwater Stands:-		1	r		T	, ,	0 T	
Depth (m)		Soil De	scription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)	
0.0- 0.05	FILL. Sile some fine	ty sand, grey brown, fi roots.			н	VL					
0.05- 0.3	FILL. Sar fine to coa 30 mm.	TLL. Sandy clayey gravel, mottled brown and black, ine to coarse sand, gravel and bitumen fragments to 0 mm.					Т				
0.3- 0.45	FILL. Sili	ty sandy clay, greyish roots, some flecks of a	orange brown, fine sand ash.	l,		<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L				
0.45- 0.75	Silty CLA	Y. Greyish orange bro	own, some fine sand.		CL/ CH over CH	<pl< td=""><td>M/H over H</td><td>Fb</td><td></td><td></td></pl<>	M/H over H	Fb			
0.75- 1.0	Clayey gra calcrete fra	avelly SILT. Creamy agments to 20 mm, hig	brown, some fine sand, shly calcareous.		ML	Н	VL				
1.0- 1.1	Silty CLA calcareous	Y. Creamy brown, so	me fine sand, highly		CL	<pl< td=""><td>М</td><td>Fb</td><td></td><td></td></pl<>	М	Fb			
	END OF I	BOREHOLE 1.1 m									
							•				
		-									
Moistur D = Dry H = Hu Da = Da M = Mc W = We PL = Pla LL = Liq	e Content mid mp sist et stic Limit uid Limit	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High	Consistency VS = Very Soft S = Soft F = Firm St = Stift VSt = Very Stift H :: Hard Fb = Friable	Plan/Rema	rks				J		

100 North Terrace, Adelaide S.A. 500 Facsimile (C3) 212 46F Telephone (C3) 212 57: N.A.T.A.R.E.G.I.S.T.E.R.E.D.M.A.T.E.R.I.A.L.S.T.E.S.I.I.N.G. L.A.B.O.R.A.T.O.R.Y.

Borehole Log

	Client: Project:	Client: Department of Environment & Natural Resources D Project: Hillcrest Hospital Complex C							No ed by cked b	27F3 28/1 yP	58А 0/94 ВЛН ГWL
	Drilling	Method: H	lydraulic Push Tube	& Hydraulic Hamme	r			Bore	Locat	ion:	
	Ground	water Struc	k: Nil Gr	oundwater Stands:-						• •	7
	Depth (m)		Soil De:	scription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.05	FILL. Silt fine roots.	y sand, grey brown, fi	ne to medium sand, son	ne		н	VL			
	0.05- 0.3	FILL. Silt gravel/bitu 100ts.	FILL. Silty sandy clay, grey brown, fine sand, some gravel/bitumen fragments to 40 mm, some ash, some fine roots.					Ļм			
	0.3- 0.45	Silty CLA roots.	Silty CLAY. Orange brown, some fine sand, some fine roots.				<pl< td=""><td>н</td><td>Fb</td><td></td><td></td></pl<>	н	Fb		
	0.45- 1.1	Silty CLAY. Creamy brown, some fine sand, some fine calcrete fragments, highly calcareous. END OF BOREHOLE 1.1 m				CL	<pl< td=""><td>Ļм</td><td></td><td></td><td></td></pl<>	Ļм			
GEO-12			÷								
	Moistur D = Dry H = Hu Da = Da M = Mo W = We PL = Pla LL = Liq PI = Pla	e Content mid mp sist stic Limit stic Limit stic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	Consistency VS = Very Soft S = Soft F = Firm St = Stiff VSt = Very Stiff H = Hard Fb = Friable	Plan/Rema	rks				A	

100 North Terrace, Adelaide S.A. 50 Facsimile (08) 212 46 Telephone (08) 212 57

N.A.T.A. REGISTERED MATERIALS TESTING LABORATORY

## Borehole Log

(

	Client: Project:	ient: Department of Environment & Natural Resources						Job Date Teste Chec	Job No. Date Tested by Checked by		58A 0/94 BJH FWL
	Drilling	Method: H	lydraulic Push Tube	& Hydraulic Hamme	r			Bore	Locat	ion:	<u> </u>
	Ground	water Struc	k Nil Gro	oundwater Stands:-						\$	3
	Depth (m)		Soil Des	cription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.2	FILL. Silt some fine	FILL. Silty clay, grey brown over greyish orange brown, some fine sand, fine roots.					M/H over H			
	0.2- 0.55	FILL. Silty sandy clay, greyish dark brown, fine sand, ash fragments.					<pl< td=""><td>Ļм</td><td></td><td></td><td></td></pl<>	Ļм			
	0.55- 0.7	Silty sandy CLAY. Orange brown, fine to medium sand.				CL	<pl< td=""><td>L</td><td>Fb</td><td></td><td></td></pl<>	L	Fb		
	0.7- 0.95	Silty CLAY. Orange brown, some fine sand.				СН	<pl< td=""><td>н</td><td>H/ Fb</td><td>-</td><td></td></pl<>	н	H/ Fb	-	
	0.95- 1.1	Clayey SII calcrete fra	Clayey SILT. Creamy, creamy brown, some fine sand, fine calcrete fragments, highly calcareous.				H	T/ VL			
		END OF I	BOREHOLE 1.1 m					-			
GEO-12			-								
	Moistur D = Dry H = Hu Da = Da M = Mo W = We PL = Pla LL = Liq PI = Pla	e Content / mid mp iist it stic Limit uid Limit stic Index	Plasticity NP = Non-plastic T = Trace VL = Very Low L = Low M = Medium H = High VH = Very High EH = Extra High	Consistency VS = Very Soft S = Soft F = Firm St = Shift VSt = Very Shift H = Hard Fb = Friable	Plan/Rema	rks					



#### N.A.T.A. REGISTERED MATERIALS TESTING LABORATORY

# Borehole Log

:

	Client: Project:	Department of Environment & Natural Resources							Job No. Date Tested by Checked by		358A 10/94 BJH FWL
•	Drilling	Method: H	vdraulic Push Tube	& Hydraulic Hamme				Bore	Locat	<u>.</u> ion:	
	Ground	water Struc	k: Nil Gro	oundwater Stands:-							9
	Depth (m)		Soil Des	scription		USC Symbol	Moisture Content	Plasticity	Consistency	Pocket Pene - trometer (kPa)	Depth (m)
	0.0- 0.1	FILL. San roots.	FILL. Sandy silt, grey brown, fine to medium sand, fine roots.					T/ VL			
	0.1- 0.55	FILL. Silt roots, some some bitum	FILL. Silty sandy clay, grey brown, fine sand, some fine roots, some fine calcrete fragments, some brick fragments some bitumen.					L			
	0.55- 0.75	FILL. Silty clay, creamy brown, some fine sand, highly calcareous, some bitumen, some ash.					<pl< td=""><td>L</td><td></td><td></td><td></td></pl<>	L			
	0.75- 0.95	FILL. Silty clay, dark brown, some fine sand, some flecks of ash.					<pl< td=""><td>н</td><td></td><td></td><td></td></pl<>	н			
	0.95- 1.1	Silty CLA	Y. Dark brown, some	fine sand.		СН	<pl< td=""><td>н</td><td>H/ Fb</td><td></td><td></td></pl<>	н	H/ Fb		
		FND OF F	BOREHOLE 1.1 m							•	
						-					•
EO-12			<del>.</del> .								
G	Moistur	e Content	Plasticity	Consistency	Plan/Rema	 rks				l	
	D = Dry	/	NP = Non-plastic	VS = Very Soft		-1					
	H = Hu Da = Do	mid mo	T = Trace	S = Soft							
	M = Mo	ist	L = Low	r = rum St = Shft							
	W = We	et	M = Medium	VSt= Very Stiff							
	PL = Pla	stic Limit	H : High VH = Vory High	H Hard							
	PI = PIa	stic Index	EH = Extra High								

## Appendix K

:

Laboratory Methodology and Quality Assurance; Laboratory Analytical Reports





١ PAGE i of

CLIENTER DE L'ERE REFY LTD ADDRESS: CONTRACT NOT ADDRESS: CONTRACT

LABORATORY: ENVIRORMENTAL BATCH NUMBER: 日秋105ら8一0

SPRENTER GA Seed

No. of SAMPLES: DATE RECEIVED: 31/10/04 DATE COMPLETED: 14/11/24

ORDER No:		SAM	IPLE TYPE: SQ I L.		PROJECT	NO:	·····
		FLEMENT	Norsture	P. (3	C.;	E b	1
SAMPLE	NUMBER	UNIT	2	and the		ag/ka	- 51. · · ·
		METHOD	E A = 0 5/1	してそったら出す。	1.6-04型)	EG-00% [	EC 00
		2871	13 6	41	10	: 0	!
	10 11-10 434	28/1	12.1	3	36	25	ب: ا
	e sizien da.	2371	11.4	4	12	15	
• •	- <u>-</u>	2071	12.7	2	. 8	3	1
	n In In	2879	0.11		123	35	2
· .	er	2871	7, $2$	E*	17	31	
	1 1 2 3 0 4	n 287	13 4	1.0	25	23.0	L.
·	5 E B B	23/10	9.3	<u>د.</u>	17	63	1 12
<b>n</b>	8、353、7124	2871	E E E	с,	10	11	t t
1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	o th∘e.9‰	5 <u>2</u> 87	12 1	3	1 11	17	9.
	9-0-51a-23	37197	8-7	-	11	19	4
• • t = + + - + + - + + - + + - + + + - +	0-0.05m d	3/10/	5.0	3	7	10	1
1912 - 1912 - S	0+0 (Sm 2)	3/10/	7.5	3	3	17	1
1.1.3 1.5 7	医牙外 计原始工作	3/3 0 /	6.6	3	3	1.8	1
					No. 025 This taboratory is regist Association of Testimular test(s) reported hurdin in accordance with its term document shill much be re	TY SYSTEN TY SYSTEN DEFICIENCY DEFICIEN	
ETECTION LIMIT:			0.1	1	1	1	1

Alice Springs Laboratory Phone: (089) 52 6020 Fax: (089) 52 6028 Bendigo Laboratory rone: (054) 46 1390 Fax: (054) 46 1389 risbane Laboratory rone: (07) 352 5577 Fax: (07) 352 5109 \_harters Towers Laboratory Phone: (077) 87 4155 Fax: (077) 87 4220

Cloneumy Laboratory Phone: (077) 42 1323 Fax: (077) 42 1685 Kalgooriia Laboratory Phone: (090) 21 1457 Fax: (090) 21 6253 Mt Isa Laboratory Phone: (077) 49 5545 Fax: (077) 48 5546 Orange Laboratory Phone: (063) 63 1722 Fax: (063) 63 1189

Perth Laboratory Phone: (09) 249 2988 Fax: (09) 249 2942 Townaville Laboratory Phone: (077) 79 9155 Fax: (077) 79 9729

All pages of this report have been checked and approved for release

. .





PAGE 1 of 1

CONTACT: 115 CONTRACT: 115 CONTACT: 115 CONTRACT: 115 CONTRACT: 2000 CONTRACT: 20

LABORATORY: UNV (ROMMENTA) BATCH NUMBER: EN(10540) +0

No. of SAMPLES: 14 DATE RECEIVED: 217402294 DATE COMPLETED: 142714294

OBDER No	SAN	IPLE TYPE: OUAL	irz coureg.	PROJECT	No:	
SAMPLE NUMBER	ELEMENT UNIT METHOD	Nesature 2 EZ-055	A⊴ e(g./kg £€~0057	Cu ng/kg EG-005T	មម ធថ្ងវេសព្វ ៩៩-១០៣)	Zo 109/97 86-903
- 11 - 1 0 20 10PK - 11 - 500 0 0 0 00PK - 11 - 60 0 20 10FK	REC 2 197197 REC 2	:0 7	79.0% 7 86.0%	76 0% 8 7% 0%	90,0% 3 89,0%	75 - 15 75 - 0
				<u>_</u>		
				No. 825		
				This unboratory is rep Association of Trating A test(s) reparted horizon accordance with to tan document shall not be n	forad by the National Contins, Austraba, The West Vota performed in to Gregistration, The produced except in full.	
DETECTION LIMIT:		0.1	1	1	1	1

OMMENTS:

Results which appear on this report are routine laboratory checks for QUALITY CONTROL purposes.

Alice Springs Laboratory Phone: (089) 52 6020 Fax: (089) 52 6028 Rendigo Laboratory hone: (054) 46 1390 Fax: (054) 46 1389 risbene Laboratory hone: (07) 352 5577 Fax: (07) 352 5109 harters Towers Laboratory Phone: (077) 87 4155 Fax (077) 87 4220

Cloncumy Laboratory Phone: (077) 42 1323 Fax: (077) 42 1685 Kalgoorile Laboratory Phone: (090) 21 1457 Fax: (090) 21 6253 Mi Isa Laboratory Phone: (077) 49 5545 Fax: (077) 48 5546 Orange Laboratory Phone: (063) 63 1722 Fax: (063) 63 1189

Perth Laboratory Phone: (09) 249 2988 Fax: (09) 249 2942 Townsville Laboratory Phone: (077) 79 9155 Fax: (077) 79 9729

. .



	MR L GRAY				Page 1	of 4	
	RUST PPK PTY LTD						
	100 NORTH TERRACE				ENVIRONMENTA	L	
					Batch-no:	10568	
	ADELAIDE SA 5000				Sub-batch:	1	
					No.samples:	11	
ORDER-NO		SAM	PLE-TYP	Ξ	Received:	31/10/94	
3057		SOIL		Completed:	14/11/94		
				L1 S1	L2 S2		L3 S3
ethod	Analysis description	Units	LOR	0.2-0.35m	0.3-0.4	3m	0.25-0.4m
		<u> </u>		28/10/94	28/10/94		28/10/94
A-055	Moisture Content (dried @ 103'C)	×	0.1	13.6	12.1		11.4
P-075B-SS	POLYNUCLEAR AROMATICS						
	Naphthalene	mg/kg	0.5	<0.5	<0.5	•	<0.5
	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	2-Chloronaphthalene	mg∕kg	0.5	<0.5	<0.5	i	<0.5
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	,	<0.5
	Acenaphthene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	Fluorene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	Phenanthrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Anthracene	mg/kg	0.5	<0.5	<0.5	i i	<0.5
	Fluoranthene	mg/kg	0.5	<0.5	<0.5		<0.5
	Pyrene	mg/kg	0.5	<0.5	<0.5		<0.5
	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.5		<0.5
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	Chrysene	mg/kg	0.5	<0.5	<0.5	•	<0.5
	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1		<1
	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5	•	<0.5
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	,	<0.5
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5		<0.5
	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5	•	<0.5
	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.5		<0.5

SAMPLES ANALYSED AS RECEIVED Samples analysed on an as received basis. Results reported on a dry weight basis. Sample preparation techniques: Semivolatile - Separatory Funnel and Tumbler, Volatile - Purge and Trap. Sample analysis techniques: Semivolatile - GC/MS, TPH - GC/FID; Volatile - GC/MS; Pesticides - GC/ECD, GC/MS.



(

М

E E

#### AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

**B R I S B A N E** Phone: (07) 352 5577 Fox: (07) 352 5109 S Y D N E Y Phone: (02) 899 5722 Fox: (02) 899 3200 MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

PERTH Phone: (09) 249 2988 Fox: (09) 249 2942





ļ	MR L GRAY •RUST PPK PTY LTD 100 NORTH TERRACE				Page 2 ENVIRONMENTA Batch-no:	2 of 4 L 10568	
	ADELAIDE SA 5000				Sub-batch:	1	
081	NFR-NO	SAM	PLE-TYP	F	No.samples: Received:	11	
305	57	SOI	L	-	Completed:	14/11/94	
1				L4 S4a	L5 S5b		L6 S6
Method	Analysis description	Units	LOR	0.3-0.45m 28/10/94	0.33-0. 28/10/	.5m /94	0.3-0.45m 28/10/94
EA-055	Moisture Content (dried @ 103'C)	x	0.1	12 <b>.</b> 9 <sup>-</sup>	0.9	2	7.8
EP-075B-SS	POLYNUCLEAR AROMATICS						
1	Naphthalene	mg/kg	0.5	<0.5	<0.5	5	<0.5
}	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	2-Chloronaphthalene	mg/kg	0.5	<0.5	、 <0.5	5	<0.5
1	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Acenaphthene	mg/kg	0.5	<0.5	<0.5	5	<0.5
•	Fluorene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Anthracene	mg/kg	0.5	<0.5	<0.5	5	<0.5
1	Fluoranthene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Pyrene	mg/kg	0.5	<0.5	<0.5	<b>i</b>	<0.5
1	N-2-Fluorenylacetamide	mg/kg	0.5	· <0.5	<0.5	5	<0.5
ļ	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	i	<0.5
	Chrysene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1		<1
{	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
•	Benzo(a)pyrene	mg∕kg	0.5	<0.5	<0.5	<b>i</b>	<0.5
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5	i	<0.5
1	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5	i	<0.5
I	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.5		<0.5
	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.5	i	<0.5

SAMPLES ANALYSED AS RECEIVED

...

Ę

#### AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

B R I S B A N E Phone: (07) 352 5577 Fox: (07) 352 5109 S Y D N E Y Phone: (02) 899 5722 Fox: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

**PERTH** Phone: (09) 249 2988 Fox: (09) 249 2942

M. Myear





	MR L GRAY RUST PPK PTY LTD				Page 2	of ·	4
	100 NORTH TERRACE				ENVIRONMENT	AL .	
				-	Batch-no:	10568	
-	ADELAIDE SA 5000				Sub-batch:	1	·
					No.samples:	11	
ORDER-NO		SAM	PLE-TYP	E	Received:	31/10/	94
305	·7	SOI	L		Completed:	14/11/	94
				L7 S7a	L8 S8		L9 S9a
Method	Analysis description	Units	LOR	0.17-0.40m	0.2-0	.5m	0.4-0.75m
		· · · · · · · · · · · · · · · · · · ·		28/10/94	28/10/94		28/10/94
EA-055	Moisture Content (dried @ 103'C)	%	0.1	13.4	9.3	в	11.1
EP-0758-SS	POLYNUCLEAR AROMATICS						
	Naphthalene	mg/kg	0.5	<0.5	<0.	5	<0.5
	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.	5	<0.5
	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Acenaphthylene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Acenaphthene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Fluorene	mg/kg	0.5	<0.5	<0.1	5	<0.5
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	5	<0.5
	Anthracene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Fluoranthene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Pyrene	mg/kg	0.5	<0.5	<0.	5	<0.5
	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.	5	<0.5
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Chrysene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<	1	<1
	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.1	5	<0.5
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.	5	<0.5
i	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.1	5	<0.5
	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.	5	<0.5
	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.	5	<0.5

SAMPLES ANALYSED AS RECEIVED

...

#### AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

B R I S B A N E Phone: (07) 352 5577 Fax: (07) 352 5109 **S Y D N E Y** Phone: (02) 899 5722 Fox: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fox: (03) 853 0730

PERTH Phone: (09) 249 2988 Fax: (09) 249 2942

é

10? 1200-





MR I	GI	RAY		
RUST	C DI	bk f	PTΥ	LTD
100	NOI	ктн	TER	RACE

of 4 Page 4

10568

ENVIRONMENTAL Batch-no:

i	ADELAIDE SA 5000				Sub-batch: No.samples:	1 11
ORD 305	ORDER-NO 3057		PLE-TYP 1.	E	Received:	31/10/94 14/11/94
		_		L9 S9b	COMP 10/11	
' Method	Analysis description	Units	LOR	0.75-0.95m 28/10/94	28/10/	/94
EA-055	Moisture Content (dried @ 103'C)	%	0.1	12.1	6.8	3
EP-0758-SS	POLYNUCLEAR AROMATICS					
	Naphthalene	mg/kg	0.5	<0.5	<0.5	5
	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5	5
1	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.5	5
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<b>j</b>
1	Acenaphthene	mg/kg	0.5	<0.5	<0.5	5
1	Fluorene	mg/kg	0.5	<0.5	<0.5	<b>j</b>
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<b>j</b>
1	Anthracene	mg/kg	0.5	<0.5	<0.5	<b>;</b>
1	Fluoranthene	mg/kg	0.5	<0.5	<0.5	5
	Pyrene	mg/kg	0.5	<0.5	<0.5	5
	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.5	<b>j</b>
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	5
1	Chrysene	mg/kg	0.5	<0.5	<0.5	i
	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1	l
1	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5	<b>;</b>
l	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	5
	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5	<b>j</b>
f	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5	•
	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	•
)	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.5	i

SAMPLES ANALYSED AS RECEIVED

.

177 Gen

#### AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

BRISBANE Phone: (07) 352 5577 Fox: (07) 352 5109

SYDNEY Phone: (02) 899 5722 Fax: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fox: (03) 853 0730

PERTH Phone: (09) 249 2988 Fax: (09) 249 2942





	MR L GRAY RUST PPK PTY LTD 100 NORTH TERRACE				Page 1 ENVIRONMENTA	of L	2	
	ADELATDE SA 5000	•			Sub-batch:	2	0	
					No.samples:	4		
ORD	DER-NO	SAM	IPLE-TYPE	:	Received:	31/1	0/94	
3057		SOIL			Completed:	14/11/94		
				L7 S7b	COMP 12/1	3	co	MP 10/11
Method	Analysis description	Units	LOR	0.4-0.4m	S14 0-0	0.15		s15 0-0.1
				28/10/94	28/10,	28/10/94		28/10/94
EA-055	Moisture Content (dried @ 103'C)	×	0.1	14.7	6.9	>		6.8
EP-067A-SS	ORGANOCHLORINE PESTICIDES							
	alpha_BHC	mg/kg	0.05	<0.05	<0.0	5		<0.05
	beta- & gamma-BHC	mg/kg	0.1	<0.1	<0.	1		<0.1
	delta-BHC	mg/kg	0.05	<0.05	<0.0	5		<0.05
	Heptachlor	mg/kg	0.05	<0.05	<0.0	5		<0.05
	Aldrin	mg/kg	0.05	<0.05	<0.0	5		<0.05 ·
	Heptachlor epoxide	mg/kg	0.05	<0.05	<0.0	<b>j</b>		<0.05
	Endosulfan 1	mg/kg	0.05	<0.05	<0.0	5		<0.05
	4.4'-DDE	mg/kgi	0.05	<0.05	<0.05	5		<0.05
	Dieldrin	mg/kg	0.05	<0.05	<0.05	5		<0.05
	Endrin	mg/kg	0.05	<0.05	<0.05	5		<0.05
	Endosulfan 2	mg∕kg	0.05	<0.05	<0.05	<b>i</b>		<0.05
	4.4'-DDD	mg/kg	0.05	<0.05	<0.05	5		<0.05
	Endrin aldehyde	mg/kg	0.05	<0.05	<0.05	5		<0.05
	Endosulfan sulfate	mg/kg	0.05	<0.05	<0.05	5		<0.05
	4.4'-DDT	mq/kq	0.2	<0.2	<0.2	2		<0.2

SAMPLES ANALYSED AS RECEIVED

ţ

Samples analysed on an as received basis. Results reported on a dry weight basis. Sample preparation techniques: Semivolatile - Separatory Funnel and Tumbler, Volatile - Purge and Trap. Sample analysis techniques: Semivolatile - GC/MS, TPH - GC/FID; Volatile - GC/MS; Pesticides - GC/ECD, GC/MS.

Malten



BRISBANE Phone: (07) 352 5577 Fax: (07) 352 5109

SYDNEY Phone: (02) 899 5722 Fox: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fax: (03) 853 0730

PERTH Phone: (09) 249 2988 Fax: (09) 249 2942




### ANALYTICAL REPORT

	MR L GRAY RUST PPK PTY LTD				Page	2	of	2
	ENVIRONMENTAL							
			Batch-no: 10568					
	ADELAIDE SA 5000				Sub-batch:	· 2	2	
					No.samples:	4	ł	
ORDER-NO 3057		SAMPLE-TYPE SOIL			Received:	3	1/10	)/94
					Completed:	1	14/11/94	
			1	COMP 1/6				
Method	Analysis description	Units	LOR	S16				
				28/10/94				
EA-055	Moisture Content (dried @ 103/C)	%	0.1	11.2				·
EP-067A-SS	ORGANOCHLORINE PESTICIDES							
	alpha-BHC	mg/kg	0.05	<0.05				
	beta- & gamma-BHC	mg/kg	0.1	<0.1				
	delta-BHC	mg/kg	0.05	<0.05				
	Heptachlor	mg/kg	0.05	<0.05				
	Aldrin	mg/kg	0.05	<0.05				
	Heptachlor epoxide	mg/kg	0.05	<0.05				
	Endosulfan 1	mg/kg	0.05	<0.05				
	4.4'-DDE	mg/kg	0.05	<0.05				
	Dieldrin	mg/kg	0.05	<0.05				
	Endrin	mg/kg	0.05	<0.05				
	Endosulfan 2	mg/kg	0.05	<0.05		•		
	4.4'-DDD	mg/kg	0.05	<0.05				
	Endrin aldehyde	mg/kg	0.05	<0.05				
	Endosulfan sulfate	mg/kg	0.05	<0.05				
	4.4'-DDT	mg/kg	0.2	<0.2				

SAMPLES ANALYSED AS RECEIVED

-

M Hunn

# AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

B R I S B A N E Phone: (07) 352 5577 Fax: (07) 352 5109 **S Y D N E Y** Phone: (02) 899 5722 Fox: (02) 899 3200 MELBOURNE Phone: (03) 853 5299 Fox: (03) 853 0730

• .

**PERTH** Phone: (09) 249 2988 Fox: (09) 249 2942





### ORGANICS QUALITY CONTROL REPORT

#### BATCH No. : EN10568

### DATE BATCH RECEIVED : 31/10/94

#### CLIENT : Rust PPK Pty Ltd

### DATE BATCH COMPLETED : 17/11/94

Method Test Matrix QC Lot Date Date Code Number Samples Samples Extracted Analysed OCOPS246 EP-067 Pesticides Soil 07/11/94 10/11/94 EP-075 Semivolatile Soil SVOCS145 07/11/94 10/11/94 Scan

ORGFORM(60/0)

## AUSTRALIAN LABORATORY SERVICES P/L A.C.N. 009 936 029

BRISBANE Phone: (07) 352 5577 Fox: (07) 352 5109 A.C.N. **S Y D N E Y** Phone: (02) 899 5722 Fox: (02) 899 3200

MELBOURNE Phone: (03) 853 5299 Fox: (03) 853 0730

**PERTH** Phone: (09) 249 2988 Fox: (09) 249 2942



# BATCH QUALITY CONTROL

### ALS EP-067 : PESTICIDES

QC LOT No. : OCOPS246 MATRIX: Soil

ANALYST: J. Langford

	Blank	Spike	[	Control Limits						
	Conc	Level	SCS	DCS	Average	RPD	Rec.		RPD	
COMPOUND			Conc	Conc	Rec.					
	mg/kg	mg/kg	mg/kg	mg/kg	%	%	Low	High	%	
EP-067A : ORGANOCHLORINE PESTICIDES										
alpha-BHC	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>79</td><td>5</td><td>60</td><td>115</td><td>20</td></lor<>	0.20	0.16	0.15	79	5	60	115	20	
beta & gamma-BHC	< LOR	0.40	0.33	0.32	81	2	60	117	20	
delta-BHC	<lor< td=""><td>0.20</td><td>0.17</td><td>0.16</td><td>79</td><td>5</td><td>67</td><td>113</td><td>20</td></lor<>	0.20	0.17	0.16	79	5	67	113	20	
Heptachlor	< LOR	0.20	0.16	0.15	76	5	38	125	20	
Aldrin	< LOR	0.20	0.16	0.19	86	17	53	116	20	
Heptachlor epoxide	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>76</td><td>7</td><td>62</td><td>114</td><td>20</td></lor<>	0.20	0.16	0.15	76	7	62	114	20	
Endosulfan 1	<lor< td=""><td>0.20</td><td>0.17</td><td>0.18</td><td>85</td><td>6</td><td>67</td><td>111</td><td>20</td></lor<>	0.20	0.17	0.18	85	6	67	111	20	
4,4'-DDE	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>75</td><td>6</td><td>68</td><td>114</td><td>20</td></lor<>	0.20	0.16	0.15	75	6	68	114	20	
Dieldrin	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>75</td><td>5</td><td>67</td><td>113</td><td>20</td></lor<>	0.20	0.16	0.15	75	5	67	113	20	
Endrin	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>77</td><td>6</td><td>41</td><td>129</td><td>20</td></lor<>	0.20	0.16	0.15	77	6	41	129	20	
Endosulfan 2	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>76</td><td>5</td><td>68</td><td>112</td><td>20</td></lor<>	0.20	0.16	0.15	76	5	68	112	20	
4,4'-DDD	<lor< td=""><td>0.20</td><td>0.16</td><td>0.14</td><td>73</td><td>9</td><td>67</td><td>111</td><td>20</td></lor<>	0.20	0.16	0.14	73	9	67	111	20	
Endrin aldehyde	<lor< td=""><td>0.20</td><td>0.15</td><td>0.13</td><td>68</td><td>16</td><td>66</td><td>112</td><td>20</td></lor<>	0.20	0.15	0.13	68	16	66	112	20	
Endosulfan sulfate	<lor< td=""><td>0.20</td><td>0.16</td><td>0.15</td><td>75</td><td>7</td><td>64</td><td>117</td><td>20</td></lor<>	0.20	0.16	0.15	75	7	64	117	20	
4,4'-DDT	<lor< td=""><td>0.20</td><td>0.18</td><td>0.17</td><td>86</td><td>6</td><td>71</td><td>107</td><td>20</td></lor<>	0.20	0.18	0.17	86	6	71	107	20	
EP-067B : ORGANOF	HOSPHOR	US PEST	FICIDES							
Dichlorvos	<lor< td=""><td>0.20</td><td>0.14</td><td>0.13</td><td>. 66</td><td>4</td><td>52</td><td>116</td><td>20</td></lor<>	0.20	0.14	0.13	. 66	4	52	116	20	
Dimethoate	<lor< td=""><td>0.20</td><td>0.15</td><td>0.14</td><td>72</td><td>2</td><td>54</td><td>114</td><td>20</td></lor<>	0.20	0.15	0.14	72	2	54	114	20	
Diazinon	<lor< td=""><td>0.20</td><td>0.14</td><td>0.13</td><td>67</td><td>4</td><td>53</td><td>117</td><td>20</td></lor<>	0.20	0.14	0.13	67	4	53	117	20	
Chlorpyrifos methyl	< LOR	0.20	0.13	0.13	64	5	63	115	20	
Malathion	<lor< td=""><td>0.20</td><td>0.14</td><td>0.13</td><td>65</td><td>6</td><td>62</td><td>116</td><td>20</td></lor<>	0.20	0.14	0.13	65	6	62	116	20	
Fenthion	<lor< td=""><td>0.20</td><td>0.13</td><td>0.13</td><td>65</td><td>0</td><td>59</td><td>115</td><td>20</td></lor<>	0.20	0.13	0.13	65	0	59	115	20	
Chlorpyrifos	<lor< td=""><td>0.20</td><td>0.13</td><td>0.12</td><td>63 ·</td><td>6</td><td>65</td><td>112</td><td>20</td></lor<>	0.20	0.13	0.12	63 ·	6	65	112	20	
Pirimiphos ethyl	<lor< td=""><td>0.20</td><td>0.13</td><td>0.13</td><td>64</td><td>5</td><td>45</td><td>120</td><td>20</td></lor<>	0.20	0.13	0.13	64	5	45	120	20	
Bromophos ethyl	<lor< td=""><td>0.20</td><td>N/A</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td></lor<>	0.20	N/A	N/A						
Prothiofos	<lor< td=""><td>0.20</td><td>0.14</td><td>0.14</td><td>68</td><td>6</td><td>65</td><td>113</td><td>20</td></lor<>	0.20	0.14	0.14	68	6	65	113	20	
Ethion	<lor< td=""><td>0.20</td><td>0.13</td><td>0.12</td><td>61</td><td>8</td><td>52</td><td>123</td><td>20</td></lor<>	0.20	0.13	0.12	61	8	52	123	20	

### COMMENTS :

1) The control limits are based on ALS laboratory statistical data (Method QWI-ORG/06)

2) \* : Recovery or RPD falls outside of the recommended control limits.

### BATCH QUALITY CONTROL

### ALS EP-075 : SEMIVOLATILE SCAN

QC LOT No. : SVOCS145 MATRIX: Soil

### ANALYST: L. Baker

	Blank	Spike		OC SPIKE	Control Limits							
	Conc.	Level	SCS	DCS	Average				-			
COMPOUND			Conc	Conc	Rec.	RPD	Recovery		RPD			
	mg/kg	mg/kg	mg/kg	mg/kg	%	%	Low	High	%			
EP-075B : POLYAROMATIC HYDROCARBONS												
Naphthalene	<lor< td=""><td>1.25</td><td>1.16</td><td>1.08</td><td>90</td><td>7</td><td>56</td><td>107</td><td>35</td></lor<>	1.25	1.16	1.08	90	7	56	107	35			
2-Methylnaphthalene	<lor< td=""><td>1.25</td><td>1.19</td><td>1.18</td><td>95</td><td>0</td><td>49</td><td>113</td><td>35</td></lor<>	1.25	1.19	1.18	95	0	49	113	35			
2-Chloronsphthalene	<lor< td=""><td>1.25</td><td>1.14</td><td>1.15</td><td>. 92</td><td>1</td><td>52</td><td>104</td><td>35</td></lor<>	1.25	1.14	1.15	. 92	1	52	104	35			
Acenaphthalene	<lor< td=""><td>1.25</td><td>1.18</td><td>1.23</td><td>96</td><td>4</td><td>52</td><td>107</td><td>35</td></lor<>	1.25	1.18	1.23	96	4	52	107	35			
Acenaphthene	<lor< td=""><td>1.25</td><td>1.20</td><td>1.24</td><td>98</td><td>3</td><td>53</td><td>112</td><td>35</td></lor<>	1.25	1.20	1.24	98	3	53	112	35			
Fluorene	<lor< td=""><td>1.25</td><td>1.21</td><td>1.23</td><td>97</td><td>2</td><td>54</td><td>111</td><td>35</td></lor<>	1.25	1.21	1.23	97	2	54	111	35			
Phenanthrene	<lor< td=""><td>1.25</td><td>1.34</td><td>1.27</td><td>104</td><td>5</td><td>56</td><td>115</td><td>35</td></lor<>	1.25	1.34	1.27	104	5	56	115	35			
Anthracene	<lor< td=""><td>1.25</td><td>0.96</td><td>0.98</td><td>77</td><td>3</td><td>49</td><td>118</td><td>35</td></lor<>	1.25	0.96	0.98	77	3	49	118	35			
Fluoranthrene	<lor< td=""><td>1.25</td><td>1.33</td><td>1.36</td><td>108</td><td>3</td><td>55</td><td>118</td><td>35</td></lor<>	1.25	1.33	1.36	108	3	55	118	35			
Pyrone	<lor< td=""><td>1.25</td><td>1.33</td><td>1.30</td><td>105</td><td>3</td><td>55</td><td>120</td><td>35</td></lor<>	1.25	1.33	1.30	105	3	55	120	35			
N-2-Fluorenylacetimide	<lor< td=""><td>1.25</td><td>1.22</td><td>1.24</td><td>99</td><td>2</td><td>29</td><td>111</td><td>· 35</td></lor<>	1.25	1.22	1.24	99	2	29	111	· 35			
Benz(a)anthracene	<lor< td=""><td>1.25</td><td>1.23</td><td>1.36</td><td>103</td><td>10</td><td>54</td><td>118</td><td>35</td></lor<>	1.25	1.23	1.36	103	10	54	118	35			
Chrysene	<lor< td=""><td>1.25</td><td>1.39</td><td>1.47</td><td>114</td><td>6</td><td>51</td><td>124</td><td>35</td></lor<>	1.25	1.39	1.47	114	6	51	124	35			
Benzo(b) & (k) fluoranthene	<lor< td=""><td>2.50</td><td>2.35</td><td>2.46</td><td>96</td><td>4</td><td>53</td><td>123</td><td>35</td></lor<>	2.50	2.35	2.46	96	4	53	123	35			
7,12-Dimethyl benz(a)anthracene	<lor< td=""><td>1.25</td><td>0.98</td><td>1.12</td><td>84</td><td>13</td><td>37</td><td>187</td><td>35</td></lor<>	1.25	0.98	1.12	84	13	37	187	35			
Benzo(a)pyrene	<lor< td=""><td>1.25</td><td>0.85</td><td>1.04</td><td>75</td><td>20</td><td>44</td><td>124</td><td>35</td></lor<>	1.25	0.85	1.04	75	20	44	124	35			
3-Methylchloanthrene	<lor< td=""><td>1.25</td><td>0.85</td><td>0.95</td><td>72</td><td>11</td><td>45</td><td>118</td><td>35</td></lor<>	1.25	0.85	0.95	72	11	45	118	35			
Indeno(1,2,3-cd)pyrene	<lor< td=""><td>1.25</td><td>1.49</td><td>1.49</td><td>119</td><td>0</td><td>43</td><td>123</td><td>35</td></lor<>	1.25	1.49	1.49	119	0	43	123	35			
Dibenz(a,h)anthracene	<lor< td=""><td>1.25</td><td>1.46</td><td>1.59</td><td>122</td><td>9</td><td>39</td><td>123</td><td>35</td></lor<>	1.25	1.46	1.59	122	9	39	123	35			
Benzo(g,h,i)perylene	<lor< td=""><td>1.25</td><td>1.43</td><td>1.55</td><td>119</td><td>8</td><td>44</td><td>119</td><td>35</td></lor<>	1.25	1.43	1.55	119	8	44	119	35			

COMMENTS :

1) The control limits are based on ALS laboratory stastical data (Method QWI-ORG/06).

2) \*: Recovery or RPD falls outside the recommended limits.

# Appendix L

Site Plan Showing Location of Trial Excavation Area



# Appendix M

ŗ

Photographic Record of Backhoe Excavation



(\_\_)

;

Photo 1: The backhoe used in the trial excavation. Pieces of concrete are visible in the excavation material.



Photo 2: A piece of concrete present in the excavation material.



Photo 3: In the centre foreground, shows a large piece of concrete which could not be removed by the backhoe. It's volume was estimated to be at least 0.2m<sup>3</sup>.

 $\langle \cdot \rangle$ 

---

**.** 

j.



Photo 4: Distinct rows where grass is growing well relative to other areas. Building rubble is thought to buried in trenches below these areas. The area of lush vegetation in the background may be the location of a large burial pit.