Q BUILD PROJECT SERVICES

FURTHER INVESTIGATION LAND CONTAMINATION QUEENSLAND COTTON CORPORATION SITE EAGLE FARM

RTI DL RELEASE - EHP

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LIMITATIONS OF REPORT

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It is recommended that any plans and specifications prepared by others and relating to the content of this report or amendments to the original plans and specifications be reviewed by Hollingsworth Dames & Moore to verify that the intent of our recommendations is properly reflected in the design.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

There are always some variations in subsurface conditions across a site which cannot be fully defined by investigation. Hence it is unlikely that the measurements and values obtained from sampling and testing during the investigation will represent the extremes of conditions which exist within the site.

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1.0 INTRODUCTION

Hollingsworth Dames & Moore was commissioned by Q Build Project Services to provide a "Supplementary Investigation Report and Management Plan" in relation to contamination of the Queensland Cotton Corporation site at Eagle Farm. The work undertaken was based on **Stage II Further Investigation** outlined in the **Guidelines for the Assessment of Contaminated Land in Queensland** (CHEM Unit 1992).

Significant contamination due to arsenic was initially detected at the site and reported in a **Pre-Disposal Assessment of the site for Queensland Cotton Corporation** (Reference 1). The results of this assessment indicated that the contamination may be associated with the siting of an old railway line (now dismantled) immediately adjacent to the existing buildings at the north of the site; the most probable source of contamination being from the spraying of herbicides by Queensland Railways in the maintenance of the tracks. It is understood that arsenic was used as a herbicide until the 1950s.

Further work was subsequently undertaken to confirm the existence of arsenic contamination and to determine whether the contamination was associated with the old railway line. The results of the further investigation are included in the **Pre-Disposal Assessment - Phase 2** for the site (Reference 2).

The Phase 2 assessment confirmed that very high levels of arsenic contamination identified at the site were related to previous maintenance and vegetation control associated with the railway tracks. Detailed enquiries associated with the Phase 2 assessment also identified the type of herbicides used by Queensland Railways in track maintenance, however arsenic was the only type which was found to persist in the site soil. The arsenic contamination was also found to be limited to within 1 m of the surface and within a corridor approximately 15 m wide encompassing the dismantled railway line.

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These two previous investigations were carried out for the site in July 1991 and September 1991 respectively, and resulted in the CHEM (Chemical Hazards and Emergency Management) Unit giving the site a Restricted classification – which implies either limited use or on–site activity or else appropriate site management or remediation to relieve such restrictions.

This supplementary investigation has been undertaken to further assess potential contamination associated with another existing railway line at the site which is also located within the site boundary but further north of the area of the dismantled track previously investigated.

The site is planned to be use by the State Government for an extension of the Gateway TAFE College and the existing railway lines are also to be dismantled as part of demolition at the site prior to construction of the proposed college development.

The results of this supplementary investigation, in conjunction with previous investigation data, are to be utilised in the formulation of a management plan to deal with the site contamination taking into account the proposed site development.

Permission has been granted by Queensland Cotton to use the previous investigation results in association with this supplementary investigation report to develop various management options for the site.

This report includes details of the supplementary investigation for submission and liaison with the CHEM Unit in regard to a suitable site management plan.

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2.0 SITE DESCRIPTION

The site location, property description, ownership, topography, surface drainage, geology and hydrogeology characteristics of the site have previously been addressed in the Pre–Disposal Assessment for the site undertaken for the Queensland Cotton Corporation (Reference 1). Following is a brief review of these characteristics for reference.

2.1 Location

The site is located at the corner of Kingsford Smith Drive and Woonah Avenue as indicated in Figure 1. The site is bounded in the north by the Brisbane–Pinkenba rail link. The remainder of the site is bounded by real property boundaries and by Woonah Avenue.

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2.2 Description

The real property description of site is defined as Lot 1 on Registered Plan 195569.

The site is relatively flat and is predominantly covered with existing buildings and concrete slabs. Railway tracks are located to the north of the site. A site plan showing the layout of existing site and associated features is presented as Figure 2.

2.3 Topography

The property is located within the coastal plain adjacent to the Brisbane River. The site is relatively flat, with a gentle slope towards the river to the south. The entire site is located at approximately 10 m above mean sea level (amsl).

2.4 Surface Drainage

Examination of the topographic and geological maps and of the aerial photographs covering the site indicate a drainage channel crossing the site from the north west corner and exiting at about the middle of the southern boundary. An early oblique photograph shows a farm dam located to the midwest of the site.

2.5 Geology

The site is located within the alluvial plains area adjacent to the coastal plain and is underlain entirely by Pleistocene alluvial deposits (Reference 1). The deposits underlying the site are typical flood plain sediments composed of unconsolidated sand, silt, clay and gravels. These deposits represent the lower of the two alluvial terraces.

The areas immediately to the south, east and north of the site are composed of Holocene alluvial levee and tidal flats deposits.

The site is probably underlain at depth by rocks of the Tertiary Petrie Formation. The Petrie Formation consists of poorly consolidated sediments composed of mudstone, shale and sandstone with basaltic layers present. These basaltic layers occur randomly throughout the sequence and are generally slightly to completely weathered, jointed and non vesicular.

2.6 Hydrogeology

The hydrogeology of the area adjacent to the International Airport was the subject of an investigation carried out by the Queensland Water Resources Commission (Reference 1). The report indicated that the water table in the flood plain was commonly located at between 1.5 to 2.0 m below the ground surface. Water quality tests carried out as part of this study indicated that the salinity of the surface water and shallow groundwater was generally high.

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3.0 FIELD INVESTIGATION AND SAMPLING PROGRAMME

3.1 Field Investigation

The previous investigation results enabled targeted sampling for this supplementary investigation. Sampling locations were selected to determine the degree of uniformity of contamination and its vertical and lateral extent in relation to the railway tracks. The location of test pits and sampling sites, however, was restricted due to the extent of existing concrete slabs and building cover at the site.

Samples were recovered from a total of 20 test pits at the locations indicated in Figure 2. The test pits were excavated to a depth of 1.0 m using a backhoe. Representative duplicate soil samples were recovered from discrete levels within the test pits.

A standpipe piezometer was installed in TP18 in order to investigate and monitor the groundwater level at the site and also to facilitate sampling of the groundwater for chemical analysis. A groundwater sample was subsequently recovered using a teflon bailer.

A Work Plan is presented in Appendix A which details the work undertaken and the procedures that were undertaken used during the field investigation including:

- decontamination procedures
- sample handling and preservation
- storage and shipment of samples.

The test pit logs for this supplementary investigation (TP6 – TP25) are presented in Appendix B. Also included in the Appendix B are the test pit logs for the Queensland Cotton Pre–Disposal Assessment – Phase 2 (TP1 – TP5) for reference.

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3.2 Soil and Groundwater Profile

The soil profile which was encountered in the test pit excavations is summarised in Table 1. The soil profile was relatively uniform.

Table 1

Soil Profile Summary – Test Pit

Soil Type	Depth Range (m)	Average Thickness (m)
Fill – Sandy/Clayey GRAVEL	0.0–0.8	0.4 m
Silty SAND or CLAY (low plasticity)	0.2–0.7	0.2 m
CLAY (high plasticity)	+0.3	

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Surface fill material was consistently encountered across the site and predominantly included gravelly material. An intermediate layer of either silty sand or low plasticity clay was encountered at most locations immediately overlying high plasticity clay, which was also consistently encountered across the site.

Although no groundwater was encountered in the test pits during the supplementary investigation, subsequent monitoring of the piezometer installed in TP18 indicated a groundwater level of between 0.6 m and 1.25 m.

In situ measurements determined for the groundwater indicate conductivity levels of between 3000 – 5400 µS/cm,which reflects brackish water. It is also anticipated that the groundwater would be partially tidal.

4.0 LABORATORY ANALYTICAL RESULTS

4.1 Soil Analysis Results

Selected soil samples from the test pits were analysed in the laboratory for a range of heavy metals (including cadmium, chromium, copper, lead, mercury, nickel and zinc) and the metalloid arsenic. A limited number of samples were also analysed for organic compounds including hydrocarbons, BTEX (Benzene, Toluene, Ethyl–Benzene and Xylene) and PCB (polychlorinated biphenyls). In addition, two samples were also analysed for the presence of herbicides.

Toxicity Characteristic Leaching Procedure (TCLP) tests were subsequently conducted on two samples exhibiting medium and high arsenic concentrations. This analysis is designed to determine the mobility of analytes in the soil.

The laboratory soil analyses results from this supplementary investigation and previous investigations are summarised in the following tables (Table 3–7) for comparison. A summary of the soil analyses for each investigation is included in Table 2.

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Table 2

Soil Analysis Summary

Table No.	Analyses	Investigation	Location
3	Inorganics	Q Build	Southern (Dismantled) Railway Line
4	Inorganics	Q Build	Northern (Existing) Railway Line
5	Inorganics	Queensland Cotton – Phase 2	Southern (Dismantled) Railway Line
6	Inorganics	Queensland Cotton	Southern (Dismantled) Railway Line
7	Organics	Q Build	Northern (Existing) Railway Line

The laboratory analyses results included in these tables refer to concentrations related to dry weights. They have been converted from the laboratory report to enable comparisons with Guideline values.

Quality control of the laboratory analysis was also undertaken through submission of duplicate samples of soil to the principal laboratory in order to test the repeatability of results (Table 8). In consideration of the natural variability of the soil these results indicate that a reasonable degree of confidence can be attributed to the results obtained. In addition both quality control was also undertaken by the principal laboratory.

All of the laboratory analyses reports are included in Appendix C for reference.

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Table 3

Soil Analysis Results – Inorganics
Southern (Dismantled) Railway Line

Sample No	Test Pit	Depth (m)	Moisture Content %	Arsenic As	Lead Pb	Cadmium Cd	Chromium Cr	Copper Cu	Zinc Zn	Nickel Ni	Soil Type
QC1-1	TP6	0.0-0.1	16.4	100	86.7	<0.5	16.7	70.6	313	31.7	(F) GP
QC2-1	TP6	0.2-0.4	16.7	81.0							(A) SM
QC3-1	TP6	0.4-0.6	26.8	2.7							(A) CH
QC4-1	TP7	0.0-0.1	26.9	49.0							(F) GP
QC8-1	TP8	0.0-0.1	21.5	22.3							(F) GP
QC11-1	TP9	0.0-0.1	13.6	52.7							(F) GP
QC14-1	TP10	0.0-0.1	10.5	11.2							(P) GC
QC18-1	TP11	0.0-0.1	15.2	54.8	288	<0.5	6.5	6.5	221	7.1	(F) GP
QC20-1	TP12	0.0-0.1	9.4	139							(F) GP
QC21-1	TP12	0.2-0.4	14.1	217							(F) GP
QC22-1	TP12	0.4-0.8	25.5	1.3							(A) CH
QC23-1	TP13	0.0-0.1	3.6	9.3							(F) GP
QC25-1	TP14	0.0-0.1	6.0	452	756	<0.5	4.2	55.3	243	6.9	(F) GP
QC26-1	TP14	0.2-0.4	9.5	375							(F) GP
QC27-1	TP14	0.4-1.0	25.1	2.0							(A) CH
QC28-1	TP15	0.0-0.1	4.3	14.6							(F) GP
QC29-1	TP15	0.2-0.4	9.2	<0.5							(F) GP
QC30-1	TP15	0.4-1.0	12.1	<0.5							(A) SC
Detection Limits (ALS)			0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	- -
"Background Levels" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				0.2-30	<2-200	0.04-2	0.5-110	1-190	2-180	2-400	- -
"Environmental Investigation Thresholds" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				20	300	3	50	60	200	60	- -
"Health Based Investigation Thresholds" Guidelines for the Assessment of Contaminated Land (January 1992)				100	300	20	NA	NA	NA	NA	- -
Health Based Investigation Level Dutch B				30	150	5	250	100	500	100	- -
Health Based Investigation Level Dutch C				50	600	20	800	500	3000	500	- -

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Note: Results from Q Build Assessment
All results in mg/kg, dry weight, unless otherwise specified.
Threshold and Indicative values in mg/kg dry weight
Moisture Content values based on mg/kg wet weight
Shaded values indicate concentrations in excess of GACLQ Environmental Investigation Threshold values
Bold values indicate concentrations in excess of GACLQ Health Based Investigation Threshold values
NA Not analysed
F Fill
A Alluvium
GP Gravel (poorly graded)
SM Silty sand
SC Clayey Sand
CH Clay (high plasticity)

Table 4

Soil Analysis Results – Inorganics
Northern (Existing) Railway Line

Sample No	Test Pit	Depth (m)	Moisture Content %	Arsenic As	Lead Pb	Cadmium Cd	Total Chromium Cr	Copper Cu	Zinc Zn	Nickel Ni	Soil Type	
QC31-1	TP16	0.0-0.1	19.3	13.6							(F)	GC
QC33-1	TP16	0.1-0.3	21.9	48.0							(F)	GP
QC36-1	TP16	0.0-0.1	14.9	23.5							(F)	GC
QC37-1	TP17	0.1-0.3	24.2	68.6							(F)	GP
QC38-1	TP17	0.3-0.6	19.8	50.9							(A)	CL
QC40-1	TP18	0.1-0.2	19.0	26.5							(F)	GP
QC41-1	TP18	0.3-0.5	14.6	38.6							(A)	CL
QC42-1	TP18	0.5-1.0	20.0	29.4							(A)	CH
QC44-1	TP19	0.1-0.2	25.0	48.0							(F)	GP
QC45-1	TP19	0.2-0.4	12.9	20.1							(F)	SP
QC46-1	TP19	0.4-0.6	21.6	5.7							(A)	CH
QC47-1	TP20	0.2-0.3	19.7	57.3	38.6	<0.5	6.9	30.5	46.1	24.9	(F)	GP
QC50-1	TP21	0.2-0.3	27.5	105							(F)	GP
QC53-1	TP22	0.2-0.3	28.3	181							(F)	GP
QC57-1	TP23	0.2-0.3	27.7	398							(F)	GP
QC60-1	TP24	0.2	22.0	337							(F)	CH
QC63-1	TP25	0.2	17.7	283							(F)	GP
QC64-1	TP25	0.2-0.3	16.5	393							(F)	GP
QC65-1	TP25	0.3-0.5	10.9	25.8							(A)	MH
Detection Limits (ALS)			0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-	-
"Background Levels" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				0.2-30	<2-200	0.04-2	0.5-110	1-190	2-180	2-400	-	-
"Environmental Investigation Thresholds" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				20	300	3	50	60	200	60	-	-
"Health Based Investigation Thresholds" Guidelines for the Assessment of Contaminated Land (January 1992)				100	300	20	NA	NA	NA	NA	-	-
Investigation Level Dutch B				30	150	5	250	100	500	100	-	-
Investigation Level Dutch C				50	600	20	800	500	3000	500	-	-

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Note: Results from Q Build Assessment
All results in mg/kg, dry weight, unless otherwise specified.
Threshold and Indicate values in mg/kg dry weight
Moisture Content values based on mg/kg wet weight
NA Not analysed
ND Not Detected
Shaded values indicate concentrations in excess of GACLQ Environmental Investigation Threshold values
Bold values indicate concentrations in excess of GACLQ Health Based Threshold values
F Fill
A Alluvium
GC Clayey gravel
GP Gravel (poorly graded)
CL Clay (low plasticity)
CH Clay (high plasticity)
MH Silt (high plasticity)
SP Sand (poorly graded)

Table 5

Soil Analysis Results – Inorganics
Southern (Dismantled) Railway Line

Sample No	Test Pit	Depth (m)	Moisture Content %	Arsenic As	Lead Pb	Cadmium Cd	Total Chromium Cr	Copper Cu	Zinc Zn	Nickel Ni	Soil Type	
S1	TP1	0.0–0.1		16.2							(F)	SM
S2	TP1	0.0–0.1		16.9							(F)	SM
S3	TP1	0.0–0.1		19.0							(F)	SM
S3	TP1	0.5		12.7							(F)	SM
S3	TP1	0.75		3.9							(F)	ML
S4	TP1	0.25		48.5							(F)	SM
S5	TP2	0.0–0.1		19.7							(F)	SM
S5	TP2	0.25		13.6							(F)	SM
S5	TP2	0.50		67.8							(F)	SM
S5	TP2	0.75		31.2							(A)	CL
S5	TP2	1.00		3.6							(A)	CL
S6	TP2	0.25		23.6							(F)	SM
S6	TP2	0.50		429							(F)	SM
S6	TP2	0.75		293							(A)	CL
S6	TP2	1.00		4.0							(A)	CL
S6	TP2	1.25		1.8							(A)	CL
S7	TP2	0.0–0.1		16.3							(F)	SP
S7	TP2	0.25		14.5							(F)	SP
S7	TP2	0.50		441							(F)	SP
S7	TP2	0.75		8.4							(A)	CL
S7	TP2	1.0		6.4							(A)	CL
S8	TP2A	0.0–0.1		18.0							(F)	SP
S8	TP2A	0.25		270							(F)	SP
S8	TP2A	0.50		272							(F)	SP
S9	TP2A	0.0–0.1		90.4							(F)	SP
S9	TP2A	0.75		7.0							(A)	CL
S9	TP2A	1.00		3.2							(A)	CL
S10	TP3	0.0–0.1		24.8							(F)	GC
S10	TP3	0.50		122							(F)	GC
S11	TP4	0.0–0.1		22.9							(F)	GC
S12	TP5	0.0–0.1		17.6							(F)	GC
S12	TP5	0.50		3.8							(F)	GC
S12	TP5	0.75		1.7							(A)	CH
Detection Limits (ALS)		0.75	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	–	–
"Background Levels" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				0.2–30	<2–200	0.04–2	0.5–110	1–190	2–180	2–400	–	–
"Environmental Investigation Thresholds" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				20	300	3	50	60	200	60	–	–
"Health Based Investigation Thresholds" Guidelines for the Assessment of Contaminated Land (January 1992)				100	300	20	NA	NA	NA	NA	–	–
Investigation Level Dutch B				30	150	5	250	100	500	100	–	–
Investigation Level Dutch C				50	600	20	800	500	3000	500	–	–

Note: QC Results from Queensland Cotton Pre-disposal Assessment – Phase 2 (Reference 2)
All results in mg/kg, dry weight, unless otherwise specified.
NA Not analysed
ND Not Detected
Shaded values indicate concentrations in excess of GACLQ Environmental Investigation Thresholds
Bold values indicate concentrations in excess of GACLQ Health Based Investigation Thresholds
F Fill
A Alluvium
SM Silty sand
SP Sand (poorly graded)

ML Silt (low plasticity)
CL Clay (low plasticity)
CH Clay (high plasticity)
GC Clayey gravel

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Table 6

Soil Analysis Results – Inorganics
Southern (Dismantled) Railway Line

Sample No	Test Pit	Depth (m)	Moisture Content %	Arsenic As	Lead Pb	Cadmium Cd	Total Chromium Cr	Copper Cu	Zinc Zn	Nickel Ni	Mercury Hg	Soil Type	
	AH1			15	35	<0.5	60	11	45	5	0.60		
	AH2			115	160	1	5	40	361	14	0.34		
	AH3			185	105	<0.5	15	43		8	0.21		
	AH4			25	315	1	5	47		13	0.33		
	AH4D			5	200	1	10	18		14	0.20		
	AH2	0.00–0.05		23								(F)	GP
	AH2	0.05–0.25		62			85		420		<50	(F)	GP
	AH2	0.25–0.50		30								(F)	GP
	AH2	0.50–0.75		64			110		130		<50	(F)	GP
	AH3	0.00–0.05		23			110		70		<50	(F)	GP
	AH3	0.05–0.25		67								(F)	GP
	AH3	0.25–0.50		185			90		175		<50	(F)	GP
	AH3	0.50–0.75		112			390		45		<50	(A)	CL
Detection Limits (ALS)			0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.05	-	-
"Background Levels" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				0.2–30	<2–200	0.04–2	0.5–110	1–190	2–180	2–400	0.001–0.1	-	-
"Environmental Investigation Thresholds" Guidelines for the Assessment of Contaminated Land in Queensland (January 1992)				20	300	3	50	60	200	60	1	-	-
"Health Based Investigation Thresholds" Guidelines for the Assessment of Contaminated Land (January 1992)				100	300	20	NA	NA	NA	NA	NA	-	-
Health Based Investigation Level Dutch B				30	150	5	250	100	500	100	2	-	-
Health Based Investigation Level Dutch C				50	600	20	800	500	3000	500	10	-	-

Note: QC Results from Queensland Cotton Pre-disposal Assessment (Reference 1)
All results in mg/kg, dry weight, unless otherwise specified.
NA Not analysed
Shaded values indicate concentrations in excess of GACLQ Environmental Investigation Threshold levels
Bold values indicate concentrations in excess of GACLQ or Dutch Health Based Investigation Threshold levels
F Fill
A Alluvium
GP Gravel (poorly graded)
CL Clay (low plasticity)

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Table 7

Soil Analysis Results – Organics
Northern (Existing) – Railway Line

Sample No.	Test Pit	Depth (m)	Moisture Content %	$C_5 - C_9$	$C_{10} - C_{14}$	$C_{15} - C_{28}$	$C_{29} - C_{36}$	Benzene	Toluene	Ethyl-Benzene	Xylene m&p	Xylene o	PCBs	Soil Type	
QC47-1	TP20	0.2-0.3	19.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	(F)	GP
QC50-1	TP21	0.2-0.3	27.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	(F)	GP
QC53-1	TP22	0.2-0.3	28.3	14	ND	1810	1490	ND	ND	ND	ND	ND	ND	(F)	GP
QC57-1	TP23	0.2-0.3	27.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	(F)	GP
QC60-1	TP24	0.2	22.0	ND	ND	130	200	ND	ND	ND	ND	ND	ND	(F)	CH
Detection Limits (ALS)			0.1	2	50	100	100	0.20	0.20	0.20	0.40	0.20	0.20	-	-
"Investigation Thresholds" Draft Guidelines for Assessment of Contaminated Land in Queensland (March 1991)				$\frac{C_5 - C_{10}}{100}$	$\frac{C_{10} - C_{16}}{100}$	$\frac{C_{17>}}{1000}$		7				-	-	-	-
Health Based Investigation Level Dutch B				100	100	1000	1000	0.5	3	5	5	-	-	-	-
Health Based Clean-up Level Dutch C				800	800	5000	5000	5	30	50	50	-	-	-	-

Note: QB QBuild Assessment
All results in mg/kg, dry weight, unless otherwise specified.
Shaded values indicate concentrations in excess of GACLQ Environmental Investigation Threshold levels
ND Not Detected
F Fill
A Alluvium
GP Gravel (poorly graded)
CH Clay (high plasticity)

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Table 8

Summary of Results (Internal Quality Control)

Parameter		TP6		TP7		TP12		TP16		TP25	
		QC1-1	QCD-5	QC4-1	QCD-1	QC22-1	QCD-2	QC36-1	QCD-3	QC64-1	QCD-4
Arsenic	As	100	106	49.0	65.1	1.3	2.0	23.5	24.6	292	397
Cadmium	Cd	<0.5	<0.5	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	Cr	16.7	10.6	NA	NA	NA	NA	NA	NA	NA	NA
Copper	Cu	70.6	44.2	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	Ni	30.7	41.3	NA	NA	NA	NA	NA	NA	NA	NA
Lead	Pb	86.7	73.1	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	Zn	313	259	NA	NA	NA	NA	NA	NA	NA	NA

QB QBuild Assessment
All results in mg/kg dry weight, unless otherwise specified
NA Not Analysed.

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4.2 Groundwater Analysis Results

A groundwater sample recovered from TP18 was also analysed in the laboratory for a range of heavy metals and the metalloid arsenic. These analyses results are summarised in Table 9.

Table 9

Water Analysis Results – Inorganics

Sample No	Type	Conductivity uS/cm	Arsenic As	Lead Pb	Cadmium Cd	Chromium Cr	Copper Cu	Zinc Zn	Nickel Ni
QCW-1	G	4000	0.16	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01
QCW-2	G	5400	0.13	NA	NA	NA	NA	NA	NA
Detection Limits (ALS)		1	0.01	0.01	0.005	0.01	0.01	0.01	0.01
ANZECC Water Quality Guidelines Aquatic Ecosystems (Marine)			0.05	0.005	0.002	0.002	0.005	0.05	0.015
Health Based Investigation Level Dutch B			0.03	0.05	0.0025	0.05	0.05	0.2	0.05
Health Based Clean-Up Level Dutch C			0.10	0.2	0.01	0.2	0.2	0.8	0.2

Note: All results in mg/l, unless otherwise specified
Guideline and Indicative values in mg/l
ND Not Detected
NA Not Analysed
Shaded values indicate concentrations which exceed Dutch B Investigation or ANZECC levels
Bold values indicate concentrations which exceed Dutch C Clean-Up levels
G Groundwater
Samples from TP18

5.0 DISCUSSION OF RESULTS

The significance of the assessment results may be determined by reference to the following criteria:

- **CHEM Unit "Investigation Thresholds" for Contaminants in Soils**
  These values indicate when detailed assessment of remediation is likely to be required by the Queensland Government's CHEM Unit (Reference 3).

- **ANZECC Water Quality Guidelines**
  These values indicate water quality guidelines for to protect aquatic ecosystems (Reference 4).

- **Dutch B Investigation Levels for Contaminants in Soil and Water**
  These values indicate when further investigation is recommended under health based criteria established by the Dutch Government.

- **Dutch C Clean-Up Levels for Contaminants in Soil and Water**
  The values indicate when clean-up of contaminated land is likely to be required under health based criteria established by the Dutch Government. There are no corresponding criteria for Queensland. Dutch C levels have been suggested by ANZECC as possible interim action levels for contaminated site remediation and/or management in Australia.

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5.1 Soil

The laboratory analysis results confirm that the upper soil profile surrounding both the existing and dismantled railway lines consistently exhibit arsenic contamination. The distribution of arsenic concentration is presented in Figure 3.

Arsenic contamination of the soil appears to be confined to the upper 1.0 m of soil profile, with minimal contamination detected at 1.0 m. The majority of contamination generally occurs in the upper 0.5 m of profile, with maximum concentrations typically noted within the upper 0.3 m.

The lateral extent of arsenic contamination appears to be limited to a corridor approximately 15 m wide of the railway tracks and this appears to be consistent with the methodology which may have been used for maintenance (e.g. boom sprays). The potential zones of arsenic contamination in the soil at the site are indicated in Figure 4.

The investigation results indicate that the most severe contamination is associated with surface soils along the western section of the northern (existing) track and the middle section of the southern (dismantled track).

The concentration levels in the upper 0.3 m in these areas exceed "Health Based Investigation Threshold" in the **Guidelines for the Assessment of Contaminated Land in Queensland** (Reference 3). Below these levels and across the site in general the concentration levels in the upper 0.5 m exceed "Environmental Investigation Threshold" (Reference 3). A marked reduction of arsenic concentration was generally detected below 0.5 m and most values below this depth were below the "Environmental Investigation Threshold"

Analysis of the potential mobility of arsenic to leach from selected surface samples exhibiting medium and high concentrations was undertaken by the Toxicity Characteristic Leaching Procedure (TLCLP). The results of this analysis indicated levels less than 0.01 mg/l which is within ANZECC water quality guideline levels for marine aquatic ecosystems (Reference 4).

Some other heavy metal (i.e. lead, copper and zinc) concentrations in excess of the CHEM Unit "Environmental Investigation Threshold" were also detected in some of the surface soil samples. However, this contamination did not appear to be consistent across the site as in the case of the arsenic and generally occurred in association with arsenic contamination.

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Analysis of organic concentrations generally indicated either nil or relatively low levels of organic compounds in the soil samples analysed. Higher concentrations of heavier hydrocarbon fractions were determine in the surface soil at TP22. These concentrations were marginally in excess of Dutch B Investigation levels and may be associated with a localised spill on the track near this location.

Analysis of two surface samples recovered from the northern railway line (TP18 and TP24) did not detect any phenoxy acid herbicides, including 2, 4–D; 2, 4, 5–T; or 2,4–DP picloran or triclophyr.

5.2 Groundwater

The groundwater sample analyses indicated the presence of arsenic at a concentration of 0.13–0.16 mg/l at TP18.

The groundwater in this region is likely to interface with the tidal reaches of the Brisbane River which constitutes a marine environment. The arsenic concentration detected in the groundwater exceeds the ANZECC guideline value of 0.05 mg/l for marine water. However, dispersion and dilution of the arsenic may be anticipated prior to entering the marine environment.

The arsenic concentration detected in the groundwater also exceeds the health based Dutch C Clean–Up level (e.g. for consumption).

This high arsenic concentration value however, appears incongruous with a leached product given the very low leaching characteristic of the surface soils.

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6.0 RISK ASSESSMENT

Arsenic is present in all soils, and may also appear in groundwater associated with arsenic rich ground strata. Arsenic and its compounds are acute toxins and are also established human carcinogens (Reference 5). It is therefore, a hazardous substance and hence poses potential environmental and health risks. Such risks may occur due to interaction with the environment and exposure from a health perspective. Exposure routes for humans typically include inhalation, absorption and ingestion.

6.1 Environmental

Arsenic concentrations in the upper 0.5 m of the zone of contamination are in excess of the CHEM Unit "Environmental Investigation Threshold".

Provided the site is sealed and the environmental risks to the atmosphere and to vegetation, may be minimised.

Arsenic concentrations in the groundwater and the volume contaminated may need to be confirmed in order to fully assess the environmental risk associated with the groundwater.

6.2 Health

Arsenic concentrations are in excess of the CHEM Unit "Health Based Investigation" Threshold in some surface soils, particularly near the western section of the northern (existing) line and middle section of the southern (disused) line.

At present it is considered that the contamination does not pose a significant health threat due to the relative low level of arsenic in the surface soil (maximum 452 mg/kg) the relative small area of the railway line and contaminated (only two samples) and the fact that the site is not in use. However, it is considered that health risk would be significant by the proposed site development and associated foot traffic generated by the college extension.

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7.0 MANAGEMENT PLAN OPTIONS

A TAFE college development is proposed for the site. The initial development includes the refurbishment of existing buildings. It is understood that the future construction of additional buildings on the site is proposed in 5 years.

Following is a review of various management plan options which may be considered with respect to the proposed site development. It should be noted that *in situ* remediation of the site soil is not considered a viable option due to the fact that arsenic is not easily removed from soil.

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7.1 Excavation and Disposal of All Contaminated Soil

This option would include the excavation and disposal of all contaminated soil with arsenic concentrations in excess of predetermined level based on environmental considerations. The experience of HDM indicates that the most practicable course of action is to remove all contaminated soil in excess of the "Environmental Investigation Threshold".

Based on the potential area of contamination including 15 m wide corridors and with excavation to 0.5 m this option would involve approximately 4,500 m^3 of contaminated soil. Replacement with inert fill should enable classification of the site as a "former" site (Reference 3) in the Contaminated Land Register.

7.2 Partial Excavation and Disposal of Contaminated Soil

This option would include the excavation and disposal of contaminated soil with arsenic concentrations in excess of a higher limit than indicated previously. Given the lower environmental risk associated with the site consideration could be given to soil concentrations in excess of the "Health Based Investigation Threshold".

Based on the potential contamination including 15 m wide corridors zones and with excavation to 0.3 m this option would include approximately 1,350 m^3 of contaminated soil.

The site classification would remain "restricted" if this option was adopted.

7.3 Seal the Area with Contaminated Soil

This option would include sealing the surface of any contaminated areas at the site. A suitable seal may include construction of either concrete slabs, asphaltic pavement or low permeability, compacted inert fill.

This option would minimise any potential health risk associated with contact. Environmental risks would also be minimised because of removal of a pathway for water to the contaminated material.

7.4 Relocation of the Contaminated Soil

The most practicable solution under this option would be to utilise the material for a building platform (This option is presented in view of the fact that soil is frequently contaminated as part of pest control measures).

This option may be adopted in conjunction with sealing the site as a temporary measure associated with the proposed immediate development. Excavation and relocation of the contaminated soil would occur at the time of future site development.

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8.0 CONCLUSIONS

The following conclusions are made with respect to the investigation of the Queensland Cotton Corporation site.

- Contamination of the site is predominantly from arsenic within the upper 0.5 m of the soil profile and within a corridor of approximately 15.0 m in each side of the railway lines.

- A groundwater sample indicates a higher than expected arsenic concentration; however, this appears incongruous with the leaching characteristics of the surface soils.

- Environmental and health risks associated with the arsenic contamination at the site may be minimised by either sealing or disposal of the contaminated soil as appropriate.

- Various site management plan options as outlined in Section 8.0 need to be discussed with the Contaminated Land Unit.

- A management plan including a contractors works specification needs to be developed for the preferred management option.

- Appropriate Health and Safety plans would be required for any activities associated with the contaminated soil or site development in the area of contamination.

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REFERENCES

1. Hollingsworth Dames & Moore, 1991 (July): "Pre-Disposal Assessment at Eagle Farm" Report No. 22707-001-362.

2. Hollingsworth Dames & Moore, 1991 (September): "Pre-Disposal Assessment - Phase 2; Contamination at Eagle Farm" Report No. 22707-002-362.

3. Chemical Hazards and Emergency Management Unit, 1992 (January): "Guidelines for Assessment of Contaminated Land in Queensland".

4. Australian and New Zealand Environment Conservation Council, 1992 (January): "Draft Australian Water Quality Guidelines".

5. National Occupational Health and Safety Commission, 1989 (December): "Arsenic and Its Compounds".

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FIGURES

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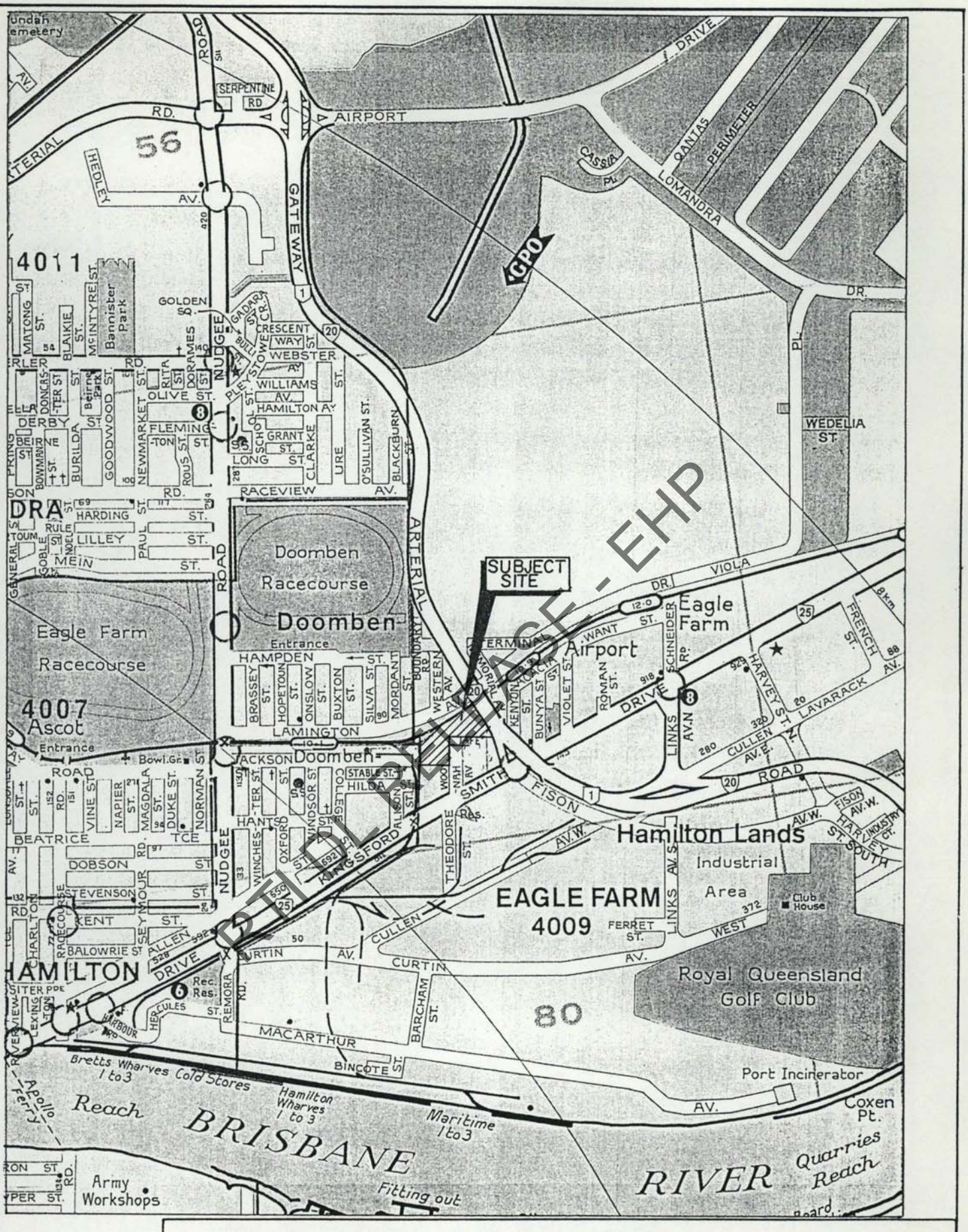
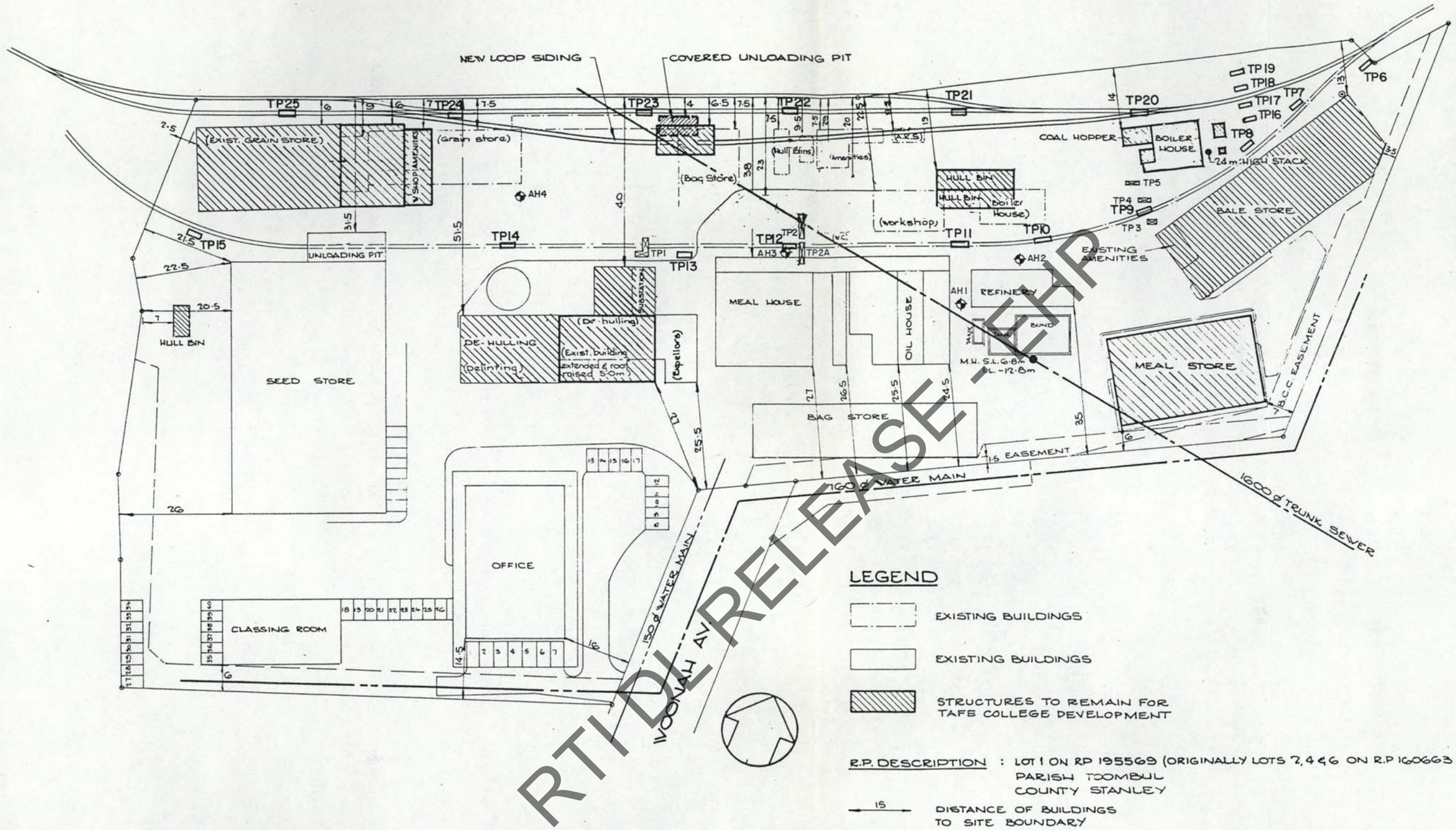


HOLLINGSWORTH DAMES & MOORE Engineers and Planners		
DRAWN	Q - BUILD PROJECT SERVICES	
CHECKED GEP	SUPPLEMENTARY INVESTIGATION - QLD COTTON SITE	
DATE November 1992	LOCALITY PLAN	
FILE REF. H010170 22707-003-362	SCALE 0 500 1000m	Figure 1

RTI 14-409



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LEGEND

- EXISTING BUILDINGS
- EXISTING BUILDINGS
- STRUCTURES TO REMAIN FOR TAFE COLLEGE DEVELOPMENT

R.P. DESCRIPTION : LOT 1 ON RP 195569 (ORIGINALLY LOTS 2, 4 & 6 ON R.P 160663
PARISH TOOMBUL
COUNTY STANLEY

15 — DISTANCE OF BUILDINGS TO SITE BOUNDARY

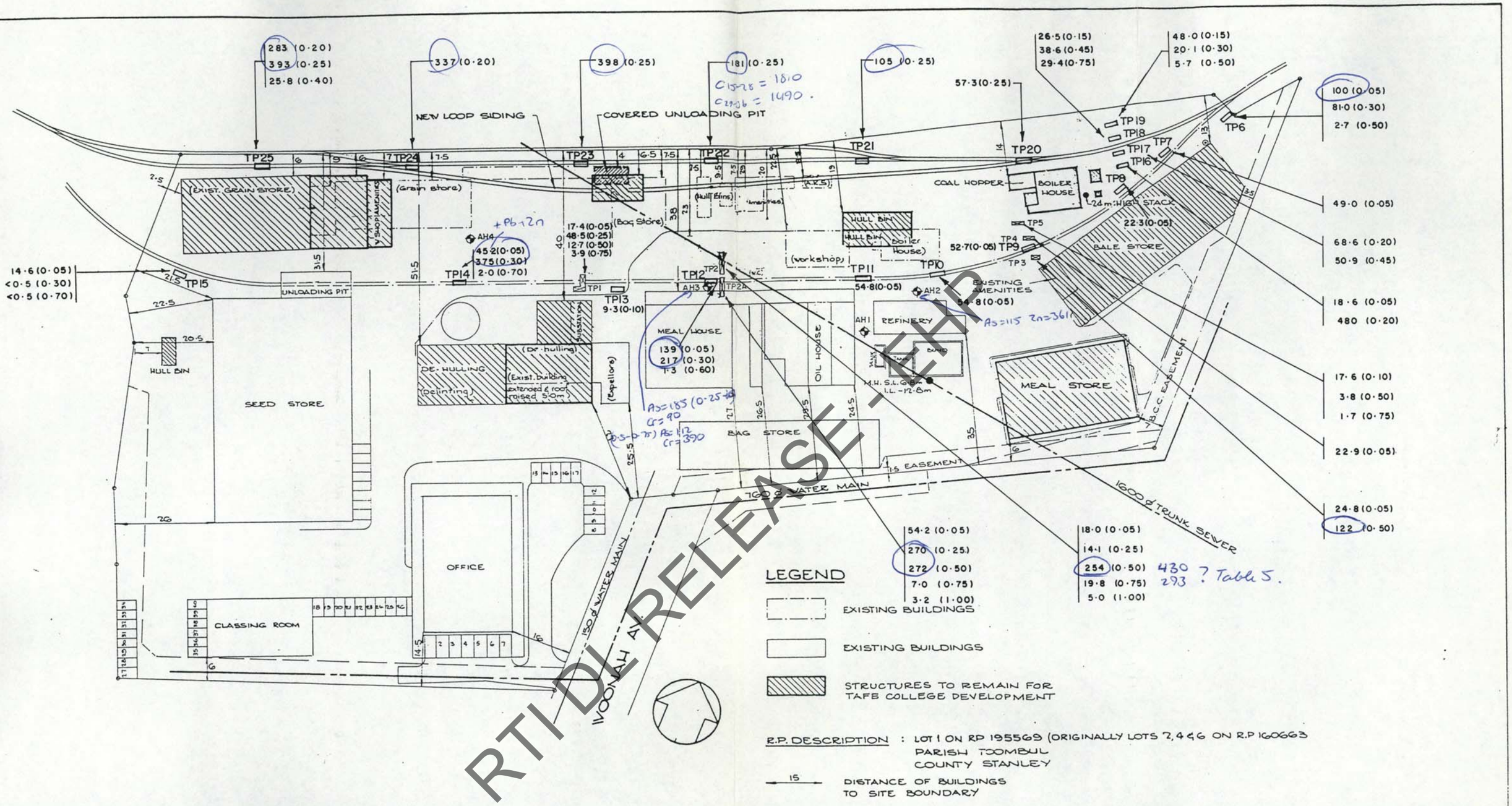
AH — Auger Holes QCC Pre Disposal Assessment, July 1991
TP — Test Pit QCC Pre Disposal Assessment-Phase 2, Sept. 1991
TP — Test Pit Q Build Supplementary Investigation, November 1992

Existing Railway Lines
Dismantled Railway Line

HOLLINGSWORTH DAMES & MOORE	Engineers and Planners	
DRAWN GEP/AB	Q-BUILD PROJECT SERVICES	
CHECKED GEP	SUPPLEMENTARY INVESTIGATION	
DATE November 1992	SAMPLE LOCATIONS	
FILE REF. H010170 22707-003-362	SCALE 0 10 20 30 40 50m	Figure 2

File A

RTI-14-409



LEGEND

- EXISTING BUILDINGS
- EXISTING BUILDINGS
- STRUCTURES TO REMAIN FOR TAFE COLLEGE DEVELOPMENT

R.P. DESCRIPTION : LOT 1 ON RP 195569 (ORIGINALLY LOTS 2, 4 & 6 ON R.P 160663 PARISH TOOMBUL COUNTY STANLEY

15 — DISTANCE OF BUILDINGS TO SITE BOUNDARY

AH — Auger Holes QCC Pre Disposal Assessment, July 1991

TP — Test Pit QCC Pre Disposal Assessment-Phase 2, Sept. 1991

TP — Test Pit Q Build Supplementary Investigation, November 1992

Existing Railway Lines

Dismantled Railway Line

48·5 — Arsenic Concentration > CHEM Unit Environmental Investigation Threshold (20mg/kg)

337 — Arsenic Concentration > CHEM Unit Health Based Investigation Threshold (100mg/kg)

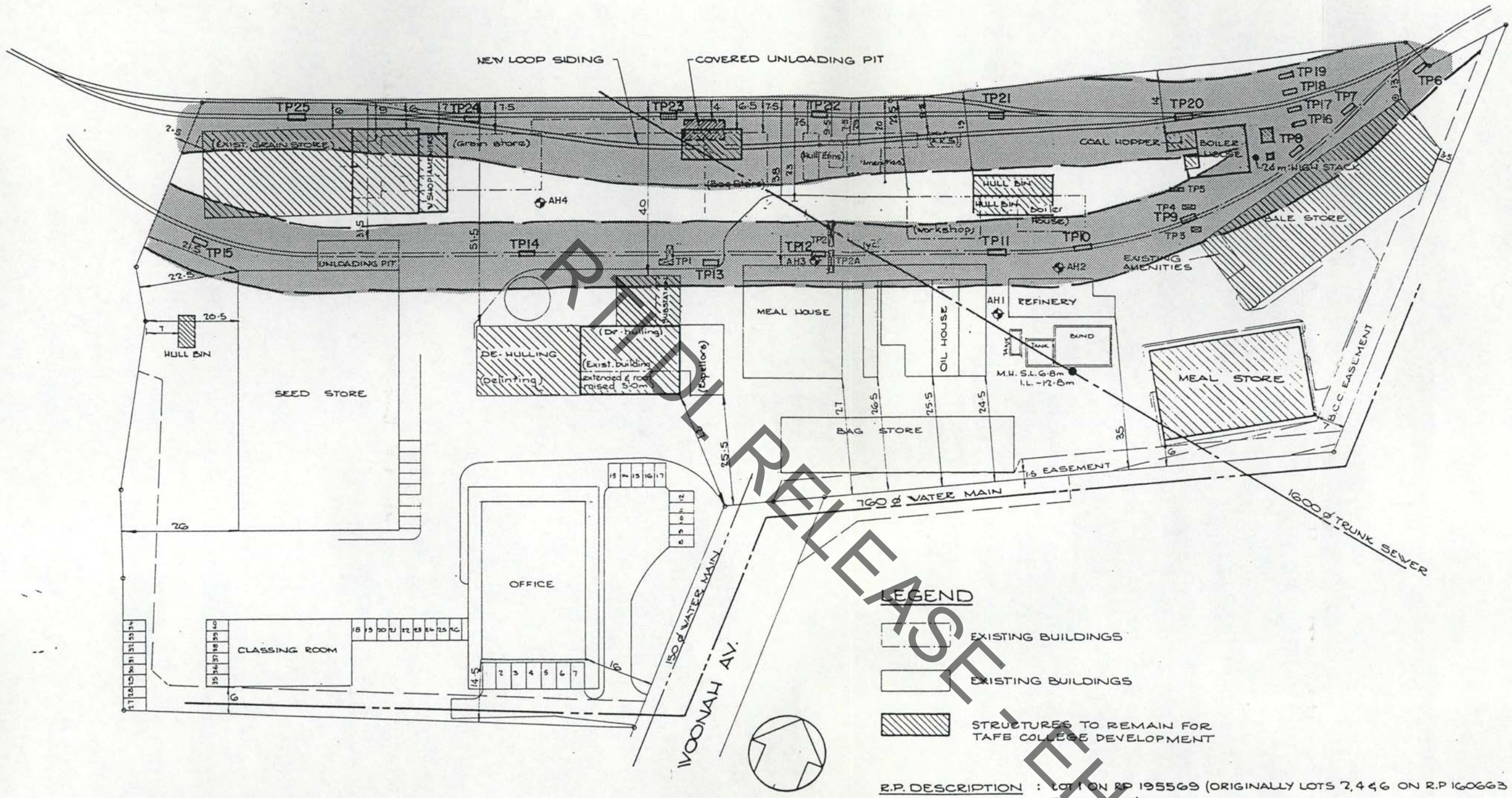
(0·20) — Average Depth

HOLLINGSWORTH DAMES & MOORE Engineers and Planners		
DRAWN GEP/AB	Q-BUILD PROJECT SERVICES	
CHECKED GEP	SUPPLEMENTARY INVESTIGATION	
DATE November 1992	ARSENIC CONCENTRATIONS	
FILE REF. H010170 22707-003-362	SCALE 0 10 20 30 40 50m	Figure 3

RTI-DL RELEASE - EHP

File A

RTI-14-409



RELEASED

AH Auger Holes QCC Pre Disposal Assessment, July 1991

TP Test Pit QCC Pre Disposal Assessment-Phase 2, Sept. 1991

TP Test Pit Q Build Supplementary Investigation, November 1992

Existing Railway Lines

Dismantled Railway Line

Potential Zones of Arsenic Contamination

HOLLINGSWORTH DAMES & MOORE Engineers and Planners		
DRAWN GEP/AB	Q-BUILD PROJECT SERVICES	
CHECKED GEP	SUPPLEMENTARY INVESTIGATION	
DATE November 1992	POTENTIAL ZONES OF SOIL CONTAMINATION	
FILE REF. H0101 70 22707-003-362	SCALE 0 10 20 30 40 50m	Figure 4

File A

APPENDIX A

Work Plan

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APPENDIX A

WORK PLAN

1.0 INTRODUCTION

This work plan contains directions for the collection and dispatch of soil samples from the Queensland Cotton site at Eagle Farm.

2.0 SCOPE OF FIELD INVESTIGATION

To investigate the presence of soil contamination, a grid sampling strategy has been devised. Figure 1 indicates the locations to be sampled.

The locations will be identified by measuring offsets from fixed landmarks with a measuring tape.

To investigate the lateral and vertical distribution of contamination, the samples will be taken where possible at the following depths:

0.0 – 0.1 m
0.1 – 1.0 m
1.0 – 2.0 m
0.0 – 0.25 m
0.5 – 0.75 m
1.0 – 1.25 m
2.0 – 2.25 m
3.0 – 3.25 m
4.0 – 4.25 m

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The sampling program will be undertaken in two stages. The sample locations for the second stage of the investigation will be made taking cognisance of the results from the first stage investigation.

3.0 SAMPLING PROCEDURES

3.1 Test Pitting

Surface vegetation, leaves, debris and other material not intended for sampling are to be cleared from the sampling location.

Any unusual appearances of the surrounding area or the test pit are to be recorded on the HDM label and reported to the project manager.

3.1.1 Sample Handling

The soil from each sampling interval is placed in a metal composting box and mixed. The sample is then subdivided into two portions and packed in aluminium lined paper bags for transport. Samples should be preferably 1 kg in size, minimum of 0.5 kg. The pairs of bags are identified by attachment of HDM labels marked with the same number. Those samples from the upper levels which are to be analysed during the first round are segregated from the remainder while on site.

3.1.2 Sample Records

The following information will be recorded on the label stubs which are to be retained by HDM:

- Sample Number
- Sample Location
- Sample Depth
- Sample Date
- Sampler's Initials
- Remarks

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4.0 SAMPLE SHIPPING

The requirement for sample transport and storage are presented below.

Prior to the sample shipment leaving the office, a member of the project team shall complete a copy of the Sample Analysis Request Sheet and send the original with the sample shipment. The shipment of samples shall be clearly labelled and addressed to the selected laboratory and marked to the attention of the laboratory's selected representative.

A copy of the signed Sample Analysis Request Sheet shall be returned to the Project Manager.

APPENDIX B

Test Pit Logs

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engineering log
borehole

HOLLINGSWORTH DAMES & MOORE

Borehole No.: TP1
Sheet 1 of 1

Client : QUEENSLAND COTTON CORPORATION LTD
Project : PRELIMINARY CONTAMINATION ASSESSMENT
Location : EAGLE FARM
Job No. : 22707-002

Date Drilled : 30/8/91 Drill Type : BACKHOE Bore Size : RL Surface : –
Logged by : NJK Driller : – Drilling Fluid : – Ch/Coords :

Drilling: Method	Drilling: Casing	Drilling: Water	Depth (m) 1:25	Interpreted Profile	Graphic Log	Soil Description	Moisture Condition	Consistency Rel. Density	Samples/Tests: Sample Type & No.	Samples/Tests: Depth (m)	Field Records
BACKHOE			.6	SM		Dark grey – black, fine – medium grained, slightly moist, loose, gravelly SAND. (FILL).	SM	L			
			.8	ML		Brown, very fine grained, slightly moist, soft, sandy SILT. (FILL).	SM	S			
			1.0	CL		Brown mottled reddish brown, very fine grained, slightly moist, firm, residual, sandy CLAY.	SM	F			
			2.0			E					
			3.0								
			4.0								
			5.0								

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engineering log
borehole

HOLLINGSWORTH DAMES & MOORE

Borehole No.: TP2/2A
Sheet 1 of 1

Client : QUEENSLAND COTTON CORPORATION LTD
Project : PRELIMINARY CONTAMINATION ASSESSMENT
Location : EAGLE FARM
Job No. : 22707-002

Date Drilled : 30/8/91 Drill Type : BACKHOE Bore Size : RL Surface : –
Logged by : NJK Driller : – Drilling Fluid : – Ch/Coords :

Drilling: Method	Drilling: Casing	Drilling: Water	Depth (m) 1:25	Interpreted Profile	Graphic Log	Soil Description	Moisture Condition	Consistency Rel. Density	Samples/Tests: Sample Type & No.	Samples/Tests: Depth (m)	Field Records
BACKHOE			.3	SM		Black, medium – coarse grained, slightly moist, loose, gravelly SAND. (FILL).	SM	L			
			.6	SM		Brown ,fine grained, slightly moist, soft – firm, residual silty fine SAND.	SM	S – F			
			1.0	CL		Dark brown mottled reddish brown, very fine grained, slightly moist, firm, residual, sandy CLAY.	SM	F			
			2.0								
			3.0								
			4.0								
			5.0								

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engineering log
borehole

HOLLINGSWORTH DAMES & MOORE

Borehole No.: TP3/4/5
Sheet 1 of 1

Client : QUEENSLAND COTTON CORPORATION LTD
Project : PRELIMINARY CONTAMINATION ASSESSMENT
Location : EAGLE FARM
Job No. : 22707-002

Date Drilled : 30/8/91 Drill Type : BACKHOE Bore Size : RL Surface : –
Logged by : NJK Driller : – Drilling Fluid : – Ch/Coords :

Drilling: Method	Drilling: Casing	Drilling: Water	Depth (m) 1:25	Interpreted Profile	Graphic Log	Soil Description	Moisture Condition	Consistency Rel. Density	Samples/Tests: Sample Type & No.	Samples/Tests: Depth (m)	Field Records
BACKHOE			.6	GC		Black, medium – coarse grained, slightly moist, loose, sandy clayey GRAVEL. (FILL).	SM	L			
BACKHOE			1.0	CH		Grey – black, very fine grained, moist, soft, residual, high plasticity, marine sandy CLAY.	SM	S			
			2.0								
			3.0								
			4.0								
			5.0								

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 6
Job No : 1750
Date Drilled : 23/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, black, fine to coarse,	0.0-0.1	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)			
0.2	Silty SAND, grey, fine to medium grained,	0.2-0.4	D	
	moist, medium dense (SM)			
0.4	Silty CLAY, mottled grey brown, medium plas-	0.4-0.6	D	
	ticity, some fine to medium grained sand, moist,			
	firm to stiff (CH)			
1.0	Test Pit terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 7
Job No : 1750
Date Drilled : 23/10/92

Strata Depth (m)	Classification (Australian Standard AS1726–1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, black, fine to coarse,	0.0–0.1	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)	0.2–0.3	D	
0.3	Sandy Silty CLAY, grey, low to medium plas-	0.3–0.5	D	
	ticity, sand fine grained, moist, stiff (CL)			
0.5	Silty CLAY, mottled grey brown, medium plas-	0.5–0.6	D	
	ticity, some fine to medium grained sand,			
	moist, soft to firm (CH)			
1.0	Test Pit terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P – Hand penetrometer estimate of shear strength, kPa
SPT – Standard Penetration Test – N (no. of blows for 300mm)
VS – Vane Shear (Cohesion – kPa)

T50 – 50mm tube sample
D – disturbed sampl
U50 – undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 8
Job No : 1750
Date Drilled : 23/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, black, fine to coarse,	0.0-0.1	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)	0.2-0.4	D	
0.4	Silty SAND, grey, fine to medium grained, moist	0.4-0.8		
	medium dense (SM) hydrocarbon odour			
0.6	Silty CLAY, mottled grey brown, medium plas-			
	ticity, some fine to medium grained sand, moist,			
	firm to stiff (CH)			
1.0	Test Pit 8 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

RTI DL RELEASE - EHP

EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 9
Job No : 1750
Date Drilled : 23-10-92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, black, fine to coarse,	0.0-0.1	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)	0.2-0.5	D	
0.5	Silty SAND, grey, fine to medium grained,	0.5-0.9	D	
	moist, medium dense (SM)			
0.7	Silty CLAY, mottled grey brown, medium plas-			
	ticity, some fine to medium grained sand, moist,			
	soft to firm (CH)			
1.4	Test Pit terminated at 1.4m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

RTI DL RELEASE - EHP

EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 10
Job No : 1750
Date Drilled : 23-10-92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Clayey GRAVEL, brown, fine to coarse,	0.0-0.1	D	
	clay of low plasticity, medium dense (GC)			
0.2	FILL - Clayey GRAVEL, blue-green, fine to	0.2-0.4	D	
	coarse phyllite, moist, mediun dense (GC)			
0.4	FILL - Sandy GRAVEL, black, fine to coarse,	0.4-0.8	D	
	moist, loose (GP) (chitters)			
0.8	Silty CLAY, mottled grey brown, medium plas-	0.8-1.2	D	
	ticity, some fine to medium grained sand, moist,			
	firm to stiff (CH)			
1.2	Test Pit 10 terminated at 1.2m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 11
Job No : 1750
Date Drilled : 23-10-92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, black, fien to coarse,	0.0-0.1	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)			
0.2	Silty SAND, grey, fine to medium grained,	0.2-0.4	D	
	moist, medium dense (SM)			
0.4	Silty CLAY, mottled grey brown, medium plas-	0.4-1.0	D	
	ticity, some fine to medium grained sand,			
	moist, firm to stiff (CH)			
1.0	Test Pit 11 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 12
Job No : 1750
Date Drilled : 23-10-92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, light brown, fine to medium	0.0-0.1	D	
	moist, loose (GP)			
0.2	FILL - Sandy GRAVEL, black, fine to coarse,	0.2-0.4	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)			
0.4	Sandy Silty CLAY, grey, low to medium plas-	0.4-0.8	D	
	ticity, sand fine grained, moist, stiff (CH)			
0.6	Silty CLAY, mottled grey brown, medium plas-			
	ticity, some fine to medium grained sand, moist			
	firm to stiff (CH)			
1.0	Test Pit 12 terminated at 1.0m			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 13
Job No : 1750
Date Drilled : 23-10-92

Strata Depth (m)	Classification (Australian Standard AS1726–1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, light brown, fine to	0.0–0.1	D	
	medium, moist, loose (GP)			
0.2	FILL - Sandy GRAVEL, black, fine to coarse,	0.2–0.4	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)			
0.5	Sandy Silty CLAY, grey, low to medium plas-	0.4–0.8	D	
	ticity, sand fine grained, moist, stiff (CL)			
0.8	Silty CLAY, brown mottled red brown, high plas-			
	ticity, firm (CH)			
1.4	Test Pit 13 terminated at 1.4m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P – Hand penetrometer estimate of shear strength, kPa
SPT – Standard Penetration Test – N (no. of blows for 300mm)
VS – Vane Shear (Cohesion – kPa)

T50 – 50mm tube sample
D – disturbed sampl
U50 – undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 14
Job No : 1750
Date Drilled : 23-10-92

Strata Depth (m)	Classification (Australian Standard AS1726–1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, black, fine to coarse,	0.0-0.1	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)	0.2-0.4	D	
0.4	Silty CLAY, grey brown, meduim to high plas-	0.4-1.2	D	
	ticity, moist, firm (CH)			
1.2	Test Pit 14 terminated at 1.2m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P – Hand penetrometer estimate of shear strength, kPa
SPT – Standard Penetration Test – N (no. of blows for 300mm)
VS – Vane Shear (Cohesion – kPa)

T50 – 50mm tube sample
D – disturbed sampl
U50 – undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 15
Job No : 1750
Date Drilled : 23-10-92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - Sandy GRAVEL, black, fine to coarse,	0.0-0.1	D	
	some low plasticity fines, moist, medium dense			
	(GP) (chitters)	0.2-0.4		
0.4	Silty Clayey SAND, brown mottled red brown,	0.4-1.0	D	
	fine to meidum grained, clay of low to medium			
	plasticity, moist, loose to medium dense (SC)			
1.2	Test Pit 15 terminated at 1.2m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

TSO - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 16
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL, misture chitters and clay, moist (GC)	0.0-0.1	D	
0.1	FILL - Sandy GRAVEL, chitters (GP)	0.1-0.3	D	
0.3	Snady Silty CLAY, grey, low to medium plas-	0.3-0.6	D	
	ticity, snad fine grained, moist, stiff (CL)			
0.5	Silty CLAY, mottled grey brown, medium plas-			
	ticity, some fine to medium grained sand, moist			
	firm to stiff (CH)			
1.2	Test Pit 16 terminated at 1.2m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 17
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - mixture chitters and clay, moist (GC)	0.0-0.1	D	
0.1	FILL - Sandy GRAVEL, chitters (GP)	0.1-0.3	D	
0.3	Sandy Silty CLAY, grey, low to medium plasticity, sand fine grained, moist, stiff (CL)	0.3-0.6	D	
0.5	Silty CLAY, mottled grey brown, medium plasticity, some fine to medium grained sand, moist firm to stiff (CH)			
1.2	Test Pit 17 terminated at 1.2m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 18
Job No : 1750
Date Drilled : 27/10/92.

Strata Depth (m)	Classification (Australian Standard AS1726–1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0-2	D	
0.2	FILL - SAND, black and brown, medium to coarse	0.2-0.3	D	
	grained, some fine gravel (deco) (SP)			
0.3	Sandy Silty CLAY, grey, low to medium plas-	0.3-0.5	D	
	ticity, sand fine grained, moist, stiff (CL)			
0.5	Silty CLAY, mottled grey brown, medium plas-	0.5-1.0	D	
	ticity, some fine to medium grained sand, moist			
	firm to stiff (CH)			
1.3	CLAY, grey mottled red brown, high plasticity,			
	moist, stiff to very stiff (CH)			
3.0	Test Pit 18 terminated at 3.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P – Hand penetrometer estimate of shear strength, kPa
SPT – Standard Penetration Test – N (no. of blows for 300mm)
VS – Vane Shear (Cohesion – kPa)

T50 – 50mm tube sample
D – disturbed sampl
U50 – undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 19
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0.15	D	
0.15	FILL - Silty Gravelly SAND, black, fine to	0.15-0.25	D	
	coarse grained, fines of low plasticity (SP)			
0.25	Sandy Silty CLAY, grey, low to medium plas-	0.25-0.4	D	
	ticity, sand fine grained, moist, stiff (CL)			
0.4	Silty CLAY, mottled grey brown, medium plas-	0.4-0.6	D	
	ticity, some fine to medium grained sand, mosit			
	firm to stiff (CH)			
1.0	Test Pit 19 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 20
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0-2	0	
0.2	FILL - Sandy GRAVEL, chitters (GP)	0.2-0.3	D	
0.3	Silty CLAY, mottled grey brown, medium plas-	0.3-0.6	D	
	ticity, some fine to medium grained sand, moist			
	firm to stiff (CH)			
1.0	Test Pit 20 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 21
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0·2	0	
0.2	FILL - Sandy GRAVEL, chitters (GP)	0.2-0.3	D	
0.3	Silty CLAY, mottled grey brown, medium plasticity, some fine to medium grained sand, moist firm to stiff (CH)	0.3-0.5		
1.0	Test Pit 21 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 22
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0.2	D	
0.2	FILL - Sandy GRAVEL, chitters (GP)	0.2-0.3	D	
0.3	Sandy Silty CLAY, grey, low to medium plas-	0.3-0.4	D	
	ticity, sand fine grained, moist, stiff (CL)			
0.4	Silty CLAY, mottled grey brown, medium plas-	0.4-0.8	D	
	ticity, some fine to medium grained sand, moist			
	firm to stiff (CH)			
1.0	Test Pit 22 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sample
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 23
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726–1981)	Sample & Field Testing: Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0-2	D	
0.2	FILL - Sandy GRAVEL, chitters (GP)	0.2-0.3	D	
0.3	Sandy Silty CLAY, grey, low to medium plas-	0.3-0.5		
	ticity, sand fine grained, moist, stiff (CL)			
0.4	Silty CLAY, mottled grey brown, medium plas-			
	ticity, some fine to medium grained sand, moist			
	firm to stiff (CH)			
1.0m	Test Pit 23 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P – Hand penetrometer estimate of shear strength, kPa
SPT – Standard Penetration Test – N (no. of blows for 300mm)
VS – Vane Shear (Cohesion – kPa)

T50 – 50mm tube sample
D – disturbed sampl
U50 – undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 24
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0.2	D	
0.2	FILL - Gravelly Sandy CLAY, brown, medium plas-	0.2-0.3	D	
	ticity, gravel fine to medium, stiff (CH)			
0.3	Sandy Silty CLAY, grey, low to medium plas-	0.3-0.6	D	
	ticity, sand fine grained, moist, stiff (CL)			
0.5	Silty CLAY, mottled grey brown, medium plas-			
	ticity, some fine to medium grained sand, moist			
	firm to stiff (CH)			
1.2	Test Pit 24 terminated at 1.2m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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EARTHTECH LABORATORIES

RECORD OF TEST PIT

Client : Hollingsworth Dames & Moore
Project : Queensland Cotton Site
Location : Eagle Farm

Borehole No : TP 25
Job No : 1750
Date Drilled : 27/10/92

Strata Depth (m)	Classification (Australian Standard AS1726-1981)	Sample & Field Testing		
		Sample Depth (m)	Sample Type	Field Test Results
0.0	FILL - GRAVEL, grey, angular, coarse (ballast)			
	(GP)	0-2	D.	
0.2	FILL - Sandy GRAVEL, chitters (GP)	0.2-0.3	D	
0.3	Gravelly Clayey SILT, grey brown, low to medium	0.3-0.5	D	
	plasticity, gravel fine to medium (MH)			
0.5	CLAY, brown mottled orange brown, high plas-			
	ticity, moist, firm to stiff (CH)			
1.0	Test Pit 25 terminated at 1.0m.			

Driller : L & D Earthmoving
Logged by : RT

Drill Type : Backhoe JCB
Bore Size : ..... mm

Water Noted : ..... m
Steady Level : ..... m

P - Hand penetrometer estimate of shear strength, kPa
SPT - Standard Penetration Test - N (no. of blows for 300mm)
VS - Vane Shear (Cohesion - kPa)

T50 - 50mm tube sample
D - disturbed sampl
U50 - undisturbed 50mm tube sample

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APPENDIX C

Laboratory Analysis Reports

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AUSTRALIAN LABORATORY SERVICES P/L
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Brisbane Head Office and Laboratory
32 Shand Street, Stafford, Q. 4053
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ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR N KENNEDY

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3568-0

No. of SAMPLES: 18
DATE RECEIVED: 26/10/92
DATE COMPLETED: 30/10/92

ORDER No: 4627 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Moisture % EA-055	As mg/kg EG-005T	Cd mg/kg EG-005T	Cr mg/kg EG-005T	Cu mg/kg EG-005T
-01 QC 1-1 26/10/92		16.4	84.0	<0.5	14.0	59.0
-02 QC 2-1 26/10/92		16.7	67.5	-----	-----	-----
-03 QC 3-1 26/10/92		26.8	2.0	-----	-----	-----
-04 QC 4-1 26/10/92		26.9	36.0	-----	-----	-----
-05 QC 8-1 26/10/92		21.5	17.5	-----	-----	-----
-06 QC 11-1 26/10/92		13.6	45.5	-----	-----	-----
-07 QC 14-1 26/10/92		10.5	10.0	-----	-----	-----
-08 QC 18-1 26/10/92		15.2	46.5	<0.5	5.5	5.5
-09 QC 20-1 26/10/92		9.4	126	-----	-----	-----
-10 QC 21-1 26/10/92		14.1	186	-----	-----	-----
-11 QC 22-1 26/10/92		25.5	1.0	-----	-----	-----
-12 QC 23-1 26/10/92		3.6	9.0	-----	-----	-----
-13 QC 25-1 26/10/92		6.0	42.5	<0.5	4.0	52.0
-14 QC 26-1 26/10/92		9.5	339	-----	-----	-----
-15 QC 27-1 26/10/92		25.1	1.5	-----	-----	-----
-16 QC 28-1 26/10/92		4.3	14.0	-----	-----	-----
-17 QC 29-1 26/10/92		9.2	<0.5	-----	-----	-----
-18 QC 30-1 26/10/92		12.1	<0.5	-----	-----	-----
ETECTION LIMIT:		0.1	0.5	0.5	0.5	0.5

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COMMENTS: *** DUPLICATE ASSAYS.
Samples as received digested by USEPA method 3051 prior to the determination of metals. Results reported on an as received basis.

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nge Laboratory
one: (063) 63 1722 Fax: (063) 63 1189
ndigo Laboratory
one: (054) 46 1390 Fax: (054) 46 1389
Perth Laboratory
Phone: (09) 249 2988 Fax: (09) 249 2942
Kalgoorlie Laboratory
Phone: (090) 21 1457 Fax: (090) 21 6253
Southern Cross Laboratory
Phone: (090) 49 1292 Fax: (090) 49 1374

All pages of this report have been checked and approved for release.

Schedule 4 - signature

Signed

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

Brisbane Head Office and Laboratory
32 Shand Street, Stafford, Q. 4053
P.O. Box 66, Everton Park, Q. 4053
Telephone: (07) 352 5577
Facsimile: (07) 352 5109

ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR N KENNEDY

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3568-0

No. of SAMPLES: 18
DATE RECEIVED: 26/10/92
DATE COMPLETED: 30/10/92

ORDER No: 4627 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Ni mg/kg EG-005T	Pb mg/kg EG-005T	Zn mg/kg EG-005T
-01 QC 1-1 26/10/92		26.5	72.5	268
-02 QC 2-1 26/10/92		-----	-----	-----
-03 QC 3-1 26/10/92		-----	-----	-----
-04 QC 4-1 26/10/92		-----	-----	-----
-05 QC 8-1 26/10/92		-----	-----	-----
-06 QC 11-1 26/10/92		-----	-----	-----
-07 QC 14-1 26/10/92		-----	-----	-----
-08 QC 18-1 26/10/92		6.0	244	187
-09 QC 20-1 26/10/92		-----	-----	-----
-10 QC 21-1 26/10/92		-----	-----	-----
-11 QC 22-1 26/10/92		-----	-----	-----
-12 QC 23-1 26/10/92		-----	-----	-----
-13 QC 25-1 26/10/92		6.5	711	228
-14 QC 26-1 26/10/92		-----	-----	-----
-15 QC 27-1 26/10/92		-----	-----	-----
-16 QC 28-1 26/10/92		-----	-----	-----
-17 QC 29-1 26/10/92		-----	-----	-----
-18 QC 30-1 26/10/92		-----	-----	-----
DETECTION LIMIT:		0.5	0.5	0.5

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ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR N KENNEDY

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3605-0

No. of SAMPLES: 20
DATE RECEIVED: 28/10/92
DATE COMPLETED: 09/11/92

ORDER No: 4627 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Moisture % EA-055	As mg/kg EG-005T
QC50-1 28/10/92		27.5	76.0
QC53-1 28/10/92		28.3	130
QC57-1 28/10/92		27.7	288
QC60-1 28/10/92		22.0	263
QC63-1 28/10/92		17.7	233
QC64-1 28/10/92		16.5	328
QC65-1 28/10/92		10.9	23.0
QC39-1 28/10/92		14.2	-----
QC60-2 28/10/92		16.9	-----
QC31-1 28/10/92		19.3	11.0
QC33-1 28/10/92		21.9	37.5
QC36-1 28/10/92		14.9	20.0
QC37-1 28/10/92		24.2	52.0
QC38-1 28/10/92		19.8	41.0
QC40-1 28/10/92		19.0	21.5
QC41-1 28/10/92		14.6	33.0
QC42-1 28/10/92		20.0	23.5
QC44-1 28/10/92		25.0	36.0
QC45-1 28/10/92		12.9	17.5
QC46-1 28/10/92		21.6	4.5
ETECTION LIMIT:		0.1	0.5

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OMMENTS: *** DUPLICATE ASSAYS.
Samples as received digested by USEPA method 3051 prior to the determination of Arsenic. Results reported on an as received basis.

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arters Towers Laboratory
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ange Laboratory
one: (063) 63 1722 Fax: (063) 63 1189
ndig Laboratory
one: (054) 46 1390 Fax: (054) 46 1389
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ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR N KENNEDY

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3605-1

No. of SAMPLES: 1
DATE RECEIVED: 28/10/92
DATE COMPLETED: 09/11/92

ORDER No: 4627 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Moisture % EA-055	As mg/kg EG-005T	Cd mg/kg EG-005T	Cr mg/kg EG-005T	Cu mg/kg EG-005T
QC47-1 28/10/92		19.7	46.0	<0.5	5.5	24.5
DETECTION LIMIT:		0.1	0.5	0.5	0.5	0.5

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ge Laboratory
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go Laboratory
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ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR N KENNEDY

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3605-1

No. of SAMPLES: 1
DATE RECEIVED: 28/10/92
DATE COMPLETED: 09/11/92

ORDER No: 4627 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Ni mg/kg EG-005T	Pb mg/kg EG-005T	Zn mg/kg EG-005T		
QC47-1 28/10/92		20.0	31.0	37.0		
DETECTION LIMIT:		0.5	0.5	0.5		

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ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR G PERRYMAN

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3629-0

No. of SAMPLES: 4
DATE RECEIVED: 02/11/92
DATE COMPLETED: 06/11/92

ORDER No: 4712 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Moisture % EA-055	As mg/kg EG-005T
QCD-1 26/10/92		26.3	48.0
QCD-2 26/10/92		25.6	1.5
QCD-3 26/10/92		15.6	25.0
QCD-4 26/10/92		22.6	307
DETECTION LIMIT:		0.1	0.5

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COMMENTS: *** DUPLICATE ASSAYS.
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ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR G PERRYMAN

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3629-1

No. of SAMPLES: 1
DATE RECEIVED: 02/11/92
DATE COMPLETED: 06/11/92

RDER No: 4712 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Moisture % EA-055	As mg/kg EG-005T	Cd mg/kg EG-005T	Cr mg/kg EG-005T	Cu mg/kg EG-005T
QCD-5 26/10/92		15.2	89.5	<0.5	9.0	37.5
TECTION LIMIT:		0.1	0.5	0.5	0.5	0.5

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Sample as received digested by USEPA method 3051 prior to the determination of metals. Results reported on an as received basis.

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Telephone: (07) 352 5577
Facsimile: (07) 352 5109

ANALYTICAL REPORT

CLIENT: HOLLINGSWORTH DAMES & MOORE
ADDRESS: P O BOX 251
SPRING HILL
QLD 4004

CONTACT: MR G PERRYMAN

LABORATORY: ENVIRONMENTAL
BATCH NUMBER: EN3629-1

No. of SAMPLES: 1
DATE RECEIVED: 02/11/92
DATE COMPLETED: 06/11/92

DER No: 4712 J:22707-003-362 SAMPLE TYPE: SOIL PROJECT No:

SAMPLE NUMBER	ELEMENT UNIT METHOD	Ni mg/kg EG-005T	Pb mg/kg EG-005T	Zn mg/kg EG-005T		
QCD-5 26/10/92		35.0	62.0	220		
ECTION LIMIT:		0.5	0.5	0.5		

IMENTS:

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ENVIRONMENTAL
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24 NOV 1992

ANALYTICAL REPORT

HOLLINGSWORTH DAMES & MOORE
P O BOX 251
SPRING HILL
QLD 4004

ENVIRONMENTAL
Batch-no: 3710
Sub-batch: 0
No.samples: 2
Received: 10/11/92
Completed: 20/11/92

ATTENTION
MR G PERRYMAN

ORDER-NO
4627 J:22707-003-362

SAMPLE-TYPE
SOIL

ethod	Analysis description	Units	LOD	QC 57-1	QC 20-1
EG-030C	Arsenic - TCLP	mg/L	0.01	<0.01	<0.01

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SAMPLES ANALYSED AS RECEIVED

The concentrations reported are those determined on the TCLP leachate.

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Certificate

Government Authority

State of Queensland

92QP 552/553 MH/RC:EN

To Australian Laboratory Services P/L
PO Box 66
EVERTON PARK Q 4053 ATTN: M GIBLES

I, the undersigned, Director of the Government Chemical Laboratory in the State of Queensland, do hereby certify that I received on the thirtieth day of November 1992, from you, two samples of mud (order # 24167) for determination of phenoxy acid herbicides and declare the result of the Examination of the same, to be as follows:

Ref. No: EN3605 (8) QC 39-1
EN3605 (9) QC 60-2

No 2,4-D, 2,4,5-T, 2,4-DP, 2,4-DB, picloram or triclopyr were detected at a detection limit of 5 µg/kg calculated on a dry weight basis.

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D W CONNELL
DIRECTOR

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At Government Chemical Laboratory,
P.O. Box 594, Archerfield, Qld 4108
17 November, 1992

ENVIRONMENTAL
GUARANTEED TESTING

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23 NOV 1992

ANALYTICAL REPORT

BATCH NUMBER:	EN3605
CLIENT:	Hollingsworth, Dames and Moore
ADDRESS:	PO Box 251
	Spring Hill 4004
CONTACT:	Nick Kennedy
CLIENT JOB No.:	22707-003-362
DATE RECEIVED:	28/10/1992
DATE COMPLETED:	9/11/1992
SAMPLE TYPE:	Soil
ANALYSIS REQUESTED:	
	Aromatics (BTEX) - 6
	Total Petroleum Hydrocarbon (TPH) by Fractions - 6
METHOD OF ANALYSIS:	
BTEX in Solids	ALS Method Code: EP-080
	Extraction: Purge & Trap
	Analysis: GC/MS
TPH	ALS Method Code: EP-071
	Extraction: Volatiles - Purge & Trap
	Semivolatiles - Ultrasonication
	Analysis: Volatiles - GCMS
	Semivolatiles - GCFID

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Signed.

Joanne Boden
Senior Organic Chemist

NATA
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ANALYTICAL RESULTS SHEET

ALS EA-055 : MOISTURE CONTENT

BATCH No: EN3605
ANALYST: S. Fan

MATRIX: Soil
UNITS: %

Lab I.D.	-1	-2	-3	-4	-5	-21
Client I.D.	QC 50-1	QC 53-1	QC 57-1	QC 60-1	QC 63-1	QC 47-1
Moisture %	27.5	28.3	27.7	22.0	17.7	19.7

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ANALYTICAL RESULTS SHEET

ALS EP-071 : Total Petroleum Hydrocarbons by Fractions

BATCH No.: EN3605
ANALYST: D. Mehonoshen / P. Blow

MATRIX: Soil
UNITS: mg/kg

COMPOUND	Lab I.D.	-1	-2	-3	-4	-5	-21
	Client I.D.	QC 50-1	QC 53-1	QC 57-1	QC 60-1	QC 63-1	QC 47-1
	LOR						
C5 - C9	2	<LOR	10	<LOR	<LOR	<LOR	<LOR
C10 - C14	50	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
C15 - C28	100	<LOR	1300	120	<LOR	130	110
C29 - C36	100	200	1200	220	<LOR	200	<LOR

RTI DL RELEASE - EHP

COMMENTS:

1. Results are reported on an as recieved basis
2. LOR : Level Of Reporting

BATCH QUALITY CONTROL - TPH

ALS EP-071 : Total Petroleum Hydrocarbons by Fractions

MATRIX: Soil

ANALYST: D.Mehonoshen/ P. Blow
SPIKING STD: n-Alkane

Volatile Components *

COMPOUND	Level Of Reporting (LOR)	Blank conc	SOIL SPIKE RESULTS					CONTROL LIMITS		
			Spike Conc.	SCS conc	DCS conc	Av. Rec.	RPD	Recovery (%)		RPD
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	Low	High	%
QC Lot No.: VOCS025 Applicable to Samples EN3605-1 to -21										
C6-C9	2	<LOR	40	41	40	101	2	70	130	20
C10	50	<LOR	10	11	12	113	5	70	130	20

Semivolatile Components

COMPOUND	Level Of Reporting (LOR)	Blank conc	SOIL SPIKE RESULTS					CONTROL LIMITS		
			Spike Conc.	SCS conc	DCS conc	Av. Rec.	RPD	Recovery (%)		RPD
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	Low	High	%
QC Lot No.: TPHES044 Applicable to Samples EN3605-1 to -21										
C11-C14	50	<LOR	500	416	460	88	10	70	130	20
C15-C28	100	<LOR	260	244	255	96	4	70	130	20
C29-C36	100	<LOR	N/A	N/A	N/A	N/A	N/A	70	130	20

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* Surrogate standards are added to every QC spike and sample to monitor method performance.

ANALYTICAL RESULTS SHEET

ALS EP-080 : BTEX IN SOIL

QC Lot No.: VOCS025
Batch No.: EN3605

Matrix : Soil
Units: mg/kg

Target Compounds	Lab I.D. / Client I.D. / LOR	1 QC 50-1	2 QC 53-1	3 QC 57-1	4 QC 60-1	5 QC 63-1	21 QC 47-1
Benzene	0.20	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Toluene	0.20	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Chlorobenzene	0.20	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Ethylbenzene	0.20	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
m- & p-Xylene	0.40	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
o-Xylene	0.20	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR

Form_3s

LOR: Level Of Reporting

COMMENTS:

1. Results are reported on an as received basis.
2. Surrogate standards are added to every sample to monitor the method performance.

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BATCH QUALITY CONTROL

ALS EP-080 : BTEX IN SOIL

Matrix : Soil
QC Lot No.: VOCS025

Analyst : P. Blow
Spiked Aliquot : Reagent Grade Water

BTEX COMPOUNDS	Level Of Reporting (LOR)	Blank Conc	QC SPIKE RESULTS					Control Limits		
			Spike Conc	SCS	DCS	Average Recovery	RPD	Recovery		RPD
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	Low	High	%
Benzene	0.20	ND	1.00	1.05	1.05	105	1	80	120	20
Toluene	0.20	ND	1.00	1.01	1.03	102	1	80	120	20
Chlorobenzene	0.20	ND	1.00	0.99	1.03	101	3	80	120	20
Ethylbenzene	0.20	ND	1.00	1.00	1.04	102	3	80	120	20
m- & p-Xylene	0.40	ND	2.00	2.00	2.08	102	4	80	120	20
o-Xylene	0.20	ND	1.00	1.03	1.07	105	4	80	120	20

Form_5s

* Samples are spiked with 50ug/L of each surrogate compound. The level of surrogate detected in the sample must fall between 42.5 and 57.5 ug/L for a result to be accepted.

ND: Compound not detected

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ANALYTICAL REPORT

HOLLINGSWORTH DAMES & MOORE
P O BOX 251
SPRING HILL
QLD 4004

ENVIRONMENTAL
Batch-no: 3757
Sub-batch: 0
No.samples: 1
Received: 16/11/92
Completed: 27/11/92

ATTENTION
MR G PERRYMAN

ORDER-NO
4546 J:22707-003-362

SAMPLE-TYPE
WATER

thod	Analysis description		Units	LOD	QC W-1 13/11/92
-005F	Cadmium	- Filtered	mg/L	0.005	<0.005
-005F	Chromium	- Filtered	mg/L	0.01	<0.01
EG-005F	Copper	- Filtered	mg/L	0.01	<0.01
EG-005F	Nickel	- Filtered	mg/L	0.01	<0.01
-005F	Lead	- Filtered	mg/L	0.01	<0.01
-005F	Zinc	- Filtered	mg/L	0.01	<0.01
EG-030F	Arsenic	- Filtered	mg/L	0.01	0.16

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SAMPLES ANALYSED AS RECEIVED

Schedule 4 - signature

Australian Laboratory Services PTY LTD

CONSULTING ANALYTICAL CHEMISTS

INCORPORATED IN QUEENSLAND

LABORATORY REPORT

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To: Hollingsworth Dames & Moore
Attn: Mr Geoff Perryman

ENVIRONMENTAL

PRELIMINARY RESULTS REPORT

Batch-no : EN3874
No. Samples : 2
Received : 27/11/92
Sample Type : WATER
Project No :

Client O/N: 5272 J: H0I0176
Fax Nos: 07,832,1687

Method	Analysis description	Units	Det	QC W-2 27/11/92 LAB 1	QC W-3 27/11/92 LAB 2
EG-030F	Arsenic - Filtered	mg/L	0.01	0.13	0.08

RTI DL RELEASE - EHP

A.L.S. BRISBANE ENV LAB

Date Completed : 02/12/92

Signature: _____
Brian Williams