Site Audit Report
Former Telstra OTC
Eastern Road
Doonside, NSW 2767





HLA-Envirosciences Pty Limited
Environmental, Planning,
Engineering & OHS Services

Site Audit Report
Former Telstra OTC
Eastern Road
Doonside, NSW 2767

Prepared for

Telstra Corporation Limited and Department of Urban Affairs and Planning
C/O Telstra Corporation
Locked Bag 6544
Sydney NSW 2001

HLA-Envirosciences Project No J1509

by

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This document was prepared at the joint request of Telstra Corporation Limited and the Department of Urban Affairs and Planning (DUAP). The audit is based on a review of the condition of the site at the time of validation, as described in the Draft Validation Report (Australian Site Assessment, February 2001). The Auditor has reviewed the Phase I & II Environmental Site Assessment Report (Australian Site Assessment, October 1998), Phase III Environmental Site Assessment (Australian Site Assessment, August 1999), Remedial Action Plan (Australian Site Assessment, March 1999), Supplementary Remedial Action Plan (Australian Site Assessment, April 1999), Draft Validation Investigation (Australian Site Assessment, February 2001) and various additional correspondence from Australian Site Assessment. This audit report has been prepared in consideration of the relevant guidelines used for site contamination assessment in New South Wales at the time that the audit was performed. The Auditor notes that subsurface conditions can vary over short distances and it is possible that small areas of contaminated soil may not have been detected between the sampling points. However, in the opinion of the Auditor these should not present an unacceptable risk to present or future occupants of the site.

This audit is a non-statutory audit and should not be used to meet any statutory requirements without written permission of the site Auditor.

CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background

This site audit report for the former Telstra Overseas Telecommunications Centre (OTC) site on Eastern Road, Doonside, NSW was prepared for the Telstra Corporation and the Department of Urban Affairs and Planning (DUAP), as requested by Mr Warren Gibson of the Telstra Corporation on 17 June 2000. The audit was conducted by Mr Christopher Kidd, an accredited auditor (Accreditation No. 9813) under the NSW Site Auditor Scheme (Contaminated Land Management Act, 1997). The audit follows "Guidelines for the NSW Site Auditor Scheme" published in 1998 by the NSW Environment Protection Authority (NSW EPA, 1998) and subsequent auditor guidance notes issued by the NSW EPA.

The purpose of this audit is to review reports on the Phase I & II Environmental Site Assessment (ESA) prepared by Australian Site Assessment (ASA) (October 1998), Phase III ESA prepared by ASA (August 1999), Remediation Action Plan (RAP) prepared by ASA (March 1999), Supplementary RAP prepared by ASA (April 1999), draft Validation Report prepared by ASA (February 2001) and subsequent additional information provided by ASA (March 2001) and determine if the remediation and validation works render the site suitable for the proposed land use, which is understood to be mixed residential (with gardens and accessible soil) and public open space (in floodplain areas). The audit is a non-statutory audit under the Contaminated Land Management Act (1997).

1.2 Reports Reviewed

The following reports were reviewed to assess the environmental status of the site:

1. *Phase One & Two Environmental Site Assessment, Eastern Road, Doonside, NSW, Part One.* Australian Site Assessment report, reference ASA2929DO/97/004, dated 12 October 1998.

2. *Phase One & Two Environmental Site Assessment, Eastern Road, Doonside, NSW, Part Two.* Australian Site Assessment report, reference ASA2929DO/97/004, dated 12 October 1998.

3. *Phase Three Environmental Site Assessment, Eastern Road, Doonside, NSW, Part One.* Australian Site Assessment report, reference ASA2929DO/99/002, dated 3 August 1999.

4. *Phase Three Environmental Site Assessment, Eastern Road, Doonside, NSW, Part Two.* Australian Site Assessment report, reference ASA2929DO/99/002, dated 3 August 1999.

5. *Remediation Action Plan, Eastern Road Doonside, Contaminated Site Remediation & Underground Fuel Storage Tank Removal.* Australian Site Assessment report, reference ASA2929DO/98/009, dated 30 March 1999.

6. *Remediation Action Plan - Supplementary Report, Eastern Road Doonside, Contaminated Site Remediation & Underground Fuel Storage Tank Removal.* Australian Site Assessment report, reference ASA2929DO/98/025, dated 10 April 1999.

7. *Validation Investigation, OTC Transmitting Station, Great Western Highway, Doonside, NSW.* Australian Site Assessment report, reference ASA2929DO/97/008, dated 6 February 2001.

Other information reviewed as part of the audit includes:

1. ASA facsimile dated 13 September 2000, regarding the analytical results for the water contained in the fountain at the front of the former Main Building.
2. ASA facsimile dated 23 October 2000, regarding the Heritage Status of Bungarribee House.
3. ASA facsimile dated 1 November 2000, regarding sampling plan for importing 1000m^3 fill material to the site for backfilling.
4. ASA facsimile dated 18 December 2000, regarding sampling plan for beneath stockpile areas.
5. ASA facsimile dated 19 December 2000, regarding sampling plan for beneath stockpile areas.
6. ASA facsimile dated 20 December 2000, regarding sampling plan for beneath stockpile areas.
7. ASA facsimile dated 8 January 2001, regarding PAH contamination at FA183.
8. ASA facsimile dated 7 March 20001, Report Review (comment on Auditors response on the validation report)
9. ASA letter dated 13 March 2001, additional information as requested by Auditor.

1.3 Previous Contamination Assessments

No previous contamination assessments have been reported as being conducted by either the site owner or the environmental consultant.

2.0 SITE INFORMATION

2.1 Site and Legal Description

The site is located at Eastern Road, Doonside, NSW, and is described in the ASA reports as Lot 10 Deposited Plan (DP) 835394. The site location is shown in Figure 1. The site is approximately 300 ha in area, and is bounded by the Great Western Highway, Doonside Road, Belmore Road, Telegraph Road, Curry Street and Eastern Road. The site is in the Blacktown Council Local Government Area. The Section 149 (2) certificate records the site zoning as 5(a) Special Uses – Corridor and 5(b) Special Uses – Arterial Road and Arterial Road Widening. The Auditor notes that a portion of the site referred to as the Bungarribee House has been excised from the site, and is not included in this Audit review. The location of the excised area within the site is shown in Figure 2.

At the time of the initial site inspection, ASA noted that the site was no longer in use as an Overseas Telecommunications Centre (OTC). The site contained a number of disused buildings, workshops and staff residential quarters. Concrete footings for the transmission cables were noted at regular intervals across the site, generally at 100-150m spacings. Eastern Creek and Bungarribe Creeks flowed through the site. The majority of the site was and still is cleared with wooded areas along the creeks and northern and south-east regions of the site. ASA noted that the site topography varies from generally flat west of Eastern Creek to small rises and falls east of Eastern Creek.

For ease of description, the site was divided by ASA into two areas, Area 1 being the area proposed to be rezoned as residential, and Area 2 being the area proposed to be rezoned as public open space in the floodplain. The ASA report presents a detailed listing of observations in each of the portions of the site at the time of inspection.

Auditor's Comments

The Auditor notes that no Section 149 (2) certificate was provided by ASA in the Phase I & II ESA report and that it was subsequently provided in the ASA Phase III ESA report. The Section 149(2) Certificate confirms that the legal description as reported by ASA was correct.

The Auditor considers that the detailed description of each of the portions of the site was satisfactory. The Auditor considers that these descriptions provided information of the site conditions at the time of inspection.

2.2 Site History

ASA collected information on the site history from: Telstra property files, aerial photograph review (1951, 1961, 1970, 1978, 1986), land title review, selected site history, and interviews with former Telstra employees.

ASA summarised that the site was originally a portion of the 2000 acres purchased by Major John Campbell upon which Bungarribee House was built in 1826. Between 1826 – 1950, the land was owned by various people, and used for cultivation and dairying purposes. Small portions of land on the site were sold (date not provided) as small farming allotments in the south-east portion of the site. In 1953-1952, Telstra purchased the site, and constructed a number of the site buildings, and the onsite landfill. Aerials and transmitters were constructed between 1954-1961, and staff houses were constructed in 1960. Two of the staff houses were demolished between 1961-1970, and by 1978 the remaining staff house was demolished, and Bungarribee House destroyed by storm. Between 1980-1982, the oil in the 10 electrical transformers was changed over, and the waste oil reportedly disposed offsite. ASA reported that the onsite landfill ceased to be used by 1982. In 1985, the former timber transmission feeder poles were replaced with steel poles.

ASA reported that areas of the site were sprayed with organochlorine pesticides (OCPs) in the 1960 – 1970's. ASA discuss the results of a 1989-90 NSW Agriculture & Fisheries survey, which investigated areas sprayed in the 1960s. ASA noted that 4 concentrations of chlordane were above ANZECC (1992) (maximum 1.55 mg/kg). ASA noted that these areas would be targeted for OCP analysis. In addition to these areas, ASA noted that another NSW Fisheries & Agriculture report indicated that 5,343 gallons of chlordane was sprayed over 58 acres of the site in 1975, to eradicate the Argentine ant.

ASA conducted an interview with site former Telstra employees, and noted the following:

- 2 diesel underground storage tanks (USTs) and 1 super UST existed in the OTC Main Building
- Transformer oil was disposed offsite in 1980-1982 when the oil was 'change over'.
- The concrete footings of the transmission feeder poles were sprayed with dieldrin continually over a long period of time to protect the wooden feeder poles.
- Staff houses were demolished in 1996-1997.
- The landfill was constructed in 1953. Wastes disposed in the landfill included steel wires and poles, insulation bats, electronic parts including switches and valves, electrical transformer, mercury switches and valves, household and construction wastes.
- Bungarribee Creek occasionally has an oily film on the surface, and was noted as occasionally (in 1992) foams up with thick creamy yellow foam.

ASA did not provide zoning details in their Phase I & II ESA.

ASA did not investigate whether the site has been recorded under the provisions of the NSW EPA Unhealthy Building Land Act (1990).

ASA report that no trade Waste licence or Agreement existed for the site.

Auditor's Comments

The Auditor notes that Appendices 13-18 were not provided for review.

The Auditor is not able to confirm the aerial photograph interpretation provided by ASA due to the poor quality of photos provided in the report. The Auditor notes that whilst interviews with former employees have provided useful site information, ASA did not specifically investigate waste management practices from the site operations. The Auditor notes that the potential for unidentified buried waste at the site is addressed later in this report.

3.0 CONTAMINATION ASSESSMENT

3.1 Contamination investigations

Contamination investigations conducted by ASA are reported in the Phase I & II ESA (October 1998) and the Phase III ESA (August 1999). The content of these investigations is summarised below.

3.1.1 Phase I & II Environmental Site Assessment, ASA, October 1998

ASA divided the site into two areas based on the future proposed landuse in each area. The two areas were further subdivided based on former landuse and activities. These are:

Location	Area (ha)	Number of test pits
Area One (for re-zoning as residential)	**220**	
• General area grid	220	223
• Former farm Allotment area	50	40
• Former Telstra Staff house Area	15	60
• Bungarribee House	9	20
• Telstra Operations Centre	9	23
Area Two (floodplain, to be re-zoned as public open space)	**80**	
• Remainder of Area Two	80	80
• Landfill Area	0.2	1

ASA collected 896 samples from 447 test pits, 10 groundwater samples from 5 groundwater bores around the landfill, 2 sediment samples and 4 surface water samples. The sample point locations are shown in Appendix A of this report.

ASA analysed the soil and sediment samples for a range of heavy metals, organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs), USEPA scan (semi volatile organics), asbestos, polycyclic aromatic hydrocarbons (PAHs), benzo(a)pyrene B(a)P, total petroleum hydrocarbons (TPHs) and benzene, toluene, ethyl benzene, xylene (BTEX). Groundwater and surface water samples were analysed for heavy metals, and the USEPA scan.

ASA report that samples were analysed at WSL Environmental Consulting Pty Ltd (WSL), and split samples were analysed at Water EcoScience Pty Ltd. ASA collected field duplicate and interlaboratory duplicate samples at a rate of 1 per 20 samples analysed. Equipment blanks were collected at a rate of 1 per 2 sampling days.

Auditor's Comments

The Auditor notes that another Victorian based EPA Accredited Auditor has previously approved the sampling plan prior to the implementation of the sampling program. The Auditor notes that the sampling density (1 per hectare) does not comply with the minimum sampling density as outlined in the NSW EPA (1995) *Sampling Design Guidelines*. However, the Auditor considers that the sampling density is adequate to provide background information on analytical concentrations across the 300ha site, and provides information on specific targeted areas. The Auditor notes that additional sampling of areas identified in Stage II as potential areas of contamination, were further sampled on a smaller grid in Stage III. The Auditor notes that most of these additional sampling has been conducted as part of the Phase III investigations, and are discussed below. The Auditor notes that a number of areas of specific concern were not sampled in the Stage II investigation. These include:

- Underground Storage Tank (UST)
- PCB transformers
- OCP under concrete antennae footings
- Waste characterisation of the landfill
- Contents of decommissioned wells across the site
- Riggers workshop
- South Storage Shed
- Hazardous materials associated with the onsite buildings

The Auditor notes that the ASA chain of custody samples do not contain sample preservation method as outlined in the National Environment Protection Measures (NEPM) (1999) guidelines. However, despite this non-conformance, the Auditor notes that the field sampling methods including equipment decontamination and sample handling under chain-of-custody is consistent with industry practice and is considered satisfactory by the Auditor.

3.1.2 Phase III ESA, ASA, August 1999

ASA collected a further 505 soil samples from 438 test pits during the Phase III Investigation in order to obtain further information on the areas listed below. The sample point locations are shown in Appendix B of this report.

Location	Area (ha)	Sample grid size	NSW EPA (1995) recommended number of sample locations	Number of test pits excavated
Area One (for re-zoning as residential)	**220**			
• Former Homestead	4	~30m	50	49
• Telstra Operations Centre	4	~30m	50	49
• Staff Houses	6	~30m	66*	101
• Former Farm Allotments	19	~30m	209*	209
• Cell R13 (piles of rubbish)	1	~30m	21	21
• Cell R15	1	~30m	21	21

* The NSW EPA recommends that sites larger than 5ha be divided into subsites. This number of samples is calculated at a rate of 11 test pits per hectare

Samples were analysed for a range of heavy metals, PAHs, BaP, TPHs, OCPs, OPPs and chlorinated phenoxy acid herbicides.

The Phase III report does not provide a summary of the analytical data collected in this investigation. ASA provide comment on the number of samples exceeding NEHF A criteria, and have calculated the 95% upper confidence limit (UCL) of the mean for the data collected at each subsite. The Auditor has summarised the 95% UCL for each analyte against NEHF A criteria for each subsite as shown in the table below:

Subsite	No of exceedances of NEHF A	95% UCL of the mean
Former Homestead	1 for Pb	All analytes within NEHF A criteria
Telstra Operations Centre	1 for Cu	All analytes within NEHF A criteria
Former Staff Houses	1 for asbestos	All analytes within NEHF A criteria, asbestos detected
Former Farm Allotments	1 for Pb, 1 for PAH & BaP	All analytes within NEHF A criteria
Cell R13	0	All analytes within NEHF A criteria
Cell R15	0	All analytes within NEHF A criteria

ASA report that samples were analysed at GM Laboratories, and split samples were analysed at Australian Environmental Laboratories (AEL). ASA collected field duplicate and interlaboratory

duplicate samples at a rate of 1 per 10 samples analysed. One equipment blank was collected each sampling day.

Auditor's Comments

The Auditor notes that a discrepancy with the nomenclature of Cells R13 & R14 exist. The Phase I & II Site Plan refers to these cells as R12 and R14. The Auditor requested confirmation of the correct nomenclature, and purpose for targeting these areas. ASA stated that "*Cell R13 and R15 were targeted for additional investigation as part of the Phase Three Additional Sampling Program due to the discovery of some concrete slabs, rubbish piles, and other evidence of activity similar to that of the farming allotments to the north. Reference to their location as R12 and R14 is erroneous*".

The Auditor has not included the former homestead (Bungarribee House) in the review, as it has been excised from the site.

The Auditor notes that the appropriate criteria for assessing the data is the successor to the NEHF guidelines, namely the:

- Lesser of the NSW EPA (1998) *Soil Investigation Level (SIL) Column 1 (Residential with gardens and accessible soil)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity criteria)*
- Lesser of the NSW EPA (1998) *SIL Column 3 (Parks, recreational open space)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity criteria)*
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites*

Using these criteria, the Auditor notes exceedances in As, Cd, Cu, Ni, Zn, PAH, BaP, OCP and asbestos. These exceedances are listed in Section 5.1.1.

The Auditor notes that a number of potentially contaminated areas have not been specifically targeted during this investigation. The Auditor notes that a number of these areas were addressed in the remediation and validation works discussed later in this report. For completeness, the Auditor notes the following areas of concern:

- Not all samples were analysed.
- No TPHs analysis in the TOC building, around the UST or under the stockpiles of decommissioned USTs.
- A number of elevated (but within criteria) Hg analytical results in the former farm allotment area.
- No OCP analysis around or beneath antennae footprints.
- No characterisation of waste in the onsite landfill.
- No analysis of PCB transformers.
- No characterisation of the contents in the decommissioned waste wells across the site.
- No investigation of soil contamination around the Riggers workshop.

- No investigation of soil contamination around the South Storage Shed.
- No assessment of hazardous materials associated with the onsite buildings.
- No analysis of service trenches, drains and natural drainage areas from the Telstra Operations Centre Building (TPHs, BTEX and Hg of concern).

The Auditor notes that the ASA chain of custody samples did not contain sample preservation method as outlined in the NEPM (1999) guidelines. However, despite this minor non-conformance, the Auditor notes that the field sampling methods including equipment decontamination and sample handling under chain-of-custody is consistent with industry practice and is considered satisfactory by the Auditor.

3.2 Soil Stratigraphy and Hydrogeology

The borelogs produced by ASA were not provided for review in Appendix 19-24 of the Phase I & II ESA.

ASA describe the geology of the site from interpretations of the 1:100,000 Soil Landscape Map, Soil Conservation of NSW and the Geology Survey of NSW Department of Minerals and Energy, Penrith Sheet 9030 Edition 1, 1:100,000. Regionally, ASA note that the site is located within the Cumberland Lowlands, which is characterised by the Middle Triassic Wianamatta Group (Ashfield Shale, Michinbury Sandstone and Bringelly Shale) and Quaternary Alluvium (fine grained sand, silt and clay).

ASA report that the soil landscape associated with the Bringelly shale is called the Blacktown (bt) soil landscape series. These soils are hard setting mottled texture contrast soils, red and brown podzolic soil on crests, and yellow podzolic soils on lower slopes and natural drainage lines.

ASA state that the soils associated with the Quaternary Alluvium geology exist along the Eastern and Bungarribee Creeks, and are comprised of the South Creek (sc) soil landscape series including deep layered sediments over bedrock.

ASA state that according to the Soil Conservation Sheets, Penrith Sheet, the area underlain by the Bringelly Shale does not contain many groundwater bores, as the water is very saline and often hard.

ASA report that based on information supplied by the Department of Land and Water Conservation, the nearest registered groundwater well is located on Eastern Road at Rooty Hill. This well was installed in 1961 for the purposes of disposal of drainage and septic effluent. The standing level of this well was 33.50 mbgl, and the groundwater was generally saline.

ASA state that the regional groundwater flow is towards the east-west based on the topography. ASA report that groundwater was intersected "*adjacent to the landfill at the site... at approximately 3-4m*". A total of 5 groundwater wells were installed and sampled by ASA around the landfill located at the site.

Auditor's Comments

The Auditor considers that the level of reporting on soil stratigraphy, geology and hydrogeology is satisfactory at the scale of the site, but did not provide much detail of depth to groundwater etc at potential sources of liquid contamination, such as the USTs.

3.3 Potential Contaminants of Concern

In the Phase I & II ESA, ASA nominated areas of potential concern based on a review of the site history and aerial photographs. In some instances, ASA stated potential contaminants of concern associated with these areas. The Auditor has summarised the information provided by ASA, and presents this information in the table below.

Location	Potential area of concern	Potential analytes of concern
	Area 1 (for residential redevelopment)	
General to most areas	Underground wells	Unknown contents
	Around concrete base of wooden feeder poles	Dieldrin
	Electrical transformers	PCBs
	Hobby farm adjacent western fence	Not stated
Farm Allotments	Areas sprayed by Department of Agriculture	Chlordane
	Footprints of former farm allotment buildings	Pesticides or other chemicals
Former Telstra Staff Houses	Under Staff House Buildings	Pesticides, asbestos
TOC Building	2 diesel and 1 petrol underground storage tanks	Not stated
	Roadways and under building – unknown fill	Not stated
	Vehicle wash bay and Riggers Workshop	Dieldrin, petroleum based products, paints, solvents
	Area 2 (floodplain area)	
Creek	From offsite contamination sources	TPHS, PAHs and heavy metals
Landfill	Waste disposal	Asbestos, heavy metals, PCBs, OCPs. Ground and surface water contamination possible

ASA note that this information was reviewed and approved by a Victorian based EPA Accredited Auditor (Mr Richard Wolfe) prior to the present Auditor's (C. H. Kidd) appointment to the site. The Auditor's report was not sighted during the present audit.

ASA provided a summary of the analysis conducted in the Phase I & II investigation, as shown below.

Location	Test pits	Area (ha)	Density (TP/ha)	Metals	OCP / OPP	PCB	USEPA Scan	Asbestos	PAH	TPH	BTEX
Area 1											
Grid Samples	222	220	1	444	110	-	-	-	-	-	-
Telstra Houses	60	15	4	120	60	-	-	10	30	-	-
Abandoned well	1	-	-	2	-	-	1	2	-	-	-
Farm Allotments	40	50	1.25	80	80	-	-	20	20	-	-
TOC building	23	9	2.55	46	20	6	-	5	11	13	13
USEPA screen	-	-	-	-	-	-	22	-	-	-	-
Transformer swabs	-	-	-	-	-	10*	-	-	-	-	-
Area 2											
Grid samples	80	80	1	160	32	-	8	-	20	-	-

Location	Test pits	Area (ha)	Density (TP/ha)	Metals	OCP / OPP	PCB	USEPA Scan	Asbestos	PAH	TPH	BTEX
Landfill Area	1	0.2	40	2	-	-	2	2	-	-	-
Sediment Samples	-	-	-	4	-	-	2	-	-	-	-
Surface Water	-	-	-	2	2	-	-	-	2	-	-
Groundwater samples	-	-	-	10	-	-	10	-	-	-	-
TOTAL	**447**			**910**	**324**	**16**	**45**	**44**	**93**	**13**	**13**
QA/QC	**48**			**92**	**31**	**1**	**3**	**4**	**8**	**1**	**1**

* Samples not collected as transformers were still connected

TP/ha – Test pits per hectare

Auditor's Comments

The Auditor notes that ASA does not state that potential contaminants of concern for each specific area of concern. However, the Auditor considers that the analyte list was inclusive of the main potential contaminants of concern, with the exception of solvents in the Riggers Workshop.

The Auditor has previously noted that a number of areas, that the Auditor considers to be potential areas of concern, were not included for sampling during the Phase I & II ESA and the Phase III investigation. The Auditor notes that these two ASA reports were reviewed, and additional investigations requested to address these other areas. ASA investigated a majority of the additional areas during the remediation and validation reports. The investigation of these areas will be discussed later in this report.

Despite these deficiencies in the potential areas of concern investigated by ASA in the Phase I & II investigations, the Auditor notes that the range of analytes in the Phase I & II ESA (metals, PAHs, TPHs, OCPs, PCBs and asbestos) is sufficient to detect most of the common types of contamination expected on a former Telstra Overseas Telecommunication Centre site, including wooden antennae poles treated with OCPs, refuelling activities and landfilling of non-putrescible waste.

3.4 Rationale for Sample Site Selection

Phase II used a stratified sampling program consisting of:-

- Test pit locations were placed on a systematic (100m x 100m) grid across the site in the Phase II ESA, and were excavated to an average depth of 1m bgl, and a maximum depth of 3m bgl. Two samples were collected from each test pit, generally at the surface, and at 0.5m depth bgl.
- Additional samples were collected from test pits excavated in areas targeted by ASA as areas of potential concern. These samples were generally collected from a judgemental or targeted sampling pattern. The sample analysis plan is shown in Section 3.3 above.

Phase III involved a systematic (30m x 30m) grid sampling of specific areas identified as potential sources of contamination in Phase I and II. The sampling is described in Section 3.1.2.

Auditor's Comments

The Auditor notes that another Victorian EPA Accredited Auditor has previously approved the sampling plan prior to the implementation of the sampling program. The Auditor notes that the sampling density for the systematic grid (100m x 100m or 1 per hectare) does not comply with the minimum sampling density as outlined in the NSW EPA (1995) *Sampling Design Guidelines*. However, the Auditor considers that the sampling density is adequate to provide background information on analytical concentrations across the 300ha site, and identify any substantial areas on contaminated soil not identified by the site history.

The Auditor considers that the Phase II sampling when combined with Phase III, detailed grid sampling of specific areas complies with the NSW EPA (1995) *Sample Design Guidelines* and ANZECC (1992) Guidelines for dealing with large sites with scattered activities.

4.0 ANALYTICAL REVIEW

4.1 Laboratory Methods (Phase I & II, Phase III and Validation Assessments)

The ASA Phase I & II report provides a summary of the laboratory methods used by WSL Laboratory (WSL), which was used as the main laboratory, and Water EcoScience, which was used as an interlaboratory duplicate laboratory. ASA also sent additional supplicate samples to AMDEL for analysis. ASA do not provide an assessment as to the suitability of the analytical methods used by the laboratories.

The ASA Phase III report states that the samples were analysed by GM Laboratories (GM) and the interlaboratory duplicate samples were sent to Australian Environmental Laboratories (AEL). ASA do not provide an assessment as to the suitability of the analytical methods used by the laboratories.

The ASA Validation Investigation Report provides a summary of the laboratory methods used by Gribbles as the main laboratory, and by Australian Environmental Laboratories (AEL) as the second laboratory for interlaboratory duplicates. ASA do not provide an assessment as to the suitability of the analytical methods used by the laboratories.

NATA endorsed laboratory certificates were provided in the Validation Reports. The Auditor notes that the analytical reports from GM in the Phase III investigation are not NATA stamped. No NATA certificates were provided for the Phase I & II Report. In the NATA certificates provided for review, the laboratory methods are noted on the laboratory reports, however, these are generally referred to as in house method references rather than the United States Environment Protection Agency (USEPA) or other approved methods.

Auditor's Comments

The Auditor requested that the NATA report for the Phase I & II be provided for review, but notes that these were not received.

The Auditor requested confirmation from ASA that the Water EcoScience laboratory was a NATA registered laboratory for the analyses performed. The Auditor notes that ASA did not provide this information as requested. The Auditor has contacted NATA, who has stated that the laboratory was not NATA accredited for the analysis performed. Therefore, the Auditor considers that the results provided

by Water EcoScience are not suitable for this investigation, as they do not comply with minimum standards for laboratory analysis required by NSW EPA endorsed guidelines.

The Auditor reviewed the laboratory methods detailed in the Phase I & II report, and notes that the TPHs C_6-C_9 were not extracted at the WSL or Water EcoScience laboratories by the purge and trap method endorsed by the NSW EPA as outlined in the ANZECC (1996) *Guidelines for the Laboratory Analysis of Contaminated Soils*.

The Auditor is unable to provide comment on the analytical methods used by GM in the Phase III report, as the methods are not reported by the laboratory, and not NATA stamped. The Auditor has independently reviewed the analytical methods for GM, and notes that they are NATA registered for the heavy metals, PAHs, TPHs, OCP and OPPs. The Auditor notes that the GM did not use the purge and trap extraction method for TPHs C_6-C_9 as outlined in the ANZECC (1996) *Guidelines for the Laboratory Analysis of Contaminated Soils* and endorsed by the NSW EPA.

The Auditor has reviewed the Gribbles and AEL methods summarised in the ASA Validation Report. The Auditor notes that the analytical method for TPHs C_6-C_9 were not extracted by the purge and trap method endorsed by the NSW EPA, and the Gribbles method for PAHs was not as outlined in the ANZECC (1996) *Guidelines for the Laboratory Analysis of Contaminated Soils*.

The Auditor notes that ASA has not commented on the suitability of the laboratories for the analysis conducted as required by the NSW EPA guidelines, despite requests from the Auditor.

Based on the evaluation conducted by the Auditor, on the basis of laboratory methods, the Auditor makes the following comments:

- The Auditor considers that the data reported by Water EcoScience is not suitable for use in this investigation.
- The Auditor notes that it is poor practice for GM to not note which analytes are NATA registered on the laboratory reports.
- The Auditor notes that the analytical results reported for TPHs C_6-C_9 may be marginally less than the actual volatiles present in the samples due to some volatile loss during the extraction method. However, the Auditor considers that this will not greatly affect the analytical results, as the majority of the samples were reported as not detected.
- Whilst the PAHs method used by Gribbles did not reflect USEPA methods, the Auditor considers that this analysis will not greatly affect the acceptance of these results, as the detection limits were sufficiently low to detect any individual compounds of concern.
- The Auditor notes that the use of different labs for each investigation makes comparison of the analytical results from each investigation difficult to assess.

4.2 QA/QC

4.2.1 Data Quality Objectives (DQOs)

ASA do not state DQOs in the Phase I & II, Phase III or Validation Reports.

4.2.2 Field

The field QA/QC was reported by ASA to consist of standard sampling methods, procedures for handling samples under chain of custody and standard decontamination procedures.

In the Phase I & II Investigation, ASA collected a total of 48 field duplicate samples from the 896 samples submitted for analysis. ASA state that approximately 90% of the relative percentage differences (RPDs) are less than 30%. ASA do not provide an explanation of those RPDs greater than 30%. ASA also submitted 44 samples to Water EcoScience for analysis. When these results were received, the majority of the RPDs were greater than 30%. The Auditor appointed at the time noted that these results were not appropriate for the investigation, and therefore, an additional 30 samples were collected and submitted to WSL and AMDEL for analysis. ASA note that approximately 67% of the RPDs were less than 30%, and that the RPDs exceeding 30% are due to the low concentrations of the samples.

In the Phase III investigation, ASA sent a total of 48 samples from the 505 samples submitted for analysis. ASA report that 5 RPDs were greater than their acceptance criteria of 30%. ASA state that these exceedances are due to variations in samples with small numeric concentrations, and therefore ASA consider that these results are satisfactory. ASA also sent 48 samples to AEL for interlaboratory duplicate analysis. ASA state that a total of 21 of these RPDs were greater than 30%, and are due to variations in samples with small numeric concentrations, and therefore ASA consider that these results are satisfactory.

In the Validation Report, ASA collected 66 field duplicates from a total of 944 samples submitted for analysis. ASA state that the majority of the RPDs are less than the acceptance level of 30%. ASA submitted 66 samples to a second laboratory (AEL) for analysis as interlaboratory duplicates. ASA state that the RPD exceedances are due to the variations in samples with small numeric concentrations, heterogeneity of the soil and differences in extraction procedures between the laboratories, and are therefore considered acceptable.

ASA collected equipment blanks at the following rates:

- Phase I & II 1 per 2 days sampling resulting in 11 equipment blanks over 20 days sampling
- Phase III 19 equipment blanks collected
- Validation 47 equipment blanks collected

ASA report that none of the equipment blanks were detected above the detection limit in the Phase I & II Report. In the Phase III investigation, ASA state that the equipment blanks recorded results less than the irrigation waters criteria in the *Australian Water Quality Guidelines for Fresh and Marine Waters*, November 1992. In the Validation Investigation report, ASA noted that some results were greater than the detection limits, but not 'a significantly high level', and are considered satisfactory.

Auditor's Comments

The Auditor notes that the rate of field duplicate samples (1 per 20) meets the NEPM (1999) guidelines, which refer to the Australian Standards AS4482.1-1997.

The Auditor notes that the rate of interlaboratory duplicates (1 per 20) meets the NEPM (1999) guidelines, which refer to the Australian Standards AS4482.1-1997. However, the Auditor notes that the initial interlaboratory duplicates sent to Water EcoScience are not useable on the basis that they are not

NATA approved, and therefore the Auditor has not included these results in the review, and has rather included the results from the interlaboratory duplicates sent to AMDEL.

The Auditor notes that some variation exists in the RPDs from the field duplicates associated with variations in results with small numeric concentrations. It is the Auditors opinion that if the variability in the field duplicate RPDs were applied to the validation data set, the validation data would still be within the validation criteria. Therefore, the Auditor considers that the high variability shown by the field duplicates is acceptable, and does not affect the useability of the data.

ASA did not provide comment on holding times in any of their reports. The Auditor has reviewed a selection of chain of custody and NATA reports, and notes that for the samples reviewed, the holding times were met.

4.2.3 Laboratory QC

ASA did not provide a comment on the laboratory QA/QC in the Phase I & II report, the Phase III report or the Validation report. The Auditor requested that this assessment be provided for review, and notes that this information has not been provided for review. The Auditor considers that this is a major deficiency of the ASA reports, and does not comply with the minimum requirements of the NSW EPA guidelines.

ASA did not include a formal laboratory data validation and did not comment on the precision, accuracy representativeness and completeness of the data. However, they have stated that analytical data is of suitable quality and reliable for use in the investigation and validation, but it is unclear what ASA based this claim on. The Auditor notes that this is considered to be a major deficiency with respect to the NSW EPA guidelines in these reports, especially given that the NATA reports for the Phase I & II were not provided for review.

Auditor's Comments

The Auditor has reviewed a proportion of the NATA reports in the Phase II and Validation reports, and notes that the Phase I & II NATA reports were not provided for review. The laboratory NATA reports generally include:

- Method blanks
- Laboratory Duplicates
- Matrix and Surrogate Spike Recoveries
- Control samples
- Acceptance criteria for spike recoveries, laboratory duplicate RPDs,

The Auditor notes that a number of the GM NATA reports state that various laboratory duplicate samples were outside the method acceptance criteria. The Auditor requested justification from ASA for accepting these results, since GM has noted that not all data quality objectives were met. The Auditor notes that no justification has been provided by ASA despite this request. Apart from these exceptions, the Auditor notes that in the majority of laboratory NATA reports reviewed, the laboratory assessed the results, and all results were reported as being within the expected levels.

The Auditor notes that an assessment of the laboratory QA/QC should have been included in the ASA reports, and is considered to be a major deficiency in the ASA report, and does not meet NSW EPA

requirements. The Auditor has reviewed the results reported by GM in the NATA reports, and notes that if the variability / uncertainty highlighted in exceedances of their QA procedures was placed on the investigation data, the resulting data set would not dramatically change the outcome of the initial investigations. The Auditor has independently assessed the laboratory QA/QC from a selection of the NATA reports, and is generally satisfied that the laboratory QA/QC was within the standard laboratory acceptance criteria.

The Auditor also refers to comments made previously in Section 4.1 regarding the suitability of the laboratory methods for the analyses performed.

The Auditor has reviewed the laboratory practical quantitation limits (PQLs), and notes that they are generally less than the criteria for the site. However, in the Phase I & II report, the Auditor requested confirmation as to the PQL for the groundwater analytes. ASA assessed the groundwater samples against the irrigation waters criteria rather than the freshwater criteria in ANZECC (1992). The Auditor notes that a number of the detection limits were not sufficiently low to be less than the freshwater criteria for copper (Cu), lead (Pb) and mercury (Hg). ASA did not provide comment on the detection limits, or justification for using the irrigation waters criteria.

It is the Auditors opinion that close monitoring and reporting of the laboratory QA/QC by ASA would have resulted in a more robust, technically sound data set for the site. Despite the deficiencies noted by the Auditor in the reporting and control of laboratory data QA/QC, the Auditor, on the basis of his independent review of the data, is satisfied that the data set is useable for the site, although some degree of uncertainty exists due to the poor quality of the consultants reports.

4.3 Analytical Results and Evaluation

The Auditor notes that there are a number of major deficiencies in the investigation and validation conducted by ASA including the use of non NATA registered laboratories (although this was later rectified by reanalysis at a NATA approved laboratory), not providing Phase I & II NATA reports for review, and poor quality of reporting laboratory QA/QC.

Based on the Auditors independent review of a portion of the available laboratory results, the Auditor is satisfied that the data set is useable for the site, although some degree of uncertainty exists due to the poor quality of the consultant reports, which did not follow the guidelines for assessing and reporting QA/QC.

5.0 SITE EVALUATION

5.1 Environmental Quality Criteria Used for the Site

5.1.1 Soil

It is understood that the site is to be developed for a combination of residential landuse (in the non-floodplain area) and public open space (in the floodplain area of the site). ASA refer to the residential area of the site as Area 1, and the public open space floodplain area as Area 2.

In the Phase I & II, Phase III and RAP, ASA compared the analytical results to the following soil criteria:

- ANZECC (1992) Human Health and Environmental Soil Quality Guidelines for Assessment and Management of Contaminated Sites.

- NEHF Level A (Residential with accessible soil)
- NEHF Level E (Parks and public open space)

ASA compared the groundwater analytical data against the ANZECC (1992) *Australian Water Quality Guidelines for Fresh and Marine Waters* guidelines for irrigation water.

Auditor's Comments

The Auditor notes that the appropriate criteria for the site based on the future residential and open space development is outlined in the NSW EPA (1998) *Guidelines for the NSW Site Auditor Scheme*. The Auditor notes that these criteria are considered appropriate in preference to the NEPM health based investigation levels, as the latter criteria do not include assessment of risk to the environment.

The criteria that the Auditor considers as appropriate are outlined below:

- In residential areas, the lesser of the NSW EPA (1998) *Soil Investigation Level (SIL) Column 1 (Residential with gardens and accessible soil)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*
- In public open space areas, NSW EPA (1998) *SIL Column 3 (Parks, recreational open space)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*
- ANZECC (1992) *Australian Water Quality Guidelines for Fresh and Marine Waters* guidelines for fresh water.
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites*

The Auditor has assessed the data collected against the above criteria, and notes exceedances in As, Cd, Cu, Cr, Ni, Hg, Pb, Zn and BaP. These exceedances are shown below.

Phase I & II Analytical Data: Summary of analytical results exceeding SIL Column 1& 5 (residential areas) and SIL Column 3 & 5 (Parks and public open space)

Sample Point	Sample Depth (m)	Analyte exceeding criteria (mg/kg)
Area 1 – General Area		
F2	0.05	As (22)
L12	0.1	Cr (72), Cu (140), Pb (3400), Zn (6800)
M4	0.05	Zn (310)
N14	0.1	Zn (420)
N14	0.5	Pb (400), Zn (590)
R12	0.1	As (31), Cu (120), Pb (430), Hg (1.1), Ni (79), Zn (1800)
T3	0.5	As (21)
Area 1 – Former Farm Allotments		
FA2	0.1	Cu (110), Pb (400), Zn (1000)
FA6	0.1	Zn (560)
FA11	0.1	Zn (210)
FA12	0.1	Cd (4.5), Cu (120), Pb (830), Zn (2500)

Sample Point	Sample Depth (m)	Analyte exceeding criteria (mg/kg)
FA17	0.1	Pb (440), Zn (1500)
FA18	0.1	Zn (510)
FA19	0.05	Zn (220)
Area 1 – Staff House Area		
SH34	0.05	Cu (280)
SH42	0.05	As (85), BaP (20), PAH (260)
SH45	0.05	Cu (250)
SH48	0.05	As (22)
SH49	0.05	Cd (4.1), Zn (1100)
SH53	0.05	As (30)
F2	0.05	As (22)
SH27	0.05	BaP (1.1)
Area 1 – Telstra Operations Centre Building		
TOC2	0.5	As (22)
TOC4	0.5	Cu (87), Zn (460)
TOC5	0.05	Cu (470), Zn (1700)
TOC6	0.05	Zn (460)
TOC10	0.5	As (21)
TOC14	0.05	Cu (110), Zn (210)
TOC19		Zn (310)
Area 2 – General Area		
H7	0.05	Ni (70)
H7	0.5	Pb (2000), Zn (420)
L5	0.05	BaP (9), PAH (120)

Phase III Analytical Data: Summary of analytical results exceeding SIL Column 1& 5 (residential areas) and SIL Column 3 & 5 (Parks and public open space)

Sample point	Analyte exceeding criteria (mg/kg)
Area 1 – Telstra Operations Centre	
TO9A	Asbestos
TO45A	Ni (180)
TO48A	Cu (1200)
Area 1 – Former Staff Houses	
SH2A	Zn (310)
SH6A	Zn (270)
SH9A	Zn (250)
SH18A	Zn (340)
SH29A	Zn (260)
SH94A	Zn (340)
SH28A	Cu (210), Zn (980)
SH43A	Zn (400)
SH45A	Asbestos
SH100A	Cu (150), Zn (720)
SH77A	Zn (240)
SH50A	Zn (220)
SH51A	Zn (330)

Sample point	Analyte exceeding criteria (mg/kg)
Area 1 – Former Farm Allotments	
FA104A	Zn (280)
FA217A	Zn (210)
FA183A	PAH (380), BaP (33)
FA105A	Zn (560)
FA177A	Cd (5)
FA175A	Hg (1.5)
FA115A	Ni (71)
FA17A	Cd (4)
FA74A	Zn (470)
FA75A	Zn (540)
FA53A	As (140)
FA15A	OCP (27)
FA59A	Cd (4)
FA180A	Cd (5)
FA205A	Zn (270)
FA71A	Zn (500)
FA91A	Zn (260)
FA51A	Zn (950)

The Auditor also notes that comparison of the groundwater analytical results against the ANZECC (1992) freshwater criteria shows exceedances in Cd, Ni and Zn. The Auditor notes that the detection limits for Cu, Pb and Hg are greater than the ANZECC (1992) freshwater criteria, and therefore any potential exceedances can not be noted.

5.1.2 Groundwater

In the Phase I & II investigation, ASA installed 5 groundwater wells around the large landfill at the site. ASA state that groundwater at these locations was encountered at 3-4 m (below ground level). Groundwater samples were collected from these wells during two sampling events. Samples were analysed for As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn and the USEPA scan. ASA compared the analytical results against the ANZECC (1992) irrigation waters criteria, and noted one exceedance for Cd.

No groundwater was sampled as part of the Phase III investigation.

No groundwater was sampled as part of the UST remediation or validation.

Auditor's Comments

The Auditor also notes that comparison of the groundwater analytical results against the ANZECC (1992) freshwater criteria shows exceedances in Cd, Ni and Zn. The Auditor notes that the detection limits for Cu, Pb and Hg are greater than the ANZECC (1992) freshwater criteria, and therefore any potential exceedances can not be noted.

The Auditor considers that the groundwater should have been investigated in the proximity of the USTs, as required by the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*. However, the Auditor notes that groundwater is not likely to be used in the area, the USTs were located well away from

the watercourses and validation testing of the soils below the USTs did not detect significant TPH contamination.

Following the removal of the USTs and the buried waste in the landfills at the site, the Auditor considers that the potential for significant groundwater contamination is low given that the potential contamination points sources have been removed and validated.

5.2 Investigation Results

5.2.1 Phase I & II Investigation

In the Phase I & II Investigation, ASA divided the site into two areas based on the future proposed landuse in each area. The two areas have been further subdivided based on former landuse and activities. These are:

Location	Area (ha)	Number of test pits
Area One (for re-zoning as residential)	**220**	
• General area grid	220	223
• Former farm Allotment area	50	40
• Former Telstra Staff house Area	15	60
• Bungarribee House	9	20
• Telstra Operations Centre	9	23
Area Two (floodplain, to be re-zoned as public open space)	**80**	
• Remainder of Area Two	80	80
• Landfill Area	0.2	1

ASA collected 896 samples from 447 test pits, 10 groundwater samples from 5 groundwater bores around the landfill, 2 sediment samples and 4 surface water samples. The sample point locations are shown in Appendix A of this report.

ASA analysed the soil and sediment samples for a range of heavy metals, OCPs, OPPs, PCBs, USEPA scan (semi volatile organics), asbestos, PAHs, B(a)P, TPHs and BTEX. Groundwater and surface water samples were analysed for heavy metals, and the USEPA scan.

ASA have compared the analytical results to the following soil criteria:

- ANZECC (1992) Human Health and environmental Soil Quality Guidelines for Assessment and Management of Contaminated Sites.
- NEHF Level A (Residential with accessible soil)
- NEHF Level E (Parks and public open space)

ASA compared the groundwater analytical data against the ANZECC (1992) *Australian Water Quality Guidelines for Fresh and Marine Waters* guidelines for irrigation water.

The samples exceeding criteria are listed in Chapters 6-12 of the ASA Phase I & II Report. Based on the analytical results, ASA identified a number of areas that required further investigation, including:

- Decommissioned well (N14)

- Transformers
- Test pit F12 for asbestos
- Determine extent of contamination at N13 and N14
- Determine extent of contamination at R12
- Determine extent of contamination at R14 and Q15
- Additional sampling in ditch at southwest of the site
- Further investigate wells on Farm Allotment 1 and 3
- Further investigate OCPs and Pb contamination on Farm Allotments 1,2, and 3
- Determine extent of PAHs and heavy metals contamination at SH42, SH45 and SH48
- Further investigate rubbish at SH34
- Determine extent of heavy metal and PAHs contamination at SH27, SH49 and SH53
- Remove USTs and associated fixtures, and validate the excavated soil and the resulting excavation.
- Investigate drainage area from the Riggers Workshop
- Determine extent of heavy metal and OCPs contamination at the Riggers Workshop
- Demolish and sample beneath the Telstra Operations Centre building
- Sample under South Storage Shed to determine extent of heavy metal contamination
- Determine extent of Pb contamination at H7
- Determine extent of PAHs contamination at L5
- Excavate landfill and dispose of contents to an offsite landfill

Auditor's comments

The Auditor has compared the analytical results against the criteria considered appropriate for the site (as outlined in Section 5.1.1. Using these criteria, the Auditor notes a number of exceedances in criteria, as summarised in Section 5.1.1.

The Auditor notes that a number of areas of specific concern were not sampled in this investigation. These include:

- Underground Storage Tank (UST)
- PCB transformers
- OCP under concrete antennae footings
- Waste characterisation of the landfill
- Contents of decommissioned wells across the site
- Riggers workshop

- South Storage Shed
- Hazardous materials associated with the onsite buildings

The Auditor agrees with the ASA Phase I & II report recommendations for additional sampling at the site to better define the contamination status of the site.

5.2.2 Phase III Investigation

ASA collected a further 505 soil samples from 438 test pits during the Phase III Investigation in order to obtain further information on the areas listed below. The sample point locations are shown in Appendix B of this report.

Location	Area (ha)	Sample grid size	Number of test pits
Area One (for re-zoning as residential)	**220**		
• Former Homestead	4	~30m	49
• Telstra Operations Centre	4	~30m	49
• Staff Houses	6	~30m	101
• Former Farm Allotments	19	~30m	209
• Cell R13 (piles of rubbish)	1	~30m	21
• Cell R15	1	~30m	21

Samples were analysed for a range of heavy metals, PAHs, BaP, TPHs, OCPs, OPPs and chlorinated phenoxy acid herbicides.

The Phase III report did not provide a summary of the analytical data collected in this investigation. ASA commented on the number of samples exceeding NEHF A criteria, and have calculated the 95% upper confidence limit (UCL) of the mean for the data collected at each subsite. A summary of the 95% UCL for each analyte against NEHF A criteria for each subsite is provided below:

Subsite	No of exceedances of NEHF A	95% UCL of the mean
Former Homestead	1 for Pb	All analytes within NEHF A criteria
Telstra Operations Centre	1 for Cu	All analytes within NEHF A criteria
Former Staff Houses	1 for asbestos	All analytes within NEHF A criteria, asbestos detected
Former Farm Allotments	1 for Pb, 1 for PAH & BaP	All analytes within NEHF A criteria
Cell R13	0	All analytes within NEHF A criteria
Cell R15	0	All analytes within NEHF A criteria

Auditor's comment

The Auditor notes that a discrepancy with the nomenclature of Cells R13 and R14 exist. The Phase I & II Site Plan refers to these cells as R12 and R14. The Auditor notes that the correct nomenclature as confirmed by ASA is R13 and R15.

The Auditor notes that no tables were presented in this report summarising the analytical concentrations of the samples collected. The Auditor has reviewed the analytical results by looking through the NATA reports provided.

The Auditor has compared the analytical results against the criteria considered appropriate for the site (as outlined in Section 5.1.1. Using these criteria, the Auditor notes a number of exceedances in criteria, as summarised in Section 5.1.1.

The Auditor notes that a number of potentially contaminated areas have not been specifically targeted during this investigation. The Auditor notes that some of these areas were investigated as part of the remediation process. For completeness, the Auditor notes the following areas of concern:

- Not all samples were analysed.
- No TPHs analysis in the TOC building, around the UST or under the former UST stockpiles.
- A number of elevated (but within criteria) Hg analytical results in the former farm allotment area.
- No OCP analysis around or beneath antennae footprints.
- No characterisation of waste in the onsite landfill.
- No analysis of PCB transformers
- No characterisation of the contents in the decommissioned waste wells across the site.
- No investigation of soil contamination around the Riggers workshop.
- No investigation of soil contamination around the South Storage Shed.
- No assessment of hazardous materials associated with the onsite buildings.
- No analysis of service trenches, drains and natural drainage areas from the Telstra Operations Centre Building (TPHs, BTEX and Hg of concern).

6.0 REMEDIATION

6.1 Introduction

ASA prepared a Remedial Action Plan (RAP) for the contaminated site remediation and fuel UST removal in March 1999. An additional RAP was prepared in April 1999, which included management of Heritage issues at the site. The content of the RAPs and the actual remediation conducted are presented below.

6.2 Remediation Options and Strategy

The ASA RAP outlined works to be conducted as part of the validation works for the site. These included:

- Demolition of the following buildings: Main TOC Building, Riggers Workshop, two Storage Sheds, car parking area, concrete slabs associated with the former Telstra Staff Houses, concrete slabs associated with former Farm Allotments, concrete slabs associated with Bungarribee Homestead and Barn, the Electrical Transformer Building, four septic wells and pipework, all abandoned wells.
- Removal and decommissioning of all electrical transformers at the site.
- Removal of 3 USTs and associated pipe work and dispensing equipment adjacent to the TOC Building.
- Removal of 2 ASTs from inside the TOC Building
- Excavate landfill and adjacent area
- Remove all main electricity cables
- Remove all remaining antennae from the site
- Remove all underground electrical cables and trenches
- Remove all fencing around antennae
- Remove all rubbish and other waste material from the site.

ASA proposed to conduct an asbestos survey prior to the commencement of any demolition works.

ASA stated that all areas identified as being contaminated were to be excavated, stockpiled and analysed prior to disposal to an off-site EPA licenced facility. Areas of contamination were identified as those areas exceeding the Health Risk 'A' and Health Risk 'E' Levels. ASA stated that validation samples would be collected prior to reinstatement of the excavations.

ASA stated that a number of stockpiling locations would exist on the site, for the stockpiling of clean fill, crushed rock, contaminated materials, building rubble, rubbish and concrete footings. ASA stated that the stockpile areas would be validated at the completion of the works.

ASA stated that all material would be disposed in accordance with the NSW EPA (1997) *Guidelines for the Assessment and Management of Non-Liquid Wastes*.

ASA stated that validation sampling at the site would include:

- Residual soils in areas excavated due to contamination sampled at a rate of 1 sample per $25m^2$ (ie 1 per 5m x 5m excavation). Samples analysed for the identified contaminant of concern.
- The UST excavation sampled at the base (1 sample) and each wall (1 per wall). A multiple tank pit would be sampled at the density similar to that used for a single tank.
- The material excavated from the UST excavation would be sampled at a rate of 1 sample per $50m^3$, and analysed for heavy metals, TPH, and VOCs. The material would be landfarmed (with BIOSOLVE® additive). Validation samples for the landfarmed material would be collected at a rate of 1 sample per $25m^3$ and analysed for the identified contaminants.

- Imported fill material would be sampled at a rate of 1 per $100m^3$ (for known quarry origin) and 1 per $25m^3$ (for fill of unknown origin), and a 5-point composite sample submitted for analysis. The samples would be analysed for heavy metals, TPHs, BTEX, PCB, OCPs, and OPPs.

- The area beneath the main building and other demolished structures would be sampled in accordance with the NSW EPA (1995) *Sample Design Guidelines*.

- The area beneath the stockpiled materials would be validated to ensure that no leachate has affected the quality of the soil beneath.

- The antennae concrete footings would be removed, and the area adjacent the footings (2m x 2m x 1m) excavated, stockpiled and analysed for disposal to landfill. The excavations would be validated and backfilled with clean fill, and compacted to 95%.

- The landfill waste in the landfill would be excavated, sorted (by shaker grid) and taken to the stockpile area for classification for offsite disposal. ASA stated that the landfill excavation would be validated and re-instated with validated imported clean fill.

- All waste disposal wells at the site would be excavated to 6m depth, the excavated material stockpiled for disposal to landfill, and a soil validation sample collected at the base of the excavation (6m). ASA proposed to fill the bottom 4m with slurry, and 2m of clean fill at the top.

- The electrical cables feeding the substations would be excavated. ASA proposed to sample the excavation trenches at a rate of 1 per 50m. The analysis plan is not stated. The validated trenches would be backfilled.

The Supplementary RAP provided details of the European and Aboriginal Archaeological Assessment of the site.

Auditor's comment

The Auditor notes that no alternate strategies were presented by ASA for the remediation. However, the Auditor considers that the remediation methodologies presented by ASA for the various works at the site were consistent with NSW EPA guidelines, with the exceptions of the items noted below.

The Auditor made the following comments upon receipt of the remediation plan:

- The Auditor noted that the appropriate criteria for assessing the data is the successor to the NEHF guidelines, namely the:

  - NSW EPA (1998) *Soil Investigation Level (SIL) Column 1 (Residential with gardens and accessible soil)*

  - NSW EPA (1998) *SIL Column 3 (Parks, recreational open space)*

  - NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity)*

- The Auditor noted that all material for offsite landfill disposal must be classified, transported and disposed in accordance with the *Protection of the Environment Operations (Waste)*

Regulations (1996) and the NSW EPA (1999) *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes.*

- The Auditor noted that all asbestos should be dealt with in accordance with the *Asbestos Wastes Chemical Control Order* (1989) and disposed of in accordance with Section 29 of the *Protection of the Environment Operations (Waste) Regulations* (1996). The Auditor required as part of the validation works, that an emu-bob to remove fragments of asbestos material on the surface of the soil be conducted in areas identified with asbestos. ASA reported that a visual inspection for asbestos was undertaken as part of the validation works.

- The Auditor noted that all validation works for the remediation, validation and backfilling the UST excavations must be conducted in accordance with the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*. The Auditor noted that the landfarmed material should also be analysed for BTEX.

- The Auditor considered that the sampling rate and analytical plan for the validation of imported fill was in accordance with the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*. However, the Auditor noted that it is not appropriate to composite samples for analysis of volatile components. Additionally, ASA must ensure that the validation criteria for assessing the soil is adjusted to reflect the composite sampling, and that the composite sub samples are similar in description. Also, the Auditor noted that material of unknown origin should also be analysed for PAHs.

- The Auditor noted that the validation of the subfloor of the demolished buildings and demolished structures such as concrete slabs should be sampled at a rate greater than the minimum sampling densities for site investigation as outlined in the NSW EPA (1995) *Sampling Design Guidelines*, say 1 per $25m^2$, (1 per 5m x 5m).

- The Auditor noted that the area beneath the stockpiled materials at the site (both past and those created during the remediation works) required sampling and analysis. The Auditor requested that the validation sampling density be nominated by ASA. This information was subsequently provided by ASA, and agreed to by the Auditor.

- The Auditor noted that it may not be appropriate to sort the material with a shaker grid, especially if asbestos material is identified as part of the waste. The Auditor requested that this be considered in the implementation of the remediation works. The Auditor also noted that the groundwater and surface water management plan should ensure that no contamination is able to enter the groundwater system or nearby creeks and drainage areas, and that any contaminated water is dealt with appropriately.

- The Auditor requested that the validation sampling rate and analytical plan for the excavations beneath the former concrete antennae be nominated as part of the validation plan.

- The Auditor noted that the waste disposal wells excavations should be validated on the walls (if soil) as well as the base. The Auditor noted that a number of OH&S issues associated with this validation work should be addressed prior to the remediation works. The Auditor requested confirmation on the definition of 'slurry'. The Auditor noted that any material used for backfill must meet the site acceptance criteria.

- The Auditor requested that the analytes for the validation of the electrical cables excavations be provided. The Auditor considered that the validation sampling density (1 per 50m) is satisfactory.

- The Auditor requested confirmation that the service trenches, drains and natural drainage areas from the Telstra Operations Centre Building are not contaminated with TPHs, BTEX and Hg.

- The Auditor requested that ASA provide a map with the areas requiring remediation based on the acceptance criteria listed above. The Auditor also required ASA to amend the validation plan to include the items discussed above.

- The Auditor noted that heritage issues are outside the scope of works for the site audit. However, the Auditor noted that the recommendations and requirements with respect to heritage items as discussed in the Supplementary report be followed.

- The Auditor considers the adopted remediation strategy was satisfactory, despite alternate options not being provided.

The Auditor notes that the RAP prepared by ASA did not strictly comply with the NSW EPA (1997) *Guidelines for Consultants Reporting on Contaminated Sites*, but the Auditor was satisfied that there was sufficient information in the RAP to characterise the site, and present the proposed remediation plan.

6.3 Remediation Works

In the Validation Report, ASA present the remediation and validation works conducted at the site. ASA state that the remediation works involved the "*excavation and disposal off-site of identified contaminated material and general rubbish from the site...the removal of all above ground structures (buildings and footings etc), removal of USTs and associated infrastructure, removal of infrastructure associated with the disconnected underground and above ground services (power, telephone, sewer, stormwater) and removal of footings formerly housing the OTC antennae.*" A summary of the areas in which remediation occurred is provided in the ASA report, and is reproduced below:

Area	Remediation Works Conducted
OTC and Surrounding Area	• Demolition and disposal of the OTC building and validation of the area beneath. • Excavation and removal of three UST's and validation of residual soil • Demolition and validation of the areas beneath the North Storage Shed, South Storage Shed and the Riggers Workshop. • Excavation, removal and validation of an area of oil impacted soil downslope from the OTC building. • During the course of the works the lining underneath the stockpile area located at grid reference R7 was damaged, thus at the completion of activities, a validation sampling program was carried out to ensure that the residual soil was free from contamination.
Staff Houses	• Excavation and removal of asbestos impacted soil identified in several hotspots identified in the earlier investigations. The material was stockpiled, classified and disposed off-site, excavations were

Area	Remediation Works Conducted
	validated. • The removal of power poles from adjacent to the service road and the excavation/disposal of PAH contaminated soil surrounding their bases. • Excavation and validation of an underground service cable trench and the sewer line/septic tank. • Removal of general surface rubbish. • Reinstatement of the excavations with validated imported fill material.
Farm Allotments	• Excavation of various hotspots identified in the earlier investigations. Contaminated soil was stockpiled in a dedicated area and disposed off-site, excavations were validated and returned a non-erodable state. • Removal and disposal of concrete slabs associated with the former farms and rubble material beneath. • During the course of the works the lining underneath the stockpile area was damaged, thus at the completion of activities, a validation sampling program was carried out to ensure that the residual soil was free from contamination.
Site Office Area	• Demolition and removal of the Electrical Sub-station located at grid reference U4. Excavation and validation of the residual soil. • Removal of power poles from the area and excavation and stockpiling of PAH impact soil from around their bases. Contaminated soil was disposed off-site and excavations validated and reinstated. • Removal of an Electrical Booster Box, validation and reinstatement.
Northern Boundary	• Sampling, classification (in two stages) and off-site disposal of dumped soil and building rubble from an area adjacent to the Northern Boundary. The area was validated following removal of the contaminated soil.
Antennae Footings	• Two hundred and ten (210) concrete footings were found onsite, formerly used to secure the OTC transmitting antennae. The footings were excavated along with the immediately surrounding soil and dispose off-site, all footings were validated prior to reinstatement.
Cable trenches	• Nineteen cable trenches were excavated and the cable and/or conduit removed and disposed. Validation samples were collected from along the length of the trenches and from the excavated overburden at a rate of one sample per 100 metres. Where validation and overburden samples were found to be free from contamination, the trenches were reinstated using the overburden.

Area	Remediation Works Conducted
	• Where samples recorded elevated contaminate levels, the affected material was stockpiled and disposed off-site, all further excavations were re-validated and the trenches reinstated with validated fill.
Wells	• Five wells were identified on the site and had been used for the disposal of site waste and rubbish. Material dumped down the wells was removed, stockpiled and disposed off-site. The residual soils were validated and the excavations reinstated with imported, validated fill.
Landfills	• Three landfills were identified on the site having been used in the past for disposal of a variety of different materials. Fill from within was excavated, stockpiled and disposed off-site and all landfills were validated.
Hotspots	• Hotspot TO48 was identified during the previous investigations and required remediation due to elevated heavy metal concentration, the area was excavated, validated and reinstated, contaminated soil was disposed off-site. • Hotspot L5 was identified during the previous investigations and required remediation due to elevated PAH concentrations, the area was excavated, validated and reinstated, contaminated soil was disposed off-site. • Hotspot H7 was identified during the previous investigations and required remediation due to elevated heavy metal concentrations, the area was excavated, validated and reinstated, contaminated soil was disposed off-site.

Auditor's Comments

The Auditor requested that ASA provide a summary of volumes, sample points and waste classification of the material disposed from the site to landfill. This information was provided as an addendum to the draft validation report. This information is summarised below.

Origin	Samples	Classification	Approval No.	Date Disposed	Volume (t)
Staff Houses (SH42, SH45, other asbestos)	SP42V1-4, SP451-2, OAV1-10	Solid	AO142rc	30-31/08/00, 01/09/00, 04/09/00	695.86
Northern Boundary	ISP1, 2, 5-11	Solid	AO145rc	01/09/00, 04/09/00	1081.96
Trench 5	L5SPV1-7	Solid	AO161rc	04/10/00	781.38
Footings 2	FSP2V1-10	Solid	AO164rc	13/10/00	213.06
Trench 2	L2SP1-6	Solid	AO165rc	04/10/00	102.3
Footings 1	FSPV1-8	Solid	AO167rc	04/10/00	228.82
OCT Misc.	OTCMISC1-6	Solid	AO168rc	03/11/00	225.86

Origin	Samples	Classification	Approval No.	Date Disposed	Volume (t)
Landfill 1	LFSP1-14	Solid	AO170rc	04/10/00	144.78
Wells 1-4	W1SPV1-2, W2SPV1, W3SPV1, W4SPV1-3	Solid	AO179rc	25/10/00	386.30
Trench 16	TR16SPV1-9	Solid	AO181rc	03/11/00	285.02
Landfill 2	LF2V1, 2, 4, 5	Solid	AO182rc	21/10/00	61.84
OTC sewer trench	SSPOTC1-5	Solid	AO183rc	03/11/00	82.52
OTC	ASPOTC1-4	Solid	AO185rc	03/11/00	94.04
Landfill2/2	LF2V3	Solid	AO186rc	09/11/00	78.16
UST 2&3	BIOV1-2	Solid	AO187rc	06/11/00	317.64
Staff Houses (sewer trench)	SHSOBV1-7	Solid	AO189rc	02-03/11/00	998.36
Northern Boundary (2nd round), Oil Trench	ISI1-14, OSP1V1-3, OSP2V1-8	Solid	AO190rc	06-08/11/00, 06/12/00, 12/12/00	1242.76
Trench 5 OB	OB5V7	Solid	AO194rc	06/11/00	31.90
Trenches 12 & 13	TR12SP1, TR13SP1	Solid	AO196rc	03/11/00	41.20
Farm Allotments FA183, FA53, L12	FA183SP1, FA53SP1, L12SP1-3	Solid	AO202rc	07/11/00	165.48
Farm Allotments (FA12, FA17, L12)	FA12SP1-2, FA17SP1-5, L12SP4-5	Solid	AO203rc	07/11/00	174.56
Landfill 3	LF3SP1-5	Solid	AO210rc	29-30/11/00, 13/12/00	262.54
TO48, H7	TO48SP1-2, H7SP1	Solid	AO211rc	06/12/00	112.5
L5, H7	L5SP1-2, H7/SP1	Solid	AO213rc	05-06/12/00	84.30
Well 5	W5SP/1-2	Solid	AO214rc	27/11/00	70.72
Secondary power poles	2PPSP1-4	Solid	AO215rc	05/12/00	215.14
FA 183/2, Substation, Riggers Workshop	FA183SPV2, FA183/1/2, FA183/10/2, RIG, SUB	Solid	A1002rc	12/01/01	161.02
Stockpile Areas, North/South Sheds	SCRAPPINGS1-4, NTHS1-3, 1/2, STHS1-3, 2/2	Solid	A1004rc	12/01/01	23.98
OTC Stockpile Area	OTC11	Solid	A1009rc	24/01/01	25.50
Trench 16 Re-ex	TR16V1, OB16V1	Solid	A1014rc	05/02/01	19.40
Northern Boundary	ISP3, 4	Industrial	D0070ah	01/09/00	315.64
Northern Boundary	NB7	Industrial	250101-4585	25/01/01	8.22
Staff Houses power poles	2PPSP5, PPSPV1, PPSPV2	Hazardous	22000705-006124	08/12/00	20.20
Solid Waste					**8,815.70**
Industrial Waste					**323.86**
Hazardous Waste					**20.20**
Total					**9,159.76**

The Auditor also requested that the toxicity characteristic leachate potential (TCLP) data used for the disposal of this material be provided for review. This information was provided as an addendum to the draft validation report. The Auditor notes that in general, sufficient data was provided to show that the material disposed from the site was classified in accordance with the NSW EPA (1999) *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes*.

The Auditor conducted a site visit following the remediation works. The Auditor provided comment on the observations made during this visit including:

- The Auditor noted that blocks of concrete and bitumen existed along the banks of a portion of Eastern Creek. It appeared that these blocks were placed along the creek as a stabilisation method. The Auditor noted that these blocks could remain alongside the creek bank (as disturbing them is likely to increase erosion and disturbance of the creek) as long as it was demonstrated that the material along the edge of the bank was natural material. Bovis Lend Lease (BLL) brought a loader to the area, and dug at two locations, confirming that the material along the banks was likely to be natural.
- An excavation for the former asbestos lined pipe running in a northerly direction along Eastern Creek was shown to the Auditor. The excavation was approximately 1.5-2m in depth. The Auditor inspected a portion of the line, and noted that no visible asbestos pieces were evident.
- The former landfill area had been excavated, and some of the material stockpiled in the Auditors previous visit had been removed. The Auditor noted that some debris material has been tracked across the landfill excavation, and required removing. The Auditor also noted that another area of landfill had been identified further west along Bungarribee Creek. This small buried material landfill was reportedly discovered accidentally, and was not identified in the site history. The Auditor suggested that the Auditor's representative investigate the presence of other possible landfills along Bungarribee Creek by walking along the densely vegetated creek beds and looking for physical evidence of unidentified landfills.
- The excavation for the former TOC building was inspected. The Auditor noted that this area would be suitable for regrading to allow natural drainage following review of the validation results for the excavation.
- The Auditor noted a number of drums containing PCBs (a scheduled chemical) stored in the stockpile area. These drums were not appropriately labelled, stored or contained. The Auditor noted that this was not appropriate in accordance with EPA regulations. BLL informed the Auditor that these drums were being removed for disposal on that day. The Auditor required confirmation in the validation report that these drums were suitable disposed, and the area under the drums be validated. ASA provided this information in an addendum to the validation report.
- The Auditor visited the area in which a number of stockpiles had been dumped from unknown sources. The Auditor noted that this material should be appropriately classified and disposed to an EPA approved landfill (or reused on site if validated for that use).
- The Auditor did not note any staining, or evidence of plant stress during the inspection.

Following this site visit, the Auditor's representative walked the entire length of both creeks and on both banks of the creek to investigate the potential for additional landfill and record any evidence of disturbance from filling activities. No such filling activities were obvious.

On the basis of the site observations, and the information provided in the Validation report, the Auditor considers that the remediation was conducted in an appropriate manner.

7.0 VALIDATION

7.1 Validation Testing

Validation sample point locations are shown in Appendix C of this report.

Validation samples were collected by ASA from the following locations.

Area	Validation Samples	Stockpile samples	Total Samples	Analysed for a range of:
TOC Building	52	15	67	Metals, asbestos, OCPs, OPPs, PCBs, PAHs, TPHs
Oil Pipe	16	15	31	Metals, PCBs, PAHs, TPHs, BTEX
UST	19	8	27	Metals, asbestos, TPHs, BTEX
Staff Houses	86	12	98	Metals, asbestos, herbicides, OCPs, phenols, cresols, PCBs, PAHs
Site Office Area	16	2	18	Metals, asbestos, PCBs, PAHs
Sheds	19	-	19	Metals, asbestos, PAHs
Cable Trenches	57	73	130	Metals, asbestos, herbicides, OCPs, PCBs
Landfills (3)	21	24	45	Metals, asbestos, OCPs, OPPs, PCBs, PAHs, TPHs, BTEX
Farm Allotments / Hotspots	125	53	178	Metals, asbestos, PAHs
Wells	20	9	29	Metals, asbestos, OCPs, OPPs, PAHs, TPHs, BTEX
Northern Boundary	8	25	33	Metals, OCPs, PAHs, TPHs, BTEX
Antennae Footings	212	18	230	Metals, OCPs, OPPs
Stockpile Areas	22	4	26	Metals, asbestos, PCBs, PAHs, TPHs
Imported Fill	-	-	13	Metals, OCPs, OPPs, PCBs, PAHs, TPHs
TOTAL	**673**	**258**	**944**	

ASA compared the validation data against the NEPM Health Investigation Level (HIL) "A" criteria, and the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*. ASA did not provide a summary of the exceedances in criteria in the validation data set, or comment on the 95% upper confidence limit (UCL) of the mean for the validation data set. ASA state that the site "*complies with the EPA requirements for residential development*".

Auditor's Comments

The Auditor notes that the sampling density for the entire site does not strictly comply with the NSW EPA (1995) *Sample Design Guidelines*. However, on the basis of the size of the sub-areas identified for remediation and validation, the investigations conducted to date, the extent of remediation and the

validation data, the Auditor considers that the sampling density conducted by ASA in the validation report is sufficient to validate the areas of concern identified by ASA

The Auditor requested that ASA calculate the mean and 95% UCL of the mean for the validation data set. These calculations were provided by ASA as an addendum to the draft validation report.

The Auditor notes that the NEPM (1999) guidelines discuss that data should be considered against the appropriate HIL for the proposed landuse, and the Interim Urban Ecological Investigation Levels (EILs) - which are phytotoxicity based criteria. The Auditor notes that these NEPM criteria, with the exception of TPHs, are the same as the NSW EPA (1998) SIL_1 and SIL_5 criteria listed in the *Guidelines for the NSW Site Auditor Scheme*. The much less conservative TPHs criteria in the NEPM can only be used if the appropriate analytical method is followed, and the Auditor notes that this method was not used for this assessment. Therefore, the Auditor considers that it is appropriate to compare the validation data against the following criteria:

- In residential areas, the lesser of the NSW EPA (1998) *Soil Investigation Level (SIL) Column 1 (Residential with gardens and accessible soil)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*
- In public open space areas, the lesser of the NSW EPA (1998) *SIL Column 3 (Parks, recreational open space)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites*

The Auditor provides the following summary of exceedances in the validation data of the adopted criteria:

Validation Analytical Data: Summary of analytical results exceeding SIL Column 1& 5 (residential areas) and SIL Column 3 & 5 (Parks and public open space)

Area	Sample point	Analyte exceeding criteria (mg/kg)	95% UCL of the mean (mg/kg)
TOC building	OTC16	Cu (640)	All 95% UCLs are less than the criteria
	OTC22	Zn (1900), BaP (1.7)	
	OTC30	Cu (300)	
	OTC33	Cu (760)	
Oil Pipe	OIL16	Zn (220)	All 95% UCLs are less than the criteria
UST	USTV10	Cu (110), Zn (250)	All 95% UCLs are less than the criteria
North Shed	NTHS1	Cu (490)	Not calculated by ASA. Auditor
	NTHS2	Cu (110)	calculated 95% UCL for Cu (603)
	NTHS3	Cu (140)	
South Shed	STHS1	Cu (250)	Not calculated by ASA. Auditor
	STHS2	Cu (250)	calculated mean for Cu (250)
Riggers Workshop	RIG1	Zn (620)	Not calculated by ASA. Auditor
	RIG2	Zn (330)	calculated 95% UCL for Zn (789)
Site Offices	SUB1	Zn (230)	Not calculated by ASA. Auditor calculated 95% UCL for Zn (262)
Staff Houses	SHPPV5	As (69)	ASA 95% UCL calculation does not the
	SHPPV7	As (25)	include these results. Auditor calculated
	SHPPV8	As (22)	95% UCL of the power pole results to be

Area	Sample point	Analyte exceeding criteria (mg/kg)	95% UCL of the mean (mg/kg)
	SHPPV10	As (25)	As (28)
Hotspot FA 183	FA183V/1/2	**BaP (3.1), PAHs (36)**	Bitumen road.
	FA183V/10/3	**BaP (1.6), PAHs (130)**	Bitumen road
Hotspot FA17	FA17/4	Zn (870)	ASA calculated 95% UCL for Zn
	FA17/6	Zn (420)	to be Zn (332)
	FA17/7	Zn (230)	
Hotspot FA12	FA12/2	Zn (240)	ASA calculated 95% UCL for Zn
	FA12/5	Zn (780)	to be Zn (320)
	FA12/9	Zn (240)	
Hotspot L12	L12/8	Zn (350)	ASA calculated 95% UCL for Zn to be Zn (114)
Hotspot R12	R12/2	Zn (680)	ASA calculated 95% UCL for Zn
	R12/3	Zn (530)	to be Zn (321)
	R12/4	Zn (380)	
	R12/8	Zn (280)	
	R12/12	Zn (220)	
Hotspot F2	F2/1	Zn (370)	ASA calculated 95% UCL for Zn
	F2/2	Zn (340)	to be Zn (453)
	F2/5	Zn (300)	
	F2/6	Zn (1000)	
	F2/7	Zn (340)	
	F2/10	Zn (260)	
	F2/11	Zn (430)	
	F2/12	Zn (290)	
Landfills			No exceedances
Wells			No exceedances
Northern Boundary			No exceedances
Footings	FS7	Zn (590)	ASA have not calculated the 95% UCL
	FR5A	Zn (600)	for this data set
	FS9	Zn (710)	
	FT10A	Zn (740)	
	FI8B	Zn (760)	
	FK8A	Zn (320)	
	FO15	Zn (320)	
	FH9	Zn (210)	
	FN4B	Zn (570)	
	FN3A	Zn (590)	
	FI5	Zn (650)	
	FM5	Zn (670)	
	FM4	Zn (730)	
	FM13B	Zn (250)	
	FO14	Zn (270)	
	FM6	Zn (380)	
	FJ8A	Zn (530)	
	FP4A2	Zn (650)	
	FM2	Zn (790)	
	FK8B	Zn (4300), Cd (9.5)	
	FS14	Zn (510)	

Area	Sample point	Analyte exceeding criteria (mg/kg)	95% UCL of the mean (mg/kg)
	FH6B	Zn (360)	
	FQ14	Zn (340)	
Trenches	TR3AV2	Zn (1400)	Not calculated by ASA. Auditor calculated 95% UCL for Zn (1614)
	TR3AV3	Zn (760)	
	TR3AV4	Zn (1900)	
	TR6V1	Zn (1400)	Only one sample collected
	TR13V1	Cu (920)	Only one sample collected
	TR10V1	Zn (610)	Only one sample collected
	TR12V1/2	**BaP (6), PAHs (79)**	Only one sample collected
	TR18V1	Cu (180)	Only one sample collected
Stockpile Area			No exceedances
Imported fill			No exceedances

The Auditor notes that three samples in the validation data set (FA183V/1/3, FA183V/10/3 and TR12V1/2) exceed the NSW EPA (1998) SIL1 or NEPM (1999) HIL "A" criteria for BaP (3.1mg/kg, 1.6 mg/kg and 6mg/kg respectively) and PAHs (36 mg/kg, 130 mg/kg and 79 mg/kg respectively).

ASA state that the exceedances noted at samples FA183V/1/3 and FA183V/10/3 from Hotspot 183 was due to the presence of a bitumen road. The Auditor had confirmed to ASA that bitumen roads do not form part of the environmental sign off of the site, and therefore, this exceedances is not considered significant if associated with the bitumen road. ASA confirmed in the Validation report that these exceedances were related to the bitumen roadway.

ASA state that the sample taken from trench TR12 initially detected high BaP and PAHs concentrations, but this contaminated material was excavated and disposed to landfill. ASA state that the re-validation sample (TR12V1/2) BaP and PAHs concentration was acceptable, and the trench was backfilled with clean material. The Auditor notes that the data presented suggests that this trench is not validated. However, the Auditor notes that the risk of contact with this soil is low since the trench was backfilled with validated material.

The Auditor notes that a number of samples exceed the phototoxicity based criteria for Cu and Zn (and limited samples for Cd) as outlined in the NSW EPA (1998) SIL_5 or NEPM (1999) EILs. The Auditor notes that ASA do not provide any justification for not adopting these criteria. The Auditor considers that whilst these exceedances do not pose a risk to human health, it is recommended that in the future development, that zinc and copper tolerant plants be chosen as part of the redevelopment works.

The Auditor considers that the validation works conducted by ASA are generally appropriate.

The field sampling methods including the equipment decontamination and sample handling under chain-of-custody are consistent with industry practice and are considered satisfactory by the Auditor.

7.2 Sampling Rational/Methodology

The Validation data set reported by ASA for the site consists of a total of 673 samples from 673 sample point locations at the site, and a further 258 samples for the analysis of stockpiled material at the site. Additionally, the Auditor notes that the validation data set should include the sample point locations meeting criteria from the initial Phase I & II Investigation and the Phase III investigation, although these

have not been included by ASA in the validation data set reported in the Validation Report. The location of the validation sample points reported by ASA is shown in Appendix C.

The validation samples were analysed for a range of metals, asbestos, OCPs, OPPs, PCBs, TPHs, BTEX, PAHs, phenols, cresols and herbicides as outlined in Section 7.1.

ASA visually delineated areas of concern for asbestos and PAHs contamination in a number of areas. ASA stated that the asbestos material was confirmed by ASA as being removed by an emu bob at the site.

Auditor's Comments

The Auditor notes that it is not generally considered appropriate to visually delineate contamination. However, the Auditor notes that the contamination from asbestos at the site was due to asbestos AC sheeting which had been included in samples. The Auditor therefore notes, that a visual emu-bob type approach to the validation for asbestos materials in the areas of concern are considered acceptable. The Auditor considers it inappropriate to visually delineate PAHs contamination, unless the contamination is associated with bitumen roadways. The Auditor notes that the Riggers Workshop subfloor was scraped, and a validation sample taken form the centre of the excavation. Therefore, the Auditor notes that the PAHs contamination at the site may not have been appropriately delineated beyond the building subfloor.

The Auditor notes that the sampling density for the entire site does not strictly comply with the NSW EPA (1995) *Sample Design Guidelines*. However, on the basis of the size of the subsites identified for remediation and validation, the data from the initial investigations conducted, the extent of remediation and the validation data, the Auditor considers that the sampling density conducted by ASA in the validation report is sufficient to validate the areas of concern identified by ASA.

No groundwater testing was conducted during the validation works, including the removal and validation of three fuel USTs at the site. ASA did not provide any justification for not investigating the groundwater during the UST removal and validation works. The Auditor notes that groundwater testing was conducted around the main landfill at the site at five locations during the Phase I & II Investigation. The Auditor is satisfied that there is little risk to the groundwater at the site because:

- Perched groundwater was not encountered during the investigation, remediation or validation works.
- The groundwater at the site was identified 3-4m below ground level in the low lying floodplain area of the site.
- The UST excavations were typically 3.5 m deep, including excavation of 1m below the UST (pers. comms. ASA representative), and groundwater was not encountered in the excavations.
- The UST excavations were made in heavy impermeable plastic clay (pers. comms. ASA representative)
- The UST excavations were validated with minor remedial works required, indicating low potential of historical contamination migration from the USTs.

7.3 Analyte Selection

The Auditor considers the analytical testing as outlined in Section 3.3 and 7.1 was appropriate for the investigation and validation of the site. The Auditor considers that the analyte selection was appropriate

to identify the main contaminants of concern associated with the former operations as a Telstra Overseas Telecommunications Centre, including the presence of OCPs sprayed wooden antennae footings, refuelling operations, staff housing and landfilling of general non-putrescible waste.

7.4 Validation QA/QC

The QA/QC for the validation testing is discussed with the QA/QC on the contamination investigations in Section 4.2.

The Auditor notes that there are a number of major deficiencies in the investigation and validation conducted by ASA including the use of non NATA registered laboratories (although this was later rectified by reanalysis at a NATA approved laboratory), not providing Phase I & II NATA reports for review, and poor quality of reporting laboratory QA/QC.

Based on the Auditors independent review of a portion of the available laboratory results, the Auditor is satisfied that the data set is useable for the site, although some degree of uncertainty exists due to the poor quality of the consultant's reports, which did not follow the guidelines for assessing and reporting QA/QC.

7.5 Remediation/Validation Acceptance Criteria

ASA compared the validation data against the NEPM Health Investigation Level (HIL) "A" criteria, and the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*.

Auditor's Comments

The Auditor notes that the NEPM (1999) guidelines discuss that data should be considered against the appropriate HIL for the proposed landuse, and the Interim Urban Ecological Investigation Levels (EILs) - which are phytotoxicity based criteria. The Auditor notes that these NEPM criteria, with the exception of TPHs, are the same as the NSW EPA (1998) SIL_1 and SIL_5 criteria listed in the *Guidelines for the NSW Site Auditor Scheme*. The much less conservative TPHs criteria in the NEPM can only be used if the appropriate analytical method is followed, and the Auditor notes that this method was not used for this assessment. Therefore, the Auditor considers that it is appropriate to compare the validation data against the following criteria, which are considered to be the most conservative criteria applicable to the proposed residential and public open space redevelopment landuse.:

- In residential areas, the lesser of the NSW EPA (1998) *Soil Investigation Level (SIL) Column 1 (Residential with gardens and accessible soil)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*
- In public open space areas, NSW EPA (1998) *SIL Column 3 (Parks, recreational open space)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites*

8.0 EVALUATION OF SITE

8.1 Assessment of Risk

ASA has not conducted a site-specific risk assessment. The Auditor considers the risk posed by any small amounts of contamination (such as identified at depth in trench 12) that may be remaining at the site to be negligible.

However, given the large portions of the open areas of the site which have not been intensively test pitted or analysed as part of the target area investigations, the Auditor considers that there is some, albeit remote, possibility of encountering buried waste or contaminated material at the site during the redevelopment works. Therefore, the Auditor requires that a Management Plan, which has been approved by a NSW EPA Accredited Auditor, be implemented during earthworks associated with the site redevelopment works. This Management Plan should include procedures to deal with contamination in the unlikely event that any is uncovered.

8.2 Potential Migration of Contamination

ASA did not include a discussion of the potential for contaminant migration in the Phase I & II, Phase III or Validation Report.

Auditor's Comments

Based on the information presented by ASA, the Auditor considers that the potential for off-site migration of contaminants from the site is negligible via groundwater or via surface water runoff for the following reasons:

- Low concentrations of soil samples collected in the validation
- Low permeability of clay soil underlying the site
- Groundwater was identified at 3-4 m depth in the floodplain area, and was sampled and analysed. The analytical results show that no significant groundwater contamination was identified around the landfill at the site.
- Removal of all potential contamination point sources from the site.

8.3 Compliance with Regulatory Guidelines

In general, investigations were conducted in accordance with Sampling Design Guidelines (EPA, 1995), Guidelines for Consultants Reporting on Contaminated Sites (EPA, 1997), Guidelines for Assessing Service Stations (EPA, 1994), National Environmental Protection Measures (NEPM 1999) and Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (EPA, 1999).

The Auditor notes that there are a number of major deficiencies in the investigation and validation conducted by ASA including the use of non NATA registered laboratories (although this was later rectified by reanalysis at a NATA approved laboratory), not providing Phase I & II NATA reports for review, and poor quality of reporting laboratory QA/QC.

Based on the Auditors independent review of a portion of the available laboratory results, the Auditor is satisfied that the data set is useable for the site, although some degree of uncertainty exists due to the poor quality of the consultant reports, which did not follow the guidelines for assessing and reporting QA/QC.

8.4 Land Use Suitability

ASA has stated that the testing indicates the site "*complies with EPA requirements for residential development*".

The Auditor has assessed the data collected from the site against the most conservative criteria for the stated residential and public open space proposed redevelopment. Based on the site investigation and validation data and the NSW EPA (1998) *SIL Column 1 (Residential with access to soil)* and *SIL Column 5 (Provisional Phytotoxicity)*, the Auditor is of the opinion that the site has been remediated and validated to a level that renders it suitable for residential landuse with access to soil. The Auditor notes that the soil concentrations are also suitable for less sensitive landuses including:

- Residential with minimal access to soil including high rise apartments
- Parks and recreational open space
- Commercial/industrial

9.0 CONCLUSIONS

9.1 Suitability of Investigations

The methods employed in the investigation, remediation and validation work generally complied with the relevant NSW EPA guidelines. Where deviations occurred as outlined in this report, the Auditor is satisfied these did not adversely impact on the outcome of the remediation and validation.

The Auditor considers that sufficient investigation has been performed to determine the nature and extent of potential contaminants in the soils on the site.

9.2 Phase I & II Investigations

Specifically, in the Phase I & II Investigation, ASA divided the site into two areas based on the future proposed landuse in each area. The two areas have been further subdivided based on former landuse and activities. ASA collected 896 samples from 447 test pits, 2 sediment samples and 4 surface water samples. The sample point locations are shown in Appendix A of this report. ASA analysed the soil and sediment samples for a range of heavy metals, OCPs, OPPs, PCBs, USEPA scan (semi volatile organics), asbestos, PAHs, B(a)P, TPHs and BTEX. The QA/QC of the Phase I and II did not meet NSW EPA or NEPM guidelines. ASA did not appear to appreciate the importance of QA/QC.

9.3 Phase III Investigation

ASA collected a further 505 soil samples from 438 test pits during the Phase III Investigation in order to obtain further information on the areas of potential concern. The sample point locations are shown in Appendix B of this report. Samples were analysed for a range of heavy metals, PAHs, BaP, TPHs, OCPs, OPPs and chlorinated phenoxy acid herbicides. The QA/QC in Phase III was better than Phase II, but still did not fully comply with the NSW EPA guidelines.

9.4 Soil Sampling Plan

ASA used a stratified sampling plan, which the Auditor considered was appropriate for a site of this scale and conforms to NSW EPA (1995) *Sampling Design Guidelines* and ANZECC (1992) guidelines for large sites. The plan consisted of a coarse (100m x 100m) grid for background screening of the site coupled with targeted sampling of specific areas or features identified from the site history and supplemented by detailed systematic grid (30m x 30m) of potentially contaminated areas of the site such as the Operations Centre. About 37ha of the 300ha were covered by the 30m x 30m grid sampling.

9.5 Groundwater Investigations

In the Phase I & II investigation, ASA installed 5 groundwater wells around the large landfill at the site. ASA state that groundwater at these locations was encountered at 3-4 m (below ground level). Groundwater samples were collected from these wells during two sampling events. Samples were analysed for As, Cd, Cr, Cu, Pb, Hg, Ni, Se and Zn and the USEPA scan. ASA compared the analytical results against the ANZECC (1992) irrigation waters criteria, and noted one exceedances for Cd. No groundwater was sampled as part of the Phase III investigation. No groundwater was sampled as part of the UST remediation or validation.

The Auditor notes that comparison of the groundwater analytical results against the ANZECC (1992) freshwater criteria shows exceedances in Cd, Ni and Zn. The Auditor notes that the detection limits for

Cu, Pb and Hg are greater than the ANZECC (1992) freshwater criteria, and therefore any potential exceedances can not be noted.

The Auditor considers that the groundwater should have been investigated in the proximity of the USTs, as required by the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*. Based on the information presented by ASA, the Auditor considers that the potential for off-site migration of contaminants from the site is negligible via groundwater or via surface water runoff for the following reasons:

- Low concentrations of soil samples collected in the validation
- Low permeability of clay soil underlying the site
- Groundwater was identified at 3-4 m depth in the floodplain area, and was sampled and analysed. The analytical results show that no significant groundwater contamination was identified around the landfill at the site.
- Removal of all potential contamination point sources from the site.

9.6 Remediation Works

In the Validation Report, ASA present the remediation and validation works conducted at the site. ASA state that the remediation works involved the "*excavation and disposal of off-site of identified contaminated material and general rubbish from the site...the removal of all above ground structures (buildings and footings etc), removal of USTs and associated infrastructure, removal of infrastructure associated with the disconnected underground and above ground services (power, telephone, sewer, stormwater) and removal of footings formerly housing the OTC antennae.*"

On the basis of the site observations made by the Auditor prior to and following the remediation works, and the information provided in the Validation report, the Auditor considers that the remediation was conducted in an appropriate manner, with the exception of the onsite handling of PCB drums.

9.7 Validation Criteria

ASA compared the validation data against the NEPM Health Investigation Level (HIL) "A" criteria, and the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*.

The Auditor notes that the NEPM (1999) guidelines discuss that data should be considered against the appropriate HIL for the proposed landuse, and the Interim Urban Ecological Investigation Levels (EILs) - which are phytotoxicity based criteria. The Auditor notes that these NEPM criteria, with the exception of TPHs, are the same as the NSW EPA (1998) SIL_1 and SIL_5 criteria listed in the *Guidelines for the NSW Site Auditor Scheme*. The much less conservative TPHs criteria in the NEPM can only be used if the appropriate analytical method is followed, and the Auditor notes that this method was not used for this assessment. Therefore, the Auditor considers that it is appropriate to compare the validation data against the following criteria, which are considered to be the most conservative criteria applicable to the proposed residential and public open space redevelopment landuse:

- In residential areas, the lesser of the NSW EPA (1998) *Soil Investigation Level (SIL) Column 1 (Residential with gardens and accessible soil)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*

- In public open space areas, NSW EPA (1998) *SIL Column 3 (Parks, recreational open space)* and the NSW EPA (1998) *SIL Column 5 (Provisional Phytotoxicity) criteria.*

- NSW EPA (1994) *Guidelines for Assessing Service Station Sites*

9.8 Validation Data

The Validation data set reported by ASA for the site consists of a total of 673 samples from 673 sample point locations at the site, and a further 258 samples for the analysis of stockpiled material at the site. Additionally, the Auditor notes that the validation data set should include the sample point locations meeting criteria from the initial Phase I & II Investigation and the Phase III investigation, although these have not been included by ASA in the validation data set reported in the Validation Report. The location of the validation sample points reported by ASA is shown in Appendix C of this report.

The validation samples were analysed for a range of metals, asbestos, OCPs, OPPs, PCBs, TPHs, BTEX, PAHs, phenols, cresols and herbicides as outlined in Section 7.1

The Auditor notes that three samples in the validation data set (FA183V/1/3, FA183V/10/3 and TR12V1/2) exceed the NSW EPA (1998) SIL1 or NEPM (1999) HIL "A" criteria for BaP (3.1mg/kg, 1.6 mg/kg and 6mg/kg respectively) and PAHs (36 mg/kg, 130 mg/kg and 79 mg/kg respectively).

ASA state that the exceedances noted in samples FA183V/1/3 and FA183V/10/3 from Hotspot FA183 was due to the presence of a bitumen road. The Auditor had confirmed to ASA that bitumen roads do not form part of the environmental sign off of the site, and therefore, this exceedances is not considered significant if associated with the bitumen road. ASA confirmed in the Validation report that these exceedances were related to the bitumen roadway.

ASA state that the sample taken from trench TR12 initially detected high BaP and PAHs concentrations, but this was excavated. ASA state that the re-validation sample (TR12V1/2) BaP and PAHs concentration was acceptable, and the trench was backfilled with clean material. The Auditor notes that the data presented suggests that this trench was not validated. However, the Auditor notes that the risk of contact with this soil is low since the trench was backfilled with validated material.

The Auditor notes that a number of samples exceed the phototoxicity based criteria for Cu and Zn (and limited samples for Cd) as outlined in the NSW EPA (1998) SIL_5 or NEPM (1999) EILs. The Auditor notes that ASA did not provide any justification for not adopting these criteria. The Auditor considers that whilst these exceedances do not pose a risk to human health, it is recommended that in the future development, that zinc and copper tolerant plants be chosen as part of the redevelopment works.

9.9 Assessment of Risk

The coarse nature of the background systematic sampling grid (ie. 100m x 100m) means a relatively high uncertainty is inherent on the soil sampling results in those parts of the site covered only by the coarse grid. Small burial pits or fuel or chemical spills could well remain undetected especially with thick grass cover. However, the Auditor considers that while the sampling uncertainty is high, the site history indicates a relatively low risk of contamination over most of the site apart from those areas identified based on site history, as having a higher potential for contamination, which have been sampled in greater detail (30m x 30m) in conformance with the minimum number of sampling points recommended in the NSW EPA (1995) *Sampling Design Guidelines*. The detailed grid should detect a "hot spot" of approximately 35.4m diameter with a 95% confidence level.

The Auditor considers that the residual risk of small areas of contaminated soil remaining is relatively high, but most of these would be uncovered during extensive site development earthworks and could readily be dealt with at that time provided an appropriate Management Plan is in place and adhered to. Once the site is developed the risk posed by any contamination that may remain would be very small.

9.10 Compliance with Guidelines

In general, the Auditor notes that investigations were conducted in accordance with Sampling Design Guidelines (EPA, 1995), Guidelines for Consultants Reporting on Contaminated Sites (EPA, 1997), Guidelines for Assessing Service Stations (EPA, 1994), National Environmental Protection Measures (NEPM 1999) and Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (EPA, 1999).

The Auditor notes that there are a number of major deficiencies in the reporting of QA/QC in all of the investigation and validation reports, and these reports were not conducted in accordance with the guidelines. Additionally, the Auditor notes that ASA used a non NATA registered laboratory in the Phase I & II investigation (although this was later rectified by reanalysis at a NATA approved laboratory in the Phase III investigation). The Auditor also notes that ASA did not provide NATA reports for review in the Phase I & II investigation. The Auditor therefore notes that the work conducted by ASA for the QA/QC was not conducted in accordance with the guidelines.

Based on the Auditors independent review of a portion of the available laboratory results, the Auditor is satisfied that the data set is useable for the site, although some degree of uncertainty exists due to the poor quality of the consultant reports, which did not follow the guidelines for assessing and reporting QA/QC.

9.11 Suitability for Proposed Landuse

ASA has stated that the testing indicates the site "*complies with EPA requirements for residential development*".

The Auditor has assessed the data collected from the site against the most conservative criteria for the stated residential and public open space proposed redevelopment. Based on the site investigation and validation data and the NSW EPA (1998) *SIL Column 1 (Residential with access to soil),* the Auditor is of the opinion that the site has been remediated and validated to a level that renders it suitable for residential landuse with access to soil. The Auditor notes that the soil concentrations are also suitable for less sensitive landuses including:

- Residential with minimal access to soil including high rise apartments
- Parks and recreational open space
- Commercial/industrial

However, because of the number of samples exceeding the *Column 5 phytotoxicity criteria* and the inherent uncertainty related to the coarse sampling grid used on such a large site, the Auditor has stipulated a Management Plan shall be prepared in the unlikely event contamination is encountered with site development earthworks, and be implemented prior to the commencement of the development works. This Management Plan must be authorised by a NSW EPA Accredited Auditor.

10.0 REFERENCES

1994, NSW Environment Protection Authority, Sydney, *Contaminated Sites: Guidelines for Assessing Service Stations Sites,*

1995, NSW Environment Protection Authority Sydney, *Contaminated Sites: Sampling Design Guidelines,*

1997, NSW Environment Protection Authority, Sydney *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*

1999, NSW Environment Protection Authority, Sydney, *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes*

1998, NSW Environment Protection Authority, Sydney, *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*

1996, Imray P & Langley A, *Health-based Soil Investigation Levels*, National Environmental Health Forum Monographs, Soil Series No. 1, South Australian Health Commission, Adelaide

ANZECC, 1996, *Guidelines for the Laboratory Analysis of Contaminated soils,* Australian and New Zealand Environment and Conservation Council

1999, National Environment Protection (*Assessment of Site Contamination*) Measure, Schedule B of the Measure.

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

DISTRIBUTION

Site Audit Report, Former Telstra OTC, Eastern Road, Doonside, NSW

26 March 2001

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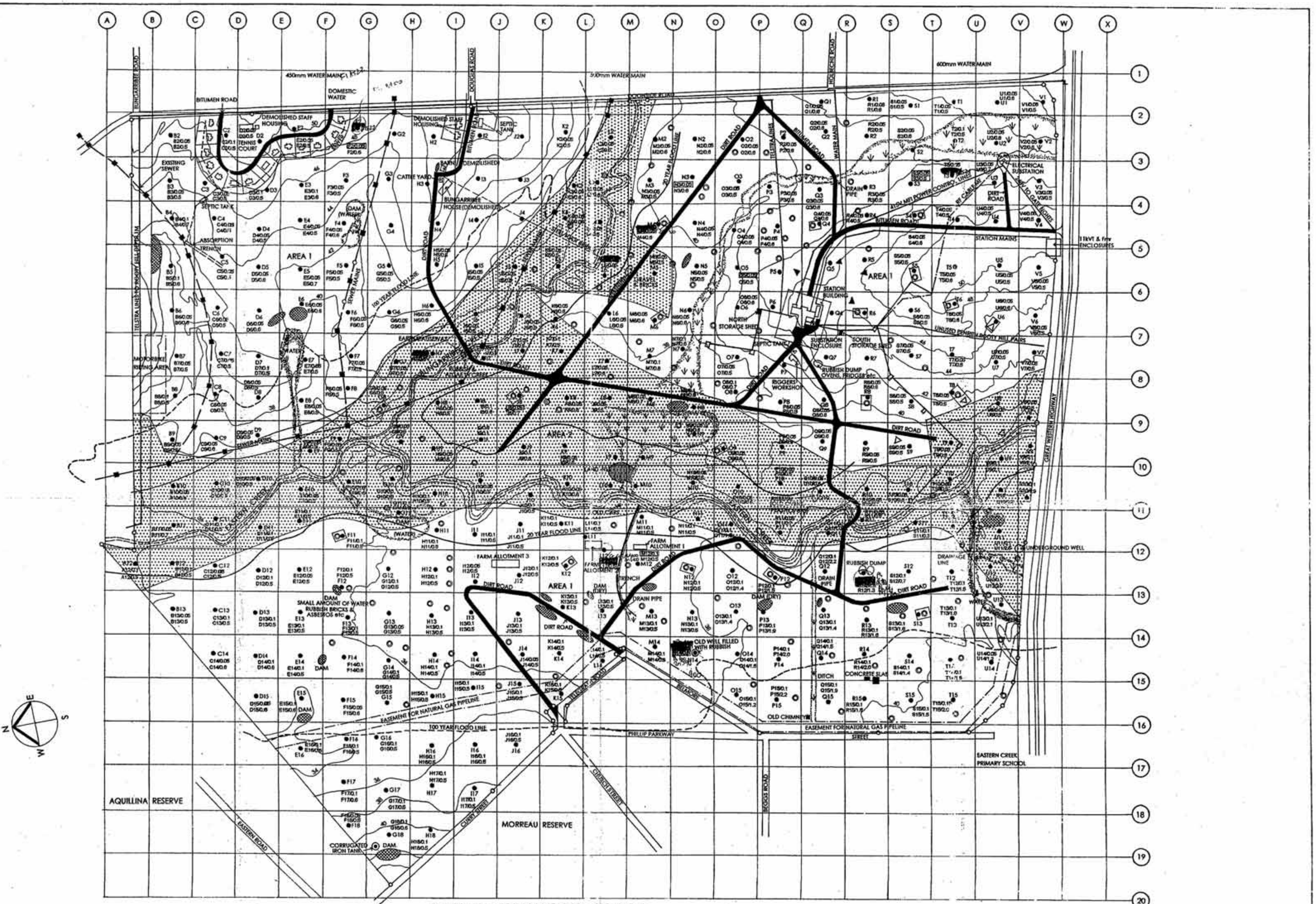
Original	HLA Project File

Quality Control Reviewer

FOR Brad Eismen BSc
Principal Hydrogeologist

APPENDIX A



SITE PLAN & GRID SAMPLING LOCATIONS
AREA ONE & TWO

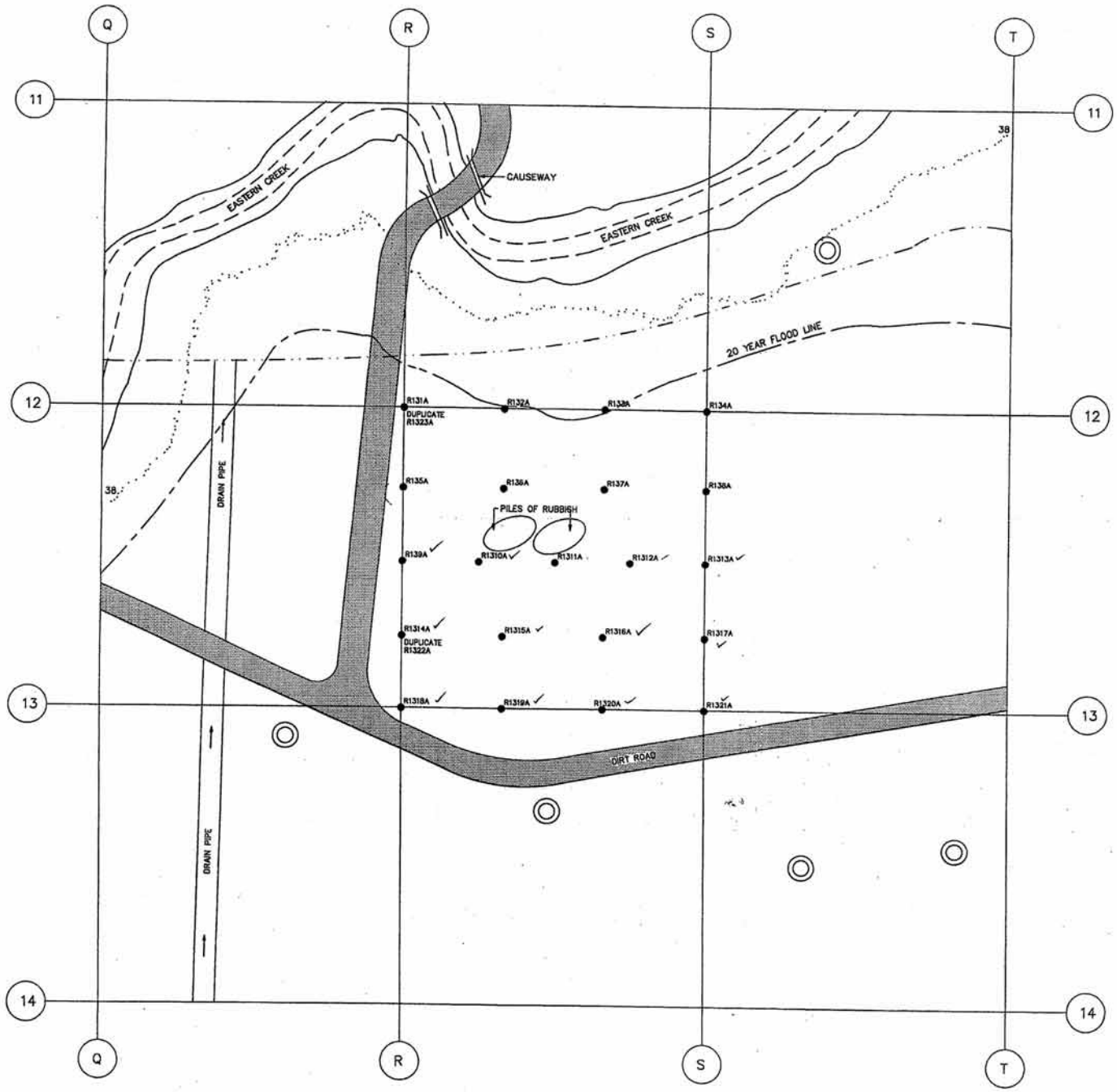
APPROXIMATE SCALE 1:4000

METRES

DWG: SITE PLAN
SCALE: 1:4000
DATE: JUNE 1998

APPENDIX B

CELL R13 – FARM ALLOTMENT REMEDIATION AREAS
ADDITIONAL SAMPLING LOCATIONS



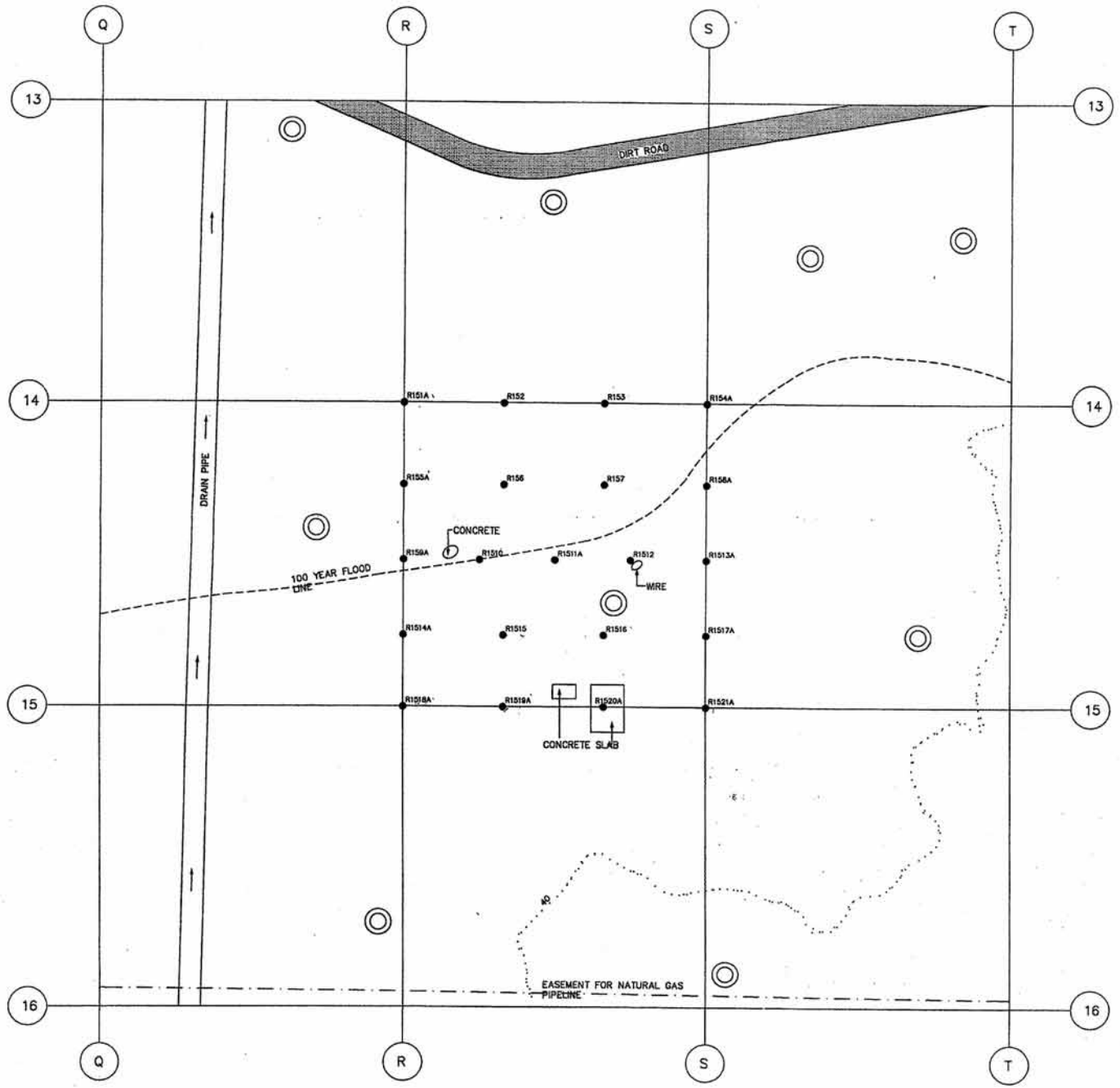
LEGEND

R1313A = ADDITIONAL SAMPLING LOCATIONS

APPROXIMATE SCALE
0 50 100
METRES

AUSTRALIAN SITE ASSESSMENT	
OVERSEAS TELECOMMUNICATIONS COMMISSION DOONSIDE	
DWG: CELL R13 – FARM ALLOTMENT ADDITIONAL SAMPLING LOCATION PLAN	
SCALE: 1:1000	22
DATE: JUNE 1999	
JOB NO: ASA 29290	
BY: JENNI DANG (02)9798 0232	

CELL R15 – FARM ALLOTMENT REMEDIATION AREAS
ADDITIONAL SAMPLING LOCATIONS



not all samples analysed

LEGEND

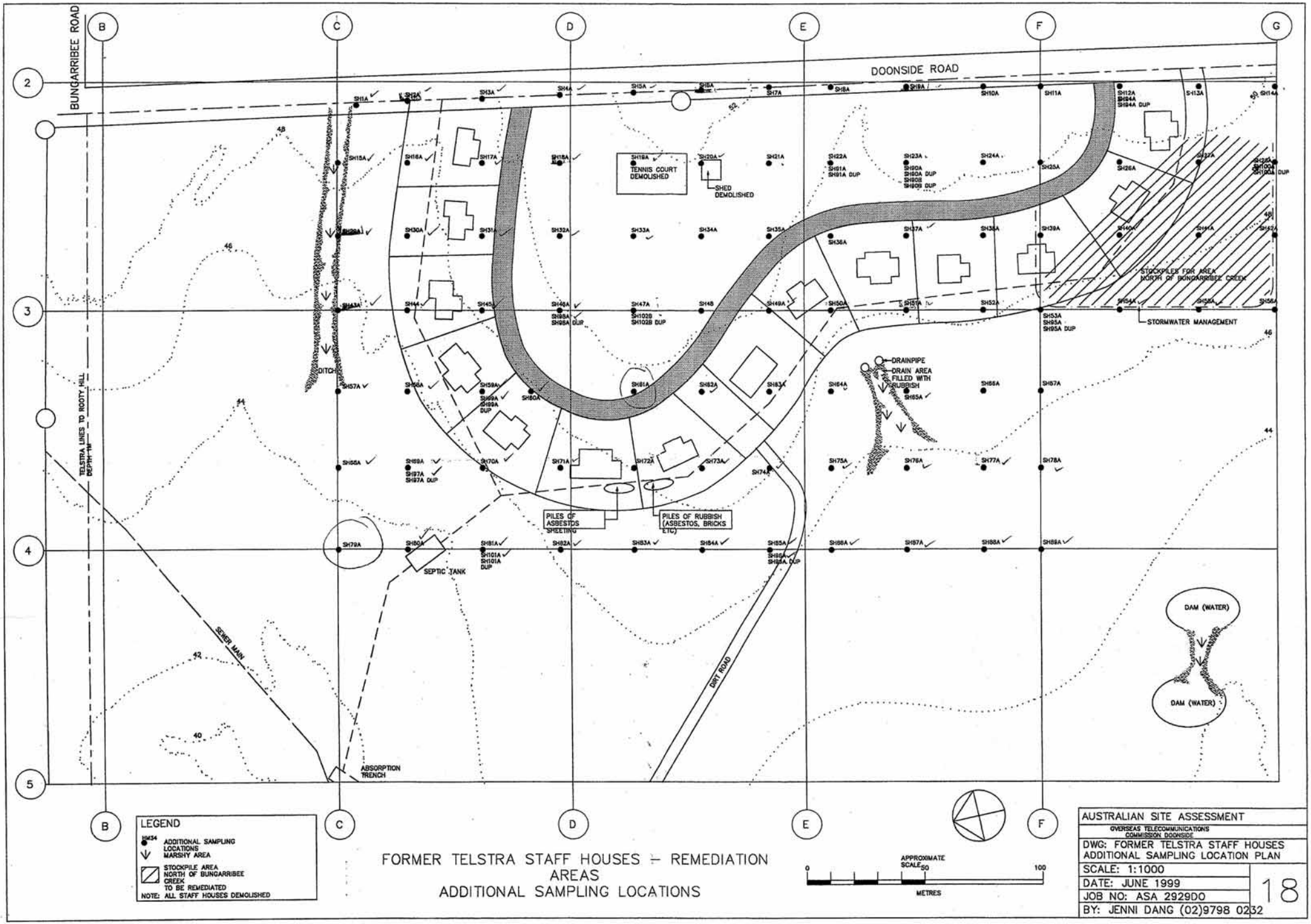
R1513A = ADDITIONAL SAMPLING LOCATIONS

APPROXIMATE SCALE

0 50 100

METRES

AUSTRALIAN SITE ASSESSMENT	
OVERSEAS TELECOMMUNICATIONS COMMISSION DOONSIDE	
DWG: CELL R15 – FARM ALLOTMENT ADDITIONAL SAMPLING LOCATION PLAN	
SCALE: 1:1000	23
DATE: JUNE 1999	
JOB NO: ASA 2929DO	
BY: JENNI DANG (02)9798 0232	

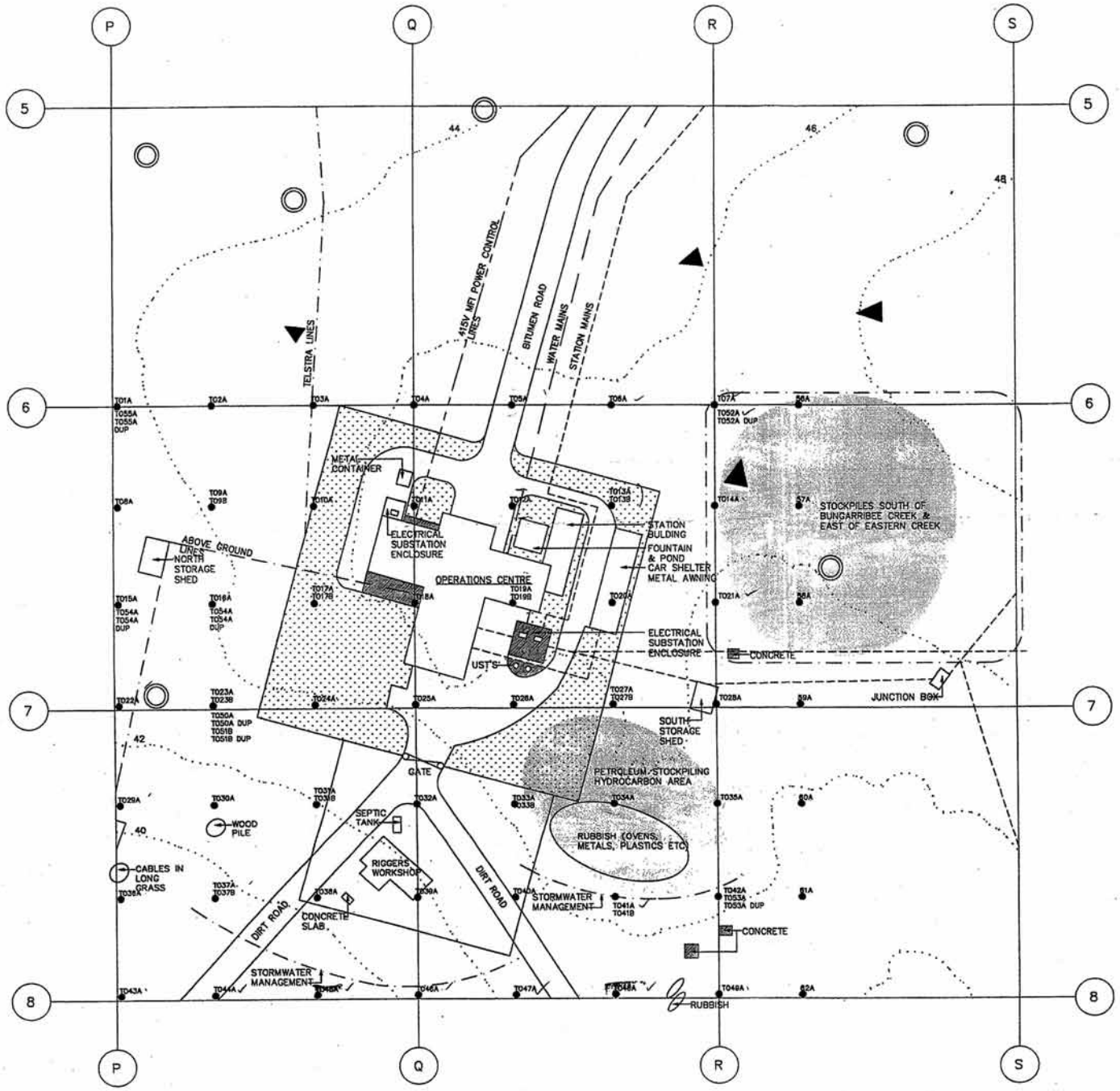


FORMER TELSTRA STAFF HOUSES – REMEDIATION AREAS
ADDITIONAL SAMPLING LOCATIONS

AUSTRALIAN SITE ASSESSMENT
OVERSEAS TELECOMMUNICATIONS COMMISSION DOONSIDE
DWG: FORMER TELSTRA STAFF HOUSES ADDITIONAL SAMPLING LOCATION PLAN
SCALE: 1:1000
DATE: JUNE 1999
JOB NO: ASA 2929DO
BY: JENNI DANG (02)9798 0232

18

TELSTRA OPERATIONS CENTRE
REMEDIATION AREAS – ADDITIONAL SAMPLING LOCATIONS



LEGEND

T020A = ADDITIONAL SAMPLING LOCATIONS

= CONCRETE

= GRASS

= SOLARIS ANTENNAE

= TRANSFORMER

APPROXIMATE SCALE 0 50 100 METRES

AUSTRALIAN SITE ASSESSMENT	
OVERSEAS TELECOMMUNICATIONS COMMISSION DOONSIDE	
DWG: TELSTRA OPERATIONS CENTRE ADDITIONAL SAMPLING LOCATION PLAN	
SCALE: 1:1000	20
DATE: JUNE 1999	
JOB NO: ASA 2929DO	
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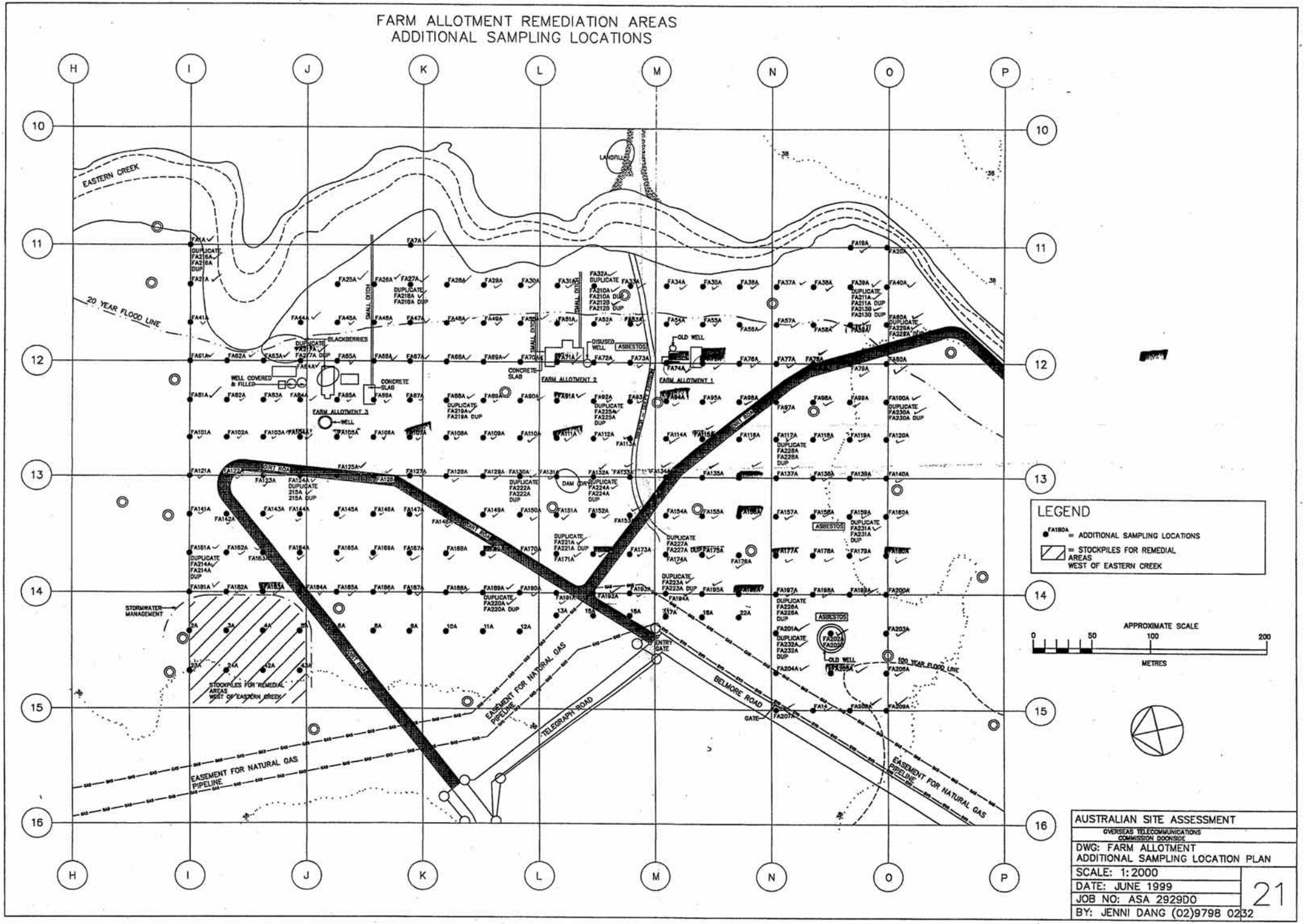
FARM ALLOTMENT REMEDIATION AREAS
ADDITIONAL SAMPLING LOCATIONS



AUSTRALIAN SITE ASSESSMENT	
OVERSEAS TELECOMMUNICATIONS COMMISSION DOONSIDE	
DWG: FARM ALLOTMENT ADDITIONAL SAMPLING LOCATION PLAN	
SCALE: 1:2000	21
DATE: JUNE 1999	
JOB NO: ASA 2929DO	
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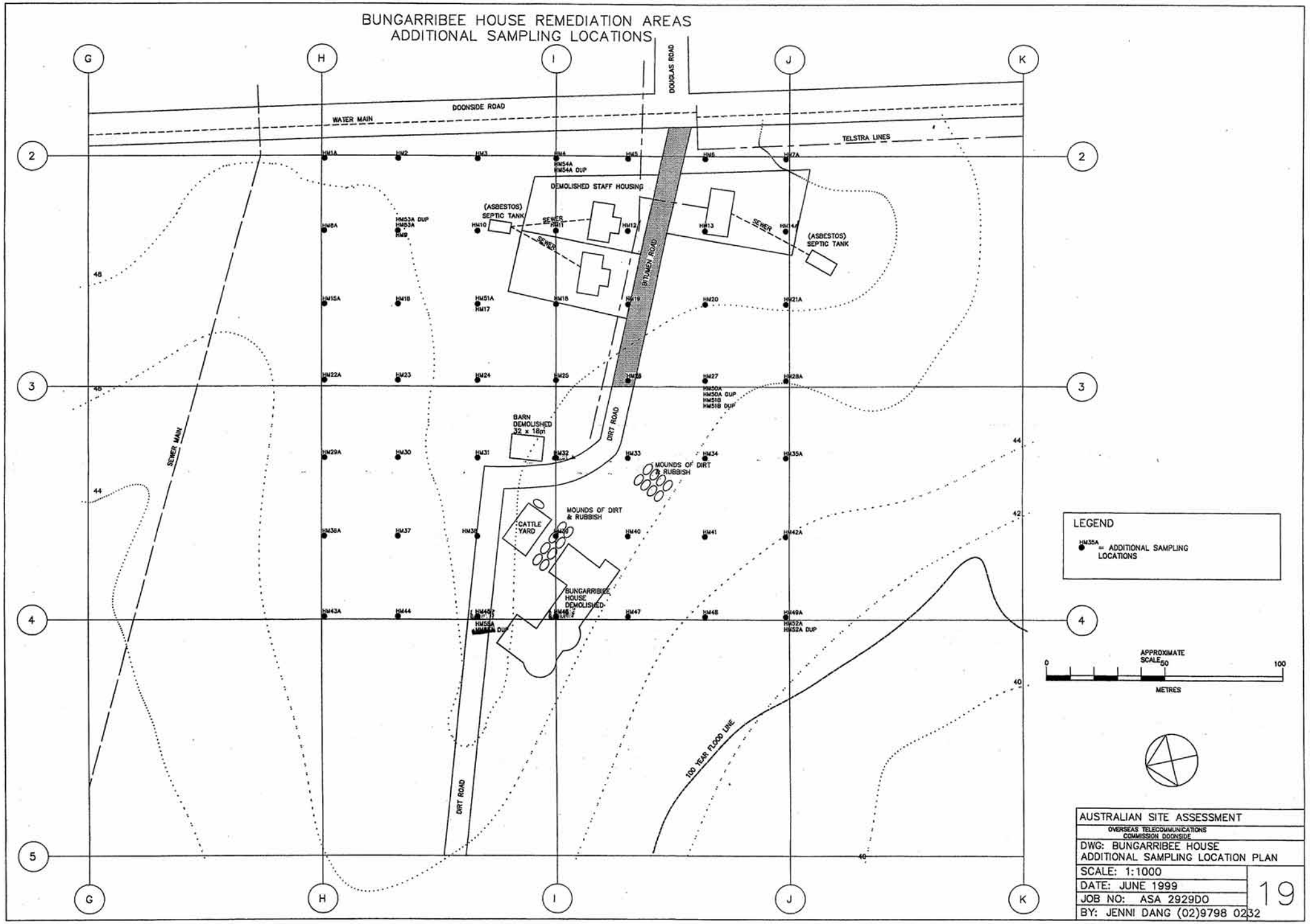
BUNGARRIBEE HOUSE REMEDIATION AREAS
ADDITIONAL SAMPLING LOCATIONS



AUSTRALIAN SITE ASSESSMENT	
OVERSEAS TELECOMMUNICATIONS COMMISSION DOONSIDE	
DWG: BUNGARRIBEE HOUSE ADDITIONAL SAMPLING LOCATION PLAN	
SCALE: 1:1000	19
DATE: JUNE 1999	
JOB NO: ASA 2929DO	
BY: JENNI DANG (02)9798 0232	

APPENDIX C

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