

**THE HYDROGEOLOGICAL CONTEXT  
OF CEMETERY OPERATIONS  
AND PLANNING IN AUSTRALIA**

by

**Boyd B. Dent**

**VOLUME II  
(Appendices)**

**A thesis submitted to The University of Technology, Sydney  
for the Degree of Doctor of Philosophy in Science  
December, 2002**

**APPENDIX A**

**ABBREVIATIONS, CONTACT DETAILS, WORK STATISTICS**

## ABBREVIATIONS AND COMMON TERMS

A large number of terms are simplified by acronyms or abbreviations in order to make the text clearer or are common scientific usage. Some words are also given a specialised meaning as they are also used repetitively for clarity. These are listed below. A list of chemical abbreviations is also included. It is common practice in reporting groundwater analyses to ignore the electronic valence symbols for ions: these are usually only used if it is necessary to clarify the species' operations in a reaction.

**Table A1. Acronym References for Cemetery Sites**

Acronym	Cemetery Site*
BOT	Botany Cemetery, NSW
CEN	Centennial Park Cemetery, SA
GUI	Guildford Cemetery, WA
HEL	Cheltenham Cemetery, SA
LAU	Carr Villa Memorial Park (Launceston), TAS
MEL	Melbourne General Cemetery, VIC
NEW	Bunurong Memorial Park, VIC
SPR	The Necropolis (Spring Vale), VIC
WOR	Woronora General Cemetery, NSW

\* greater detail about site locations and names is given elsewhere in Appendix A

**Table A2. Explanation of Terms, Abbreviations and Symbols**

/1 - 7	designation for groundwater sampling event; preceded by a cemetery identifier, for example: CEN/1
1E-6 m/sec media;	scientific notation, consistent with method of reporting for electronic media; in this case equivalent to $1 \times 10^{-6}$ m/sec
ACCA	Australian Cemeteries and Crematoria Association
adipocere	an intermediate decomposition product, whitish or white-grey in colour, waxy lustre, composed of fatty acids; chemically it is neither a wax nor a fat
adipose	as in adipose tissue, i.e. fat tissue

AEC	Anion Exchange Capacity, a property of soil's clay minerals and organic matter
aerobe	a micro-organism which requires oxygen for survival, i.e. an aerobic environment
anaerobe	a micro-organism which requires an anaerobic environment, i.e. one without oxygen, for survival
anion	an inorganic chemical species with excess negative charge
assemblage	term derived from palaeontology, meaning here the whole collection of indicator bacterial analytes considered together
B	sample designation for any sample from Botany Cemetery
BOD	Biochemical Oxygen Demand, also elsewhere denoted BOD <sub>5</sub> , is a chemical test particularly relevant to assessing the 'pollution load' of waters
borehole	same as a 'well'; term for subsurface exploratory hole or permanent sampling point. Borehole logs (or borelogs) are found in Appendices B – J; soils described in these logs, and some terminology, are further considered in Appendix K
BOT	refers to Botany Cemetery (Eastern Suburbs Memorial Park), as an adjective or a noun
BTEX	aromatic hydrocarbons associated with the petroleum refining process and including:- benzene, toluene (methylbenzene), ethylbenzene, m + p xylene, o xylene and styrene
C	sample designation for any sample from Centennial Park Cemetery
cadaverine	a gas given off due to the anaerobic decarboxylation of proteins during decomposition; a diamine, C <sub>4</sub> H <sub>8</sub> (NH <sub>2</sub> ) <sub>2</sub> , (1,4-diaminobutane) with a foul odour; toxic
cation	an inorganic chemical species with excess positive charge
CEC	Cation Exchange Capacity, a property of the soil's clay particles and organic matter
cell	in the context of a landfill means a large, properly engineered, excavated ditch which is subsequently filled with municipal waste materials and re-covered with clayey soils to prevent water infiltration

cemetery	the word is used generically and includes the ideas of "burial ground", "graveyard", and "churchyard"
CEN	refers to Centennial Park Cemetery as an adjective or a noun
CFU/100 mL	common unit of measurement for bacterial tests: colony forming units per 100 mL of tested water
CH <sub>4</sub>	methane, the simplest hydrocarbon, a gas, given off during the decomposition process;
CO <sub>2</sub>	carbon dioxide, a gas given off during decomposition of organic materials, a final product; from the atmosphere is incorporated into rainfall
COD	chemical oxygen demand (in either mg/L or equivalents of oxygen); often used as a measure of pollution and equal to the concentration of species that are readily oxidized by addition of a soluble oxidizing agent like permanganate; high values are considered to be undesirable
DC	direct electrical current
EC	electrical conductivity, measured in units $\mu\text{S}/\text{cm}$
EPA	Environment/al Protection Agency (a generic term)
equiv.(eq)/L	equivalents per litre, often also as meq - milli-equivalent; a chemical concentration unit obtained by multiplying the analyte's concentration (in mg/L) by the available ionic charge divided by the unit formula weight.
FA	Factor Analysis: a statistical technique which seeks to link variables (analytes) together in a way that recognizes their contribution to the total variation between all the results; Factors are developed after preliminary analysis (also see PCA)
facultative	in reference to micro-organisms; those that may survive in an environment with different oxygen conditions to the environment in which they thrive
formaldehyde	an organic molecule from the successive hydroxylation of methane; more properly called methanal (H-CHO); it can be oxidised to formic acid (methanoic acid) and then carbon dioxide
formalin	a solution of formaldehyde in water; solutions up to 40% formaldehyde are said to be used in the embalming process
G	sample designation for any sample from Guildford Cemetery

gilgai	Australian term for a landform initiated in swelling soils where small ridges or mounds ‘grow’ from otherwise flattish land
gram	used with the terms ‘positive’ (+) or ‘negative’ (-) to aid in the identification of bacteria using Gram’s dye test
GUI	refers to Guildford Cemetery as an adjective or a noun.
H	sample designation for any sample from Cheltenham Cemetery
ha	hectare, areal measurement, 10000 m <sup>2</sup> , equal to about 2.5 acres
HEL	refers to Cheltenham Cemetery as an adjective or a noun.
heterotrophic	in respect of bacteria; common types which need complex organic compounds for their source of carbon (i.e. to sustain them)
hydroxyapatite	a biologically derived mineral which primarily comprises bone – Ca <sub>10</sub> (PO <sub>4</sub> ) <sub>6</sub> (OH) <sub>2</sub> ; a source of calcium and phosphorus in the body
ICP	Induced Coupled Ion Spectrometry or Spectrometer (a chemical analytical method or apparatus)
i.d.	internal diameter
industry	unless the context implies otherwise means the Australian cemeteries and crematoria industry
interment	strictly the burial of human remains in soil; but can be interpreted as the encapsulation of the remains in a crypt, vault or mausoleum
invert level	the base of the grave, that is the lowest-most excavated level
k	intrinsic permeability; a measurement of the aquifer matrix only in units of metres squared
K	hydraulic conductivity; reported in many units but herein units used are either m/day or m/sec
karst	a set of landforms and sub-surface features where the solution of carbonates (like limestone or chalk) by groundwater and running water has created vast networks of underground channels, caves and structures that easily convey water
L	sample designation for any sample from Launceston Cemetery (Carr Villa Memorial Park)
L/min	litres per minute: groundwater sampling or flow rate

LAU	refers to Launceston Cemetery (Carr Villa Memorial Park), as an adjective or a noun
lift and deepen	the process of re-opening a grave for the purpose of re-use wherein any remains are gathered up and re-interred at a level below the proposed grave invert; in South Australia this is now possible after 50 years, originally 99 years
lifts and batters	in relation to landfills: lift represent typical construction layers – about 1.8 m thick; batters are the outermost finished slopes of these; the effect is often a stepped hillside
M	sample designation for any sample from Melbourne General Cemetery
MEL	refers to Melbourne General Cemetery as an adjective or a noun
mercaptans	mercaptans (or thiols) are decomposition gases containing the –SH (sulfhydryl group). They are notable for their disagreeable odour. They are acidic and form insoluble solutions with heavy metals, for example mercury.
mg/L	milligrams per litre of solution, common designation for concentration of chemical analytes in water (almost equivalent to ppm)
mL	millilitre, volume measurement identical to 1 cm <sup>3</sup> under standard conditions
mm/a	millimetres per annum; used to report annual precipitation
N	sample designation for any sample from Bunurong Memorial Park
N <sub>2</sub>	nitrogen gas; results from the denitrification of organic and inorganic nitrogen compounds via various pathways wherein the processes are driven by bacterial action
necro-leachate	the term applied to leachate of decomposition products in cemeteries
NEW	refers to Bunurong Memorial Park, as an adjective or a noun
obligate	in reference to micro-organisms; those that can only survive in an environment with specified oxygen conditions
o.d.	outside diameter
PCA	Principle Component Analysis: a statistical technique which seeks to link variables (analytes) together in a way that recognizes their contribution to the total variation between all the results; Components are developed from the raw data (also see FA)

PET	polyethylene terephthalate, a polyester
PFU/L	plaque forming units per litre (or per 100 mL), a measure of the concentration of viruses particles
PVC	polyvinyl chloride plastic; a common, relatively inert plastic used in all but some specialised groundwater sampling applications
pH	the acidity of a sample or soil measured on the pH scale of 1 - 14 units
ppb	parts per billion – a measurement of concentration; an approximate equivalent is µg/L (micro-grams per litre)
ppm	parts per million – a measurement of concentration; an approximate equivalent is mg/L (milli-grams per litre)
putrescine	a gas given off due to the anaerobic decarboxylation of proteins during decomposition; a diamine, C <sub>5</sub> H <sub>10</sub> (NH <sub>2</sub> ) <sub>2</sub> , (1,5-diaminopentane) with a foul odour; toxic
QC	Quality Control program or regime used to ensure testing integrity and reliability
QSS	Quantity Surveying Score; obtained by summing the distribution of number of interred individuals multiplied by a weighting factor based on the length of interment
quantity survey	the term adopted for the recording of grave numbers and date information relative to the sampling points
remains	the organic waste comprising all or some of the solid and fluid body parts of a deceased human; synonyms are "body", "cadaver", "corpse"
S	sample designation for any sample from Spring Vale Cemetery (The Necropolis)
site	means the cemetery location where the work was done in general
soilfluction	a mass movement phenomenon where thawing permafrost or other frozen ground gives rise to wet near-surface soils which then creep and flow
SPR	refers to Spring Vale Cemetery (The Necropolis), as an adjective or a noun; common use of this geographic descriptor is now 'Springvale'
Study	refers to the research, investigations and analyses reported and discussed in this thesis; as well, in context, the National Study of Cemetery Groundwaters



sulfur	the chemical name in its new spelling; occasionally it is still seen as "sulphur"; related variants are -sulfate & sulfite
SWL	‘standing water level’ measured in wells, usually prior to sampling, expressed in metres below the ground surface
temp	the temperature parameter measured for water samples, in degrees Celsius
thermotolerant	in reference to micro-organisms; those that survive in an identification test with elevated temperature conditions e.g. 44°C compared to those tested at usual human body temperature of about 37°C
TSE	transmissible spongiform encephalopathies – a group of debilitating/fatal diseases including Creutzfeldt-Jakob Disease (variant, vCJD) and Gerstmann-Straussler-Scheinker syndrome in humans, and ‘mad cow’ - Bovine Spongiform Encephalitis (BSE), disease in cattle
W	sample designation for any sample from Woronora General Cemetery
WOR	refers to Woronora General Cemetery as an adjective or a noun.
μSv	micro Siemen volt, a measure of the radiation received from elements’ radioactive decay events
μS/cm	micro Siemens per centimetre, common unit of reporting electrical conductivity (EC) – a reflection of dissolved ions in water or extracted from soil into water
UK	United Kingdom - essentially mainland Britain
USA	United States of America - essentially continental North America
USCS	Unified Soil Classification System
USGS	United States Geological Survey
UTS	University of Technology, Sydney
VIC	Victoria, in context is a reference to the Victorian Department of Human Services (a Contributing Research Partner) or all of the Victorian cemeteries included in the Study
XRD	X-ray Diffraction, an analytical technique, used as an adjective or noun

## Chemical Symbols

The concept of chemical species existing as an ion is usually implied; electronic valence is not usually shown.

Al – aluminium, As - arsenic, B - boron, Br – bromine, Ca - calcium, CaCO<sub>3</sub> - calcium carbonate, Cd - cadmium, Cl – chlorine, CN – cyanide radical, CO<sub>3</sub> - carbonate radical, Cr - chromium, Cu - copper, F – fluorine, Fe -iron, Fe<sup>2+</sup> iron II ion, Fe<sup>3+</sup> iron III ion, HCO<sub>3</sub> - bicarbonate, Hg – mercury, K - potassium, Mg - magnesium, Mn - manganese, Mo - molybdenum, N - nitrogen, Na – sodium, NO<sub>2</sub> - nitrite, NO<sub>2</sub>-N nitrogen in nitrite radical, NO<sub>3</sub> - nitrate, NO<sub>3</sub>- N nitrogen in nitrate radical, NH<sub>3</sub> - ammonia, NH<sub>3</sub>-N nitrogen in ammonia or ammonium radical, NH<sub>4</sub> - ammonium ion, Ni - nickel, P - phosphorus, Pb - lead, PO<sub>4</sub> - orthophosphate, PO<sub>4</sub>-P phosphorus in orthophosphate radical, S - sulfur, S<sup>2-</sup> - sulfite, Se - selenium, Si - silicon or silica\*, SO<sub>4</sub> – sulfate, Sr – strontium, Zn - zinc

\*silica is correctly SiO<sub>2</sub> but in water analyses suspended silica is often reported as simply Si - it is not ionic, but is identifiable as an element in ICP analysis

**CONTACT DETAILS FOR CEMETERIES, ORGANISATIONS  
AND CONTRIBUTING RESEARCH PARTNERS**

The Study was conducted at 9 different cemetery locations (sites). These are variously controlled by public Boards of Trustees, local government (Carr Villa Memorial Park), or statutory Boards (Guildford Cemetery). The benefactors of the Study were designated Contributing Research Partners. In the state of Victoria the Department of Human Services was responsible for the whole Study and the sites used participated with the Department's concurrence.

**Table A3 Location and Contact Information for Cemetery Sites**

Cemetery Designation	Contact Details	Physical Location
ACCA	Ms Robyn Smith Executive Officer Australian Cemeteries and Crematoria Association 472 William Street West Melbourne, VIC 3003	n/a
BOT [CPR]	Mr David Blake General Manager Eastern Suburbs Memorial Park (Botany Cemetery Trust) PO Box 11 BOTANY, NSW 2019	Eastern Suburbs Memorial Park (Botany Cemetery), between Military Road and Bunnerong Road, Phillip Bay, a suburb of Sydney, in the state of New South Wales
CEN [CPR]	Mr Norm Orchard General Manager Centennial Park Cemetery Trust 760 Goodwood Road PASADENA, SA 5042	Centennial Park Cemetery, Goodwood Road, Pasadena, a suburb of Adelaide, in the state of South Australia
GUI [CPR]	Mr Peter MacLean General Manager Metropolitan Cemeteries Board Perth General Cemetery Railway Road KARRAKATTA, WA 6016	Guildford Cemetery, Kalamunda Road, South Guildford, a suburb of Perth, in the state of Western Australia
HEL [CPR] [1]	Mr Kevin Crowden General Manager Enfield General Cemetery Trust PO Box 294 BLAIR ATHOL, SA 5084	Cheltenham Cemetery, Port Road, Cheltenham, a suburb of Adelaide, in the state of South Australia
LAU [CPR]	Mr Craig Saunders General Manager Carr Villa Memorial Park (Launceston Cemetery) 36 Nunamina Avenue	Carr Villa Memorial Park (Launceston Cemetery), Nunamina Avenue, Kings Meadows, a suburb of Launceston, in the state of Tasmania

	LAUNCESTON, TAS 7249	
MEL [2]	Mr Russ Allison General Manager Board of Trustees The Necropolis PO Box 1159 RMDC CLAYTON VIC 3169	Melbourne General Cemetery, Cemetery Road, Carlton North, a suburb of Melbourne, in the state of Victoria
NEW	Mr Peter Green General Manager Cheltenham Public Cemetery Trust Wangara Rd CHELTENHAM, VIC 3192	Bunurong Memorial Park, Frankston-Dandenong Road, Bangholme, a suburb of Melbourne in the state of Victoria
SPR [2]	Mr Russ Allison General Manager Board of Trustees The Necropolis PO Box 1159 RMDC CLAYTON VIC 3169	The Necropolis (Spring Vale Cemetery), Princes Highway, Springvale, a suburb of Melbourne in the state of Victoria
VIC [CPR] [3]	Ms Jo Fox Manager of Cemeteries & Crematoria Planning, Budget, Public Health & Development Division Vic Department Human Services GPO Box 1670N MELBOURNE, VIC 3001	n/a
WOR [CPR]	Mr Ivan Webber General Manager Woronora Cemetery Trust PO Box 4 SUTHERLAND, NSW 2232	Woronora General Cemetery, Linden Street, Sutherland, a suburb of Sydney in the state of New South Wales

Notes to the table:

[CPR] Designates A Contributing Research Partner that provided funding for the Study.

[1] During the Study the General Manager at Bunurong Memorial Park was Mr John Gilbertson.

[2] During the Study the General Manager of The Necropolis was Mr Malcolm Tucker.

[3] The Study in the state of Victoria was controlled and financed by the Victorian Department of Human Services. That Department provided a Special Research Grant Reference # 907-CO4-00658.

## LABORATORY DETAILS

Table A2 sets out details of the laboratories used for all groundwater sample testing, including the actual analytes tested at any time during the Study and the test methods used. The information recorded is as specified by the laboratories.

**Table A4. Details of Commercial Water Testing Laboratories and Test Methods**

Laboratory details	Any cemetery's samples tested	Any analytes tested	Test method
Water Environmental Laboratory Department of Land & Water Conservation 4 Guess Ave., Arncliffe, NSW 2205 [N]	BOT WOR LAU	Total coliforms Faecal coliforms <i>E. coli</i> Faecal streptococci <i>Pseudomonas aeruginosa</i> <i>Salmonella spp.</i> Bicarbonate alkalinity BOD5 Total Nitrogen (N) Total Phosphorus (P) Total Organic Carbon Chloride Sulphate Mercury Na, B Cd	APHA 9222B APHA 9222D AS1095.41.6-1981 APHA 9230C APHA 9213E AS1095.41.6-1981 APHA 2320B APHA 5210B APHA 4500-NO <sub>3</sub> F APHA 4500 -P F APHA 5310C AS 3741 AS 3741 APHA 3030K, 3114C APHA 3120B APHA 3030K, 3113B

<p>Water ECOscience Pty Ltd 68 Ricketts Road, Mt. Waverley, VIC 3149 [N, I]</p>	<p>MEL NEW SPR LAU</p>	<p>Coliforms Faecal streptococci <i>E. coli</i> <i>Pseudomonas aeruginosa</i> <i>Clostridium perfringens</i> Total Alkalinity, as CaCO<sub>3</sub> Bicarbonate Alkalinity, CaCO<sub>3</sub> Biochemical Oxygen Demand, 5 Day Nitrate and Nitrite as N Total Kjeldahl Nitrogen Total Nitrogen as N Ammonia, as N Phosphate, reactive as P Phosphorus, total as P Total Organic Carbon Chloride, as Cl Sulphate, as SO<sub>4</sub> Mercury, as Hg Bromide by IC Sodium, as Na Boron, as B Cadmium, as Cd (USN)</p>	<p>Coliform and <i>E. coli</i> counts determined by Colilert method; other microbiological test methods not specified WEC001 WEC001 WEC008 WEC043 WEC053 WEC069 WEC015 WEC052 WEC053 WEC039 WEC067/006 WEC061 WEC024 WEC006 WEC 061 WEC058 WEC023</p>
---	------------------------------------	--	---

<p>Australian Water Quality Centre Hodgson Road, Bolivar, SA 5108 [N, I]</p>	<p>CEN HEL</p>	<p>Coliforms Faecal coliforms Faecal streptococci <i>E. coli</i> <i>Pseudomonas aeruginosa</i> Total Alkalinity, as CaCO<sub>3</sub> Bicarbonate Biochemical Oxygen Demand Nitrate and Nitrite as N Nitrate as Nitrogen Nitrite as Nitrogen TKN as Nitrogen Ammonia as N Reactive Phosphate as P Phosphorus - total as P Total Organic Carbon Chloride, as Cl Sulphate, as SO<sub>4</sub> Mercury - soluble</p>	<p>80-01/02/07 76-01/02 82-01 81-07 90-01 101-01 102-01 153-01 161-01 106-01 107-01 112-01 100-01 108-01 109-01 158-05 104-02 110-31 566-01</p>
<p>Water Microbiological Laboratory Department of Primary Industry and Fisheries* Bass Highway Prospect Kings Meadows, TAS 7219 [N]</p>	<p>LAU</p>	<p>Total Coliform <i>E. coli</i> Faecal streptococcus <i>Pseudomonas aeruginosa</i> Faecal coliforms <i>Clostridium spp.</i> <i>Yersinia spp.</i> <i>Salmonella spp.</i></p>	<p>AS4276.5 AS4276 AS4276.7 AS4276.13 AS4276.7 In-house method [L] In-house method In-house method</p>

<p>Agricultural and Environmental Chemistry Laboratory  Department of Primary Industry and Fisheries  Bass Highway Prospect  Kings Meadows, TAS 7219</p>	<p>LAU</p>	<p>BOD  Boron (B)  Cadmium (Cd)  Calcium (Ca)  Chloride  Copper (Cu)  Iron (Fe)  Magnesium (Mg)  Manganese (Mn)  Mercury (Hg)  Molybdenum (Mo)  Nitrogen (N)  Phosphorus (P)  Potassium (K)  Sodium (Na)  Sulphur (S)  Zinc (Zn)</p>	<p>Specific test methods are not listed by the laboratory. Most testing of individual elements was by ICP except Cd and Hg which were by Atomic Absorption methods.</p>
<p>Ti-Tree Bend Laboratory  Technical Services Division  Launceston City Council  Ti-Tree Bend Wastewater Plant  Launceston, TAS</p>	<p>LAU</p>	<p>Biochemical Oxygen Demand (5 day)  Total Nitrogen (Kjeldahl)  Chloride  Fluoride  Total Phosphorus  Bicarbonate Alkalinity as CaCO<sub>3</sub></p>	<p>APHA 5210 (B)  APHA 4500Norg (B)  APHA Cl<sup>-</sup> (B)  APHA F<sup>-</sup> (C)  APHA 4500 P (E)  APHA 2320 (B)</p>
<p>Public Health Unit - Water Examination Laboratory ("Path Centre")  Locked Bag 2009,  Nedlands, WA</p>	<p>GUI</p>	<p>Total coliforms  Thermotolerant coliforms  Faecal streptococci</p>	<p>Waters Examination Laboratory Methods M</p>



Microserve Laboratory Pty Ltd Suite 6, 771 Beaufort St., Mt. Lawley, WA 6050 [N]	GUI	Coliforms Thermotolerant coliforms <i>E. coli</i> Faecal streptococci <i>Pseudomonas aeruginosa</i> <i>Salmonella spp.</i> <i>Yersinia enterocolitica</i> <i>Clostridium spp.</i>	MMM 4.2W MMM 4.3W MMM 4.3W MMM 4.4W MMM 4.5W MMM 4.7W MMM 2.14F APHA 36.6
Australian Government Analytical Laboratories (AGAL) 3 Clive Rd Cottlesloe, WA 6011 [N]	GUI	Alkalinity Bicarbonate as CaCO <sub>3</sub> BOD TOC Total phosphorus PO <sub>4</sub> -P (ortho) Total nitrogen Nitrate (NO <sub>3</sub> -N) Ammonia as NH <sub>3</sub> -N Chloride Sulphate	Local laboratory methods in general WL119 WL122 WL189 WL195 WL239 WL240
Australian Government Analytical Laboratories (AGAL) 51 - 65 Clarke St., South Melbourne, VIC 3205 [N, I]	GUI	Hg Other elements: Al, As, B, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Se, Si, Zn	VL250 (ICP/MS) local laboratory method
Australian Government Analytical Laboratories (AGAL) 1 Suakin Pl., Pymble, NSW 2073 [N]	GUI	Br	NW_B14 local laboratory method

Notes to the table:

[N] - indicates that the laboratory and the test methods used are endorsed by NATA (National Association of Testing Authorities, Australia)

[I] - indicates that the laboratory is an ISO 9001 Quality Systems Certified Organisation

[L] - this laboratory provides extensive testing services for Tasmanian agricultural and veterinarian needs; In-house test methods have been

developed based on heat-treated milks and abattoir waters. The methods are not necessarily accredited. (Walters, D. pers. comm.)

\* in 1998 this Tasmanian Government Department changed its name to the Department of Primary Industries, Water and Environment.

Test Methods:

MMM - denotes Microserve Methods Manual, wherein the test methods are based on Australian Standard Methods (Frankish, pers. comm.).

APHA -denotes American Public Health Association test method, the relevant method number is given.

AS - denotes Australian Standard test method, the relevant standard number is given.

In-house - see Note L.

---

**APPENDIX B**

**SITE INVESTIGATION INFORMATION**

**EASTERN SUBURBS MEMORIAL PARK (BOTANY CEMETERY),  
SYDNEY, NSW, (BOT) B**



Figure B.1 Historical Perspective of BOT – 1930  
(aerial photography Commonwealth of Australia)



Figure B.2 Piezometer Locations at BOT  
(aerial photo base – NSW Dept. Lands, 1994)

**Table B.1 Rainfall & Evaporation (Class A Pan) Data  
Period of Study and Overall  
including full month before sampling and final month  
for Station 66037, Sydney Airport (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997		130.4	42.2	7.8	166.2	78	152.8	16.8	93.6	47.4	42	16.8	970
1998	71.2	38.4	31	214	227.2	91.6	88.6	396.6					
# readings	69	69	69	69	69	69	69	69	69	69	69	69	68
lowest	5.4	2.5	6.4	7.8	2.9	2.5	0	0.2	1.6	0	5.7	4.8	522.9
highest	400.4	596.9	393	476.2	421.7	465.9	253.7	396.6	249.4	271.3	396.1	359.2	2025.2
average	99.0	111.3	122.7	106.4	99.9	125.0	68.5	81.6	63.5	72.6	82.1	75.9	1103.4
median	84.0	73.2	97.9	80.0	84.5	100.6	51.6	44.6	47.4	47.4	67.4	55.6	1073.5

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997		164.4	190.8	143	86.4	69	78.6	121	117	199	221.6	238.6	1850.4
1998	231	214.4	190.2	135.2	85.4	72.6	76.6	101.2					
# readings	25	25	25	24	24	24	24	24	24	24	24	24	24
lowest	172.7	136.2	134.1	93.5	69.4	63.5	53.6	98.8	112.6	129.6	161.6	183.2	1561.1
highest	270.6	214.4	205	152.8	119.6	96.1	104.9	149.2	206.4	234.2	226	292.9	2042.6
average	217.1	178.6	165	123.9	88.8	75.7	83.7	115.2	141.3	176.6	195.3	230.1	1788.2
median	211.5	180.4	163.2	122.3	87.9	73.3	81.5	111.6	137.6	178.6	195.4	229.3	1766.3

**Table B.2 Summary of Hydraulic Test Data**

**Slug Tests**

**K in m/sec**

Well	Bouwer & Rice	Cooper et al.	Hvorslev	Comments
B5	n/a			too quick for any method see Chapter Four
B9	n/a			too quick for any method see Chapter Four

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B1</b>
Location:	behind 'General Vault Area' northern end opposite 'General Lawn B'			RL * (ahd) Est. 15.8
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			6/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	0.68 m	Screen Length: 0.5 m Supervised By: BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s 0.7 - 0.9 B1/1 s 1.0 - 1.1 B1/2	∇ 0.4 drain ∇ 0.8  pack to 0.3 scr 0.65 - 1.15	0 - 0.5 0.5 – 0.9 0.9 – 1.15 1.15	gravelly clay fill (wet at drain invert) lt grey to yellow-white fine quartz sand, sat'd lt grey, white then beige silty fine sand sat'd complete in sandstone bedrock	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
26/3/97	09:33	1.38	B1/1, B1/111
28/5/97	>09:40	1.30	B1/2
1/8/97	09:15	1.22	B1/3
28/10/97	08:55	1.40	B1/4
10/3/98	09:11	1.61	B1/5

#### Initial Water Chemistry

Sample No: B1/1

Date:	Analyte values in mg/L			
pH	6.7	units	EC	1014 $\mu$ S/cm
Eh	-36	mV	O <sub>2</sub>	n/a % Sat
Temp	22.5	°C	BOD	<2 mg/L
Na	119.1		Cl	120.0
K	8.7		HCO <sub>3</sub>	329.7
Ca	64.8		SO <sub>4</sub>	13.0
Mg	24.8		NO <sub>2</sub> -N	0
NH <sub>4</sub>	1.33		NO <sub>3</sub> -N	0
TOC	66.0		PO <sub>4</sub>	1.9

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100 mm PVC casing on some holes and for below watertable

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B2</b>
Location:	New Lawn area N of Jewish Section			RL * m (ahd) Est. 16.0
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			4/10/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.69 m	1.4 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^ s 0.6 B2/1 s 2.0 – 2.1 B2/2 s 3.05 – 3.2 B2/3	pack 0.95  ∇ 3.21 scr 2.0 – 3.4	0 – 0.3 0.3 – 1.3 1.3 – 1.6 1.6 – 3.2 3.2 - 3.4 3.4	dk to lt grey organic-rich qtz sand lt grey-white fine qtz sand orange-br iron cemented sand (coffee rock) yellow fine – med qtz sand orange-br sand, very wet (RS?) complete on hard bedrock (sandstone?)	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	?	dry	
23/5/97	?	dry	
27/10/97	09:07	dry	
9/8/98	09:38	dry	
11/8/98	13:10	3.18	B2/6, B2/666

#### Initial Water Chemistry

Sample No: B2/6

Date:	11/8/98		Analyte values in mg/L		
pH	6.0	units	EC	367	µS/cm
Eh	82	mV	O <sub>2</sub>	n/a	% Sat
Temp	17.5	°C	BOD	<2	mg/L
Na	19.4		Cl	38.5	
K	18.0		HCO <sub>3</sub>	25.1	
Ca	29.6		SO <sub>4</sub>	22.2	
Mg	4.6		NO <sub>2</sub> -N	0.008	
NH <sub>4</sub>	0.5		NO <sub>3</sub> -N	9.5	
TOC	5.6		PO <sub>4</sub>	0.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B3</b>
Location:	General 40 (monumental) Section Row 6, above Centenary Avenue			RL * m (ahd) Est. 13.6
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			11/10/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.7 m	1.5 m	BBD
Casing, lift, soil samples	water made filter pack screen m	Depth m	Description	
^^ s 1.5 – 1.7 B3/1	∇ 1.2 pack to 0.7 scr 0.45 – 1.95	0 – 1.2 1.2 – 1.95 1.95	grey-br & mot yellow fine sandy fill, pieces of SS; wet dk grey fine qtz sand complete on sandstone - ? possible fill boulder ?	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	13:10	2.20	B3/1
29/5/97	>09:33	2.09	B3/2
30/7/97	14:26	2.09	B3/3
27/10/97	10:54	2.18	B3/4
9/3/98	10:13	2.33	B3/5
11/8/98	13:42	1.87	B3/6

#### Initial Water Chemistry

Sample No: B3/1

Date:	25/3/97		Analyte values in mg/L		
pH	6.3	units	EC	1116	µS/cm
Eh	64	mV	O <sub>2</sub>	23.5	% Sat
Temp	23.5	°C	BOD	2.0	mg/L
Na	110.6		Cl	140.0	
K	14.8		HCO <sub>3</sub>	162.9	
Ca	83.1		SO <sub>4</sub>	130.0	
Mg	28.6		NO <sub>2</sub> -N	0.011	
NH <sub>4</sub>	1.26		NO <sub>3</sub> -N	0.4	
TOC	15.0		PO <sub>4</sub>	1.1	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B4</b>
Location:	NW side of Centenary Avenue immediately below 'General 38Section'			RL * m (ahd) Est. 11.6
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			3/10/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.71 m	1.5 m	BBD
Casing, lift, soil samples	water made filter pack screen m	Depth m	Description	
^^ no s	∇ 1.15 pack to 0.35 scr 0.7 – 2.2	0 – 1.9 1.9 – 2.2 2.2	lt grey – white med-fine qtz sand orange clayey sand (RS); very wet complete in weathered sandstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	12:15	2.63	B4/1
29/5/97	13:12	2.24	B4/2
30/7/97	15:15	2.29	B4/3
27/10/97	12:01	2.61	B4/4
9/3/98	09:58	dry	
10/8/98	14:04	1.49	B4/6

#### Initial Water Chemistry

Sample No: B4/1

Date:	25/3/97		Analyte values in mg/L		
pH	6.6	units	EC	484	µS/cm
Eh	-75	mV	O <sub>2</sub>	n/a	% Sat
Temp	27.5	°C	BOD	<2	mg/L
Na	30.8		Cl	44.0	
K	8.1		HCO <sub>3</sub>	164.4	
Ca	48.6		SO <sub>4</sub>	15.0	
Mg	12.9		NO <sub>2</sub> -N	0.020	
NH <sub>4</sub>	0.58		NO <sub>3</sub> -N	0	
TOC	11.0		PO <sub>4</sub>	2.8	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>B5</b>	
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			RL * (ahd) Est. 13.2	
Location:	SE corner Jewish Section adjacent to path			Date Drilled: 5/12/96	
Driller:	B. Dent			Supervised By: BBD	
Drilling Method:	Hand Auger – 100 mm				
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.68 m	Screen Length: 1.5 m		
Casing, lift, soil samples	water made filter pack screen m	Depth m	Description		
^^	pack to 1.3  scr 2.75 – 4.25	0 – 3.5 3.5 – 4.25 4.25	It grey and white fine – med quartz sand orange silty sand (RS) complete in sandstone bedrock		

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	?	4.08	B5/1
28/5/97	>11:51	3.53	B5/2
31/7/97	08:52	3.36	B5/3
27/10/97	13:34	3.96	B5/4
10/3/98	11:01	4.00	B5/5

#### Initial Water Chemistry

Sample No: B5/1

Date:	25/3/97		Analyte values in mg/L		
pH	6.0	units	EC	596	µS/cm
Eh	167	mV	O <sub>2</sub>	24.8	% Sat
Temp	24.8	°C	BOD	<2	mg/L
Na	68.2		Cl	95.0	
K	14.2		HCO <sub>3</sub>	60.0	
Ca	30.9		SO <sub>4</sub>	48.0	
Mg	9.0		NO <sub>2</sub> -N	0.009	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	0.9	
TOC	16.0		PO <sub>4</sub>	n/a	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE	
Cemetery:		Botany Cemetery (Eastern Suburbs Memorial Park)		B6	
Location:		on pathway between "Roman Catholic 21 Section" and newer lawn, below Jewish Section		RL * m (ahd) Est. 11.3	
Driller:		B. Dent		Date Drilled:	
Drilling Method:		Hand Auger – 100 mm		4/10/96	
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots			Collar:	Screen Length:	Supervised By:
			0.69 m	1.45 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description		
^^ s 1.4 – 1.6 B6/1 s 2.4 – 2.6 B6/2	pack to 0.6  scr 1.15 – 2.6	0 - 0.3 1.4 – 1.6 1.6 – 2.1 2.1 – 2.6 2.6	dk to lt grey –white fine qtz sand dk brown iron cemented sand (coffee rock) yellow and mot orange fine-med sand orange clayey fine sand (RS), wet complete in sandstone bedrock		

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	11:25	dry	
29/5/97	10:45	2.73	B6/2
31/7/97	09:35	2.70	B6/3
27/10/97	09:18	dry	
27/3/98	09:52	dry	
11/8/98	14:22	2.02	B6/6

#### Initial Water Chemistry

Sample No: B6/2

Date:	29/5/97		Analyte values in mg/L		
pH	6.2	units	EC	670	µS/cm
Eh	77	mV	O <sub>2</sub>	12.1	% Sat
Temp	17.2	°C	BOD	<2	mg/L
Na	64.9		Cl	69.0	
K	13.2		HCO <sub>3</sub>	103.6	
Ca	49.7		SO <sub>4</sub>	89.0	
Mg	18.5		NO <sub>2</sub> -N	0.001	
NH <sub>4</sub>	0.73		NO <sub>3</sub> -N	3.5	
TOC	11.0		PO <sub>4</sub>	0.9	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>B7</b>
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			RL * m (ahd) Est. 10.8
Location:	SE corner General 38 (monumental) Section, above Centenary Avenue			Date Drilled: 5/12/96
Driller:	B. Dent			Supervised By: BBD
Drilling Method:	Hand Auger – 100 mm			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.68 m	Screen Length: 1.5 m	
Casing, lift, soil samples	water made filter pack screen m	Depth m	Description	
^^ s 1.7 – 1.8 B7/1 s 2.3 B7/2 s 1.0 – 1.4 B7/3	pack to 0.7 scr 0.9 - 2.4	0 – 0.35 0.35 – 1.4 1.4 – 1.6 1.6 – 2.4 2.4	dk grey organic sand lt grey – white fine quartz sand dk brown & orange mot cemented sand (coffee rock) yellow-br fine qtz sand complete in white sandstone bedrock	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	?	2.43	B7/1
29/5/97	11:50	1.88	B7/2
31/7/97	10:15	1.87	B7/3
27/10/97	?	2.33	B7/4
9/3/98	09:55	2.64	B7/5
11/8/98	15:28	1.13	B7/6

#### Initial Water Chemistry

Sample No: B7/1

Date:	25/3/97		Analyte values in mg/L		
pH	6.3	units	EC	910	µS/cm
Eh	45	mV	O <sub>2</sub>	n/a	% Sat
Temp	24.0	°C	BOD	<2	mg/L
Na	73.2		Cl	92.0	
K	23.8		HCO <sub>3</sub>	216.5	
Ca	75.0		SO <sub>4</sub>	78.0	
Mg	20.6		NO <sub>2</sub> -N	0.007	
NH <sub>4</sub>	1.72		NO <sub>3</sub> -N	5.7	
TOC	13.0		PO <sub>4</sub>	1.1	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B8</b>
Location:	Centenary Avenue, end of 'Roman Catholic 21' Section			RL * m (ahd) Est. 10.0
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			4/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.63 m	1.5 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^  s 3.6 – 3.7 B8/1	pack to 1.2 ∇ 2.7 scr 2.25 – 3.75	0 – 2.1 2.1 – 2.4 2.4 – 2.8 2.8 – 3.5 3.5 – 3.75 3.75	loose lt grey-white fine sand orange-br cemented sand (coffee rock) brown & orange mot sand, less cemented, wet dense yellow med qtz sand lt grey-white & beige clayey sand (RS ) complete in weathered sandstone bedrock	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	09:30	3.31	B8/1
29/5/97	13:48	2.77	B8/2
31/7/97	11:15	2.66	B8/3
28/10/97	11:05	3.15	B8/4
9/3/98	13:18	3.67	B8/5
10/8/98	12:27	2.02	B8/6

#### Initial Water Chemistry

Sample No: B8/1

Date:	25/3/97		Analyte values in mg/L		
pH	6.2	units	EC	458	µS/cm
Eh	138	mV	O <sub>2</sub>	15.2	% Sat
Temp	24.7	°C	BOD	<2	mg/L
Na	27.8		Cl	42.0	
K	6.2		HCO <sub>3</sub>	193.6	
Ca	53.3		SO <sub>4</sub>	15.0	
Mg	8.0		NO <sub>2</sub> -N	0.005	
NH <sub>4</sub>	0.44		NO <sub>3</sub> -N	0	
TOC	10.0		PO <sub>4</sub>	4.3	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B9</b>
Location:	E end of General 32 Section on Arthur Taylor Avenue near Centenary Avenue			RL * m (ahd) Est. 8.2
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			6/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.68 m	1.5 m	BBD
Casing, lift, soil samples	water made filter pack screen m	Depth m	Description	
^^ s 1.5 B9/1 s 2.8 B9/2	pack to 0.6 ∇ 2.5 scr 2.0 – 3.5	0 – 1.5 1.5 – 1.8 1.8 – 2.8 2.8 – 3.4 3.4 – 3.5 3.5	Lt grey & white fine-med qtz sand orange & br mot cemented sand (coffee rock) Lt grey & white fine-med qtz sand yellow med qtz sand yellow-br sandy clay (RS) complete in med stiff grey sandy clay (EW siltstone)	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/3/97	08:15	3.34	B9/1
29/5/97	15:15	2.73	B9/2
1/8/97	10:23	2.62	B9/3
28/10/97	09:51	2.86	B9/4, B999/4
9/3/98	14:27	3.12	B9/5
10/8/98	14:58	2.30	B9/6

#### Initial Water Chemistry

Sample No: B9/1

Date:	25/3/97		Analyte values in mg/L		
pH	6.3	units	EC	607	µS/cm
Eh	160	mV	O <sub>2</sub>	25.0	% Sat
Temp	23.2	°C	BOD	<2	mg/L
Na	52.1		Cl	76.0	
K	10.7		HCO <sub>3</sub>	104.9	
Ca	50.7		SO <sub>4</sub>	61.0	
Mg	12.2		NO <sub>2</sub> -N	0.005	
NH <sub>4</sub>	0.63		NO <sub>3</sub> -N	0.8	
TOC	9.1		PO <sub>4</sub>	2.8	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B11</b>
Location:	behind vaults facing Frost Avenue opposite 'General Lawn 34' Section, NE of water fountain area			RL * m (ahd) Est. 14.8
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			4/12/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.28 m	1.5 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^ no s	pack to 1.2  ∇ 2.4 scr 1.15 – 2.65	0 – 0.2 0.2 – 0.7 0.7 – 1.6 1.6 – 2.1 2.1 – 2.65 2.65	med-fine yellow qtz sand, roots & organic matter grey-white fine qtz sand dk br & mot yellow cemented sand (coffee rock) lt br and white mot fine qtz sand white clayey sand complete on sandstone bedrock	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
9/3/98	09:13	dry	
22/4/98	09:59	1.29	B11/E, B11/E2*
10/8/98	13:20	2.75	nil

#### Initial Water Chemistry

Sample No: B11/E

Date:	22/4/98		Analyte values in mg/L		
pH	5.8	units	EC	554	µS/cm
Eh	152	mV	O <sub>2</sub>	n/a	% Sat
Temp	23.0	°C	BOD	<2	mg/L
Na	47.2		Cl	82.0	
K	3.6		HCO <sub>3</sub>	38.0	
Ca	37.4		SO <sub>4</sub>	105.0	
Mg	10.0		NO <sub>2</sub> -N	0.002	
NH <sub>4</sub>	0.12		NO <sub>3</sub> -N	0.7	
TOC	6.9		PO <sub>4</sub>	0.6	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.  
Borehole established as anew background when B1 was found to be possibly contaminated. This bore adjacent to new construction on N side of boundary where ground level raised by about 4 m.

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Botany Cemetery (Eastern Suburbs Memorial Park)			<b>B12</b>
Location:	N boundary former power station site (W of Military Rd) adjacent to sub-station road, 1.4.m from fence corner			RL * m (ahd) Est. 20.0
Driller:	B. Dent			Date Drilled:
Drilling Method:	Hand Auger – 100 mm			4/12/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.66 m	1.5 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^ s none	pack to 1.25  scr 1.7 – 3.2	0 – 0.7 0.7 – 1.7 1.7 – 1.75 1.75 – 2.1 2.1 – 2.75 2.75 – 3.2 3.2	bitumen seal, road base and fill, coke coarse SS pieces lt grey & br fine qtz sand very hard layer of brown cemented sand (?coffee rock) white fine qtz sand yellow with br mot med-fine qtz sand yello-orange coarse gravelly sandy clay (RS) complete in sandstone bedrock	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
9/3/98	09:03	dry	
10/8/98	10:32	2.52	B12/6, B12/666

#### Initial Water Chemistry

Sample No: B12/6

Date:	10/8/98		Analyte values in mg/L		
pH	6.7	units	EC	826	µS/cm
Eh	75	mV	O <sub>2</sub>	33.4	% Sat
Temp	17.0	°C	BOD	7.0	mg/L
Na	101.7		Cl	150.0	
K	29.3		HCO <sub>3</sub>	143.9	
Ca	32.5		SO <sub>4</sub>	34.0	
Mg	10.1		NO <sub>2</sub> -N	0.007	
NH <sub>4</sub>	2.46		NO <sub>3</sub> -N	0	
TOC	13.0		PO <sub>4</sub>	0.9	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ Temporary 100mm PVC casing on some holes and for below watertable.  
New background bore in former power station site, N boundary adjacent to power sub-station road  
and W of former carpark



**APPENDIX C**

**SITE INVESTIGATION INFORMATION**

**WORONORA GENERAL CEMETERY, SYDNEY, NSW, (WOR) W**



Figure C.1 Historic Perspective of WOR – 1930  
(aerial photography Commonwealth of Australia)

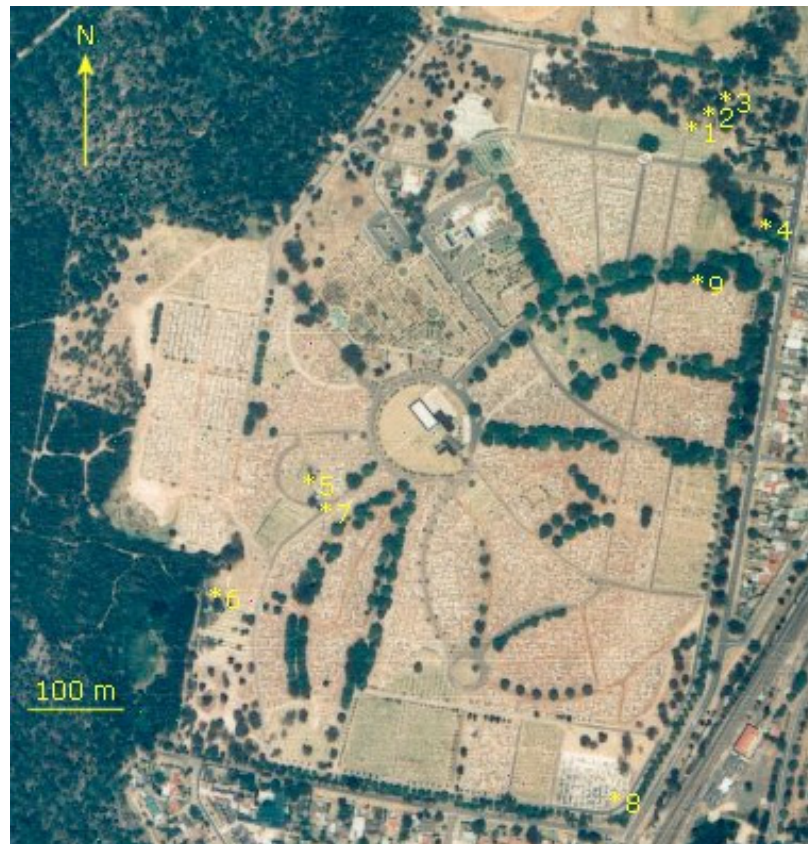


Figure C.2 Piezometer Locations at WOR  
(aerial photo base – NSW Dept. Lands, 1994)

**Table C.1 Rainfall Data & Evaporation (Class A Pan)  
 Period of Study and Overall  
 including full month before sampling and final month  
 for Station 66078, Lucas Heights (rainfall) and  
 Station 66037, Sydney Airport (evaporation) (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997			61.2	0.5	96.5	51	48.8	18.7	105.6	60.2	21.7	27.3	732.4
1998	75	56	15.5	161	203.3	80.2	86.8						
#readings	39	39	40	41	41	41	41	40	40	39	39	39	37
lowest	7.1	12.2	10.4	0.5	4.1	2.3	0.3	0	0.6	0	8.1	6.4	556.3
highest	270.7	443	329.5	397.6	270.3	449.7	363.7	403.8	249.3	213.7	432.2	273.1	1804
average	102.4	94.5	117.3	97.0	82.5	106.8	59.3	75.0	55.3	73.4	97.2	87.4	1061.0
median	80.2	70.2	90.8	66.6	75.2	70.8	39.8	30.7	48.1	48.6	71.5	65.7	1070

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997			190.8	143	86.4	69	78.6	121	117	199	221.6	238.6	1850.4
1998	231	214.4	190.2	135.2	85.4	72.6	76.6						
# readings	25	25	25	24	24	24	24	24	24	24	24	24	24
lowest	172.7	136.2	134.1	93.5	69.4	63.5	53.6	98.8	112.6	129.6	161.6	183.2	1561.1
highest	270.6	214.4	205	152.8	119.6	96.1	104.9	149.2	206.4	234.2	226	292.9	2042.6
average	217.1	178.6	165	123.9	88.8	75.7	83.7	115.2	141.3	176.6	195.3	230.1	1788.2
median	211.5	180.4	163.2	122.3	87.9	73.3	81.5	111.6	137.6	178.6	195.4	229.3	1766.3

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Woronora General Cemetery			W1
Location:	in roadway between 'Lawns 1 & 2', near northern boundary			RL * m (ahd) Est. 100.7
Driller:	Unidrill Pty. Ltd.			Date Drilled:
Drilling Method:	400 mm solid flight auger			10/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.68 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s 0.5 – 1.0 W1/2 s 1.0 – 1.2 W1/3 s 2.5 – 3.0 W1/1	pack to 1.05  ∇ 2.4 scr 1.15 – 4.15	0 – 0.3 0.3 – 1.2 1.2 – 2.0 2.0 – 4.15 4.15	dk br sandy topsoil med dense yel-br sandy clay stiff grey clay with ironstone pebbles very soft, EW grey siltstone complete in grey siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
10/4/97	10:55	2.10	W1/1
5/6/97	13:01	1.78	W1/2
29/7/97	09:39	1.74	W1/3
3/11/97	09:37	1.92	W1/4
16/3/98	13:17	2.64	W1/5
14/7/98	14:43	1.66	W1/6

#### Initial Water Chemistry

Sample No: W1/1

Date:	10/4/97		Analyte values in mg/L		
pH	6.2	units	EC	337	µS/cm
Eh	37	mV	O <sub>2</sub>	27.5	% Sat
Temp	21.8	°C	BOD	<2	mg/L
Na	17.0		Cl	22.0	
K	10.2		HCO <sub>3</sub>	100.0	
Ca	30.8		SO <sub>4</sub>	15.0	
Mg	5.6		NO <sub>2</sub> -N	0.010	
NH <sub>4</sub>	0.19		NO <sub>3</sub> -N	0	
TOC	8.8		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting  
log adapted from nearby exploration pit #1 of 25/11/96

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE W2
Cemetery:	Woronora General Cemetery			RL * m (ahd) Est. 100.0
Location:	NE of 'Lawn 1' in buffer zone			Date Drilled: 10/12/96
Driller:	Unidrill Pty. Ltd.			Supervised By: BBD
Drilling Method:	400 mm solid flight auger			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.69 m	Screen Length: 2.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s 0.2 – 1.1 W2/1 s 2.2 – 3.0 W2/2	pack to 1.1 ∇ 1.7 ∇ 2.2 scr 1.3 – 3.3	0 - 0.2 0.2 – 1.1 1.1 – 2.2 2.2 – 3.0 3.0 – 3.3 3.3	dk br sandy topsoil orange & yel-br mot sandy clay red & grey mot clay weathered grey & beige siltstone and sandstone weathered white sandstone complete in sandstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
10/4/97	12:00	1.64	W2/1
5/6/97	13:38	1.44	W2/2
29/7/97	13:59	1.43	W2/3
3/11/97	10:35	1.69	W2/4
16/3/98	14:01	2.46	W2/5
14/7/98	15:26	1.77	W2/6

#### Initial Water Chemistry

Sample No: W2/1

Date:	10/4/97		Analyte values in mg/L		
pH	6.4	units	EC	375	µS/cm
Eh	122	mV	O <sub>2</sub>	23.5	% Sat
Temp	21.0	°C	BOD	2	mg/L
Na	17.0		Cl	21.0	
K	12.9		HCO <sub>3</sub>	126.8	
Ca	32.8		SO <sub>4</sub>	29.0	
Mg	3.3		NO <sub>2</sub> -N	0.002	
NH <sub>4</sub>	0.1		NO <sub>3</sub> -N	0.5	
TOC	7.4		PO <sub>4</sub>	0.1	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting  
log adapted from nearby exploratory Pit 32 of 25/11/96

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Woronora General Cemetery			W3
Location:	NE corner of buffer zone, adjacent new residence			RL * m (ahd) Est. 99.5
Driller:	Unidrill Pty. Ltd.			Date Drilled:
Drilling Method:	400 mm solid flight auger			10/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	0.67 m	Screen Length: 2.0 m
				Supervised By: BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s no	pack to 1.1  scr 1.4 – 3.4	0 – 0.3 0.3 -1.3 1.3 - 2.2 2.2 – 3.4 3.4	lt br sandy topsoil orange & yel-br mot sandy clay grey clay with ironstone pebbles weathered (EW?) grey siltstone complete in grey siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
10/4/97	12:56	1.27	W3/1
5/6/97	12:44	1.43	nil
30/7/97	11:35	1.38	W3/3
17/3/98	12:52	2.29	W3/5
15/7/98	14:12	1.34	W3/6

#### Initial Water Chemistry

Sample No: W3/1

Date:	10/4/97		Analyte values in mg/L		
pH	10.8 <sup>s</sup>	units	EC	390	µS/cm
Eh	36	mV	O <sub>2</sub>	44.3	% Sat
Temp	21.6	°C	BOD	2.0	mg/L
Na	19.0		Cl	24.0	
K	16.0		HCO <sub>3</sub>	0	
Ca	27.8		SO <sub>4</sub>	23.0	
Mg	0.6		NO <sub>2</sub> -N	0.024	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	0.5	
TOC	7.5		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting  
log adapted from nearby exploratory Pit #7 of 25/11/96  
\$ the high pH cannot be explained, however, remainder of results in order

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>W4</b>
Cemetery:	Woronora General Cemetery			RL * m (ahd) Est. 102.2
Location:	background bore, adjacent to former residence and Linden St above lower entrance			Date Drilled: 10/12/96
Driller:	Unidrill Pty. Ltd.			Supervised By: BBD
Drilling Method:	400 mm solid flight auger			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.71 m	Screen Length: 2.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s 1.0 W4/1 s 2.1 W4/2 s 2.9 W4/3	pack to 1.0  scr 1.1 – 3.1	0 – 0.5 0.5 – 1.5 1.5 – 2.4 2.4 – 3.1 3.1	gravelly sand topsoil yel-br sandy clay, increasing ironstone pebbles HW mot purple & red-br & grey siltstone MW – HW grey siltstone complete in white sandstone (lithology change)	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
11/4/97	12:35	3.25	W4/1
5/6/97	11:26	3.10	W4/2
29/7/97	11:27	2.80	W4/3
3/11/97	11:51	3.27	W4/4
16/3/98	09:42	dry	
15/7/98	11:48	2.39	W4/6

#### Initial Water Chemistry

Sample No: W4/1

Date:	11/4/97		Analyte values in mg/L		
pH	6.0	units	EC	922	µS/cm
Eh	166	mV	O <sub>2</sub>	33.0	% Sat
Temp	21.6	°C	BOD	21.0	mg/L
Na	69.5		Cl	170.0	
K	22.6		HCO <sub>3</sub>	110.9	
Ca	30.0		SO <sub>4</sub>	72.0	
Mg	9.0		NO <sub>2</sub> -N	0.001	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	0.4	
TOC	19.0		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE W5
Cemetery:	Woronora General Cemetery			RL * m (ahd) Est. 111.5
Location:	'Abelia Lawn'			Date Drilled: 10/12/96
Driller:	Unidrill Pty. Ltd.			Supervised By: BBD
Drilling Method:	400 mm solid flight auger			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.68 m	Screen Length: 1.5 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s 0.5 – 0.8 W5/1 s 1.4 W5/2	pack to 0.9  scr 0.9 – 2.4	0 – 0.2 0.2 – 1.3 1.3 – 1.8 1.8 – 2.4 2.4	dk br organic sandy loam yel-br sandy clay br-grey & mot grey sandy clay grey clay complete in ?weathered siltstone?	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
11/4/97	13:11	2.27	W5/1
5/6/97	10:36	1.68	W5/2
30/7/97	10:28	1.62	W5/3
4/11/97	09:06	1.76	W5/4
17/3/98	11:27	2.22	W5/5

#### Initial Water Chemistry

Sample No: W5/1

Date:	11/4/97		Analyte values in mg/L		
pH	5.3	units	EC	274	µS/cm
Eh	110	mV	O <sub>2</sub>	10.4	% Sat
Temp	24.3	°C	BOD	10.0	mg/L
Na	30.5		Cl	25.0	
K	1.3		HCO <sub>3</sub>	43.9	
Ca	2.3		SO <sub>4</sub>	56.0	
Mg	2.9		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	2.62		NO <sub>3</sub> -N	0.1	
TOC	9.2		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting  
borelog adapted from adjacent exploratory Pit # 6 of 25/11/96



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Woronora General Cemetery			W6
Location:	'The Park' close to drain wetland and W boundary			RL * m (ahd) Est. 106.0
Driller:	Unidrill Pty. Ltd.			Date Drilled:
Drilling Method:	400 mm solid flight auger			10/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.69 m	1.5 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s 1.0 -2.0 W6/1 s 2.0 W6/2	pack to 0.5 1.6 H <sub>2</sub> S scr 0.6 – 2.1	0 – 0.3 0.3 – 1.2 1.2 – 2.0 2.0 – 2.1 2.1	yel-br sandy clay, moist firm white sandy clay, moist mod. stiff white & red, yel-br & grey mot sandy clay HW white & red mot med sandstone complete in sandstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
10/4/97	14:05	1.56	W6/1
4/6/97	09:50	0.87	W6/2
29/7/97	10:38	0.74	W6/3
3/11/97	13:07	1.06	W6/4
16/3/98	11:56	2.09	W6/5, W666/5
15/7/98	09:20	0.85	W6/6

#### Initial Water Chemistry

Sample No: W6/1

Date:	10/4/97		Analyte values in mg/L		
pH	6.6	units	EC	984	µS/cm
Eh	-134	mV	O <sub>2</sub>	6.9	% Sat
Temp	23.1	°C	BOD	10.0	mg/L
Na	32.9		Cl	39.0	
K	4.6		HCO <sub>3</sub>	256.0	
Ca	66.1		SO <sub>4</sub>	17.0	
Mg	8.7		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	4.72		NO <sub>3</sub> -N	0	
TOC	n/a		PO <sub>4</sub>	0.7	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting  
the general area of this bore is usually boggy except in very dry summer months

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE W7
Cemetery:	Woronora General Cemetery			RL * m (ahd) Est. 111.3
Location:	within road-enclosed triangle adjacent to 'Orthodox Section' above 'The Park'			Date Drilled: 10/12/96
Driller:	Unidrill Pty. Ltd.			Supervised By: BBD
Drilling Method:	400 mm solid flight auger			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.68 m	Screen Length: 2.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s 1.1 W7/1 s 2.1 W7/2 s 2.9 W7/3	pack to 0.8  scr 1.0 – 2.0	0 – 0.3 0.3 – 0.8 0.8 – 2.2 2.2 – 3.0 3.0	lt br & orange gravelly topsoil yel-br sandy clay yel-br & dk grey mot sandy clay weathered grey & mot yel-br siltstone complete in weathered siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
11/4/97	14:55	1.72	W7/1
5/6/97	09:15	1.39	W7/2
30/7/97	09:19	1.35	W7/3
4/11/97	10:00	1.50	W7/4
16/3/98	10:48	2.68	W7/5
15/7/98	10:01	1.19	W7/6

#### Initial Water Chemistry

Sample No: W7/1

Date:	11/4/97		Analyte values in mg/L		
pH	6.5	units	EC	390	µS/cm
Eh	51	mV	O <sub>2</sub>	17.9	% Sat
Temp	17.9	°C	BOD	110.0	mg/L
Na	32.5		Cl	21.0	
K	19.9		HCO <sub>3</sub>	134.1	
Ca	38.0		SO <sub>4</sub>	25.0	
Mg	4.1		NO <sub>2</sub> -N	0.004	
NH <sub>4</sub>	0.15		NO <sub>3</sub> -N	0	
TOC	21.0		PO <sub>4</sub>	0.8	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Woronora General Cemetery			W8
Location:	below 'Vaults Section', SE corner near Linden St			RL * m (ahd) Est. 109.2
Driller:	Unidrill Pty. Ltd.			Date Drilled:
Drilling Method:	400 mm solid flight auger			10/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.63 m	1.5 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s no	pack to 0.9 ∇ 1.3 ∇ 1.9 scr 1.0 – 2.5	0 – 0.6 0.6 – 1.4 1.4 – 1.9 1.9 – 2.5 2.5	sandy fill med stiff yel-br sandy clay red-br mot in grey clay weathered siltstone with sandstone layers; hard at 2.4 complete in siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
11/4/97	14:45	2.64	W8/1
3/6/97	11:06	1.58	W8/2
29/7/97	12:41	1.55	W8/3
3/11/97	14:10	1.73	W8/4
17/3/98	10:15	2.32	W8/5

#### Initial Water Chemistry

Sample No: W8/1

Date:	11/4/97		Analyte values in mg/L		
pH	5.8	units	EC	171	µS/cm
Eh	176	mV	O <sub>2</sub>	43.0	% Sat
Temp	22.0	°C	BOD	4.0	mg/L
Na	13.6		Cl	19.0	
K	6.9		HCO <sub>3</sub>	18.3	
Ca	9.5		SO <sub>4</sub>	16.0	
Mg	2.4		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0.03		NO <sub>3</sub> -N	0.1	
TOC	9.4		PO <sub>4</sub>	0.4	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting  
borelog adapted from adjacent exploratory Pit #8 of 27/11/96

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE W9
Cemetery:	Woronora General Cemetery			RL * m (ahd) Est. 103.0
Location:	established in rubble sub-soil drain between 'Anglican 3 and 4', on roadway at NE end			Date Drilled: 7/2/97
Driller:	Unidrill Pty. Ltd.			Supervised By: BBD
Drilling Method:	400 mm solid flight auger			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.55 m	Screen Length: 0.9 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
^^ s W9/1 sandy fill	pack to 0.58 ▽ 1.36 scr 1.2 – 2.1	2.1	adjacent to drain; rubble and fill to 2.0 m profile within sandy clays complete in ?siltstone? trench, drain & bore flooded during emplacement	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
5/6/97	14:14	1.73	W9/2
29/7/97	14:53	1.62	W9/3
4/11/97	11:00	1.95	W9/4
18/3/98	10:40	dry	
15/7/98	13:53	1.69	W9/6

#### Initial Water Chemistry

Sample No: W9/2

Date:	5/6/97		Analyte values in mg/L		
pH	5.5	units	EC	192	µS/cm
Eh	72	mV	O <sub>2</sub>	46.7	% Sat
Temp	20.5	°C	BOD	<2	mg/L
Na	24.8		Cl	24.0	
K	1.6		HCO <sub>3</sub>	2.4	
Ca	4.8		SO <sub>4</sub>	28.0	
Mg	4.3		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	0	
TOC	0.6		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ no casing used for Woronora augering or pitting  
bore constructed on side of sub-soil drain to which it is connected by sand-filled trench  
no grout seal on this bore – not feasible; sandy fill of trench sampled

**APPENDIX D**

**SITE INVESTIGATION INFORMATION**

**MELBOURNE GENERAL CEMETERY, MELBOURNE, VIC, (MEL) M**



Figure D.1 Historical Perspective of MEL – 1950  
(aerial photography Melbourne Board of Works)



Figure D.2 Piezometer Locations at MEL  
(aerial photo base – Qascophoto, 1992)

**Table D.1 Rainfall & Evaporation (Class A Pan) Data  
Period of Study and Overall  
including full month before sampling and final month  
for Station 86071, Melbourne Regional Office (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997			20	13.8	59.6	35	18.2	27.8	56.8	30.8	56.8	7.2	359.8
1998	59.4	71.6	7.4	50.2	50	50.6	39.6	22.8	35.4	78.6			
# readings	143	143	143	144	144	144	144	144	144	144	143	143	142
minimum	0.3	0.5	3.7	0	3.8	8	9.4	12.4	13.4	7.5	6.5	1.7	332.3
maximum	176	238.2	190.7	195	142.5	116.8	178.4	110.8	201.6	193.3	206.1	197.4	967.5
average	48.9	47.6	51.2	58.0	57.2	50.1	48.4	50.2	59.2	67.4	60.0	59.3	657.9
median	37.4	32.1	38.8	50.9	56.0	43.9	46.6	49.6	53.3	68.1	52.3	48.7	655.7

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997			99.6	64.8	41.2	34.6	34.8	51	63.2	107.2	128	161	1139
1998	162.6	156.2	118.2	59.4	42.2	33.6	28.4	40.2	77.8	102.2			
#readings	44	44	44	44	44	44	44	44	44	44	43	43	43
lowest	130.1	103.8	82	46	29	23.3	22.1	33.5	48.2	72.9	86.2	111.4	904
highest	260.7	229.9	193.4	113.3	71.1	47.6	66.6	88.6	123.2	151	185	260.8	1592.2
average	182.3	153.3	121.7	78.0	48.8	33.7	36.9	51.7	73.6	108.9	135.2	164.1	1189.9
median	179.0	150.6	116.8	76.2	47.1	33.6	35.8	51.1	69.9	105.6	130.2	160.5	1143.6

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE	
Cemetery:		Melbourne General Cemetery		M2	
Location:		Top of hill adjacent to new mausoleum, on edge of old roadway at 'Section P'		RL * m (ahd) Est. 49.6	
Driller:		Van-Leeuwen Foundation Drilling		Date Drilled:	
Drilling Method:		400 mm solid flight auger		16/12/96	
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots			Collar: 0.64 m	Screen Length: 1.2 m	Supervised By: BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description		
^ \$ s 1.6 M2/1 s 2.5 M2/3	pack to 1.7 scr 1.9 – 3.1	0 – 0.35 0.35 – 0.55 0.55 – 1.9 1.9 – 3.1 3.1	lt grey gravelly sandy fill grey-br sandy clay yel-br & orange & grey sandy clay, minor iron gravel weathered grey siltstone complete in firm EW siltstone, occ. yel-br mot & roots		

#### Record of Sampling and Water Levels

DATE	TIME	SWL m#	SAMPLE NO/S
1/4/97	n/a	3.04	M2/1
17/6/97	10:48	3.36	M2/2
22/7/97	09:47	3.47	M2/3
2/10/97	08:45	3.30	M2/4
13/2/98	12:13	3.29	M2/5
16/4/98	10:26	3.40	M2/6
28/10/98	07:55	2.96	M2/7

#### Initial Water Chemistry

Sample No: M2/1

Date:	1/4/97		Analyte values in mg/L		
pH	6.9	units	EC	2176	µS/cm
Eh	-28	mV	O <sub>2</sub>	n/a	% Sat
Temp	23.1	°C	BOD	>13	mg/L
Na	492.0		Cl	61.0	
K	19.3		HCO <sub>3</sub>	725.4	
Ca	17.3		SO <sub>4</sub>	450.0	
Mg	9.8		NO <sub>2</sub> -N	0.003	
NH <sub>4</sub>	0.61		NO <sub>3</sub> -N	0	
TOC	77.0		PO <sub>4</sub>	4.2	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ No casing was used during drilling at MEL  
\$ other exploratory boreholes were drilled – these were not established as sampling points, but some soil samples were taken from these



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Melbourne General Cemetery			M3
Location:	east edge of 'Roman Catholic' Section on North Avenue adjacent to rotunda			RL * m (ahd) Est. 49.7
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm solid flight auger			16/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.72 m	1.2 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^  s 1.2 M3/1 s 2.1 M3/2	pack to 1.5  scr 1.95 – 3.15	0 – 0.6 0.6 – 0.8 0.8 – 2.1 2.1 – 2.3 2.3 – 3.15 3.15	dk grey sandy clay fill & topsoil firm yel-br & grey sandy clay mot yel-br & orange & grey sandy clay grey coarse sand (weathered sandstone?) firm-hard grey weathered siltstone complete in siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL m#	SAMPLE NO/S
1/4/97	n/a	3.61	
7/6/97	12:00	3.25	
22/7/97	08:53	dry	
2/10/97	10:07	3.15	M3/4
13/2/98	09:05	3.33	M3/5
16/4/98	08:00	3.50	
24/10/98	n/a	1.64	

#### Initial Water Chemistry

Sample No: M3/4

Date:	2/10/97		Analyte values in mg/L		
pH	8	units	EC	1476	µS/cm
Eh	-47	mV	O <sub>2</sub>	13	% Sat
Temp	18	°C	BOD	53	mg/L
Na	n/a		Cl	35	
K	n/a		HCO <sub>3</sub>	732	
Ca	n/a		SO <sub>4</sub>	110	
Mg	n/a		NO <sub>2</sub> -N	n/a	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	n/a	
TOC	32		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ No casing was used during drilling at MEL

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Melbourne General Cemetery			M5
Location:	road junction at 'Presbyterian K' Section and perimeter road			RL * m (ahd) Est. 37.9
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm solid flight auger			16/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.66 m	1.5 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^ s 0.95 M5/1 s 1.6 M5/2	pack to 1.3 scr 1.45 – 2.95	0 – 0.2 0.2 – 1.3 1.3 – 2.95 2.95	lt br sandy topsoil & fill yel-br sandy clay, occ grey mot EW grey siltstone becoming mot at 1.6 complete in HW/MW siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL m#	SAMPLE NO/S
1/4/97	n/a	dry	
17/6/97	11:24	dry	
22/7/97	11:14	dry	
2/10/97	n/a	dry	
13/2/98	11:08	3.40	M5/5
16/4/98	08:10	dry	
24/10/98	n/a	dry	

#### Initial Water Chemistry

Sample No: M5/5

Date:	13/2/98		Analyte values in mg/L		
pH	6.5	units	EC	1232	µS/cm
Eh	-62	mV	O <sub>2</sub>	n/a	% Sat
Temp	21.2	°C	BOD	9.0	mg/L
Na	271.9		Cl	62.0	
K	17.1		HCO <sub>3</sub>	475.5	
Ca	20.9		SO <sub>4</sub>	130.0	
Mg	12.5		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	<0.1		NO <sub>3</sub> -N	0	
TOC	18.0		PO <sub>4</sub>	<0.02	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ No casing was used during drilling at MEL

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Melbourne General Cemetery			M6
Location:	on perimeter road in 'Presbyterian Q' Section			RL * m (ahd) Est. 40.7
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm solid flight auger			16/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.69 m	1.2 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^ s no	pack to 1.3 ∇ 2.1 – 2.6 scr 1.5 – 2.7	0 - 0.5 0.5 – 1.2 1.2 – 2.7 2.7	grey-br sandy fill & topsoil yell-br sandy clay; minor coarse sand grey EW/HW siltstone complete in grey siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL m#	SAMPLE NO/S
1/4/97	11:31	3.11	M6/1
7/6/97	11:31	3.46	
22/7/97	11:18	dry	
2/10/97	10:49	2.38	
13/2/97	10:18	3.44	
16/4/98	08:17	3.32	
28/10/97	09:14	2.80	M6/7

#### Initial Water Chemistry

Sample No: M6/1

Date:	1/4/97		Analyte values in mg/L		
pH	7.1	units	EC	5060	µS/cm
Eh	-139	mV	O <sub>2</sub>	n/a	% Sat
Temp	23.5	°C	BOD	<2	mg/L
Na	992.7		Cl	780.0	
K	11.6		HCO <sub>3</sub>	1012	
Ca	30.0		SO <sub>4</sub>	270.0	
Mg	59.5		NO <sub>2</sub> -N	0.002	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	0	
TOC	11.0		PO <sub>4</sub>	n/a	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ No casing was used during drilling at MEL

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Melbourne General Cemetery			M7
Location:	on roadway immediately downhill of 'Presbyterian R' Section			RL * m (ahd) Est. 42.0
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm solid flight auger			16/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.72 m	1.2 m	BBD
Casing, lift, soil samples	SWL filter pack screen m	Depth m	Description	
^^ s no	pack to 1.7  scr 1.5 – 2.7	0 – 0.5 0.5 – 1.2 1.2 – 2.7 2.7	grey-br sandy fill & topsoil firm yel-br sandy clay; minor coarse sand grey EW-HW siltstone with sandy laminae, hard at 2.6 complete in siltstone	

#### Record of Sampling and Water Levels

DATE	TIME	SWL m#	SAMPLE NO/S
1/4/97	n/a	3.62	M7/1
17/6/97	11:36	dry	
22/7/97	11:25	dry	
2/10/97	n/a	dry	
13/2/98	08:23	dry	
16/4/98	08:24	dry	
24/10/98	n/a	dry	

#### Initial Water Chemistry

Sample No: M7/1

Date:	11/4/97		Analyte values in mg/L		
pH	7.2	units	EC	6280	µS/cm
Eh	-111	mV	O <sub>2</sub>	n/a	% Sat
Temp	22.6	°C	BOD	nd	mg/L
Na	1529		Cl	960.0	
K	7.2		HCO <sub>3</sub>	n/a	
Ca	40.9		SO <sub>4</sub>	720.0	
Mg	96.8		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	0	
TOC	35.0		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
^^ No casing was used during drilling at MEL

**APPENDIX E**

**SITE INVESTIGATION INFORMATION**

**THE NECROPOLIS (SPRINGVALE CEMETERY), MELBOURNE, VIC,  
(SPR) S**



Figure E.1 Historical Perspective of SPR - 1951  
(aerial photography Melbourne Board of Works)



Figure E.2 Piezometer Locations at SPR  
(aerial photo base – Qascophoto 1993)

**Table E.1 Rainfall Data & Evaporation (Class A Pan) Data  
Period of Study and Overall  
including full month before sampling and final month  
for Station 86077, Moorabbin Airport (rainfall) and Station 86071,  
Melbourne Regional Office (evaporation) (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997					90	41	32.8	63.6	47.2	31.4	66	4.2	492.8
1998	122	69	20	57.8	41.2	71	37	25.8	44.8	91.8			
#readings	45	45	44	46	46	45	45	47	47	47	46	45	40
lowest	1.2	0.3	5.4	8.2	22.6	15.1	16.6	12	25	22.4	5.1	2.9	443.8
highest	137	210.5	129.6	157.8	160.1	139.8	165	127.7	122.2	165.4	180.6	146.6	965.9
average	48.1	43.8	46.5	63.4	75.8	58.3	67.0	68.6	68.7	72.7	62.0	57.2	730.1
median	40.6	36.8	44.5	61.55	77.1	59.1	64.2	68.7	62.4	73.4	54.65	54.8	726.7

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997					41.2	34.6	34.8	51	63.2	107.2	128	161	1139
1998	162.6	156.2	118.2	59.4	42.2	33.6	28.4	40.2	77.8	102.2			
#readings	44	44	44	44	44	44	44	44	44	44	43	43	43
lowest	130.1	103.8	82	46	29	23.3	22.1	33.5	48.2	72.9	86.2	111.4	904
highest	260.7	229.9	193.4	113.3	71.1	47.6	66.6	88.6	123.2	151	185	260.8	1592.2
average	182.3	153.3	121.7	78.0	48.8	33.7	36.9	51.7	73.6	108.9	135.2	164.1	1189.9
median	179.0	150.6	116.8	76.2	47.1	33.6	35.8	51.1	69.9	105.6	130.2	160.5	1143.6

**Table E.2 Summary of Hydraulic Test Data**

**Slug Tests**

**K in m/sec**

Well	Bouwer & Rice	Cooper et al.	Hvorslev	Comments
S8	7.19E-06			
S9		n/a		too rapid for Cooper method
S10	n/a			too quick for any method see Chapter Four
S12	n/a			too quick for any method see Chapter Four



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S1
Location:	'The Cedars', adjacent to entrance road, grid P473			RL * m (ahd) Est. 65.5
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm diam. solid flight auger – boom mounted			17/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		-0.05 m	2 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 0.6 S1/1 s 1.6 S1/2 s 2.4 S1/3 s 3.0 S1/4 s 3.8 S1/5 s 4.8 S1/6	pack to 2.9  scr 2.8 – 4.8	0 – 0.3 0.3 – 2.4 2.4 – 4.3 4.3 – 4.8 4.8	lt grey sandy topsoil mot red-br and orange gravelly sandy clay yel-br & red-br; grey silty and sandy layers damp red-br sand becoming FeOx rich complete in moist med sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
17/6/97	n/a	dry	
24/7/97	n/a	dry	
2/10/97	13:59	1.31	S1/4
11/2/98	15:33	4.29	S1/5
28/10/98	14:13	0.70	S1/7

#### Initial Water Chemistry

Sample No: S1/4

Date:	2/10/97		Analyte values in mg/L		
pH	7.1	units	EC	459	µS/cm
Eh	243	mV	O <sub>2</sub>	48.8	% Sat
Temp	14.8	°C	BOD	5	mg/L
Na	71.9		Cl	70.0	
K	6.1		HCO <sub>3</sub>	90.0	
Ca	23.1		SO <sub>4</sub>	74.0	
Mg	7.9		NO <sub>2</sub> -N	0.004	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	1.4	
TOC	3.0		PO <sub>4</sub>	0.3	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used for drilling bores 1 – 5 at SPR  
This borehole was originally finished above ground but in July 1997 this was altered to be below-ground (-0.05 m)

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S2
Location:	'The Maples' facing Verbena Road			RL * m (ahd) Est. 65.0
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm diam. solid flight auger – boom mounted			17/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		1.7 m	0.65 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 1.1 S2/1 s 2.1 S2/5 s 2.2 S2/2 s 3.0 S2/3 s 4.5 S2/4	pack to 3.1 scr 3.2 – 4.9	0 – 2.2 2.2 – 3.6 3.6 – 4.9 4.9	red-br, yel-br & grey mot sandy, gravel & silty sand mot red-br & yell-br & lt grey silty and clayey sands yel & red-br sands with ironstone concretions complete in iron-rich sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
17/6/97	n/a	dry	
24/7/97	17:15	4.50	S2/2
2/10/97	13:17	3.21	S2/4
10/2/98	11:28	4.95	S2/5
27/10/98	17:12	4.45	S2/7

#### Initial Water Chemistry

Sample No: S2/2

Date:	24/7/97		Analyte values in mg/L		
pH	6.8	units	EC	933	µS/cm
Eh	187	mV	O <sub>2</sub>	50.1	% Sat
Temp	16.8	°C	BOD	<1	mg/L
Na	133.7		Cl	110.0	
K	31.2		HCO <sub>3</sub>	114.6	
Ca	28.2		SO <sub>4</sub>	86.0	
Mg	11.6		NO <sub>2</sub> -N	0.010	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	14.1	
TOC	<1		PO <sub>4</sub>	0.8	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 1 – 5 at SPR

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S3
Location:	'Jewish Memorial Garden 2' near 10 <sup>th</sup> Avenue			RL * m (ahd) Est. 73.0
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm diam. solid flight auger – boom mounted			17/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.67 m	2 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 2.0 S3/1 s 2.8 S3/2 s 3.0 S3/3 s 4.8 S3/4	pack to 2.8  scr 2.85 – 4.85	0 – 0.4 0.4 – 2.0 2.0 – 2.8 2.8 – 4.85 4.85	lt grey-br sandy loam dk orange-br with red-br, yel-br & grey sandy clay firm grey silt and red/yell gravelly clay stiff grey and br sandy clay and clayey sand complete in stiff grey clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
17/6/97	15:43	1.27	S3/1
24/7/97	15:35	2.05	S3/2
2/10/97	16:03	1.71	S3/4
11/2/98	n/a	1.16	

#### Initial Water Chemistry

Sample No: S3/1

Date:	17/6/97		Analyte values in mg/L		
pH	6.7	units	EC	895	µS/cm
Eh	160	mV	O <sub>2</sub>	3.9	% Sat
Temp	16.9	°C	BOD	3.0	mg/L
Na	128.9		Cl	62.0	
K	3.7		HCO <sub>3</sub>	170.7	
Ca	16.3		SO <sub>4</sub>	59.0	
Mg	8.0		NO <sub>2</sub> -N	0.029	
NH <sub>4</sub>	0.18		NO <sub>3</sub> -N	23.4	
TOC	<1		PO <sub>4</sub>	2.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 1 – 5 at SPR

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S4
Location:	'Roman Catholic F' Section on 7 <sup>th</sup> Road			RL * m (ahd) Est. 73.2
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm diam. solid flight auger – boom mounted			17/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.73 m	2 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 2.0 S4/1 s 2.9 S4/2 s 4.7 S4/3	pack to 2.9  scr 2.85 – 4.85	0 – 0.4 0.4 – 2.9 2.9 – 4.1 4.1 – 4.85 4.85	lt grey-br sandy loam red-br and yell-br sandy clay and grey sands red and yell-br clayey sands sandy clay (med sand) & some cemented yel-r-br concs complete in grey sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
17/6/97	16:08	dry	
25/7/97	08:48	4.08	S4/2
2/10/97	15:15	1.49	S4/4
14/2/98	16:14	4.13	S4/5
17/4/98	08:48	5.05	S4/6
28/10/98	15:06	1.33	S4/7

#### Initial Water Chemistry

Sample No: S4/2

Date:	25/7/97		Analyte values in mg/L		
pH	6.3	units	EC	1074	µS/cm
Eh	-85	mV	O <sub>2</sub>	14.1	% Sat
Temp	17.2	°C	BOD	9.0	mg/L
Na	545.4		Cl	390.0	
K	3.1		HCO <sub>3</sub>	180.0	
Ca	7.4		SO <sub>4</sub>	290.0	
Mg	15.7		NO <sub>2</sub> -N	0.056	
NH <sub>4</sub>	0.22		NO <sub>3</sub> -N	0.6	
TOC	30.0		PO <sub>4</sub>	1.4	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 1 – 5 at SPR  
This bore was re-established just prior to the first sampling – moved out of a new driveway area

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S5
Location:	lowest-most background adjacent to Lakes grid G8148 and near west boundary			RL * m (ahd) Est. 56.0
Driller:	Van-Leeuwen Foundation Drilling			Date Drilled:
Drilling Method:	400 mm diam. solid flight auger – boom mounted			17/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.63 m	1.5 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 2.1 S 5/1 s 3.0 S 5/2 s 4.1 S 5/3	pack to 1.4  scr 2.8 – 4.3	0 – 0.5 0.5 – 2.1 2.1 – 3.5 3.5 – 4.3 4.3	lt grey-br sandy loam mot red-br, yell-br and grey gravelly sandy clay yel-br and grey clayey sand (med), red-br mot & concs grey clayey sand and sandy clay; yell-br mots & concs complete in grey coarse med sand, minor clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
20/6/97	08:40	4.16	S5/1
22/7/97	14:22	4.34	S5/2
3/10/97	11:24	3.68	S5/4
8/2/98	14:38	n/a	
14/4/98	14:47	n/a	
28/10/98	12:40	3.24	S5/7

#### Initial Water Chemistry

Sample No: S5/1

Date:	20/6/97		Analyte values in mg/L		
pH	6.3	units	EC	263	µS/cm
Eh	-51	mV	O <sub>2</sub>	10.1	% Sat
Temp	15.2	°C	BOD	nd	mg/L
Na	37.2		Cl	44.0	
K	1.0		HCO <sub>3</sub>	61.9	
Ca	7.8		SO <sub>4</sub>	3.2	
Mg	4.7		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0.63		NO <sub>3</sub> -N	0	
TOC	4.0		PO <sub>4</sub>	2.6	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 1 – 5 at SPR  
initially two piezometers (5A and 5B) were nested in the one hole here; 5A was dry and abandoned

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S8
Location:	background bore to underlying aquifer, adjacent to bore S5, below Lakes area and adjacent to west boundary, grid G8146			RL * m (ahd) Est. 56.5
Driller:	Geotest Drilling Pty. Ltd.			Date Drilled:
Drilling Method:	115 mm diam. solid flight auger, then 150 mm hollow flt			18/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.70 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 6.5 – 6.7 S8/1	pack to 3.0 scr 3.7 – 6.7	0 – 6.7 6.7	lithology as per borehole S5 complete in yel-br silty clay, sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
20/6/97	10:00	4.92	S8/1
22/7/97	15:38	4.88	S8/2, S888/2
3/10/97	12:40	4.48	S8/4
7/2/98	15:14	5.03	S8/5
14/4/98	15:00	5.11	S8/6
28/10/98	12:06	3.94	S8/7

#### Initial Water Chemistry

Sample No: S8/1

Date:	20/6/97		Analyte values in mg/L		
pH	5.2	units	EC	180.5	µS/cm
Eh	162	mV	O <sub>2</sub>	28.1	% Sat
Temp	17.5	°C	BOD	nd	mg/L
Na	29.5		Cl	43.0	
K	0.6		HCO <sub>3</sub>	37.1	
Ca	2.2		SO <sub>4</sub>	3.9	
Mg	1.8		NO <sub>2</sub> -N	0.002	
NH <sub>4</sub>	0.27		NO <sub>3</sub> -N	0	
TOC	2.0		PO <sub>4</sub>	3.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 8 & 9 at SPR  
solid flight auger to 4.5 m then reamed out with hollow flight and continued below watertable

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S9
Location:	'Boronia' Section near old front entrance on 1 <sup>st</sup> Avenue, far SW corner of cemetery			RL * m (ahd) Est. 57.2
Driller:	Geotest Drilling Pty. Ltd.			Date Drilled:
Drilling Method:	115 mm diam. solid flight auger, then 150 mm hollow flt			18/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.93 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 7.5 – 8.0 S9/1 s 14.0 S9/2	pack to 8.35 ∇ 11.55 scr 10.4 – 13.4	0 - 2.5 2.5 – 5.5 5.5 – ca 12 ca 12 – 14 14	red-br & mot grey sandy clay & clayey sand red-br sandy clay and clayey sand red-br coarse sand, minor clay lt yel sandy clay complete in sat'd lt yel sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
20/6/97	13:13	12.36	S9/1
25/7/97	10:30	12.31	S9/2
10/5/98	10:36	12.37	S9/5
14/4/98	16:10	12.42	S9/6

#### Initial Water Chemistry

Sample No: S9/1

Date:	20/6/97		Analyte values in mg/L		
pH	4.4	units	EC	432	µS/cm
Eh	233	mV	O <sub>2</sub>	n/a	% Sat
Temp	16.7	°C	BOD	nd	mg/L
Na	69.4		Cl	96.0	
K	0.1		HCO <sub>3</sub>	0	
Ca	2.8		SO <sub>4</sub>	14.0	
Mg	6.0		NO <sub>2</sub> -N	n/a	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	n/a	
TOC	2.0		PO <sub>4</sub>	n/a	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 8 & 9 at SPR  
solid flight auger to 8.0 m then reamed out with hollow flight and continued below watertable  
bore caved at base during piezometer installation

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	The Necropolis			S10
Location:	'Cassia Lawn' adjacent to Princes Highway, grid R1111			RL * m (ahd) Est. 57.0
Driller:	Geotech Pty Ltd			Date Drilled:
Drilling Method:	140 mm hollow flight auger, then 100 mm roller bit			18/12/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.71 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 6.0 S10/2 s 9.5 S10/1	pack to 6.4 ∇ 14.35 scr 14.3 – 17.3	0 – 6.0 6.0 – 9.5 9.5 – 14.4 14.4 – 17.3 17.3	dry red-br clay and sandy clay red-br v coarse sandy clay clayey coarse sand & ye silty sand coarse white sand complete in white sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/7/97	12:10	14.51	S10/2
8/2/98	13:48	14.60	S10/5
14/4/98	13:46	14.64	S10/6
3/10/97	n/a	14.50	

#### Initial Water Chemistry

Sample No: S10/2

Date:	25/7/97		Analyte values in mg/L		
pH	5.4	units	EC	7320	µS/cm
Eh	236	mV	O <sub>2</sub>	n/a	% Sat
Temp	14.7	°C	BOD	3.0	mg/L
Na	1168		Cl	2400	
K	8.0		HCO <sub>3</sub>	58.5	
Ca	32.7		SO <sub>4</sub>	100.0	
Mg	233.7		NO <sub>2</sub> -N	0.002	
NH <sub>4</sub>	0.01		NO <sub>3</sub> -N	0.1	
TOC	1.0		PO <sub>4</sub>	0.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 8 & 9 at SPR  
very difficult drilling, commenced with 140 mm hollow flight auger to 9.5 m then 100mm roller bit  
with air flushing



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE S12
Cemetery:	The Necropolis			RL * m (ahd) Est. 79.0
Location:	background bore to underlying aquifer , grid D9532, far NE corner of cemetery			Date Drilled: 18/12/96
Driller:	Strata Drilling Australia Pty. Ltd.			Supervised By: BBD
Drilling Method:	115 mm diam. solid flight auger, then 150 mm hollow ft			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.67 m	Screen Length: 6.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
\$ s 6 -10 S12/1 s 15 S 12/2 s 17.5 S12/3 s 23.0 S12/4 s 27 – 28 S12/5	pack to 10.4 scr 22.1 – 28.1	0 – 1.0 1.0 – 3.0 3.0 – 15.0 15.0 – 23.7 23.7 -28.1 28.1	lt br & red-br & grey mot silty clay lt br sandy clay red br sandy clay & clayey sand lt br fine sand, some med dk yel sand orange silty sand complete in sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
8/2/98	11:26	24.26	S12/5, S12/52*
14/4/98	11:10	24.52	S12/6, S12/62*

#### Initial Water Chemistry

Sample No: S12/5

Date:	8/2/98		Analyte values in mg/L	
pH	5.7	units	EC	3620 $\mu$ S/cm
Eh	201	mV	O <sub>2</sub>	24.1 % Sat
Temp	18.7	°C	BOD	8.0 mg/L
Na	663.3		Cl	1100
K	3.5		HCO <sub>3</sub>	336.5
Ca	21.6		SO <sub>4</sub>	40.0
Mg	115.9		NO <sub>2</sub> -N	0.015
NH <sub>4</sub>	0		NO <sub>3</sub> -N	3.5
TOC	3.0		PO <sub>4</sub>	0

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ no casing was used during the drilling of boreholes 12 at SPR  
solid flight auger to 23.7 m then hollow flight auger

**APPENDIX F**

**SITE INVESTIGATION INFORMATION**

**BUNURONG MEMORIAL PARK, MELBOURNE, VIC, (NEW) N**



Figure F.1 Historical Perspective of NEW - 1951  
(aerial photography Melbourne Board of Works)



Figure F.2 Historical Perspective of NEW – 1992  
(just prior to cemetery development)



Figure F.3 Piezometer Locations at NEW  
(after Cemetery Trust's CAD file)

**Table F.1 Rainfall & Evaporation (Class A Pan) Data  
Period of Study and Overall  
including full month before sampling and final month  
for Station 86077, Moorabbin Airport (rainfall) and Station 86071,  
Melbourne Regional Office (evaporation) (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997					90	41	32.8	63.6	47.2	31.4	66	4.2	492.8
1998	122	69	20	57.8	41.2	71	37	25.8	44.8	91.8			
#readings	45	45	44	46	46	45	45	47	47	47	46	45	40
lowest	1.2	0.3	5.4	8.2	22.6	15.1	16.6	12	25	22.4	5.1	2.9	443.8
highest	137	210.5	129.6	157.8	160.1	139.8	165	127.7	122.2	165.4	180.6	146.6	965.9
average	48.1	43.8	46.5	63.4	75.8	58.3	67.0	68.6	68.7	72.7	62.0	57.2	730.1
median	40.6	36.8	44.5	61.55	77.1	59.1	64.2	68.7	62.4	73.4	54.65	54.8	726.7

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997					41.2	34.6	34.8	51	63.2	107.2	128	161	1139
1998	162.6	156.2	118.2	59.4	42.2	33.6	28.4	40.2	77.8	102.2			
#readings	44	44	44	44	44	44	44	44	44	44	43	43	43
lowest	130.1	103.8	82	46	29	23.3	22.1	33.5	48.2	72.9	86.2	111.4	904
highest	260.7	229.9	193.4	113.3	71.1	47.6	66.6	88.6	123.2	151	185	260.8	1592.2
average	182.3	153.3	121.7	78.0	48.8	33.7	36.9	51.7	73.6	108.9	135.2	164.1	1189.9
median	179.0	150.6	116.8	76.2	47.1	33.6	35.8	51.1	69.9	105.6	130.2	160.5	1143.6

**Table F.2 Summary of Hydraulic Test Data**

**Slug Tests**

**K in m/sec**

Well	Bouwer & Rice	Cooper et al.	Hvorslev	Comments
N1	7.45E-06			
N2	6.86E-06			
N7	1.40E-05			too few early data for Cooper method
N8	6.08E-06	2.18E-06	3.98E-06	

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole N1
Cemetery:	Bunurong Memorial Park			RL * m (ahd) Est. n/a \$
Location:	adjacent to SE corner of main entrance			Date Drilled: <1996
Driller:	Strata Drilling Australia Pty Ltd			Supervised By: n/a
Drilling Method:	130 mm diam. hollow flight auger			
Piezometer Type: 50mm PVC class 12, PVC screen , cemented joint at top		Collar: 0.7 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.0 N2/1 s 2.8 N2/2 s 4.1 N2/3	scr 3.3 – 6.3	0 - 2 2 - 4.1 4.1 – 6.3 6.3	approximate description from nearby exploratory bore #2 on 17/12/96 soft-firm grey silty sand & sandy silt grey fine sand, yel mot fine grey sand complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
19/6/97	13:51	4.13	N1/2
24/7/97	08:37	5.21	N1/3
9/2/98	11:48	4.31	N1/5
16/4/98	14:26	4.48	N1/6
28/10/98	15:43	4.37	N1/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: N1/2

Date:	19/6/97		Analyte values in mg/L		
pH	6.6	units	EC	7820	µS/cm
Eh	140	mV	O <sub>2</sub>	39.5	% Sat
Temp	17.4	°C	BOD	2	mg/L
Na	1421		Cl	2300	
K	0.7		HCO <sub>3</sub>	148.7	
Ca	55.0		SO <sub>4</sub>	210.0	
Mg	146.9		NO <sub>2</sub> -N	0.001	
NH <sub>4</sub>	0.23		NO <sub>3</sub> -N	0	
TOC	0		PO <sub>4</sub>	3.7	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others (N1 – N6)  
Boreholes N1 – N6 completed with bentonite plug above sand pack

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole N2
Cemetery:	Bunurong Memorial Park			RL * m (ahd) Est. n/a \$
Location:	extreme NE corner of cemetery adjacent to boundary with farmhouse and main road			Date Drilled: <1996
Driller:	Strata Drilling Australia Pty Ltd			Supervised By: n/a
Drilling Method:	130 mm diam. hollow flight auger			
Piezometer Type: 50mm PVC class 12, PVC screen , cemented joint at top		Collar: 0.7 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.8 N1/1 s 2.2 N1/2 s 2.5 N1/3	scr 3.2 – 6.2	0 – 0.3 0.3 – 2.6 2.6 – 3.8 3.8 – 6.2 6.2	approximate description from nearby exploratory bore #1 on 17/12/96 lt br-grey sandy topsoil mot red-br yel-br & grey gravelly clay and sands grey clayey sand & yel0br sandy clay, 60 mm cobbles yel-br sandy silt and silty sands complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
19/6/97	15:33	3.55	N2/2
24/7/97	10:25	3.55	N2/3
9/2/98	12:52	3.79	N2/5
15/4/98	14:38	3.98	N2/6
28/10/98	14:10	3.92	N2/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: N2/2

Date:	19/6/97		Analyte values in mg/L		
pH	6.7	units	EC	3880	µS/cm
Eh	141	mV	O <sub>2</sub>	66.6	% Sat
Temp	16.1	°C	BOD	3	mg/L
Na	564.2		Cl	1200	
K	0.3		HCO <sub>3</sub>	100.0	
Ca	31.2		SO <sub>4</sub>	95.0	
Mg	81.9		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	0	
TOC	<1		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of  
borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others (N1 – N6)  
Boreholes N1 – N6 completed with bentonite plug above sand pack

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole N3
Cemetery:	Bunurong Memorial Park			RL * m (ahd) Est. n/a \$
Location:	SW corner of maintenance shed compound			Date Drilled: <1996
Driller:	Strata Drilling Australia Pty Ltd			Supervised By: n/a
Drilling Method:	130 mm diam. hollow flight auger			
Piezometer Type: 50mm PVC class 12, PVC screen , cemented joint at top		Collar: 0.7 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
	scr 2.9 – 5.9	5.9	no description available complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
24/7/97	12:16	4.35	N3/3
11/2/98	14:13	4.15	N3/5

#### INITIAL WATER CHEMISTRY

SAMPLE NO: N3/3

Date:	24/7/97		Analyte values in mg/L		
pH	6.3	units	EC	10850	µS/cm
Eh	137	mV	O <sub>2</sub>	3.2	% Sat
Temp	15.8	°C	BOD	1.0	mg/L
Na	1794		Cl	3500	
K	1.3		HCO <sub>3</sub>	243.8	
Ca	129.1		SO <sub>4</sub>	240.0	
Mg	275.5		NO <sub>2</sub> -N	0.003	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	0	
TOC	<1		PO <sub>4</sub>	0.1	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others (N1 – N6)  
Boreholes N1 – N6 completed with bentonite plug above sand pack



National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole N7
Cemetery:	Bunurong Memorial Park			RL * m (ahd) Est. n/a \$
Location:	adjacent to front of administration block and carpark, in garden			Date Drilled: 2/4/97
Driller:	Geotech Pty. Ltd.			Supervised By: BBD
Drilling Method:	160 mm diam. hollow flight auger			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.29 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 5 – 6 N7/1 s 8.3 N7/2	pack to 2.95 scr 5.3 – 8.3	0 – 2.2 2.2 – 3.5 3.5 – 8.3 8.3	well compacted clay fill red-br silty clay lt br fine sandy silt and silty sands, minor clay complete in silty sand	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
19/6/97	11:40	5.20	N7/2
23/7/97	09:45	5.12	N7/3
9/2/98	08:15	5.33	N7/5
15/4/98	08:55	5.53	N7/6
28/10/98	10:07	5.40	N7/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: N7/2

Date:	19/6/97		Analyte values in mg/L		
pH	6.5	units	EC	13320	µS/cm
Eh	144	mV	O <sub>2</sub>	9.5	% Sat
Temp	17.2	°C	BOD	1.0	mg/L
Na	2266		Cl	4400	
K	1.4		HCO <sub>3</sub>	207.3	
Ca	161.0		SO <sub>4</sub>	230.0	
Mg	369.8		NO <sub>2</sub> -N	0.003	
NH <sub>4</sub>	0.67		NO <sub>3</sub> -N	0	
TOC	<1		PO <sub>4</sub>	6.3	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others located in garden bed – unobtrusive collar

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole N8
Cemetery:	Bunurong Memorial Park			RL * m (ahd) Est. n/a \$
Location:	in lawn between Administration complex and crematorium			Date Drilled: 2/4/97
Driller:	Geotech Pty. Ltd.			Supervised By: BBD
Drilling Method:	160 mm diam. hollow flight auger			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.79 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 6 – 7 N8/1	pack to 1.8 ∇ 6.59 scr 5.5 – 8.5	0 – ca 2 2 – 3.5 3.5 – 8.55 8.55	clayey fill stiff red-br sandy clay lt br sandy silt complete in sandy silt	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
18/6/97	11:48	5.71	N8/2
23/7/97	10:44	5.44	N8/3
9/2/97	10:35	5.59	N8/5
15/4/98	12:22	5.71	N8/6
28/10/98	10:43	5.81	N8/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: N8/2

Date:	18/6/97		Analyte values in mg/L		
pH	6.4	units	EC	11500	µS/cm
Eh	-18	mV	O <sub>2</sub>	56.1	% Sat
Temp	17.2	°C	BOD	<25	mg/L
Na	2026		Cl	3700	
K	1.4		HCO <sub>3</sub>	195.1	
Ca	140.5		SO <sub>4</sub>	250.0	
Mg	315.7		NO <sub>2</sub> -N	0.005	
NH <sub>4</sub>	0.52		NO <sub>3</sub> -N	0	
TOC	4.0		PO <sub>4</sub>	5.0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others  
This borehole was re-opened and sand pack lowered 1 month after initial establishment

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole
Cemetery:	Bunurong Memorial Park			NT1
Location:	lawn area immediately in front of Administration complex, towards main driveway			RL * m (ahd) Est. n/a \$
Driller:	cemetery staff			Date Drilled:
Drilling Method:	Trench – excavation with 450 mm backhoe			27/2/97
Piezometer Type: 50mm PVC class 18, 0.5 mm slotted PVC screen		Collar:	Screen Length:	Supervised By:
		0.6 m	6.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.8 NT1/1 s 2.2 NT1/2 s 2.9 NT1/3 s 1.4 NT1/4	pack covers scr by 0.3 m	0 – 2.3 2.3 2.9	lt br sandy clay fill, minor gravel natural stripped surface: dk br sandy clay sump depth	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
2/4/97	n/a	n/a	NT1/1
18/6/97	09:21	1.26	NT1/2
23/7/97	14:26	1.26	NT1/3
9/2/98	14:53	1.25	NT1/5
15/4/98	10:09	1.24	NT1/6
28/10/98	11:59	1.24	NT1/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: NT1/1

Date:	2/4/97		Analyte values in mg/L		
pH	10.5	units	EC	1528	µS/cm
Eh	-254	mV	O <sub>2</sub>	n/a	% Sat
Temp	19.6	°C	BOD	15.0	mg/L
Na	281		Cl	260	
K	16.9		HCO <sub>3</sub>	n/a	
Ca	54.5		SO <sub>4</sub>	90.0	
Mg	1.6		NO <sub>2</sub> -N	n/a	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	0	
TOC	78.0		PO <sub>4</sub>	n/a	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others (N1 – N6)

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole
Cemetery:	Bunurong Memorial Park			NT2
Location:	lawn area immediately in front of Administration complex, towards crematorium end			RL * m (ahd) Est. n/a \$
Driller:	cemetery staff			Date Drilled:
Drilling Method:	Trench – excavation with 450 mm backhoe			27/2/97
Piezometer Type: 50mm PVC class 18, 0.5 mm slotted PVC screen		Collar:	Screen Length:	Supervised By:
		0.6 m	6.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
	pack covers scr by 0.3 m	3.3	excavated in clayey fill sump depth	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
18/6/97	09:58	1.09	NT2/2
23/7/97	13:13	1.11	NT2/3
9/2/98	15:35	1.12	NT2/5
15/4/98	10:52	1.02	NT2/6
29/10/98	12:34	1.56	NT2/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: NT2/2

Date:	18/6/97		Analyte values in mg/L		
pH	7.5	units	EC	1914	µS/cm
Eh	-132	mV	O <sub>2</sub>	4.6	% Sat
Temp	15.7	°C	BOD	11.0	mg/L
Na	245.4		Cl	190.0	
K	13.6		HCO <sub>3</sub>	n/a	
Ca	78.1		SO <sub>4</sub>	51.0	
Mg	57.2		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	0	
TOC	240.0		PO <sub>4</sub>	n/a	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others (N1 – N6)

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole
Cemetery:	Bunurong Memorial Park			NT3
Location:	rear (NW) corner of Muslim burial area adjacent to Maintenance shed			RL * m (ahd) Est. n/a \$
Driller:	cemetery staff			Date Drilled:
Drilling Method:	Trench – excavation with 450 mm backhoe			27/2/97
Piezometer Type: 50mm PVC class 18, 0.5 mm slotted PVC screen		Collar:	Screen Length:	Supervised By:
		0.74 m	6.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.0 N3/1 s 1.4 N3/2 s 2.2 N3/3	pack covers scr by 0.3 m	0 – 1.5 1.5 – 2.2 2.2	yel-br sandy silty clay fill natural stripped surface –yel-br & grey sandy clay sump depth	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
18/6/97	>15:00	dry	
23/7/97	11:30	dry	
15/4/98	16:00	dry	

#### INITIAL WATER CHEMISTRY

SAMPLE NO: nil

Date:	Analyte values in mg/L		
pH	units	EC	µS/cm
Eh	mV	O <sub>2</sub>	% Sat
Temp	°C	BOD	mg/L
Na		Cl	
K		HCO <sub>3</sub>	
Ca		SO <sub>4</sub>	
Mg		NO <sub>2</sub> -N	
NH <sub>4</sub>		NO <sub>3</sub> -N	
TOC		PO <sub>4</sub>	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
\$ accurate survey of all boreholes at NEW is required; height data was not available at the time of borehole establishment; boreholes 7, 8 and NT 1- 4 are approximately 2 m above all others (N1 – N6)

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole NT4
Cemetery:	Bunurong Memorial Park			RL * m (ahd) Est. n/a \$
Location:	front (SE) corner of Muslim burial adjacent to roadway			Date Drilled: 27/2/97
Driller:	cemetery staff			Supervised By: BBD
Drilling Method:	Trench – excavation with 450 mm backhoe			
Piezometer Type: 50mm PVC class 18, 0.5 mm slotted PVC screen		Collar: 0.69 m	Screen Length: 6.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.7 NT4/1 s 1.4 NT4/2		0 – 2.3 2.3 2.5	lt br sandy clay fill, minor gravel natural stripped surface: dk br sandy clay sump depth	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
18/6/97	15:25	RL -0.52	NT4/2
23/7/97	11:25	RL -0.58	NT4/3
11/2/98	13:19	2.29	NT4/5
16/4/98	15:25	2.56	NT4/6

#### INITIAL WATER CHEMISTRY

SAMPLE NO: NT4/2

Date:	18/6/97		Analyte values in mg/L		
pH	6.4	units	EC	1382	µS/cm
Eh	-53	mV	O <sub>2</sub>	13.9	% Sat
Temp	15.8	°C	BOD	12.0	mg/L
Na	104.2		Cl	90.0	
K	17.9		HCO <sub>3</sub>	560.8	
Ca	102.9		SO <sub>4</sub>	44.0	
Mg	55.7		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	0	
TOC	150.0		PO <sub>4</sub>	n/a	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

**APPENDIX G**

**SITE INVESTIGATION INFORMATION**

**CARR VILLA MEMORIAL PARK, LAUNCESTON, TAS, (LAU) L**



Figure G.1 Historical Perspective of LAU - 1946  
(aerial photography Tasmanian Government)





Figure G.2 Piezometer Locations at LAU  
(aerial photo base – Tasmapi, 1992)

**Table G.1 Rainfall & Evaporation (Class A Pan) Data  
 Period of Study and Overall  
 including full month before sampling and final month  
 for Station 91104, Launceston Airport (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1996					12.8	54.4	47.8	145.2	101.6	78.6	37.6	22.8	800
1997	77	27.2	17.4	10.2	105.6	36.2	40.6	32.2	65.6	28.4	38.2	13.2	491.8
1998	38.4	41.8	7	70.4	20.6	74.6	75	28.8	97.4	41.2			
# readings	67	67	67	67	67	66	66	68	68	68	67	67	65
minimum	3	0	2.1	4.6	4.4	11.7	13.1	13.2	8	13.7	9	0	409.9
maximum	153.8	164.1	106.3	183.3	183.6	181.2	192.8	229.2	149.1	163.1	121.8	140.8	953.1
average	43.5	40.1	38.8	55.8	62.1	60.8	78.1	77.6	63.4	61.5	50.8	51.3	684.4
median	38.4	31.1	31.6	47.4	56.0	55.9	70.3	71.1	60.9	56.7	48.6	46.4	661.5

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1996					41.4	27.6	27.8	54.4	79.6	111.2	137	187.5	1149.2
1997	203.8	144.6	123.2	81.6	36.2	20.4	24.6	39.2	66	117.6	156.4	214.6	1228.2
1998	233.4	183.4	na	78.8	37.4	32	33.2	47	74.8	110.7			
#readings	32	33	32	32	32	32	32	32	32	32	32	31	31
lowest	157.6	124.8	81.2	56.9	27.4	20	20.8	31.8	55.4	93.7	110	115.8	988.4
highest	284.8	233.7	181	100.6	67.1	50.6	59.9	79.7	129.2	173.1	212.5	282.7	1613.8
average	212.5	180.0	139.7	79.6	45.0	28.1	31.4	48.2	76.6	118.3	152.9	195.8	1308.5
median	206.5	182.8	138.6	80.1	44.3	26.4	30.9	46.0	73.3	113.3	152.3	191.0	1300.8

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L1
Location:	SE uphill area adjacent to Top of gully 'Lawn'			RL * m (ahd) Est. 91.0
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			18/2/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.68 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 0.8 L1/1 s 1.1 L1/2 s 1.7 L1/3 s 3.1 L1/4 s 4.7 L1/5 s 5.3 L1/6	pack to 1.9 scr 2.3 – 5.3	0 – 0.3 0.3 – 4.8 4.8 – 5.3 5.3	lt br gravelly sand yel-br & red-br clay & sandy clay clayey sand & stiff grey clay complete in clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/6/97	n/a	dry	
20/7/97	09:52	dry	
5/10/97	09:07	dry	
23/11/97	08:32	dry	
29/3/98	08:02	dry	
25/10/98	09:27	dry	

#### Initial Water Chemistry

Sample No: NIL

Date:	Analyte values in mg/L		
pH	units	EC	µS/cm
Eh	mV	O <sub>2</sub>	% Sat
Temp	°C	BOD	mg/L
Na		Cl	
K		HCO <sub>3</sub>	
Ca		SO <sub>4</sub>	
Mg		NO <sub>2</sub> -N	
NH <sub>4</sub>		NO <sub>3</sub> -N	
TOC		PO <sub>4</sub>	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
This borehole remained dry throughout the study

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L2
Location:	upper gully 'Lawn' adjacent to roadway			RL * m (ahd) Est. 83.0
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			18/2/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.68 m	1.5 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.8 L2/1 s 3.5 L2/2	pack to 0.9 scr 2.3 – 3.8	0 – 0.3 0.3 – 2.8 2.8 – 3.8 3.8	lt br clayey sand topsoil red-be & grey mot clays & sandy clays grey mot yel sands & clayey sands complete in sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/6/97	12:26	1.88	L2/1
20/7/97	10:46	1.78	L2/2, L222/2
5/10/97	10:03	1.64	L2/3
23/11/97	10:55	1.86	L2/4
29/3/98	10:20	2.50	L2/5
26/10/98	11:00	1.74	L2/6

#### Initial Water Chemistry

Sample No: L2/1

Date:	15/6/97		Analyte values in mg/L		
pH	5.2	units	EC	2580	µS/cm
Eh	-39	mV	O <sub>2</sub>	1.9	% Sat
Temp	16.8	°C	BOD	3	mg/L
Na	434.9		Cl	828.9	
K	6.3		HCO <sub>3</sub>	18.0	
Ca	8.7		SO <sub>4</sub>	21.0	
Mg	34.8		NO <sub>2</sub> -N	0.001	
NH <sub>4</sub>	1.32		NO <sub>3</sub> -N	0	
TOC	10.0		PO <sub>4</sub>	10.0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L3
Location:	middle of lower 'Lawn' section in filled gully above pond			RL * m (ahd) Est. 79.0
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			18/2/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.68 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.3 L3/1 s 1.7 L3/2 s 2.9 L3/3 s 3.6 L3/4 s 4.8 L3/5	pack to 1.9 scr 2.3 – 5.3	0 – 0.2 0.2 – 2.9 2.9 – 4.8 4.8 -5.3 5.3	lt br clay red-br & grey mot sandy clay yel & grey mot sandy clay mot yel-br sandy clay complete in grey & br sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/6/97	13:45	5.49	L3/1, L333/1
20/7/97	12:34	2.66	L3/2
5/10/97	12:00	1.57	L3/3
23/11/97	12:52	2.21	L3/4
29/3/97	14:00	3.16	L3/5
26/10/97	08:53	1.48	L3/6

#### Initial Water Chemistry

Sample No: L3/1

Date:	15/6/97		Analyte values in mg/L		
pH	4.4	units	EC	7280	µS/cm
Eh	63	mV	O <sub>2</sub>	1.9	% Sat
Temp	16.3	°C	BOD	50	mg/L
Na	1295		Cl	2430	
K	4.0		HCO <sub>3</sub>	0	
Ca	16.9		SO <sub>4</sub>	98.0	
Mg	174.6		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	1.64		NO <sub>3</sub> -N	0	
TOC	14.0		PO <sub>4</sub>	15.1	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L4
Location:	lowestmost position in "lawn" filled gully immediately adjacent and above Pond			RL * m (ahd) Est. 77.5
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			18/2/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.68 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 3.5 L4/1 s 3.9 L4/2 s 1.8 L4/3	pack to 2.1 scr 2.2 – 5.2	0 – 0.3 0.3 – 3.5 3.5 – 5.2 5.2	lt yel clayey topsoil lt yel-br clayey sand red-br & grey mot clay complete in clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/6/97	15:37	1.45	L4/1
20/7/97	13:37	0.97	L4/2
5/10/97	12:56	1.20	L4/3
23/11/97	13:54	1.64	L4/4
29/3/98	12:42	2.85	L4/5
25/10/98	16:52	1.25	L4/6

#### Initial Water Chemistry

Sample No: L4/1

Date:	15/6/97		Analyte values in mg/L		
pH	6.4	units	EC	1252	µS/cm
Eh	136	mV	O <sub>2</sub>	3.7	% Sat
Temp	14.4	°C	BOD	30.0	mg/L
Na	130.1		Cl	400.0	
K	42.4		HCO <sub>3</sub>	290.2	
Ca	67.2		SO <sub>4</sub>	72.0	
Mg	35.8		NO <sub>2</sub> -N	0.064	
NH <sub>4</sub>	1.46		NO <sub>3</sub> -N	4.6	
TOC	14.0		PO <sub>4</sub>	18.7	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L5
Location:	on perimeter road, NW boundary area below Section 'A2'			RL * m (ahd) Est. 75.0
Driller:	excavated by cemetery staff			Date Drilled:
Drilling Method:	450 mm bucket on backhoe			18/2/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.60 m	6.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s L5/1 s 1.9 L5/2 s L5/3	pack 0.4 above screen	0 – 0.3 0.3 – 1.3 1.5	lt br & grey sandy clay & gravelly sand firm – stiff yel-br & red-br clay sump	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
16/6/97	08:57	0.08	L5/1
21/7/97	10:44	0.82	L5/2
5/10/97	17:07	1.11	L5/3
25/11/97	12:20	1.48	L5/4
29/3/98	17:00	1.65	nil
26/10/98	15:19	1.72	L5/6

#### Initial Water Chemistry

Sample No: L5/1

Date:	16/6/97		Analyte values in mg/L		
pH	5.6	units	EC	2608	µS/cm
Eh	6	mV	O <sub>2</sub>	2.0	% Sat
Temp	11.3	°C	BOD	31.0	mg/L
Na	974.0		Cl	892.5	
K	2.0		HCO <sub>3</sub>	5.6	
Ca	9.7		SO <sub>4</sub>	4.0	
Mg	53.0		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0.18		NO <sub>3</sub> -N	0	
TOC	7.0		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
L5 – L7 are seepage trenches

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L6
Location:	on perimeter road, NW boundary area below Section 'A6' further NE than L5			RL * m (ahd) Est. 75.2
Driller:	excavated by cemetery staff			Date Drilled:
Drilling Method:	450 mm bucket on backhoe			18/2/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.6 m	6.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s L6/1	pack 0.3 above screen	0 – 0.3 0.3 – 1.6 1.6	lt br gravelly sand & sandy clay topsoil yel-br & red-br clay and sandy clay sump	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
16/6/97	09:36	0.78	L6/1
21/7/97	09:55	0.76	L6/2
5/10/97	16:26	1.09	L6/3
23/11/98	15:49	1.53	nil
30/3/98	09:23	1.86	L6/5
26/10/98	14:52	1.58	L6/6

#### Initial Water Chemistry

Sample No: L6/1

Date:	16/6/97		Analyte values in mg/L		
pH	4.1	units	EC	4030	µS/cm
Eh	36.7	mV	O <sub>2</sub>	15.2	% Sat
Temp	13.2	°C	BOD	10.0	mg/L
Na	681.8		Cl	1333	
K	4.1		HCO <sub>3</sub>	0	
Ca	31.6		SO <sub>4</sub>	7.0	
Mg	73.7		NO <sub>2</sub> -N	2.5	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	0.22	
TOC	10.0		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
L5 – L7 are seepage trenches



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L7
Location:	adjacent to western boundary 'A' Section			RL * m (ahd) Est. 77.5
Driller:	excavated by cemetery staff			Date Drilled:
Drilling Method:	450 mm bucket on backhoe			18/2/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.6 m	4.8 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s L7/1	pack 0.4 above screen	0 – 0.3 0.3 – 1.8 1.8	lt br & grey sandy clay & gravelly sand yel-br & red-br clay, sandy clay, some cobbles sump	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
16/6/97	10:35	0.81	L7/1
20/7/97	15:35	0.78	L7/2
5/10/97	15:31	0.97	L7/3
23/11/97	17:06	1.36	L7/4
29/3/98	16:22	1.63	L7/5
26/10/98	14:15	0.98	L7/6

#### Initial Water Chemistry

Sample No: L7/1

Date:	16/6/97		Analyte values in mg/L		
pH	5.5	units	EC	483.0	µS/cm
Eh	-85	mV	O <sub>2</sub>	2.8	% Sat
Temp	13.0	°C	BOD	100.0	mg/L
Na	842.9		Cl	1642	
K	1.3		HCO <sub>3</sub>	45.2	
Ca	13.9		SO <sub>4</sub>	6.0	
Mg	86.7		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	4.04		NO <sub>3</sub> -N	0	
TOC	16.0		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
L5 – L7 are seepage trenches

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L11
Location:	easternmost gully adjacent to Flora Reserve; attempt to find background bore – west side of gully			RL * m (ahd) Est. 75.5
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			24/11/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.53 m	1.5 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.5 L11/1	pack to 0.8 scr 1.1 -2.6	0 – 0.3 0.3 – 2.6 2.6	lt br topsoil yel & yel-red sandy clay & silty sand complete in yel-br silty sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/11/97	08:44	dry	
29/3/98	08:12	dry	
25/10/98	10:25	dry	

#### Initial Water Chemistry

Sample No: NIL

Date:	Analyte values in mg/L		
pH	units	EC	µS/cm
Eh	mV	O <sub>2</sub>	% Sat
Temp	°C	BOD	mg/L
Na		Cl	
K		HCO <sub>3</sub>	
Ca		SO <sub>4</sub>	
Mg		NO <sub>2</sub> -N	
NH <sub>4</sub>		NO <sub>3</sub> -N	
TOC		PO <sub>4</sub>	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L12
Location:	easternmost gully adjacent to Flora Reserve; attempt to find background bore – middle of gully			RL * m (ahd) Est. 75.5
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			24/11/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.57 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 3.5 L12/1 s 4.4 L12/2	pack to 1.6 scr 2.1 - 5.1	0 – 0.3 0.3 – 3.3 3.3 – 5.1 5.1	lt br sandy clay grey & mot red-grey sandy clays & clayey sands various yel sands and sandy clays complete in yel sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/11/97	08:45	dry	
29/3/98	08:14	dry	
25/10/98	09:45	dry	

#### Initial Water Chemistry

Sample No: NIL

Date:	Analyte values in mg/L		
pH	units	EC	µS/cm
Eh	mV	O <sub>2</sub>	% Sat
Temp	°C	BOD	mg/L
Na		Cl	
K		HCO <sub>3</sub>	
Ca		SO <sub>4</sub>	
Mg		NO <sub>2</sub> -N	
NH <sub>4</sub>		NO <sub>3</sub> -N	
TOC		PO <sub>4</sub>	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L13
Location:	immediately below pond in gully area			RL * m (ahd) Est. 74.0
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			24/11/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.54 m	1.5 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.5 L13/1	pack to 1.0 scr 1.2 – 2.7 ∇ 1.3	0 -1.1 1.1 – 2.5 2.5 – 2.7 2.7	dk br sandy topsoil mot grey & yel-br clayey sand orange & grey mot sandy clay complete in sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/11/97	09:36	4.82	
29/3/98	14:34	2.45	L13/5
25/10/97	14:32	1.83	L13/6

#### Initial Water Chemistry

Sample No: L13/5

Date:	29/3/98		Analyte values in mg/L		
pH	6.1	units	EC	234	µS/cm
Eh	-69	mV	O <sub>2</sub>	9.2	% Sat
Temp	16.7	°C	BOD	<2	mg/L
Na	14.7		Cl	14.0	
K	2.9		HCO <sub>3</sub>	146.3	
Ca	10.6		SO <sub>4</sub>	7.2	
Mg	17.4		NO <sub>2</sub> -N	0.004	
NH <sub>4</sub>	2.24		NO <sub>3</sub> -N	1.6	
TOC	n/a		PO <sub>4</sub>	0.7	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L14
Location:	immediately below pond in gully area			RL * m (ahd) Est. 73.5
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			24/11/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.54 m	2.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 3.5 L14/1 s 5.3 L14/2	pack to 2.8 scr 2.3 – 5.3	0 -1.1 1.1 – 2.5 2.5 – 5.3 5.3	dk br sandy topsoil mot grey & yel-br clayey sand mot red-grey sandy clay complete in sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/11/97	09:35	dry	
29/3/98	08:39	dry	
25/10/97	10:11	dry	

#### Initial Water Chemistry

Sample No: NIL

Date:	Analyte values in mg/L		
pH	units	EC	µS/cm
Eh	mV	O <sub>2</sub>	% Sat
Temp	°C	BOD	mg/L
Na		Cl	
K		HCO <sub>3</sub>	
Ca		SO <sub>4</sub>	
Mg		NO <sub>2</sub> -N	
NH <sub>4</sub>		NO <sub>3</sub> -N	
TOC		PO <sub>4</sub>	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>L15</b>
Cemetery:	Carr Villa Memorial Park			RL * m (ahd) Est. 67.0
Location:	lowest end (N) of main gully below Pond, at boundary fence of Opossum road			Date Drilled: 24/11/97
Driller:	Stacpoole Enterprises Pty Ltd			Supervised By: BBD
Drilling Method:	450 mm diam solid flight auger on boom			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.58 m	Screen Length: 1.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
	pack to 0.95 scr 1.2 – 2.2	0 – 0.5 0.5 – 1.2 1.2 – 2.2 2.2	dk br sandy topsoil yel-br & red-br mot sandy clay red-br yel-br & grey mot sandy clay & clayey sand complete in clayey sand	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/11/97	08:34	dry	
29/3/98	08:21	2.81	nil
25/10/98	12:00	1.16	L15/6

#### Initial Water Chemistry

Sample No: L15/6

Date:	25/10/98		Analyte values in mg/L		
pH	7.5	units	EC	325	µS/cm
Eh	-16.2	mV	O <sub>2</sub>	3.1	% Sat
Temp	14.0	°C	BOD	<2	mg/L
Na	56.3		Cl	16.0	
K	11.6		HCO <sub>3</sub>	98.8	
Ca	42.3		SO <sub>4</sub>	11.0	
Mg	10.0		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0.37		NO <sub>3</sub> -N	0.9	
TOC	n/a		PO <sub>4</sub>	0.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Carr Villa Memorial Park			L16
Location:	lowest end (N) of main gully below Pond, at boundary fence of Opossum road			RL * m (ahd) Est. 67.0
Driller:	Stacpoole Enterprises Pty Ltd			Date Drilled:
Drilling Method:	450 mm diam solid flight auger on boom			24/11/97
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.52 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.7 L16/1 s 4.1 L16/2 s 5.1 L16/3	pack to 2.8  scr 3.2 – 6.2	0 – 0.5 0.5 – 1.2 1.2 – 2.7 2.7 – 4.9 4.9 – 6.2 6.2	dk br sandy topsoil yel-br & red-br mot sandy clay red-br yel-br & grey mot sandy clay & clayey sand red & grey mot clayey sand yel-br sandy clay complete in sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
25/11/97	08:33	dry	
29/3/98	08:25	dry	
25/10/98	13:07	5.54	L16/6

#### Initial Water Chemistry

Sample No: L16/6

Date:	25/10/98		Analyte values in mg/L		
pH	6.1	units	EC	215.7	µS/cm
Eh	-147	mV	O <sub>2</sub>	2.7	% Sat
Temp	13.7	°C	BOD	<2	mg/L
Na	62.5		Cl	25.0	
K	5.8		HCO <sub>3</sub>	42.1	
Ca	4.3		SO <sub>4</sub>	25.0	
Mg	1.7		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0.67		NO <sub>3</sub> -N	3.7	
TOC	n/a		PO <sub>4</sub>	0.3	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

**APPENDIX H**

**SITE INVESTIGATION INFORMATION**

**CENTENNIAL PARK CEMETERY, ADELAIDE, SA, (CEN) C**





Figure H.1 Historical Perspective of CEN - 1949  
(aerial photography South Australian (S.A.) Government)



Figure H.2 Piezometer Locations at CEN  
(aerial photo base – S.A. Dept. Environment and Natural Resources, 1995)

**Table H.1 Rainfall & Evaporation (Class A Pan) Data  
Period of Study and Overall  
including full month before sampling and final month  
for Station 23031, Adelaide – Waite Institute (rainfall) and  
Station 23090, Adelaide - Kent Town (evaporation) (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997					61.2	45	34	115.6	78.4	63	48.4	21.6	546.8
1998	5.2	24.8	8.6	122.2	31.8	88.8	63	68.2	59.8	49.8			
#readings	74	74	74	74	74	74	74	74	74	74	73	72	72
lowest	0	0	0	1.4	1.6	12.3	30	11.5	9	2.4	2.1	2.4	326.4
highest	92.2	107.2	105.6	189.5	174.9	179	183.1	162.6	172.2	155	120.2	93.5	877.7
average	24.0	23.8	23.4	52.9	75.9	76.4	88.0	76.1	63.4	52.1	36.8	29.7	618.6
median	20.1	14.5	17.3	44.7	66.7	69.0	83.3	71.8	61.7	48.4	32.0	27.3	614.4

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997					39.4	42	44.4	58.6	74.4	140	171.6	185.2	1411
1998	208.2	179	145.2	79.2	57.2	35.8	32.6	57.8	100	122			
#readings	21	22	22	22	22	22	22	22	22	22	21	21	20
lowest	182	100.4	123.2	74.6	39.4	32.6	32.6	50.4	68.2	112	131.8	148.3	1268.1
highest	279.6	212.8	170.6	119.4	77.2	47.8	56.6	101	107.4	157.8	206.8	241.2	1616.4
average	220.1	184.4	152.0	91.3	58.0	41.4	45.6	64.0	89.8	135.9	170.2	201.2	1452.9
median	219.6	191.7	156.5	90.6	58.0	42.0	45.4	61.2	88.0	136.6	173.4	203.2	1436.9

Note: Continued from Chapter Three

At least two older bores are present on the site, one has probably been lost, and the second is used for some irrigation. The details of this latter bore in the northwestern corner are unknown; however, it is likely to have been established between 1970 and 1981 and is reported to be up to 97 m deep (Hall, 1994). All the official records (S.A. Dept. Mines and Energy, 1996) inaccurately record this information.

**Table H.2 Summary of Hydraulic Test Data**

**Slug Tests**

**K in m/sec**

Well	Bouwer & Rice	Cooper et al.	Hvorslev	Comments
C1	n/a			too few early data for Cooper method
C2	1.98E-06			too few early data for Cooper method
C3	n/a	7.28E-06	2.05E-05	
C4	n/a			recovery too slow for field evaluation

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C1
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 48.8
Location:	above vault area of 'Catholic J' Section, on Central Drive			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2 C1/1 s 3 C1/2	pack to ca 2.5 ▽ 3.6 scr 3.0 – 6.0	0 – 0.2 0.2 – 3.0 3.0 – 6.0 6.0	dk br sandy clay topsoil red-br sandy clay with caliche various red & br sandy clays, occ cobbles complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
17/10/96	12:15	3.62	
14/2/97	n/a	3.75	
29/6/97	16:17	3.74	C1/3
24/9/97	08:19	3.19	C1/4
22/2/97	16:13	3.75	C1/5

#### INITIAL WATER CHEMISTRY

SAMPLE NO: C1/3

Date:	29/6/97		Analyte values in mg/L		
pH	7.3	units	EC	7220	µS/cm
Eh	3	mV	O <sub>2</sub>	27.5	% Sat
Temp	17.8	°C	BOD	40	mg/L
Na	1273		Cl	1750	
K	7.1		HCO <sub>3</sub>	901.0	
Ca	153.3		SO <sub>4</sub>	261.0	
Mg	151.3		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0.01		NO <sub>3</sub> -N	0	
TOC	27.0		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C2
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 45.5
Location:	'Catholic H' Section, Central Drive near rotunda			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2 C2/1 s 4 C2/2 s 4.8 C2/3	pack to 1.8 ∇ 4.0  scr 3.5 – 6.5	0 – 0.3 0.4 – 0.6 0.6 – 6.5 6.5	lt br gravelly fill br-grey silty clay mot red-br & yel-br & grey sandy clay, caliche, occ gravel layers, minor ironstone complete in sandy clay	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
17/10/96	13:56	1.70	C2/1
14/2/97	n/a	2.21	C2/2
29/6/97	15:46	2.34	C2/3
24/9/97	10:24	1.99	C2/4

#### INITIAL WATER CHEMISTRY

SAMPLE NO: C2/1

Date:	17/10/96		Analyte values in mg/L		
pH	7.0	units	EC	7470	µS/cm
Eh	n/a	mV	O <sub>2</sub>	5.9	% Sat
Temp	18.6	°C	BOD	21	mg/L
Na	n/a		Cl	n/a	
K	n/a		HCO <sub>3</sub>	865.6	
Ca	n/a		SO <sub>4</sub>	n/a	
Mg	n/a		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	n/a		NO <sub>3</sub> -N	n/a	
TOC	9.6		PO <sub>4</sub>	2.2	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C3
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 46.1
Location:	bottom 'Catholic J' on City of Unley Avenue			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 3 C3/1 s 2.4 C3/2	pack to 0.4 ▽ 3.0 scr 1.8 – 4.8	0 – 4.8  4.8	various red-br clays & sandy clays occ gravel, refusal on cobble? complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
17/10/96	12:35	1.38	C3/1
14/2/97	n/a	2.08	C3/2
29/6/97	11:09	2.03	C3/3
24/9/97	11:14	1.64	C3/4
22/2/98	14:36	2.21	C3/5

#### INITIAL WATER CHEMISTRY

SAMPLE NO: C3/1

Date:	17/10/96		Analyte values in mg/L		
pH	6.9	units	EC	8660	µS/cm
Eh	n/a	mV	O <sub>2</sub>	81.9	% Sat
Temp	19.2	°C	BOD	<2	mg/L
Na	1324		Cl	n/a	
K	11.9		HCO <sub>3</sub>	873.0	
Ca	191.5		SO <sub>4</sub>	n/a	
Mg	186.6		NO <sub>2</sub> -N	0.005	
NH <sub>4</sub>	0.48		NO <sub>3</sub> -N	n/a	
TOC	2.8		PO <sub>4</sub>	2.0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C4
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 41.7
Location:	'Catholic K' Section, o perimeter road jctn North west Drive			Date Drilled: 21/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 9.5 C4/1 s 11 C4/2	pack to ca 4 scr 9.5 – 12.5	0 - 2.2 2.2 – 6.0 6.0 – 8.0 8.0 – 12.5 12.5	dk br gravelly clay & clay fill stiff yel-br clay often gravelly yel-br gravelly clay lt yel-br silty clay complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
17/10/96	n/a	2.59	C4/1
14/2/97	n/a	3.09	C4/2
29/6/97	12:23	3.09	C4/3, C444/3
24/9/97	10:35	2.78	C4/4
22/2/98	13:20	1.86	C4/5

#### INITIAL WATER CHEMISTRY

SAMPLE NO: C4/1

Date:	17/10/97		Analyte values in mg/L		
pH	6.7	units	EC	19520	µS/cm
Eh	n/a	mV	O <sub>2</sub>	64.3	% Sat
Temp	22.5	°C	BOD	4.0	mg/L
Na	4806		Cl	n/a	
K	67.7		HCO <sub>3</sub>	780.3	
Ca	891.5		SO <sub>4</sub>	n/a	
Mg	1310		NO <sub>2</sub> -N	0.013	
NH <sub>4</sub>	1.70		NO <sub>3</sub> -N	n/a	
TOC	3.6		PO <sub>4</sub>	1.9	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
area of this borehole substantially built up of in-cemetery clayey fill

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C5
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 43.4
Location:	adjacent to the lower gate of Central Drive, in 'General AF' Section			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2 C5/1 s 4 C5/2 s 6 C5/3	pack to 2.4 ▽ 3.0  scr 4.05 – 7.05	0 – 0.3 0.3 – 2.0 2.0 – 7.3  7.3	lt br gravelly fill lt br clay with caliche mot orange br white & grey sandy clay, caliche, occ gravel layers, minor ironstone complete in sandy clay, minor caving	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
17/10/96	14:33	6.20	C5/1, C10/1
14/2/97	n/a	1.91	C5/2
29/6/97	14:45	2.09	C5/3
24/9/97	14:12	1.49	C5/4
22/2/98	13:24	1.70	C5/5
1/10/98	12:54	1.47	C5/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: C5/1

Date:	17/10/96		Analyte values in mg/L		
pH	6.8	units	EC	23050	µS/cm
Eh	n/a	mV	O <sub>2</sub>	29.4	% Sat
Temp	20.2	°C	BOD	47.0	mg/L
Na	6959		Cl	n/a	
K	58.2		HCO <sub>3</sub>	1231	
Ca	581.0		SO <sub>4</sub>	n/a	
Mg	1662		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0.95		NO <sub>3</sub> -N	0	
TOC	15.6		PO <sub>4</sub>	0.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C6
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 68.8
Location:	adjacent to Central Drive exit from crematorium at boundary (Goodwood Road)			Date Drilled: 22/9/97
Driller:	Forests Electrical			Supervised By: BBD
Drilling Method:	450 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.5 C6/1 s 6.5 C6/2 s 3.9 C6/3	pack to 1.7 scr 2.05 – 5.05	0 – 1.5 1.5 – 2.4 2.4 – 5.05 5.05	stiff red-br clay, quartzite pebbles, caliche granules lt br clay with caliche granules and quartzite cobbles red-br sandy clays & gravelly clays, cobbles to 200mm complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
24/9/97	15:26	dry	
22/2/98	09:13	dry	
1/10/98	09:55	dry	

#### INITIAL WATER CHEMISTRY

SAMPLE NO: NIL

Date:	Analyte values in mg/L		
pH	units	EC	µS/cm
Eh	mV	O <sub>2</sub>	% Sat
Temp	°C	BOD	mg/L
Na		Cl	
K		HCO <sub>3</sub>	
Ca		SO <sub>4</sub>	
Mg		NO <sub>2</sub> -N	
NH <sub>4</sub>		NO <sub>3</sub> -N	
TOC		PO <sub>4</sub>	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
this general area used to be called 'Springbank' because of numerous springs – not now apparent  
(large sub-soil drain in Goodwood Road)



National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C7
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 44.5
Location:	lowestmost lawn part of 'Catholic G' Section adjacent to perimeter road			Date Drilled: 22/9/97
Driller:	Forests Electrical			Supervised By: BBD
Drilling Method:	450 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 5 C7/1	pack to 1.7 ∇ 3.2 – 3.6 scr 2.0 -5.0	0 - 0.2 0.2 – 0.4 0.4 – 5.0 5.0	lt br sandy loam topsoil lt grey gravelly sand yel-br and lt grey-br sandy clay with gravel bands complete in sandy clay	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
25/9/97	09:23	1.06	C7/4
22/2/98	09:35	1.60	C7/5
1/10/98	10:47	1.27	C7/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: C7/4

Date:	25/9/97		Analyte values in mg/L	
pH	7.2	units	EC	9480 μS/cm
Eh	194	mV	O <sub>2</sub>	88.6 % Sat
Temp	17.4	°C	BOD	5.0 mg/L
Na	1639		Cl	2510
K	15.7		HCO <sub>3</sub>	941.2
Ca	217.8		SO <sub>4</sub>	n/a
Mg	251.4		NO <sub>2</sub> -N	0.001
NH <sub>4</sub>	0.26		NO <sub>3</sub> -N	0
TOC	5.4		PO <sub>4</sub>	0

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole C8
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 44.0
Location:	lowestmost lawn part of 'Catholic E' Section adjacent to perimeter road			Date Drilled: 22/9/97
Driller:	Forests Electrical			Supervised By: BBD
Drilling Method:	450 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.2 C8/1 s 4.1 C8/2	pack to 1.8 ∇ 2.7 scr 2.0 – 5.0	0 - 0.5 0.5 -5.0 5.0	lt br & grey sandy loam & orange-br sandy clay mot grey & lt yel-br sandy clay, gravelly bands some caving from 2.7 complete	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s
24/9/97	15:05	1.73	C8/4
22/2/98	10:35	1.86	C8/5
1/10/98	11:55	1.29	C8/7

#### INITIAL WATER CHEMISTRY

SAMPLE NO: C8/4

Date:	24/9/97		Analyte values in mg/L		
pH	7.4	units	EC	12090	µS/cm
Eh	353	mV	O <sub>2</sub>	70.3	% Sat
Temp	17.5	°C	BOD	2.0	mg/L
Na	2137		Cl	3470	
K	24.2		HCO <sub>3</sub>	1359	
Ca	206.9		SO <sub>4</sub>	325.0	
Mg	328.0		NO <sub>2</sub> -N	0.003	
NH <sub>4</sub>	1.77		NO <sub>3</sub> -N	2.1	
TOC	9.6		PO <sub>4</sub>	0.3	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

National Study of Cemetery Groundwaters University of Technology, Sydney				Borehole CA & CB
Cemetery:	Centennial Park Cemetery			RL * m (ahd) Est. 70.9 & 73.0
Location:	two nearby holes in front lawn adjacent to Administration Complex			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2 Ca/1  s2 Cb/1 s3 Cb/2 s 4 Cb/3	nil	0 – 0.7 0.7 – 4.0 4.0 – 8.5  8.5	yel sandy fill red-br clay, occ gravel stiff, occ moist red-br & yel-br occ mot clay occ quartzite cobbles to 60 mm diam. abandoned	

#### RECORD OF SAMPLING AND WATER LEVELS

Date	Time	SWL#	Sample No/s

#### INITIAL WATER CHEMISTRY

SAMPLE NO: NIL

Date:	Analyte values in mg/L		
pH	units	EC	µS/cm
Eh	mV	O <sub>2</sub>	% Sat
Temp	°C	BOD	mg/L
Na		Cl	
K		HCO <sub>3</sub>	
Ca		SO <sub>4</sub>	
Mg		NO <sub>2</sub> -N	
NH <sub>4</sub>		NO <sub>3</sub> -N	
TOC		PO <sub>4</sub>	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
two attempts were made to intersect possible string gravel seepage lines for establishing a background bore – both attempts unsuccessful; these holes not completed with piezometers; similar soil conditions in each – this log CB borehole

**APPENDIX I**

**SITE INVESTIGATION INFORMATION**

**CHELTENHAM CEMETERY, ADELAIDE, SA, (HEL) H**



Figure I.1 Historical Perspective of HEL - 1949  
(aerial photography South Australian (S.A.) Government)



Figure I.2 Piezometer Locations at HEL  
(aerial photo base – S.A. Dept. Environment and Natural Resources, 1995)

**Table I.1 Rainfall Data (HEL) – Period of Study and Overall,  
including full month before sampling and final month;  
for Station 23034, Adelaide Airport (BOM, 2001)**

measurements in mm

Rainfall

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997	47.2	25.8	4.4	5.2	51.4	30.2	19.4	78.8	72.6	69.4	44.4	18.2	467
1998	7	20.4	8.8	95.2	26.2	74.4	44.8	44.6	49.4	43.8			
# readings	43	43	44	44	44	44	44	44	44	44	43	43	42
minimum	0.3	0	0	0.8	4.4	7.2	18.2	14.6	13.1	0.8	1	2.4	245.2
maximum	62.3	103.2	112.2	158.8	125.4	137.8	118	103.8	113.6	90.4	94.9	90.4	730.8
average	18.6	18.7	20.8	36.8	55.4	54.4	63.3	51.3	46.3	38.9	24.9	24.7	450.4
median	15.0	11.4	17.2	29.4	52.0	44.9	60.9	46.6	44.7	40.7	21.2	18.0	454.3

Evaporation

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1997	292.6	244.2	184.4	124.6	59.6	57.8	59.2	83.8	86.8	173.2	211.4	217.2	1794.8
1998	265.4	216.8	193.8	113	77.8	55.6	49.8	74.6	118.6	153.2			
# readings	17	17	17	17	17	17	17	17	17	17	17	16	16
lowest	220	185.4	142.8	106.4	59.6	48.4	49.8	72.8	85.2	132.4	154.6	183.4	1537.6
highest	332.6	284.8	236.4	139.8	106.2	64.6	73.6	111.8	136.6	199.8	271.2	298.6	2106.8
average	268.8	232.9	197.3	125.1	79.8	55.3	60.1	83.7	111.2	168.4	212.8	244.6	1844.0
median	269.8	239.0	198.8	126.8	78.2	54.8	59.4	81.0	114.4	169.2	212.6	247.0	1852.4

**Table I.2 Summary of Hydraulic Test Data**

Slug Tests

**K in m/sec**

Well	Bouwer & Rice	Cooper et al.	Hvorslev	Comments
H1	6.92E-06			
H2	5.98E-06			
H3	2.92E-05			
H4	4.84E-06			
H5	2.86E-05			
H6	4.07E-05			
H7	1.40E-05			

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>H1</b>
Cemetery:	Cheltenham Cemetery			
Location:	adjacent to Office area, High St., on Drive A, east side, south Path 1			RL * m (ahd) Est. 6.0
Driller:	Underdale Drillers Pty Ltd			Date Drilled:
Drilling Method:	150 mm solid flight auger – no casing			19/9/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		-0.05 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1 H1/1 s 3 H1/2 s 5 H1/3 s 5 H1/4	pack to 1.9  scr 2.9 -5.9	0 - 1.0 1.0 – 6.0 6.0	dk br silty caly lt br silty caly complete, some cavein	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
13/2/97	n/a	4.18	nil
30/6/97	13:27	4.49	H1/2
23/9/97	12:01	4.26	H1/3
23/2/98	15:20	4.36	H1/4
27/7/98	12:09	4.25	H1/5
1/10/98	15:08	3.97	H1/6

#### Initial Water Chemistry

Sample No: H1/2

Date:	30/6/97		Analyte values in mg/L		
pH	7.8	units	EC	4310	µS/cm
Eh	138	mV	O <sub>2</sub>	n/a	% Sat
Temp	20.3	°C	BOD	15	mg/L
Na	904.8		Cl	622	
K	13.4		HCO <sub>3</sub>	1360	
Ca	33.4		SO <sub>4</sub>	184.0	
Mg	68.3		NO <sub>2</sub> -N	0.004	
NH <sub>4</sub>	0.59		NO <sub>3</sub> -N	0	
TOC	28.0		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Cheltenham Cemetery			H2
Location:	drive A south side at Path 22, 'C' section			RL * m (ahd) Est. 5.9
Driller:	Underdale Drillers Pty Ltd			Date Drilled:
Drilling Method:	150 mm solid flight auger – no casing			19/9/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		-0.05 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2 H2/1	pack to 0.4  scr 3.0 – 6.0	0 – 0.5 0.5 – 2.8 2.8 – 6.0 6.0	dk br topsoil red-br silty clay various red-br clays & sandy clays complete some cavein	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
12/2/97	n/a	4.22	H2/1
30/6/97	10:35	4.55	H2/2
23/9/97	10:16	4.33	H2/3
23/2/98	15:15	4.43	
26/7/98	16:32	4.33	
2/10/98	n/a	3.90	H2/7

#### Initial Water Chemistry

Sample No: H2/1

Date:	12/2/97		Analyte values in mg/L		
pH	7.4	units	EC	1820	µS/cm
Eh	230	mV	O <sub>2</sub>	46.2	% Sat
Temp	24.1	°C	BOD	<2	mg/L
Na	85.2		Cl	168.6	
K	2.5		HCO <sub>3</sub>	n/a	
Ca	8.8		SO <sub>4</sub>	71.3	
Mg	9.8		NO <sub>2</sub> -N	0.006	
NH <sub>4</sub>	0.01		NO <sub>3</sub> -N	1.9	
TOC	3.2		PO <sub>4</sub>	3.2	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Cheltenham Cemetery			H3
Location:	drive B west side , north of Row 18, Section 'B'			RL * m (ahd) Est. 6.0
Driller:	Underdale Drillers Pty Ltd			Date Drilled:
Drilling Method:	150 mm solid flight auger – no casing			19/9/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		-0.05 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.5 H3/1 s 3 H3/2 s 6 H 3/3	pack to 2.15 ∇ 4.3 scr 3.0 -6.0	0 -1.5 1.5 – 6.0 6.0	dk br sandy silty clay d & lt br mot sandy clays, sometimes sandy complete	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
12/2/97	n/a	4.39	H3/1
30/6/97	14:38	4.67	H3/2
23/6/97	15:45	4.45	H3/3
23/2/98	10:19	4.52	H3/5
27/7/98	12:09	4.42	H3/6
2/10/98	13:02	4.13	H3/7

#### Initial Water Chemistry

Sample No: H3/1

Date:	12/2/97		Analyte values in mg/L		
pH	7.6	units	EC	4140	µS/cm
Eh	114	mV	O <sub>2</sub>	20.2	% Sat
Temp	25.9	°C	BOD	<2	mg/L
Na	691.8		Cl	563.0	
K	8.5		HCO <sub>3</sub>	1391	
Ca	14.7		SO <sub>4</sub>	179.3	
Mg	39.3		NO <sub>2</sub> -N	0.005	
NH <sub>4</sub>	0.16		NO <sub>3</sub> -N	2.1	
TOC	1.4		PO <sub>4</sub>	1.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>H4</b>
Cemetery:	Cheltenham Cemetery			RL * m (ahd) Est. 5.5
Location:	drive C west side , north of Path 6 , Section 'I'			Date Drilled: 19/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 4 H4/1	pack to 1.4  scr 2.5 – 5.5	0 – ca 0.3 0.3 – 4.0 4.0 – 5.5 5.5	lt br sandy fill lt br sandy silty clay lt br silty clay complete	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
12/2/97	n/a	3.74	nil
1/7/97	08:15	4.10	nil
23/9/97	14:53	3.90	nil
23/2/98	13:58	3.91	H4/5
26/7/98	16:05	3.86	
2/10/98	08:52	3.50	H4/7

#### Initial Water Chemistry

Sample No: H4/5

Date:	23/2/98		Analyte values in mg/L		
pH	8	units	EC	2670	µS/cm
Eh	42	mV	O <sub>2</sub>	n/a	% Sat
Temp	28	°C	BOD	>19	mg/L
Na	192.3		Cl	160	
K	5.5		HCO <sub>3</sub>	1000	
Ca	9.7		SO <sub>4</sub>	86	
Mg	15.7		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	3	
TOC	9		PO <sub>4</sub>	0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>H5</b>
Cemetery:	Cheltenham Cemetery			RL * m (ahd) Est. 5.3
Location:	drive C west side , north of Path 30, Section 'M'			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2 H5/1	pack to 1.7  scr 3.0 – 6.0	0 – 1.9 1.9 – 6.0 6.0	lt br silty clay silty & sandy clays complete some cavein	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
12/2/97	n/a	3.76	H5/1
1/7/97	10:37	4.10	H5/2
23/9/97	14:25	3.90	H5/3
23/9/98	12:29	3.92	H5/5
26/7/98	15:56	3.86	
2/10/98	10:10	3.51	H5/7

#### Initial Water Chemistry

Sample No: H5/1

Date:	12/2/97		Analyte values in mg/L		
pH	7.6	units	EC	3770	µS/cm
Eh	208	mV	O <sub>2</sub>	22.9	% Sat
Temp	23.6	°C	BOD	<2	mg/L
Na	592.0		Cl	213.6	
K	9.1		HCO <sub>3</sub>	1170.4	
Ca	23.1		SO <sub>4</sub>	52.2	
Mg	51.5		NO <sub>2</sub> -N	0.006	
NH <sub>4</sub>	0.41		NO <sub>3</sub> -N	0	
TOC	0.4		PO <sub>4</sub>	6.2	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>H6</b>
Cemetery:	Cheltenham Cemetery			RL * m (ahd) Est. 5.8
Location:	drive C east side , adjacent and north of Row 43, Section 'O'			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 4 H6/1 s 6 H6/2	pack to 1.8  scr 3.0 -6.0	0 – ca 0.5 0.5 – 4.0 4.0 – 6.0 6.0	dk br loamy clay with charcoal pieces mod stiff red-br clay silty sand complete	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
12/2/97	13:00	4.08	H6/1
30/6/97	15:36	4.48	H6/2
23/9/97	13:23	4.22	H6/3
20/2/97	15:09	4.22	
27/7/98	16:30	4.13	H6/6
2/10/98	11:25	3.94	

#### Initial Water Chemistry

Sample No: H6/1

Date:	12/2/97		Analyte values in mg/L		
pH	7.8	units	EC	6200	µS/cm
Eh	9	mV	O <sub>2</sub>	7.9	% Sat
Temp	24.0	°C	BOD	<2	mg/L
Na	419.1		Cl	448.4	
K	6.0		HCO <sub>3</sub>	926.6	
Ca	25.0		SO <sub>4</sub>	88.4	
Mg	59.0		NO <sub>2</sub> -N	0.002	
NH <sub>4</sub>	0.49		NO <sub>3</sub> -N	0	
TOC	1.		PO <sub>4</sub>	7.0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>H7</b>
Cemetery:	Cheltenham Cemetery			RL * m (ahd) Est. 5.5
Location:	drive D west side , between Rows 42 + 43			Date Drilled: 20/9/96
Driller:	Underdale Drillers Pty Ltd			Supervised By: BBD
Drilling Method:	150 mm solid flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: -0.05 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
	pack to 1.0 ∇ ca 3.0 scr 1.8 – 4.8	0 – 0.4 0.4 -5.5 5.5	dk br sandy clay topsoil red-br clay & silty clay complete but substantial cavein	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
13/2/97	n/a	4.01	H7/1
1/7/97	08:26	4.68	
24/7/97	18:00	4.14	H7/3
23/2/98	11:41	4.18	H7/5
27/7/98	13:18	4.03	H7/6
1/10/98	17:57	3.83	H7/7

#### Initial Water Chemistry

Sample No: H7/1

Date:	13/2/97		Analyte values in mg/L		
pH	7.5	units	EC	1738	µS/cm
Eh	137	mV	O <sub>2</sub>	39.1	% Sat
Temp	27.2	°C	BOD	<2	mg/L
Na	268.8		Cl	52.5	
K	16.8		HCO <sub>3</sub>	460.9	
Ca	32.7		SO <sub>4</sub>	22.0	
Mg	60.9		NO <sub>2</sub> -N	0.003	
NH <sub>4</sub>	0.27		NO <sub>3</sub> -N	0	
TOC	1.6		PO <sub>4</sub>	4.4	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
background bore in NE corner

**APPENDIX J**

**SITE INVESTIGATION INFORMATION**

**GUILDFORD CEMETERY, PERTH, WA, (GUI) G**



Figure J.1 Historical Perspective of GUI – 1948  
(aerial photography Western Australian (W.A.) Government)



Figure J2 Piezometer Locations at GUI  
(aerial photo base – W.A. Dept. of Land Administration, 1996)



**Table J.1 Rainfall & Evaporation (Class A Pan) Data  
Period of Study and Overall  
including full month before sampling and final month  
for Station 09021, Perth Airport (BOM, 2001)**

measurements in mm

**Rainfall**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1996											44.6	16.8	889.2
1997	0.8	7.8	27.6	26.4	77.6	105.6	121.6	124.8	105.6	31.6	6.6	0	636
1998	2.6	0	29.8	12.4	78.8	128.4	103	155.6	114.4				
# readings	54	54	54	54	55	55	55	55	55	54	54	54	53
lowest	0	0	0	0	15	65.3	63.8	23.2	11.5	1.3	1.3	0	523.8
highest	72.6	150.4	61.9	113.3	229	424.1	446.7	340.3	163	124.8	80.7	65.5	1164.7
average	6.8	16.1	15.0	41.8	105.2	173.1	161.9	118.6	71.0	47.2	26.2	11.4	797.8
median	1.8	6.5	9.7	35.9	106.8	173.7	158.4	112.4	66.0	41.6	22.8	8.5	791.2

**Evaporation**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
1996											209.6	290	2359.8
1997	385	280.6	266.2	147	104.4	58.8	77	86.6	101.2	186.4	209.2	307.4	2209.8
1998	323.4	276	251.2	153.4	93.4	64.7	58.6	81.8	115.8	189.1	233.2		
#readings	17	17	17	17	17	17	17	17	17	17	17	16	16
lowest	260.2	201.2	187.6	127.8	75.6	55.4	53	67	89.8	43.3	188.9	245	1870.8
highest	385	355.2	305.6	190.8	129	92.4	91.8	93.8	125	189.1	254.8	342.6	2359.8
average	321.9	279.2	246.4	157.9	97.1	68.3	67.8	83.0	109.1	156.0	216.3	274.5	2084.9
median	327.2	276.4	251.2	155.8	95.6	65.8	67.2	84.6	111.2	163.3	212.0	266.0	2073.9

**Table J.2 Summary of Hydraulic Test Data**

**Slug Tests**

**K in m/sec**

Well	Bouwer & Rice	Cooper et al.	Hvorslev	Comments
G1	1.74E-06			
G3	6.94E-07			
G5	n/a			too quick for any method
G8	4.47E-06			

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>G1</b>
Cemetery:	Guildford Cemetery			RL * m (ahd) 15.522
Location:	background clustered piezometer above 'Greek Orthodox' area			Date Drilled: 13/11/96
Driller:	GFWA			Supervised By: BBD
Drilling Method:	200 mm hollow flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.74 m	Screen Length: 1.5 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 1.0 G1/1 s 2.0 G1/2 s 2.8 G1/3 s 3.0 G1/4 s 3.7 G 1/5 s 6.0 G1/6	pack to 3.1 ∇ 2.9 scr 4.5 – 6.0	0 – 0.3 0.3 – 2.7 2.7 – 2.8 2.8 – 5.5 5.5 – 6.1 6.1	loose lt grey fine sand ye fine-med sand beige gravelly sand, pebbles to 15 mm diam yel silty coarse sand yel-br clayey coarse sand complete, refusal on cobble	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/96	n/a	3.74	G1/1
10/2/97	n/a	4.74	G1/2
3/7/97	09:12	5.58	G1/3
26/9/97	14:31	4.05	G1/4
24/2/98	12:40	6.18	G1/5
25/7/98	10:03	6.53	nil
25/9/98	12:46	4.10	G1/7

#### Initial Water Chemistry

Sample No: G1/1

Date:	15/11/96		Analyte values in mg/L		
pH	7.3	units	EC	903	µS/cm
Eh	142	mV	O <sub>2</sub>	29.3	% Sat
Temp	17.5	°C	BOD	n/a	mg/L
Na	100.8		Cl	n/a	
K	5.2		HCO <sub>3</sub>	163.4	
Ca	69.0		SO <sub>4</sub>	n/a	
Mg	13.8		NO <sub>2</sub> -N	0.315	
NH <sub>4</sub>	0.74		NO <sub>3</sub> -N	6.3	
TOC	n/a		PO <sub>4</sub>	n/a	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
G1 and G2 are clustered for background bores  
bores G1 & G2 are completed with bentonite seal of 0.3 m thickness

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Guildford Cemetery			<b>G2</b>
Location:	background clustered piezometer above 'Greek Orthodox' area			RL * m (ahd) 15.497
Driller:	GFWA			Date Drilled:
Drilling Method:	200 mm hollow flight auger – no casing			13/11/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.69 m	Screen Length: 3.0 m	Supervised By: BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 5.0 G 2/1	pack to 1.0 scr 2.0 -5.0 bentonite 0.7		for detail log see G1	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/96	n/a	3.69	G2/1
10/2/97	n/a	4.77	
30/7/97	08:14	dry	
26/9/97	13:55	3.99	G2/4
24/2/98	12:35	dry	
25/7/98	10:04	dry	
25/9/98	12:02	4.89	G2/7

#### Initial Water Chemistry

Sample No: G2/1

Date:	15/11/97		Analyte values in mg/L		
pH	5.8	units	EC	266.8	µS/cm
Eh	211	mV	O <sub>2</sub>	11.7	% Sat
Temp	19.6	°C	BOD	n/a	mg/L
Na	27.7		Cl	n/a	
K	2.5		HCO <sub>3</sub>	19.5	
Ca	8.1		SO <sub>4</sub>	n/a	
Mg	7.9		NO <sub>2</sub> -N	0.047	
NH <sub>4</sub>	0.02		NO <sub>3</sub> -N	7.9	
TOC	n/a		PO <sub>4</sub>	0.4	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
G1 and G2 are clustered for background bores  
bores G1 & G2 are completed with bentonite seal of 0.3 m thickness

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Guildford Cemetery			G3
Location:	far NW corner of cemetery edge of 'General F' Section clustered with G4			RL * m (ahd) 12.605
Driller:	GFWA			Date Drilled:
Drilling Method:	200 mm hollow flight auger – no casing			13-14/11/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.73 m	1.5 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2 G3/1 s 3.5 G3/2 s 6.0 -6.5 G3/3	pack to 2.2  scr 4.5 – 6.0	0 – 0.2 0.2 – 3.5 3.5 – 6.0 6.0 – 6.5 6.5	lt grey fine sand yel med sand white silty sand stiff grey-green sandy clay complete	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/96	n/a	2.70	
11/2/97	n/a	3.20	
2/7/97	n/a	dry	
27/9/97	11:50	3.23	
24/2/98	08:52	dry	
23/7/98	15:55	4.34	G3/6
25/8/98	14:45	3.44	G3/7

#### Initial Water Chemistry

Sample No: G3/6

Date:	23/7/98		Analyte values in mg/L		
pH	6.0	units	EC	366	µS/cm
Eh	60	mV	O <sub>2</sub>	n/a	% Sat
Temp	20.8	°C	BOD	5.0	mg/L
Na	21.0		Cl	20.0	
K	10.2		HCO <sub>3</sub>	24.3	
Ca	11.9		SO <sub>4</sub>	9.0	
Mg	16.3		NO <sub>2</sub> -N	0.019	
NH <sub>4</sub>	0.33		NO <sub>3</sub> -N	17.0	
TOC	5.0		PO <sub>4</sub>	3.9	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
G3 and G4 were clustered as lowest-most bores  
bore G3 was re-drilled twice as the bottom caved-in  
G3 & G4 bores required extensive de-sludging on numerous occasions – prevented early sampling

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>G4</b>
Cemetery:	Guildford Cemetery			RL * m (ahd) 12.609
Location:	far NW corner of cemetery edge of 'General F' Section clustered with G4			Date Drilled: 13-14/11/96
Driller:	GFWA			Supervised By: BBD
Drilling Method:	200 mm hollow flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.49 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
	pack to 0.6  scr 1.3 – 4.3	4.3	see log for G3  complete in sands	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/96	n/a	2.637	
11/2/97	n/a	3.54	G4/2, G84/2
2/7/97	10:06	3.90	G4/3
27/9/97	12:17	2.97	G4/4
24/2/98	08:52	4.31	
23/7/98	11:53	4.26	
25/8/98	14:08	3.37	G4/7

#### Initial Water Chemistry

Sample No: G4/2

Date:	11/2/97		Analyte values in mg/L		
pH	5.8	units	EC	607	µS/cm
Eh	226	mV	O <sub>2</sub>	40.8	% Sat
Temp	26.5	°C	BOD	<5	mg/L
Na	22.8		Cl	33.1	
K	11.7		HCO <sub>3</sub>	20.5	
Ca	22.3		SO <sub>4</sub>	<1	
Mg	22.7		NO <sub>2</sub> -N	0	
NH <sub>4</sub>	0		NO <sub>3</sub> -N	32.2	
TOC	20.0		PO <sub>4</sub>	1.0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise  
G3 and G4 were clustered as lowest-most bores  
bore G3 was re-drilled twice as the bottom caved-in  
G3 & G4 bores required extensive de-sludging on numerous occasions –prevented early sampling

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Guildford Cemetery			<b>G5</b>
Location:	adjacent to NW boundary below "Muslim" Section			RL * m (ahd) 11.718
Driller:	GFWA			Date Drilled:
Drilling Method:	200 mm hollow flight auger – no casing			13/11/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.71 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 4.4 G5/1	pack to 0.8 ∇ 1.8 scr 1.3 – 4.3	0 – 0.3 0.3 – 4.4 4.4	lt grey organic rich fine sand white-beige med fine sand refusal in firm clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/97	n/a	1.72	
10/2/97	n/a	2.60	G5/2
2/7/97	13:05	2.90	G5/3
26/9/97	15:27	2.13	G5/4, G555/4
24/2/98	09:00	3.35	G5/5
23/7/98	11:21	3.20	G5/6
29/7/97	08:34	4.37	G5/7

#### Initial Water Chemistry

Sample No: G5/2

Date:	10/2/97		Analyte values in mg/L		
pH	5.8	units	EC	667	µS/cm
Eh	174	mV	O <sub>2</sub>	11.2	% Sat
Temp	28.9	°C	BOD	<5	mg/L
Na	40.3		Cl	31.1	
K	11.6		HCO <sub>3</sub>	14.0	
Ca	43.9		SO <sub>4</sub>	<1	
Mg	23.0		NO <sub>2</sub> -N	0.013	
NH <sub>4</sub>	0.50		NO <sub>3</sub> -N	23.7	
TOC	23.0		PO <sub>4</sub>	4.7	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Guildford Cemetery			<b>G6</b>
Location:	adjacent to Kalamanda Road and W entrance on North side			RL * m (ahd) 13.830
Driller:	GFWA			Date Drilled:
Drilling Method:	200 mm hollow flight auger – no casing			13/11/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.73 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.0 G6/1 s 3.9 G6/2 s 5.4 G6/3	pack to 1.1 ▽ 2.7 scr 2.4 -5.4	0 – 0.3 0.3 -2.3 2.3 – 5.4 5.4	lt grey organic fine sand yel-br fine sand fine white sand complete	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/96	n/a	3.51	
10/2/97	n/a	4.30	G6/2
2/7/97	10:50	4.82	G6/3
27/9/97	08:37	4.00	G6/4
24/2/98	16:43	4.96	G6/5
23/7/98	10:45		
28/9/97	07:48	4.43	G6/7

#### Initial Water Chemistry

Sample No: G6/2

Date:	10/2/97		Analyte values in mg/L		
pH	6.8	units	EC	1061	µS/cm
Eh	38	mV	O <sub>2</sub>	20.6	% Sat
Temp	25.1	°C	BOD	<5	mg/L
Na	64.5		Cl	103.6	
K	1.2		HCO <sub>3</sub>	97.4	
Ca	27.8		SO <sub>4</sub>	28.9	
Mg	10.2		NO <sub>2</sub> -N	0.005	
NH <sub>4</sub>	1.0		NO <sub>3</sub> -N	10.4	
TOC	30.0		PO <sub>4</sub>	12.0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE
Cemetery:	Guildford Cemetery			<b>G7</b>
Location:	adjacent to SW corner of 'Roman Catholic D' Section			RL * m (ahd) 13.286
Driller:	GFWA			Date Drilled:
Drilling Method:	200 mm hollow flight auger – no casing			14/11/96
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar:	Screen Length:	Supervised By:
		0.78 m	3.0 m	BBD
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 2.0 G7/1	pack to 0.5 ∇ 1.7 1.2 – 4.2	0 – 0.2 0.2 – 4.2 4.2	lt grey fine sand white clayey fine sand; caving at 1.7 complete	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/96	n/a	2.65	
11/2/97	09:10	3.45	G7/2, G14/2
3/7/97	10:23	3.88	G7/3, G777/3
27/9/97	10:50	3.15	G7/4
24/2/98	12:00	4.19	
23/7/98	09:09	4.22	G7/6
29/9/97	10:31	3.36	G7/7

#### Initial Water Chemistry

Sample No: G7/2

Date:	11/2/97		Analyte values in mg/L		
pH	6.0	units	EC	611	µS/cm
Eh	223	mV	O <sub>2</sub>	30.5	% Sat
Temp	27.4	°C	BOD	<5	mg/L
Na	63.1		Cl	37.1	
K	6.2		HCO <sub>3</sub>	42.9	
Ca	12.9		SO <sub>4</sub>	14.3	
Mg	184		NO <sub>2</sub> -N	0.005	
NH <sub>4</sub>	0.38		NO <sub>3</sub> -N	3.3	
TOC	20.0		PO <sub>4</sub>	5.0	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise



NATIONAL STUDY OF CEMETERY GROUNDWATERS UNIVERSITY OF TECHNOLOGY, SYDNEY				BOREHOLE <b>G8</b>
Cemetery:	Guildford Cemetery			RL * m (ahd) 13.822
Location:	at North boundary fence, end of road between "Roman Catholic H and F" Sections			Date Drilled: 14/11/96
Driller:	GFWA			Supervised By: BBD
Drilling Method:	200 mm hollow flight auger – no casing			
Piezometer Type: 50mm PVC class 18, PVC screen 0.5mm slots		Collar: 0.68 m	Screen Length: 3.0 m	
Casing, lift, soil samples m	water made filter pack screen m	Depth m	Description	
s 5 G8/1 s 5.6 G8/2	pack to 2.3 ∇ 3.1 scr 2.6 – 5.6	0 – 0.3 0.3 – 4.0 4.0 - 5.6 5.6	organic lt grey fine sand yel & yel-br fine-med sand yel clayey sand complete in stiff grey-green sandy clay	

#### Record of Sampling and Water Levels

DATE	TIME	SWL#	SAMPLE NO/S
15/11/96	n/a	3.29	
11/2/97	n/a	4.18	G8/2
2/7/97	15:42	4.52	G8/3
27/9/97	09:32	3.67	G8/4
24/2/98	10:53	4.81	G8/5, G888/5
23/7/98	13:30	4.84	G8/6
24/9/98	09:33	3.95	G8/7

#### Initial Water Chemistry

Sample No: G8/2

Date:	11/2/97		Analyte values in mg/L		
pH	6.4	units	EC	449	µS/cm
Eh	164	mV	O <sub>2</sub>	62.8	% Sat
Temp	n/a	°C	BOD	<5	mg/L
Na	31.6		Cl	31.9	
K	4.2		HCO <sub>3</sub>	74.0	
Ca	11.5		SO <sub>4</sub>	13.1	
Mg	22.1		NO <sub>2</sub> -N	0.195	
NH <sub>4</sub>	0.24		NO <sub>3</sub> -N	9.2	
TOC	33.0		PO <sub>4</sub>	5.5	

**Notes:** \*RL is approximate at collar-natural junction; referenced to Australian Height Datum (ahd)  
# SWL measured from top of collar unless indicated otherwise

**APPENDIX K**  
**SUMMARY OF ALL SOIL TEST RESULTS**

## Notes to Table K.1 – All Soil Results

Soil samples were collected either during the preliminary investigation of each site by pitting or large diameter augering, or, during the installation of piezometers. All samples are disturbed. They are grab samples which were collected immediately after exposure on-site and placed into a labeled, new, sealed plastic bag until examined. All soil analyses were carried out in laboratories at UTS. Site borehole and trench/pit logs are found in the individual site Appendices (B – J) and indicate the location of each sample. No samples were recovered from existing graves or disturbed gravefill – all represent original soils (or piezometer filter pack).

Some errors in the various processes associated with the soil testing;: for example, in the sample numbering system, the calculation of CEC, missed testing. Where there is uncertainty in the data the result space is blank. The filter sands were not tested for all parameters. “n/a” means not available or not measured.

Notation for the data headed “Sat'd/vadose etc”

ua	the sample is from the underlying aquifer – saturated zone (for SPR, NEW, CEN)
X	the sample is from the saturated zone
EXP BH	the sample was taken from an exploratory borehole drilled prior to the establishment of sampling wells
PIT	the sample was taken from an exploratory pit dug with a backhoe prior to the establishment of sampling wells
TRENCH	the sample was taken from a sampling drainage trench during construction
W6	indicates the constructed seepage well; used in order to avoid confusion

Notation for the data headed “Description”

br	brown
concs	concentration/s, concretions
diam	diameter
dk	dark
Feox	iron oxide/s
lt	light
mat	material
med	medium
mot	mottled
occ	occasional
qtz	quartz
v	very
yel	yellow

Notation for the data headed “Colour”

Colour was determined using the Munsell Soil Colour Charts

Notation for the data headed “Grading”

The particle size distribution is reported as Cumulative Percentage Retained on the relevant sieve size.

Sieve sizes are in phi units  $[-\log_2(\text{size in mm})]$

To calculate permeabilities substitution of sizes was necessary:  $>-4.0$  phi to 4.76 mm;  $<4.0$  phi to 0.03 mm.

Notation for the data headed “USCS Classification”

The soils have been classified according to the scheme know as the USCS. Single, dual, or couple pairs of letter symbols are used to denote the soil type. Table K.2 sets out the key descriptors used and their meanings (US Bureau of Reclamation, 1960). The first letter is the most important in characterising the soil.

Table K.2 USCS Symbols and Descriptions

USCS symbol	Description
G	gravel; coarse particles $> 4.76$ mm diameter
S	sand; a coarse particle larger than 0.074 mm diameter and smaller than 4.76 mm
M	silt; a fine particle – nonplastic, demonstrate dilatancy, physically unstable when wet
C	clay; extremely fine particles which behave plastically
W	well graded; that is a regular mixture of particle sizes
P	poorly graded; that is very even-sized particles
SW	well-graded clean sand
SP	poorly graded clean sand
SM	sand with silty fines
SC	sand with clayey fines
H	fine soil with high liquid limit (high compressibility)
L	fine soil with low liquid limit (low compressibility)
ML, CL	silts or clays with low plasticity; $>50\%$ of particles are fine
MH, CH	silts or clays with high plasticity; $>50\%$ of particles are fine
common boundary classifications, or soils showing a range of properties:- SP-SM, SP-SC, SC-CL, SC-ML, ML-MH, CL-CH, ML-CL, MH-CH	

Notation for the data headed “k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup>”

Krumbein and Monk’s original work reported results in units of darcys; these have been converted to units of cm<sup>2</sup>. (1 darcy = 9.87 x 10<sup>-9</sup> cm<sup>2</sup>)

Notation for the data headed “K - hydraulic conductivity (after Hubbert's method), m/sec”

k from the previous data was converted to K by multiplying by ( $\rho_w \cdot g / \mu$ ), where  $\rho_w$  the density of water ( usually 998.2 kg/m<sup>3</sup> at 20 °C) and  $\mu$  the dynamic viscosity (usually 1.008 x 10<sup>-3</sup> kg/m.s at 20 °C) at the temperature, pressure and TDS required. g the value of gravity was taken as 9.806 m.s<sup>-2</sup>. In general, applying corrections to constants for conversion purposes has little practical value given that g, TDS (affecting density), and the governing conditions vary from place to place. However, because of the amount of data available in this Study more precise values of K were calculated using representative site data (Table K.3).

Table K.3 Representative Temperature, Density and Viscosity Values

site	groundwater temperature °C		groundwater TDS (calculated) mg/L		density*	dynamic* viscosity
	range	median (#)	range	median (#)	kg/m3	cP**
BOT	12.4-27.5	20.7 (46)	187-738	334 (40)	998.06	0.990
WOR	13.1-24.3	18.1 (47)	59-637	173 (41)	998.58	1.06
MEL	15.3-23.5	19.9 (13)	750-2596	1293 (7)	998.23	1.01
SPR	14.0-18.8	16.4 (36)	103-3984	902 (28)	998.88	1.10
NEW	11.3-21.9	16.9 (37)	828-8120	3990 (27)	998.79	1.08
LAU	9.7-21.3	14.0 (38)	169-2779	847 (20)	999.24	1.17
CEN	16.8-25.3	20.3 (30)	3723-15964	8644 (21)	1004.0	1.00
HEL	19.5-28.5	21.7 (30)	661-2989	2095 (23)	997.85	0.967
GUI	15.9-28.9	20.0 (36)	154-626	301 (26)	998.21	1.01

(#) refers to the number of measurements considered

\* approximate values given for the median groundwater temperature; at TDS < 7000 mg/L the density variation compared to pure water is considered unimportant (Hem, 1989)

\*\* 1cP (centipoise) = 1N.s/m<sup>2</sup> x 10<sup>-3</sup> = kg/m.s x 10<sup>-3</sup>

Notation for the data headed “Chemistry”

EC is reported in units of: μS/cm

pH is reported in units

CEC is reported in units of: meq/100 g dry soil

Notation for the data headed “Qualitative Mineralogy Components from XRD Analysis”

Alb	albite	Ka-s	kaolinite - several forms
Ana	anatase	Mic	microcline
Anth	anorthite	Mont	montmorillonite
Arag	aragonite	Mus	muscovite
Bar	barite	Mus2	muscovite - two forms
Ber	beryl	Mx-fel	mixed feldspars
Cal	calcite	Nac	nacrite
Dic	dickite	Orth	orthoclase
Dol	dolomite	Phlog	phlogopite
Gib	gibbsite	Pre	prehenite
Goe	goethite	Pyr	pyrite
Graph	graphite	Qtz	quartz
Gren	greenalite	Rut	rutile
Gyp	gypsum	Sid	siderite
Hem	haematite	?Act	actinolite?
Ill	illite	?Fay	fayalite?
Ill-Na	illite - sodium rich	?Mic	microcline?
Ka	kaolinite		

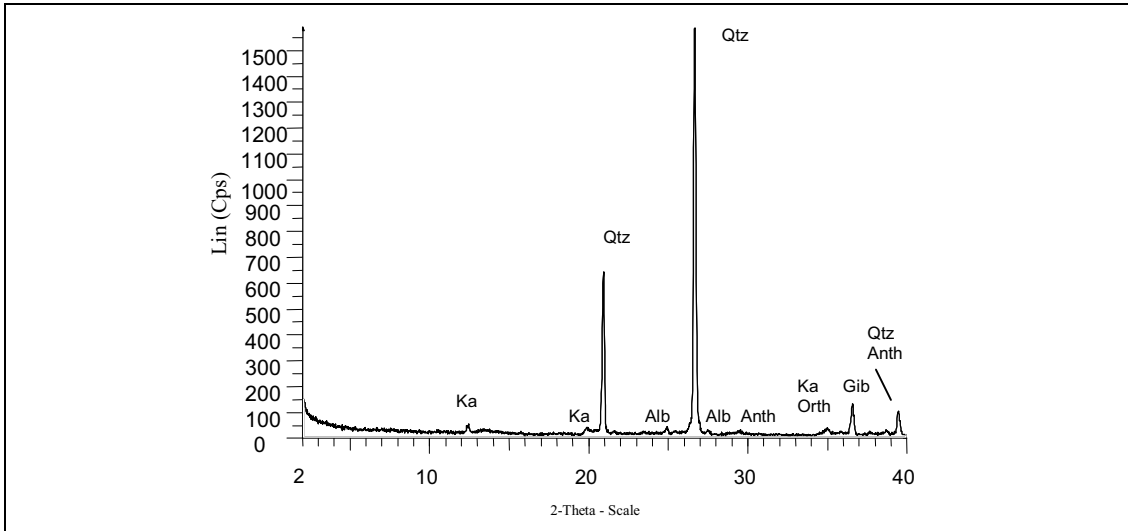
Figure K.1 Representative XRD Records for Site Soils

The following 18 graphs are selected, representative X-Ray Diffraction patterns for sites' soils. The plots have horizontal axes of '2 Theta ( $\Theta$ )' varying between  $2^\circ$  –  $3^\circ$  and  $40^\circ$ ; and vertical axes indicating relative counts.

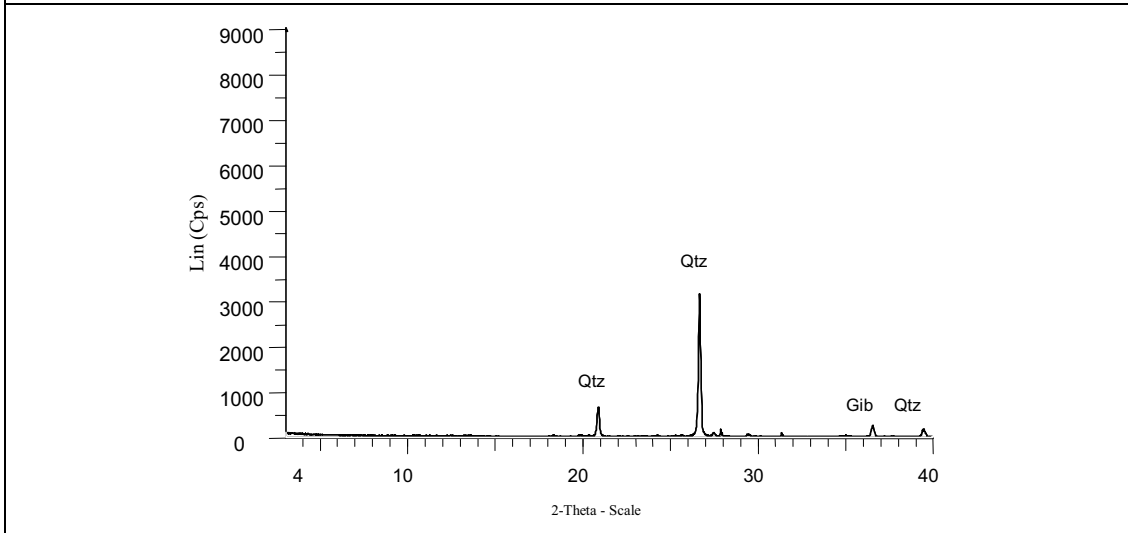
The peaks represent accumulated counts from crystal planes with the appropriate  $d$ -spacing. Some peaks are particularly associated with certain minerals; some peaks have been labelled according to the Qualitative Mineralogy Components from XRD Analysis (Table K.1).

The data graphs presented are for the soils:-

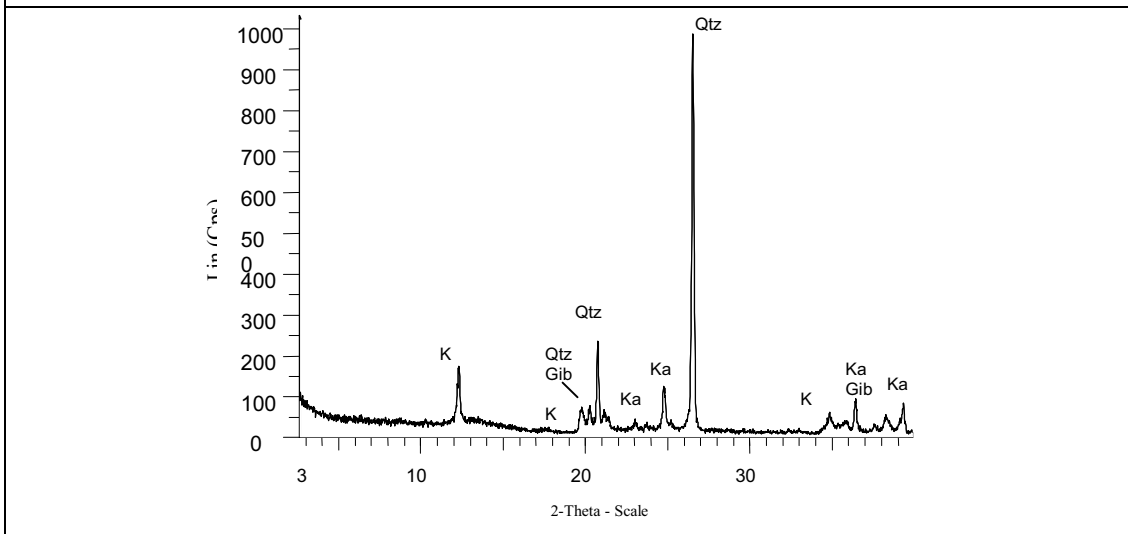
B1/2, B2/2, W4/2, W6/2, M3/2, S1/3, S9/1, S12/4, N2/2, NT3/3, L2/1, L5/2, C1/1, C6/1, H2/1, H5/1, G1/5, G6/2



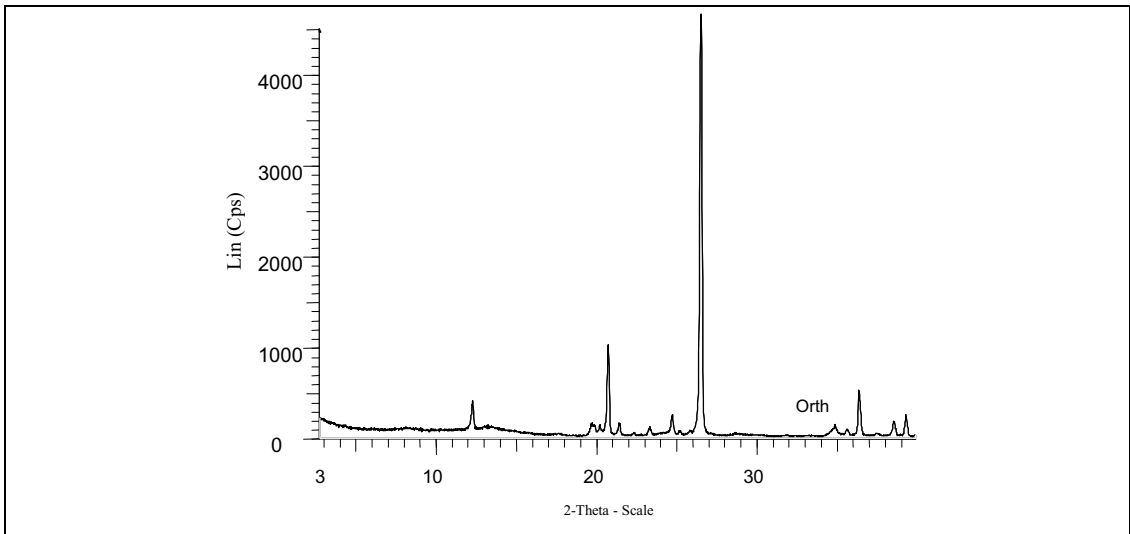
X-Ray Diffraction Pattern – Soil B1/2



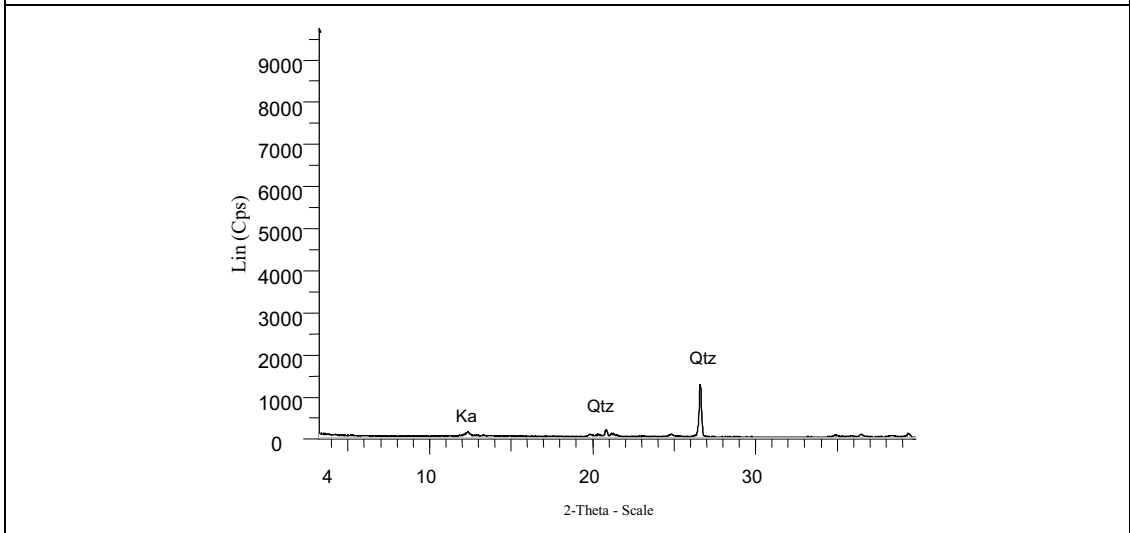
X-Ray Diffraction Pattern – Soil B2/2



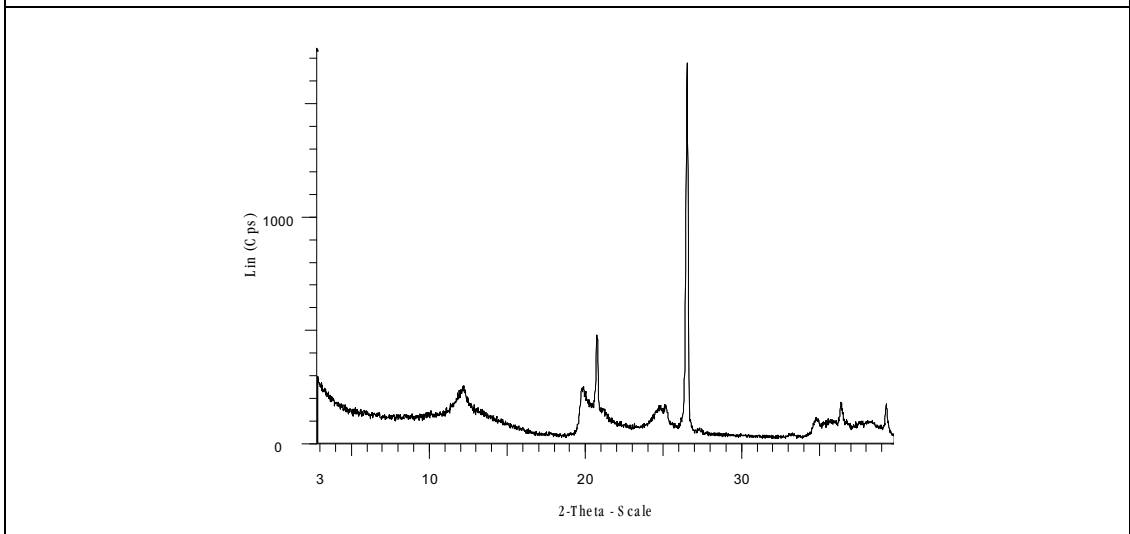
X-Ray Diffraction Pattern – Soil W4/2



X-Ray Diffraction Pattern – Soil W6/2

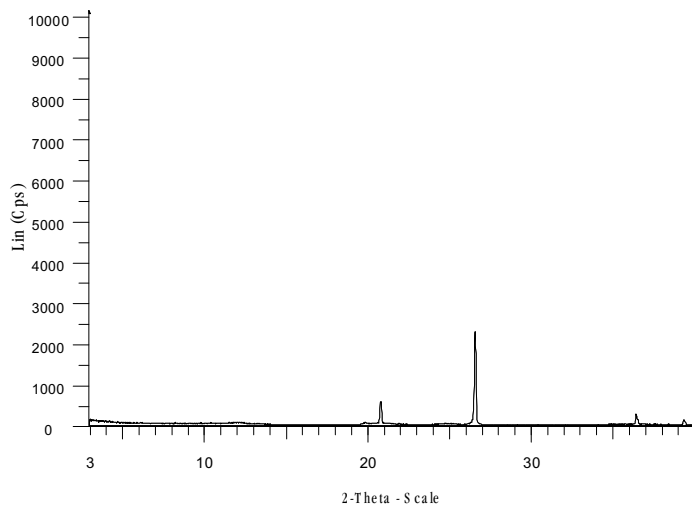


X-Ray Diffraction Pattern – Soil M3/2

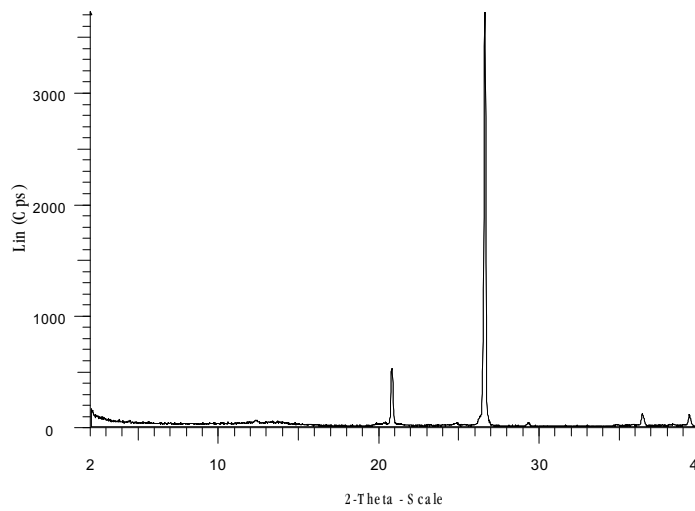


X-Ray Diffraction Pattern – Soil S1/3

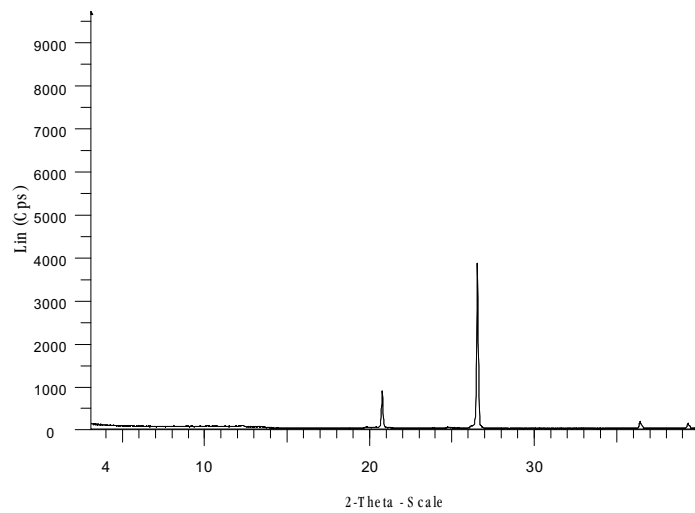




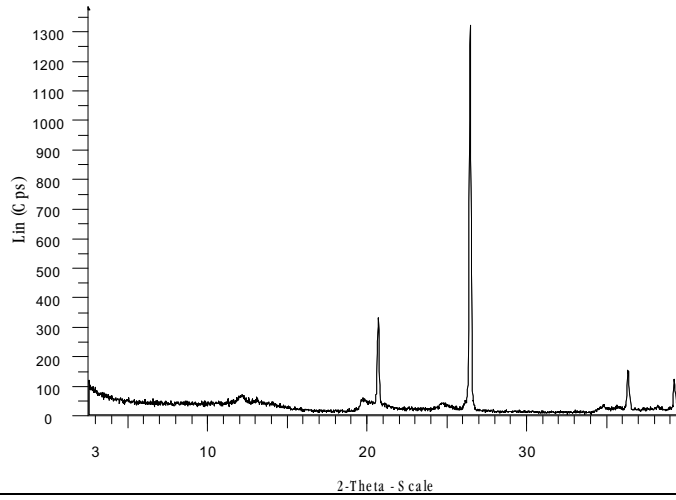
X-Ray Diffraction Pattern – Soil S9/1



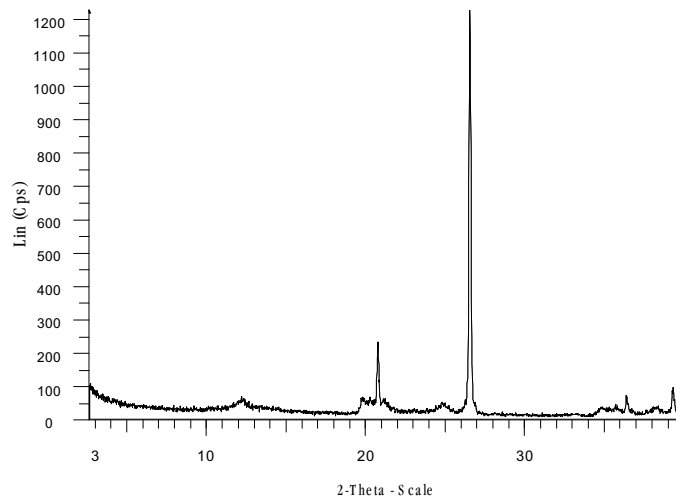
X-Ray Diffraction Pattern – Soil S12/4



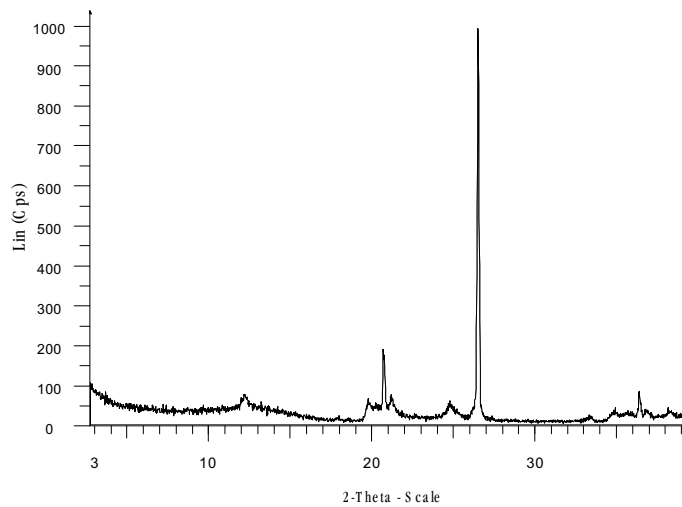
X-Ray Diffraction Pattern – Soil N2/2



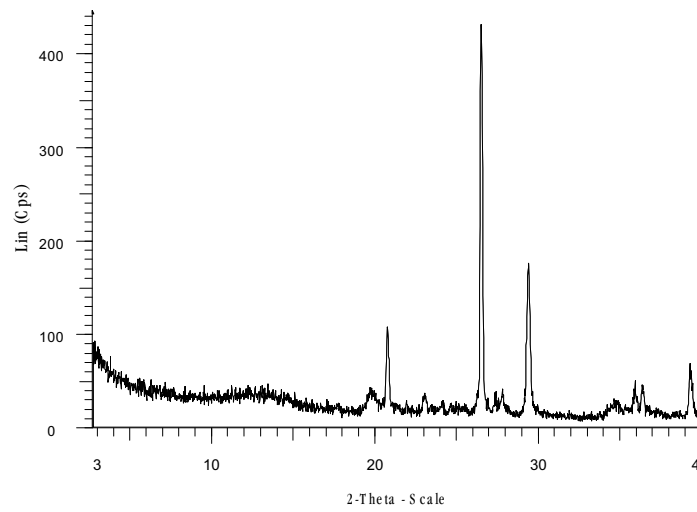
X-Ray Diffraction Pattern – Soil NT3/3



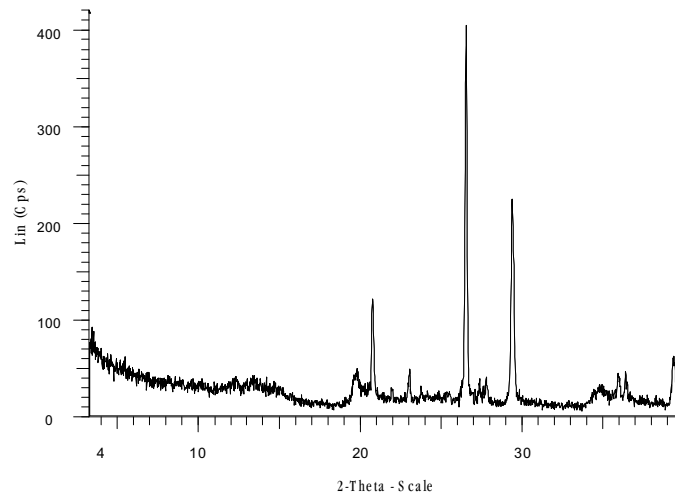
X-Ray Diffraction Pattern – Soil L2/1



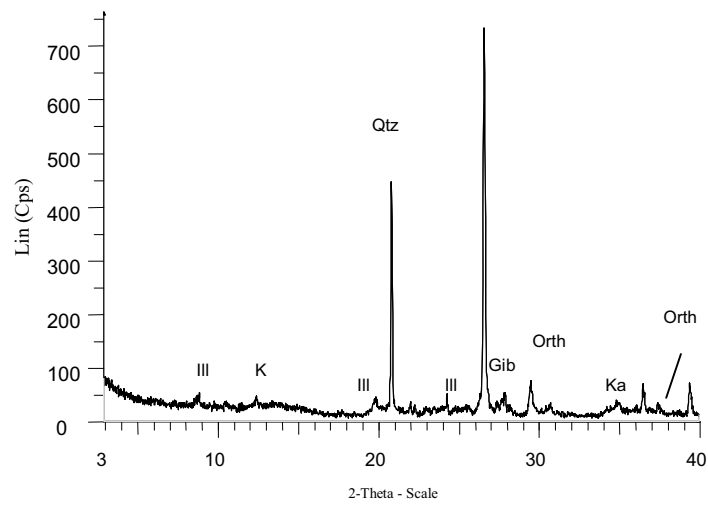
X-Ray Diffraction Pattern – Soil L5/2



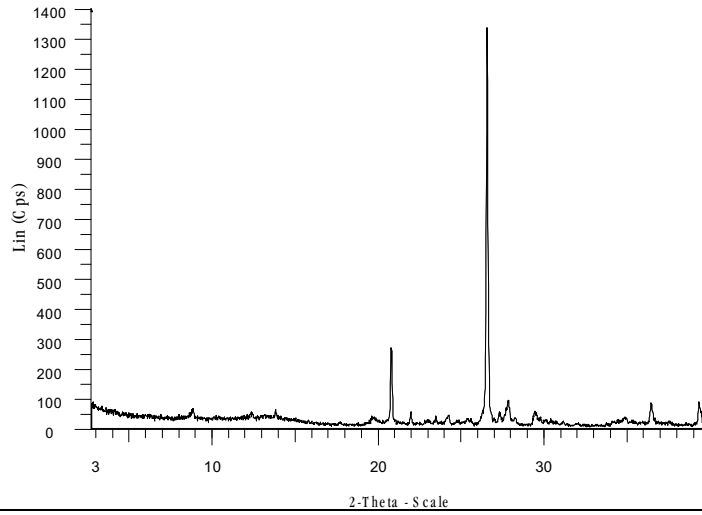
X-Ray Diffraction Pattern – Soil C1/1



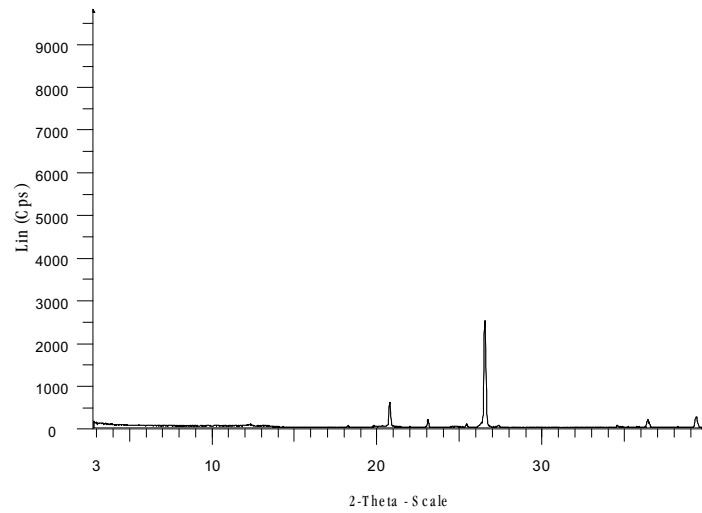
X-Ray Diffraction Pattern – Soil C6/1



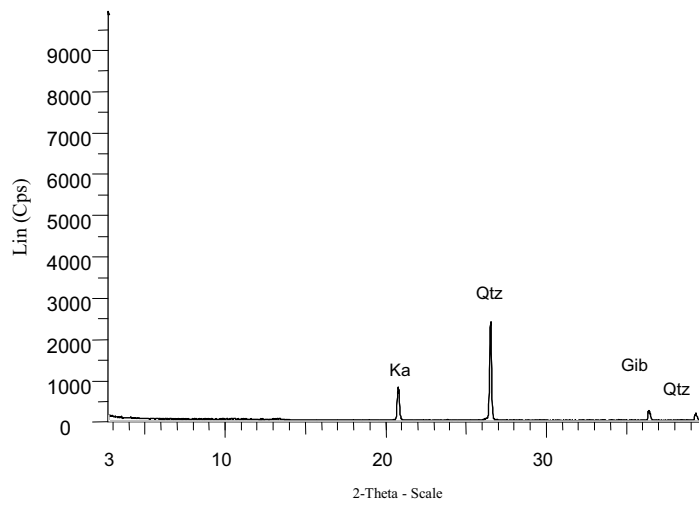
X-Ray Diffraction Pattern – Soil H2/1



X-Ray Diffraction Pattern – Soil H5/1



X-Ray Diffraction Pattern – Soil G1/5



X-Ray Diffraction Pattern – Soil G6/2



<b>Table K.1 All Soil Results</b>						
<b>Cemetery:</b>	BOTANY CEMETERY					
<b>Sample #</b>	B1/1	B1/2	B2/1	B2/2	B2/3	B3/1
<b>Sat'd/vaodse etc</b>					X	
<b>Sample Date</b>	6/12/96	6/12/96	4/10/96	4/10/96	4/10/96	11/10/96
<b>Depth</b>	0.8-1.0	1.0-1.1	0.6	2.1	3.05-3.25	1.5-1.7
<b>Description</b>	yel-white fine sand	occ pebble, lt biege sand	white fine sand	yel fine sand	yel med sand	dk grey med-fine sand
<b>Colour</b>	2.5Y 7/2	2.5Y 8/2	2.5Y 8/1	2.5Y 8/6	2.5Y 8/6	2.5Y 3/1
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>		0.0				0.0
<b>-0.5</b>		0.3				0.1
<b>0.0</b>		0.8	0.0		0.0	0.3
<b>0.5</b>		2.6	0.0	0.0	0.1	0.7
<b>1.0</b>		16.9	1.7	0.5	1.1	5.1
<b>1.5</b>		44.9	18.0	11.9	14.2	29.9
<b>2.0</b>		74.1	67.8	67.7	63.5	72.8
<b>2.5</b>		89.6	93.2	96.0	93.5	92.4
<b>3.0</b>		92.8	96.1	98.2	96.9	94.3
<b>3.5</b>		94.5	96.9	98.5	97.7	95.3
<b>4.0</b>		95.5	97.4	98.6	97.9	95.9
<b>&lt;4.0</b>		98.4	98.7	98.8	98.1	98.3
<b>Field Water Content - representative %</b>						
	13	16	0	2	15	14
<b>USCS Classification</b>						
<b>USCS</b>	SP	SP	SP	SP	SP	SP
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
		3.18E-07	3.13E-07	3.16E-07	2.96E-07	3.18E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
		3.15E-04	3.09E-04	3.12E-04	2.93E-04	3.14E-04
<b>Chemistry</b>						
<b>EC</b>	444.0	327.0	6.7	9.4	42.5	72.8
<b>pH</b>	4.3	4.0	6.4	7.2	5.2	6.8
<b>CEC</b>	39	16	6	17	6	31
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>		2.54E-03			2.73E-03	3.60E-03
<b>K</b>	1.32E-04	5.17E-03	6.93E-03	1.35E-02	1.60E-03	2.33E-03
<b>Ca</b>	3.66E-02	1.13E-01	9.85E-02	1.45E-01	7.46E-02	8.30E-02
<b>Mg</b>	1.06E-03	2.93E-03	2.48E-03	3.44E-03	2.52E-03	4.45E-03
<b>Al</b>	1.86E-04	2.51E-04	2.03E-04	6.12E-04	3.54E-04	2.28E-04
<b>Sr</b>	9.86E-05	2.96E-04	3.06E-04	4.22E-04	2.34E-04	2.44E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Qtz	Qtz
<b>Minor</b>	Orth Ka	Ka		Gib Ill		
<b>Very Minor</b>		Orth	Orth	Orth Alb Ka, Anorth	Alb	Ka

<b>Cemetery:</b>	BOTANY CEMETERY					
<b>Sample #</b>	B6/1	B6/2	B7/1	B7/2	B7/3	B8/1
<b>Sat'd/vaodse etc</b>		X				X
<b>Sample Date</b>	4/10/96	4/10/96	5/12/96	5/12/96	5/12/96	3/12/96
<b>Depth</b>	1.4-1.6	2.4 - 2.6	1.7 - 1.8	2.3	1.0 - 1.4	3.6 - 3.7
<b>Description</b>	dk br fine sand	orange-br clayey sand	dk yel-br med sand	lt beige med-fine sand	white fine sand	beige med sand
<b>Colour</b>	5YR 3/3	7.5YR 5/8	10YR 5/6	2.5Y 8/2	2.5Y 8/1	2.5Y 8/4
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>		0.0				
<b>-1.0</b>		0.3				0.0
<b>-0.5</b>	0.0	0.4	0.0			0.2
<b>0.0</b>	0.1	0.6	0.0	0.0	0.0	0.8
<b>0.5</b>	1.3	1.5	0.0	0.1	0.3	2.9
<b>1.0</b>	11.8	8.9	3.5	4.1	6.5	17.3
<b>1.5</b>	44.1	39.4	29.6	31.3	33.1	50.8
<b>2.0</b>	80.1	79.9	76.4	77.9	75.8	82.6
<b>2.5</b>	91.0	93.0	96.6	95.4	94.8	96.4
<b>3.0</b>	98.1	99.3	97.6	97.3	96.5	97.5
<b>3.5</b>	99.3	99.9	98.0	98.0	97.0	97.9
<b>4.0</b>	100.0	100.1	98.1	98.2	97.3	98.1
<b>&lt;4.0</b>	101.8		98.7	98.6	98.3	98.3
<b>Field Water Content - representative %</b>						
	6	20	8	16	0	16
<b>USCS Classification</b>						
<b>USCS</b>	SP	SP	SP	SP	SP	SP
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
	3.87E-07	3.86E-07	3.69E-07	3.74E-07	3.55E-07	4.50E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
	3.83E-04	3.81E-04	3.65E-04	3.70E-04	3.51E-04	4.45E-04
<b>Chemistry</b>						
<b>EC</b>		56.9	36.9	39.3	12.7	22.1
<b>pH</b>		5.5	6.9	6.9	6.5	5.5
<b>CEC</b>	16	14	18	6	19	3
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	3.30E-03	3.50E-03	1.57E-03	2.73E-03	4.15E-03	
<b>K</b>	3.61E-03	7.28E-04	1.11E-03	5.81E-04	4.06E-03	6.94E-04
<b>Ca</b>	1.35E-01	7.33E-02	8.93E-02	8.91E-02	1.06E-01	1.10E-01
<b>Mg</b>	7.24E-03	3.57E-03	3.03E-03	3.62E-03	2.90E-03	3.03E-03
<b>Al</b>	4.19E-04	2.70E-04	2.63E-04	3.01E-04	4.76E-04	2.84E-04
<b>Sr</b>	3.41E-04	2.18E-04	2.78E-04	2.74E-04	3.29E-04	3.24E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Qtz	Qtz
<b>Minor</b>						Ill
<b>Very Minor</b>	Orth	Mus		Orth	Orth	Orth

<b>Cemetery:</b>	BOTANY CEMETERY				
<b>Sample #</b>	B9/1	B9/2	Bsand#1		
<b>Sat'd/vaodse etc</b>					
<b>Sample Date</b>	6/12/96	6/12/96	5/12/96		
<b>Depth</b>	1.5	2.8	n/a		
<b>Description</b>	br med-fine sand	br-yel med sand	med-fine quartz sand		
<b>Colour</b>	10 YR4/4	10YR 6/8	n/a		
<b>Grading</b>					
<b>&gt;-2.25</b>					
<b>-2.0</b>					
<b>-1.5</b>					
<b>-1.0</b>	0.0	0.0	0.0		
<b>-0.5</b>	0.1	0.0	0.8		
<b>0.0</b>	0.4	0.4	48.3		
<b>0.5</b>	3.4	2.0	90.1		
<b>1.0</b>	24.5	11.9	99.7		
<b>1.5</b>	60.5	30.9	100.3		
<b>2.0</b>	88.4	50.6			
<b>2.5</b>	97.6	96.1			
<b>3.0</b>	97.6	100.2			
<b>3.5</b>	97.8				
<b>4.0</b>	97.9				
<b>&lt;4.0</b>	98.8				
<b>Field Water Content - representative %</b>					
	6	14	0		
<b>USCS Classification</b>					
<b>USCS</b>	SP	SP	SP		
<b>Calculated Permeability Parameters</b>					
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>					
	5.55E-07	2.90E-07	4.21E-06		
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>					
	5.48E-04	2.86E-04	4.16E-03		
<b>Chemistry</b>					
<b>EC</b>	24.1	27.2	5.7		
<b>pH</b>	7.0	5.7	5.9		
<b>CEC</b>	20	7	11		
<b>Extracted exchangeable cations in mg/L</b>					
<b>Na</b>		3.02E-03	1.73E-03		
<b>K</b>	2.95E-03	4.92E-04	2.57E-04		
<b>Ca</b>	9.75E-02	1.03E-01	7.15E-02		
<b>Mg</b>	2.65E-03	3.41E-03	1.98E-03		
<b>Al</b>	3.56E-04	2.93E-04	2.77E-04		
<b>Sr</b>	2.75E-04	3.22E-04	2.19E-04		
<b>Qualitative Mineralogical Components from XRD Analysis</b>					
<b>Major</b>	Qtz	Qtz			
<b>Minor</b>	Ka Gib	Mont			
<b>Very Minor</b>	Ill Mus				



<b>Cemetery:</b>	WORONORA GENERAL					
<b>Sample #</b>	W1/1	W1/2	W1/3	W2/1	W2/2	W4/1
<b>Sat'd/vaodse etc</b>	PIT	PIT	PIT	PIT	PIT	
<b>Sample Date</b>	25/11/96	25/11/96	25/11/98	25/11/96	25/02/96	10/12/96
<b>Depth</b>	2.5-3.0	0.5 - 1.0	1.0 - 1.2	0.2 - 1.1	2.2 - 3.0	1
<b>Description</b>	stiff grey sandy clay; occ red-br mots	yel-br & red-br mot sandy clay, rootlets	mot red-br, yel-br and grey sandy clay	mot yel-br & grey sandy clay with	white & beige clayey sand	red-br & grey mot sandy clay
	and concretions			with Feox concs		Feox concs.
<b>Colour</b>	10YR7/1	10YR 6/8	10YR 7/3 - 5Yr 5/8	10YR7/4-7/6	2.5YR 8/1	2.5YR 7/6-6/4
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>						3.1
<b>-0.5</b>						21.7
<b>0.0</b>						35.6
<b>0.5</b>						46.0
<b>1.0</b>						55.8
<b>1.5</b>						63.4
<b>2.0</b>						69.9
<b>2.5</b>						78.0
<b>3.0</b>						85.7
<b>3.5</b>						91.6
<b>4.0</b>						95.7
<b>&lt;4.0</b>						100.4
<b>Field Water Content - representative %</b>						
	22	0	9	10	9	8
<b>USCS Classification</b>						
<b>USCS</b>	CL	CL	CL	SC-CL	SC-CL	SM-SC
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
						1.59E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
						1.47E-04
<b>Chemistry</b>						
<b>EC</b>	59.0	50.8	50.4	34.6	31.0	65.8
<b>pH</b>	4.9	6.3	6.1	7.1	6.3	5.5
<b>CEC</b>	193	7		138	48	16
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	4.52E-03	6.27E-03	6.21E-03		2.34E-03	5.02E-03
<b>K</b>	2.16E-03	1.69E-03	2.36E-03	1.61E-03	7.22E-04	1.67E-03
<b>Ca</b>	6.26E-02	1.51E-01	1.16E-01	1.26E-01	7.08E-02	1.60E-01
<b>Mg</b>	1.44E-02	2.97E-02	2.78E-02	3.70E-02	8.74E-03	1.39E-02
<b>Al</b>	2.69E-02	2.62E-04	3.02E-04	1.71E-04	2.02E-03	3.03E-04
<b>Sr</b>	2.00E-04	4.75E-04	3.92E-04	4.18E-04	2.15E-04	4.96E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Ka	Qtz
				Ka	Qtz	Ka
<b>Minor</b>			Ka	Orth	Mus	Mus2
			Ill-Na	Gib		
<b>Very Minor</b>	Ka	Ka	Orth?	Hem	Ana	
	Cal	Gib			Nac	

<b>Cemetery:</b>	WORONORA GENERAL					
<b>Sample #</b>	W4/2	W4/3	W5/1	W5/2	W6/1	W6/2
<b>Sat'd/vaodse etc</b>			PIT	PIT		
<b>Sample Date</b>	10/12/96	10/12/96	25/11/96	25/11/96	25/11/96	25/11/96
<b>Depth</b>	2.1	2.9	0.5 - 0.8	1.4	1.0 - 2.0	2
<b>Description</b>	red-beige clayey sand, occ FeOx piths	white sandy clay occ red-br mots & Feox concs	red-br & grey mot sandy clay	yel-br silty? clay	firm yel-br sandy clay with rootlets	red-br, yel-br & grey mot sandy clay  Feox concs and stains
<b>Colour</b>	5Yr 8/3	7.5YR 8/1	5YR 8/2	7.5YR 6/8	10YR 6/8	2.5YR 4/8
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>						
<b>-0.5</b>						
<b>0.0</b>						
<b>0.5</b>						
<b>1.0</b>						
<b>1.5</b>						
<b>2.0</b>						
<b>2.5</b>						
<b>3.0</b>						
<b>3.5</b>						
<b>4.0</b>						
<b>&lt;4.0</b>						
<b>Field Water Content - representative %</b>						
	4	9	9	10	11	16
<b>USCS Classification</b>						
<b>USCS</b>	ML-CL	CL	SC-CL	ML-CL	SC-CL	SC-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
<b>Chemistry</b>						
<b>EC</b>	71.2	36.2	22.6	67.4	44.4	
<b>pH</b>	4.9	6.1	5.7	6.4	6.8	
<b>CEC</b>	21	13		64	17	
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	5.93E-03	3.28E-03	2.75E-03	3.06E-03	5.50E-03	
<b>K</b>	2.09E-03	2.21E-03	1.54E-03	5.07E-03	1.06E-03	
<b>Ca</b>	1.27E-01	8.11E-02	9.74E-02	1.12E-01	7.93E-02	
<b>Mg</b>	1.55E-02	1.22E-02	8.44E-03	1.81E-02	3.09E-02	
<b>Al</b>	3.33E-04	4.61E-04	2.57E-04	1.62E-04	2.16E-04	
<b>Sr</b>	4.30E-04	2.49E-04	2.86E-04	3.34E-04	3.06E-04	
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Ka	Qtz	Ka	Qtz	Ka
	Ka	Qtz	Ka	Qtz	Ka	Qtz
					Mus	
<b>Minor</b>	Mus		Mus		Goe	Orth
	Ill-Na		Goe		Cal	Mic
<b>Very Minor</b>			Cal	Orth		
			Pyr	Goe		

<b>Cemetery:</b>	WORONORA GENERAL					
<b>Sample #</b>	W6/3	W6/4	W7/1	W7/2	W7/3	W9/1
<b>Sat'd/vaodse etc</b>	W6	XW6	PIT	PIT	W7	PIT
<b>Sample Date</b>	10/12/96	10/12/96	27/11/96	27/11/96	10/12/96	11/12/96
<b>Depth</b>	n/a		1.1	2.1	2.9	n/a
<b>Description</b>	white-br clayey sand occ red-br concs	white fine sand	yel-br sandy clay	yel-br & lt-dk grey mot sandy clay	yel-br sandy clay, minor rootlets	sandy fill
<b>Colour</b>	10Yr8/2-8/3	2.5Y 8/1	10YR 7/8-6/8	2.5YR8/3-7/4	10YR 6/8	2.5YR 8/1
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>		0.0		0.0		0.0
<b>-0.5</b>		5.1		4.7		0.1
<b>0.0</b>		11.4		8.9		0.0
<b>0.5</b>		22.2		14.5		0.1
<b>1.0</b>		44.3		29.2		1.6
<b>1.5</b>		59.5		49.3		18.4
<b>2.0</b>		67.8		67.2		68.5
<b>2.5</b>		83.0		80.4		96.2
<b>3.0</b>		89.1		86.6		97.6
<b>3.5</b>		91.6		90.3		97.9
<b>4.0</b>		93.6		92.6		98.0
<b>&lt;4.0</b>		99.9		99.1		98.7
<b>Field Water Content - representative %</b>						
	7	2	3	12	11	0
<b>USCS Classification</b>						
<b>USCS</b>	CL	SM	SC-CL	SC	SC-CL	SP
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
		2.33E-07		1.70E-07		3.25E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
		2.15E-04		1.57E-04		3.00E-04
<b>Chemistry</b>						
<b>EC</b>		33.6	109.0	60.6	63.1	53.5
<b>pH</b>		6.1	6.4	5.6	5.0	6.1
<b>CEC</b>			4	67	74	11
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	2.78E-03	3.99E-03	8.73E-03	6.26E-03	4.64E-03	2.01E-03
<b>K</b>	6.36E-04	2.59E-03	2.18E-03	4.73E-03	1.29E-03	7.11E-04
<b>Ca</b>	5.64E-02	6.85E-02	1.29E-01	1.18E-01	1.68E-02	7.25E-02
<b>Mg</b>	1.13E-02	3.48E-02	2.77E-02	1.33E-02	9.58E-02	2.37E-03
<b>Al</b>	4.71E-03	4.42E-03	1.67E-04	2.63E-04	3.14E-04	2.77E-04
<b>Sr</b>	1.93E-04	2.69E-04	4.22E-04	3.81E-04	1.55E-04	1.77E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Ka Qtz	Qtz Ka	Qtz Ka	Qtz	Qtz Ka	Qtz
<b>Minor</b>	Mus	Orth Goe	Goe		Ill	Orth
<b>Very Minor</b>	Goe Nac		Mus	Ka Ill Mus,Mic	Goe	Graph ?Act

<b>Cemetery:</b>	MELBOURNE GENERAL CEMETERY					
<b>Sample #</b>	M1/1	M1/2	M2/1	M2/2	M2/3	M3/1
<b>Sat'd/voidse etc</b>						
<b>Sample Date</b>	16/12/96	16/12/98	16/12/96	16/12/96	16/12/96	16/12/96
<b>Depth</b>	1.75	2.75	1.2	1.6	2.5	1.2
<b>Description</b>	yel-br sandy clay	lt yrl-br silty clay sand	red & yel-br sandy clay	red, br, orange & grey mot clayey sand	soft white-yel sandy clay	firm, grey-br sandy clay
			with FeOx mot			
<b>Colour</b>	10YR 6/8	10YR 7/8-6/8	7.5YrR6/6	7.5YR 5/8	2.5Y 8/3	2.5Y 7/1
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>						
<b>-0.5</b>						
<b>0.0</b>						
<b>0.5</b>						
<b>1.0</b>						
<b>1.5</b>						
<b>2.0</b>						
<b>2.5</b>						
<b>3.0</b>						
<b>3.5</b>						
<b>4.0</b>						
<b>&lt;4.0</b>						
<b>Field Water Content - representative %</b>						
	13	12	11	9	12	10
<b>USCS Classification</b>						
<b>USCS</b>	ML-CL	CL	CL	SC-CL	CL	CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
<b>Chemistry</b>						
<b>EC</b>	212.4	207.9	101.8	121.7	89.0	77.2
<b>pH</b>	6.8	7.8	7.3	6.9	7.7	8.1
<b>CEC</b>	46	11	9	12	15	32
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.73E-02	3.94E-02	2.76E-02	4.93E-02	3.60E-02	1.59E-02
<b>K</b>	7.50E-04	5.54E-03	2.12E-03	8.94E-03	2.09E-03	5.52E-03
<b>Ca</b>	3.01E-02	1.07E-01	7.52E-02	1.30E-01	1.04E-01	9.51E-02
<b>Mg</b>	2.69E-02	6.11E-02	5.72E-02	6.52E-02	4.62E-02	6.51E-02
<b>Al</b>	1.47E-04	2.46E-04	8.84E-05	3.00E-04	2.30E-04	2.40E-04
<b>Sr</b>	1.48E-04	4.38E-04	3.33E-04	4.97E-04	3.84E-04	4.00E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz Orth	Qtz Ill	Ka Qtz	Qtz Ka Orth	Qtz Ka	Qtz Ka
<b>Minor</b>			Mus			Ill Goe Mx-fel
<b>Very Minor</b>	Ka Ill	Ka Orth Rut	Ill Goe	Mus Goe		Ana

<b>Cemetery:</b>	MELBOURNE GENERAL CEMETERY			
<b>Sample #</b>	M3/2	M5/1	M5/2	Msand#1
<b>Sat'd/vaodse etc</b>				
<b>Sample Date</b>	16/12/96	16/02/96	16/12/96	18/12/96
<b>Depth</b>	2.1	0.95	1.6	n/a
<b>Description</b>	yel & red-br & grey mot coarse sandy clay	firm, yel-br sandy clay	red & yel-br sandy clay	med-fine beige sand gravel pack
			white & Feox mot	
<b>Colour</b>	7.5YR 6/8	10YR 6/8	7.5YR 6/6	n/a
<b>Grading</b>				
<b>&gt;-2.25</b>				
<b>-2.0</b>				
<b>-1.5</b>				
<b>-1.0</b>				
<b>-0.5</b>				0.0
<b>0.0</b>				1.3
<b>0.5</b>				47.5
<b>1.0</b>				94.8
<b>1.5</b>				99.2
<b>2.0</b>				99.2
<b>2.5</b>				99.4
<b>3.0</b>				
<b>3.5</b>				
<b>4.0</b>				
<b>&lt;4.0</b>				
<b>Field Water Content - representative %</b>				
	6	14	11	0
<b>USCS Classification</b>				
<b>USCS</b>	SC-CL	CL	SC-CL	SP
<b>Calculated Permeability Parameters</b>				
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>				
				2.21E-06
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>				
				2.15E-03
<b>Chemistry</b>				
<b>EC</b>	46.4	209.2	200.4	5.7
<b>pH</b>	7.8	8.2	8.7	6.0
<b>CEC</b>	27	36	3	9
<b>Extracted exchangeable cations in mg/L</b>				
<b>Na</b>		6.56E-02	4.92E-02	1.96E-03
<b>K</b>	5.64E-03	1.03E-02	1.71E-02	5.23E-04
<b>Ca</b>	8.99E-02	1.35E-01	8.99E-02	8.21E-02
<b>Mg</b>	1.53E-02	1.20E-01	7.73E-02	2.42E-03
<b>Al</b>	1.88E-04	1.27E-04	2.47E-04	2.69E-04
<b>Sr</b>	3.04E-04	5.93E-04	3.87E-04	2.39E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>				
<b>Major</b>	Qtz	Qtz Mus	Qtz Ka	
<b>Minor</b>	Ka			
<b>Very Minor</b>	Goe	Goe Ka		

<b>Cemetery:</b>	NECROPOLIS					
<b>Sample #</b>	S1/1	S1/2	S1/3	S1/4	S1/5	S1/6
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	17/12/96	17/12/96	17/12/96	17/12/96	17/12/96	17/12/96
<b>Depth</b>	0.6	1.4	2.4		3.8	4.8
<b>Description</b>	red-br sandy clay	grey sandy clay with red & yel br mots	grey sandy clay, occ yel-br mot.		red-br clayey fine sand	red-br coarse med sand
<b>Colour</b>	2.5YR 5/8	2.5Y 7/1	2.5YR 8/2		2.5YR 5/8	2.5YR 5/8
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>					0.0	0.0
<b>-0.5</b>					8.0	3.5
<b>0.0</b>					16.2	9.2
<b>0.5</b>					24.3	16.5
<b>1.0</b>					38.5	33.6
<b>1.5</b>					60.6	61.6
<b>2.0</b>					79.3	83.0
<b>2.5</b>					87.1	91.5
<b>3.0</b>					90.5	93.9
<b>3.5</b>					92.9	95.5
<b>4.0</b>					94.4	96.4
<b>&lt;4.0</b>					99.1	99.4
<b>Field Water Content - representative %</b>						
	16	19	12		10	8
<b>USCS Classification</b>						
<b>USCS</b>	SC-CL	SC-CL	SC-CL	CL	SC	SP
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
					3.22E-07	4.82E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
					2.86E-04	4.29E-04
<b>Chemistry</b>						
<b>EC</b>	52.4	49.3	37.8	401.0	37.9	
<b>pH</b>	7.0	7.2	6.0	9.1	6.8	
<b>CEC</b>	58	11	17		23	
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.19E-02	1.21E-02	1.01E-02	4.06E-02	8.82E-03	1.18E-02
<b>K</b>	2.34E-03	9.63E-04	5.23E-03	1.11E-02	1.90E-03	6.86E-03
<b>Ca</b>	7.77E-02	7.29E-02	9.24E-02	1.50E-01	9.96E-02	1.30E-01
<b>Mg</b>	6.16E-02	8.20E-02	4.77E-02	7.43E-02	1.99E-02	2.01E-02
<b>Al</b>	1.84E-04	2.49E-04	2.51E-04	2.38E-04	2.76E-04	2.93E-04
<b>Sr</b>	3.10E-04	2.71E-04	3.01E-04	6.58E-04	3.20E-04	4.16E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Ka Mus	Ka Qtz	Ka Qtz	Ka Anth	Qtz Ka-s	Qtz
<b>Minor</b>	Qtz Mx-fel			Qtz Mus		Alb Mus
<b>Very Minor</b>	Goe	Orth Mus	Ana			
		Gyp, Pre				

<b>Cemetery:</b>	NECROPOLIS					
<b>Sample #</b>	S2/1	S2/2	S2/3	S2/4	S2/5	S3/1
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	17/12/96	17/12/96	17/12/96	17/12/96	17/12/96	17/12/96
<b>Depth</b>	1.1	2.2	3	3.6	2.1	2
<b>Description</b>	mot red-br & grey clay	grey sandy clay, occ red-br mot	red-br sandy clay occ grey mot	red-br sandy clay occ grey mot	yel-br sandy clay	red, yel-br & grey mot clay
<b>Colour</b>	2.5YR 4/8	10YR 8/2	5YR 5/8	5YR 5/8	7.5yR 6/8	2.5YR 7/1
<b>Grading</b>						
>-2.25						
-2.0						
-1.5						
-1.0						
-0.5						
0.0						
0.5						
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0						
<4.0						
<b>Field Water Content - representative %</b>						
	17	15	11	9	15	17
<b>USCS Classification</b>						
<b>USCS</b>	CL	CL	CL	CL	SM-ML	CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
<b>Chemistry</b>						
<b>EC</b>	48.2	53.8	47.0	39.1	66.4	76.0
<b>pH</b>	7.2	6.5	5.6	6.3	6.0	7.2
<b>CEC</b>	29	15	29	16	29	18
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	6.36E-03	9.79E-03	1.49E-02	1.42E-02	1.10E-02	2.80E-02
<b>K</b>	2.95E-03	5.44E-03	4.99E-03	1.06E-03	1.40E-03	1.19E-03
<b>Ca</b>	1.13E-01	7.50E-02	1.53E-01	1.86E-01	1.32E-01	7.85E-02
<b>Mg</b>	1.19E-01	4.18E-02	3.34E-02	2.26E-02	2.49E-02	9.87E-02
<b>Al</b>	1.86E-04	2.78E-04	3.87E-04	4.24E-04	2.39E-04	2.47E-04
<b>Sr</b>	5.19E-04	2.57E-04	5.14E-04	5.82E-04	4.19E-04	3.20E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Ka Ill	Qtz Ka	Qtz Ka	no file	Ka-s Qtz	Ka Qtz
<b>Minor</b>	Qtz	Orth			Nac	Mus
<b>Very Minor</b>	Gib Dol Sid					

<b>Cemetery:</b>	NECROPOLIS					
<b>Sample #</b>	S3/2	S3/3	S3/4	S4/1	S4/2	S4/3
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	17/12/96	17/12/96	17/12/96	17/12/96	17/12/96	17/12/96
<b>Depth</b>	2.8	3	4.8	2	2.9	4.7
<b>Description</b>	yel-br & grey mot sandy clay	red-br sandy clay, occ FeOx piths & grey aggregates	yel-br & red & grey mot sandy clay with Feox concs	red-br & yel-br & grey mot fine sand	red and yel-br & grey mot sandy clay	red-br occ grey mot clayey sand
<b>Colour</b>	2.5Y 8/1 &	5YR 6/8	2.5Y 7/1	10YR 7/1	7.5Yr 8/2	5YR 5/8
<b>Grading</b>						
<b>&gt;-2.25</b>		0.0				
<b>-2.0</b>		9.8				
<b>-1.5</b>		11.9				
<b>-1.0</b>		14.4		0.0		0.0
<b>-0.5</b>		23.0		7.2		1.6
<b>0.0</b>		30.7		15.0		3.5
<b>0.5</b>		38.3		25.4		7.9
<b>1.0</b>		50.6		40.8		22.1
<b>1.5</b>		66.8		56.5		47.1
<b>2.0</b>		79.8		70.7		75.6
<b>2.5</b>		87.3		81.1		88.0
<b>3.0</b>		91.4		86.0		91.0
<b>3.5</b>		93.9		89.1		93.0
<b>4.0</b>		95.6		90.9		94.1
<b>&lt;4.0</b>		99.8		99.0		98.9
<b>Field Water Content - representative %</b>						
	18	12	13	13	10	7
<b>USCS Classification</b>						
<b>USCS</b>	SC-CL	SC	CL	SM	CL	SC
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
		3.42E-07		1.74E-07		3.06E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
		3.05E-04		1.55E-04		2.73E-04
<b>Chemistry</b>						
<b>EC</b>	78.4	41.6	133.1	74.5	128.8	108.2
<b>pH</b>	6.1	5.2	7.0	7.6	6.2	6.4
<b>CEC</b>	129		56	14	14	14
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	2.04E-02	8.56E-03	1.61E-02	2.03E-02	1.89E-02	1.78E-02
<b>K</b>	1.59E-03	2.17E-03	7.06E-03	3.71E-03	1.81E-03	6.83E-04
<b>Ca</b>	2.62E-01	8.09E-02	8.60E-02	6.92E-02	8.67E-02	7.28E-02
<b>Mg</b>	1.01E-01	2.18E-02	5.82E-02	5.27E-02	2.57E-02	2.34E-02
<b>Al</b>	5.80E-04	1.77E-04	1.41E-04	2.48E-04	2.59E-04	2.51E-04
<b>Sr</b>	1.37E-03	2.46E-04	3.04E-04	2.65E-04	2.90E-04	2.34E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz Ka-s	Qtz	Qtz Ka	Ka Qtz	Qtz Ka-s	Ka Qtz
<b>Minor</b>	Mus	Ka Ill	Goe Mus	Mus Goe		
<b>Very Minor</b>			Mic?			Orth



<b>Cemetery:</b>	NECROPOLIS					
<b>Sample #</b>	S5/1	S5/2	S5/3	S8/1	S9/1	S9/2
<b>Sat'd/vaodse etc</b>				Xua		Xua
<b>Sample Date</b>	17/12/96	17/12/96	17/12/96	18/12/96	18/12/96	18/12/96
<b>Depth</b>	2.1	3	4.1	6.5	7.5-8.0	14
<b>Description</b>	yel-br & grey mot sandy clay	mot yel-br & red-br grey sandy clay	yel-br clayey sand with occ grey clay  peds	v. sticky yel-br sandy clay	red-br coarse sand	orange-br clayey sand
<b>Colour</b>	10YR 5/6	10YR 7/2	10YR 6/8	10YR 6/8 -5/6	5YR 5/8	7.5YR 5/8
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						0.0
<b>-1.0</b>			0.0		0.0	1.5
<b>-0.5</b>			5.7		11.3	3.7
<b>0.0</b>			17.9		25.8	6.4
<b>0.5</b>			29.9		36.5	11.5
<b>1.0</b>			45.2		52.3	18.4
<b>1.5</b>			65.4		72.6	25.3
<b>2.0</b>			81.9		87.5	35.7
<b>2.5</b>			91.7		93.1	60.1
<b>3.0</b>			94.1		95.2	85.2
<b>3.5</b>			95.5		96.3	92.8
<b>4.0</b>			96.4		97.0	95.4
<b>&lt;4.0</b>			99.5		98.7	99.9
<b>Field Water Content - representative %</b>						
	10	7	7	15	1	17
<b>USCS Classification</b>						
<b>USCS</b>	CL	CL	SP	SM-ML	SP	SC
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
			4.23E-07		5.73E-07	1.29E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
			3.77E-04		5.10E-04	1.15E-04
<b>Chemistry</b>						
<b>EC</b>	30.3	19.9	16.4	30.7	26.9	27.5
<b>pH</b>	6.3	6.3	6.4	7.8	7.2	5.4
<b>CEC</b>	13	16	21	13	26	12
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	7.89E-03	5.02E-03		3.85E-03		4.17E-03
<b>K</b>	3.07E-03	5.81E-04	3.26E-04	2.96E-03	7.64E-04	9.22E-03
<b>Ca</b>	9.32E-02	9.04E-02	9.85E-02	7.37E-02	8.79E-02	1.00E-01
<b>Mg</b>	4.58E-02	2.49E-02	1.58E-02	1.69E-02	1.01E-02	5.79E-03
<b>Al</b>	2.14E-04	2.55E-04	1.64E-04	2.70E-04	1.52E-04	2.15E-04
<b>Sr</b>	3.21E-04	3.01E-04	3.13E-04	2.41E-04	2.77E-04	3.24E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Ka	Ka	Ill	Qtz	Qtz
	Ka	Qtz	Qtz	Ka	Ka	
				Qtz		
<b>Minor</b>	Goe			mus	Orth	
					Alb	
<b>Very Minor</b>		Goe	Goe	Gyp		
		Ana				

<b>Cemetery:</b>	NECROPOLIS					
<b>Sample #</b>	S10/1	S10/2	S10/3	S10/4	S11/1	S12/1
<b>Sat'd/vaodse etc</b>				Xua		
<b>Sample Date</b>	3/04/97	7/04/97	3/04/97	3/04/97	4/04/97	30/09/97
<b>Depth</b>	9.5	6	14	17	12.5	6-10
<b>Description</b>	red-br coarse sand	red-br med sandy clay	yel coarse-med sand	yel-br clayey silty sand	yel-br med sand	red-br sandy clay
<b>Colour</b>	2.5YR 5/8	2.5YR 4/8	10YR 6/8	10YR 5/8	7.5YR 6/8	2.5YR 5/6
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>	0.0		0.0		0.0	
<b>-0.5</b>	23.3		9.9		2.9	
<b>0.0</b>	43.9		23.4		18.9	
<b>0.5</b>	52.8		38.4		38.9	
<b>1.0</b>	63.1		49.1		57.1	
<b>1.5</b>	75.1		58.8		79.7	
<b>2.0</b>	85.2		69.3		90.6	
<b>2.5</b>	91.1		87.4		96.2	
<b>3.0</b>	94.0		94.5		97.5	
<b>3.5</b>	95.8		96.3		98.1	
<b>4.0</b>	97.0		97.1		98.5	
<b>&lt;4.0</b>	100.3		99.4		99.8	
<b>Field Water Content - representative %</b>						
	3	7	7	14	1	12
<b>USCS Classification</b>						
<b>USCS</b>	SP	CL	SP	SM-ML	SP	SC-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
	5.61E-07		2.95E-07		7.32E-07	
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
	4.99E-04		2.63E-04		6.52E-04	
<b>Chemistry</b>						
<b>EC</b>	80.2	140.6	146.1	200.2	48.2	408.0
<b>pH</b>	5.1	4.9	5.9	6.5	7.2	6.5
<b>CEC</b>	22	23	37	16	25	16
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.31E-02	1.69E-02	6.25E-03	1.40E-02	7.82E-03	3.06E-02
<b>K</b>	2.79E-03	9.84E-04		6.09E-04	7.18E-04	2.50E-03
<b>Ca</b>	1.25E-01	6.14E-02	6.03E-02	1.09E-01	1.24E-01	1.10E-01
<b>Mg</b>	2.17E-02	4.34E-02	6.21E-03	9.96E-03	1.24E-02	7.42E-02
<b>Al</b>	7.94E-04	1.46E-04	1.48E-04	3.08E-04	2.72E-04	3.26E-04
<b>Sr</b>	3.78E-04	2.38E-04	1.81E-04	3.26E-04	3.77E-04	3.89E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Qtz	Qtz
<b>Minor</b>		Ka	Ka			Ka
<b>Very Minor</b>	Ka					Goe

<b>Cemetery:</b>	NECROPOLIS				
<b>Sample #</b>	S12/2	S12/3	S12/4	S12/5	Ssand#1
<b>Sat'd/vaodse etc</b>				Xua	
<b>Sample Date</b>	30/09/97	30/09/97	30/09/97	1/10/97	18/12/96
<b>Depth</b>	15	17.5	23	27-28	n/a
<b>Description</b>	orange-br med-fine sand	lt yel med sand	orange fine sand	orange-br med sand, occ yel mot	beige coarse-med sand
<b>Colour</b>	5YR 6/8	2.5Y 8/3	5YR 6/8	5YR6/8 -	n/a
<b>Grading</b>					
<b>&gt;-2.25</b>					
<b>-2.0</b>					
<b>-1.5</b>					0.0
<b>-1.0</b>		0.0	0.0	0.0	7.0
<b>-0.5</b>	0.0	0.1	0.1	0.1	67.0
<b>0.0</b>	0.1	2.4	0.5	1.2	96.7
<b>0.5</b>	3.5	20.3	4.0	4.0	98.4
<b>1.0</b>	48.1	47.8	24.9	13.6	99.3
<b>1.5</b>	80.1	67.3	57.1	35.4	99.7
<b>2.0</b>	93.1	86.8	89.9	76.8	99.7
<b>2.5</b>	96.5	97.1	98.4	94.2	99.8
<b>3.0</b>	97.1	98.0	99.0	96.7	99.8
<b>3.5</b>	97.6	98.3	99.1	97.9	99.8
<b>4.0</b>	98.0	98.5	99.3	98.3	99.8
<b>&lt;4.0</b>	99.4	99.1	100.0	98.7	99.8
<b>Field Water Content - representative %</b>					
	5	1	4	13	0
<b>USCS Classification</b>					
USCS	SP	SP	SP	SP	SW
<b>Calculated Permeability Parameters</b>					
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>					
	7.89E-07	5.45E-07	5.52E-07	3.60E-07	1.05E-05
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>					
	7.02E-04	4.86E-04	4.92E-04	3.20E-04	9.36E-03
<b>Chemistry</b>					
<b>EC</b>	134.4	46.6	144.1	126.9	12.5
<b>pH</b>	6.7	5.6	5.7	6.4	5.3
<b>CEC</b>	14	7	38	34	11
<b>Extracted exchangeable cations in mg/L</b>					
<b>Na</b>	1.34E-02	5.27E-03	9.09E-03	6.58E-03	1.75E-03
<b>K</b>	1.31E-03	9.47E-04	6.84E-04	3.09E-03	8.60E-04
<b>Ca</b>	9.49E-02	1.05E-01	8.01E-02	7.27E-02	8.05E-02
<b>Mg</b>	1.10E-02	3.96E-03	6.58E-03	4.28E-03	2.27E-03
<b>Al</b>	1.76E-04	2.51E-04	1.46E-04	1.45E-04	2.64E-04
<b>Sr</b>	2.75E-04	3.13E-04	2.46E-04	2.32E-04	2.51E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>					
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	
<b>Minor</b>	Ka				
<b>Very Minor</b>	Orth	Orth		Ka	

<b>Cemetery:</b>	BUNURONG MEMORIAL PARK					
<b>Sample #</b>	N1/1	N1/2	N1/3	N1/4	N1/5	N2/1
<b>Sat'd/vaodse etc</b>	EXP BH	EXP BH	EXP BH	EXP BH	EXP BH	EXP BH
<b>Sample Date</b>	27/02/97	27/02/97	27/02/97	27/02/97	17/12/96	17/12/96
<b>Depth</b>	1.8	2.2	2.5	1.4	4.2	2
<b>Description</b>	br & occ grey mot sandy clay	mot yel-br & grey sandy clay	grey-br silty clay with minor rootlets	yel-br silty sand, occ pebbles	br-yel clayey sand	grey occ yel mot clayey sand
<b>Colour</b>	7.5YR 6/4	10YR 7/4	10YR 4/2	10YR 7/8	7.5YR 5/8	2.5Y 7/1
<b>Grading</b>	<b>cumulative % retained on sieves - phi scale</b>					
>-2.25						
-2.0						
-1.5				0.0		
-1.0				2.0	0.0	
-0.5				8.9	3.3	
0.0				17.4	6.2	
0.5				26.1	8.4	
1.0				36.8	9.9	
1.5				45.7	11.2	
2.0				53.1	12.5	
2.5				65.2	43.2	
3.0				81.5	79.3	
3.5				90.4	91.7	
4.0				93.5	95.3	
<4.0				99.9	100.6	
<b>Field Water Content - representative %</b>						
	7	5	9	10	17	12
<b>USCS Classification</b>						
<b>USCS</b>	SC-CL	CL	CL-ML	SC	SC	SC-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
				1.04E-07	9.42E-08	
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
				9.45E-05	8.54E-05	
<b>Chemistry</b>						
<b>EC</b>	207.5	250.7	161.9	221.7	314.0	61.5
<b>pH</b>	9.6	6.8	5.8	8.4	6.7	7.0
<b>CEC</b>	14	37	32	11	13	71
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.69E-02	2.07E-02	2.77E-03	1.58E-02	4.85E-03	1.69E-03
<b>K</b>	1.44E-03	1.04E-03	2.48E-03	4.24E-03	1.13E-02	9.65E-03
<b>Ca</b>	1.05E-01	9.07E-02	1.16E-01	1.21E-01	1.13E-01	8.01E-02
<b>Mg</b>	2.57E-02	3.47E-02	6.52E-02	2.57E-02	1.48E-02	5.00E-02
<b>Al</b>	2.28E-04	1.42E-03	1.48E-04	1.61E-04	2.37E-04	1.64E-04
<b>Sr</b>	2.80E-04	3.08E-04	4.56E-04	3.17E-04	3.32E-04	2.79E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz Ka	Qtz Ka	Qtz	Qtz	Qtz	Qtz
<b>Minor</b>	Mus			Ka Orth Mus		orth mus
<b>Very Minor</b>	Orth			Phlog		Goe Nac

<b>Cemetery:</b>	BUNURONG MEMORIAL PARK					
<b>Sample #</b>	N2/2	N2/3	N3/1	N3/2	N3/3	N7/1
<b>Sat'd/vaodse etc</b>	EXP BH	EXP BH	EXP BH	EXP BH	X EXP BH	
<b>Sample Date</b>	17/12/96	17/12/96	27/02/97	27/04/97	17/12/96	2/04/97
<b>Depth</b>	2.8	4.1	1	1.4	3.8	5-6
<b>Description</b>	grey occ yel stained silty fine sand	lt grey fine sand	stiff, red-br sandy clay	yel-br pebbly clayey sand	lt yel-grey fine sand	lt br silty fine sand
<b>Colour</b>	2.5Y 7/1	2.5YR 8/2	7.5YR 6/6	7.5YR 5/8	2.5Y 8/2	10YR 6/6
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>		0.0				0.0
<b>-1.0</b>	0.0	4.2		0.0	0.0	1.0
<b>-0.5</b>	3.3	5.9		3.5	0.1	7.7
<b>0.0</b>	6.4	7.3		9.3	0.3	12.3
<b>0.5</b>	8.9	8.1		19.3	1.8	15.4
<b>1.0</b>	11.2	8.7		33.8	3.1	17.9
<b>1.5</b>	13.1	9.3		47.2	5.6	19.9
<b>2.0</b>	15.1	9.9		64.3	9.3	23.3
<b>2.5</b>	28.8	23.3		78.3	63.7	48.4
<b>3.0</b>	68.0	50.2		89.5	88.8	80.9
<b>3.5</b>	86.4	95.0		93.7	93.1	90.4
<b>4.0</b>	90.8	97.0		95.7	95.2	93.7
<b>&lt;4.0</b>	99.6	99.8		100.9	100.0	100.7
<b>Field Water Content - representative %</b>						
	12	13	9	22	19	18
<b>USCS Classification</b>						
<b>USCS</b>	SC	SC	SC-CL	SC	SP	SM
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
	6.69E-08	2.71E-07		1.77E-07	1.38E-07	9.46E-08
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
	6.07E-05	2.46E-04		1.60E-04	1.25E-04	8.58E-05
<b>Chemistry</b>						
<b>EC</b>	65.9	359.0	70.5	55.1	244.0	638.0
<b>pH</b>	6.9	7.1	6.0	5.7	6.8	6.3
<b>CEC</b>	43	10	19	29	42	43
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	3.47E-03	3.12E-03	1.35E-02	2.37E-02	1.78E-02	8.39E-03
<b>K</b>	1.10E-03	3.39E-03	2.35E-03	1.66E-03	6.12E-04	4.69E-04
<b>Ca</b>	1.12E-01	9.23E-02	1.15E-01	1.05E-01	7.11E-02	8.21E-02
<b>Mg</b>	3.42E-02	9.44E-03	4.55E-02	1.65E-02	1.33E-02	2.61E-02
<b>Al</b>	1.69E-04	1.48E-04	2.65E-04	2.59E-04	1.64E-04	2.68E-04
<b>Sr</b>	3.64E-04	3.12E-04	3.75E-04	3.34E-04	2.29E-04	2.92E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Qtz	Qtz
	Ka					
<b>Minor</b>			Ka	Ka	Ka	
			Goe	Goe		
<b>Very Minor</b>					Ill?	Ka

<b>Cemetery:</b>	BUNURONG MEMORIAL PARK					
<b>Sample #</b>	N7/2	N8/1	NT1/1	NT1/2	NT1/3	NT1/4
<b>Sat'd/vaodse etc</b>	Xua	Xua	TRENCH	TRENCH	TRENCH	TRENCH
<b>Sample Date</b>	2/04/97	2/04/97	17/12/96	17/12/96	17/12/96	17/12/96
<b>Depth</b>	8.3	6-7	1.8	2.2	2.9	1.4
<b>Description</b>	yel-br & red-br sandy silt	yel-br silty fine sand	mot yel, red-br & grey pebbly sandy clay	red-br stained grey sandy clay	yel br & grey mot sandy clay	red-br clayey gravel
<b>Colour</b>	2.5YR 4/8 -	10YR 6/8	2.5Y 5/1	5Y 7/1	2.5YR 7/1 -	2.5YR 4/6
<b>Grading</b>	10YR 6/4				7.5YR 6/8	
<b>&gt;-2.25</b>						0.0
<b>-2.0</b>						27.9
<b>-1.5</b>		0.0				57.7
<b>-1.0</b>	0.0	0.5				63.1
<b>-0.5</b>	4.7	4.2				68.4
<b>0.0</b>	6.7	7.7				71.6
<b>0.5</b>	9.8	10.4				73.8
<b>1.0</b>	12.4	12.8				76.0
<b>1.5</b>	14.1	14.7				79.4
<b>2.0</b>	16.4	17.0				81.3
<b>2.5</b>	55.1	43.6				86.0
<b>3.0</b>	86.3	75.7				89.4
<b>3.5</b>	90.3	88.6				90.5
<b>4.0</b>	92.4	93.0				91.1
<b>&lt;4.0</b>	98.8	100.8				97.0
<b>Field Water Content - representative %</b>						
	17	17	16	17	16	3
<b>USCS Classification</b>						
<b>USCS</b>	SM	SM	CL	CL	CL	SP-SC
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
	1.29E-07	7.84E-08				4.23E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
	1.17E-04	7.11E-05				3.84E-04
<b>Chemistry</b>						
<b>EC</b>	523.0	250.8	142.6	162.9		329.0
<b>pH</b>	6.5	6.4	6.2	6.7		6.5
<b>CEC</b>	8	17	19	22		29
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	9.47E-03	2.62E-02	3.54E-02	4.55E-02		9.99E-03
<b>K</b>	7.02E-04	9.78E-04	2.80E-03	1.79E-03		2.38E-04
<b>Ca</b>	8.95E-02	9.76E-02	1.65E-01	1.38E-01		6.64E-02
<b>Mg</b>	2.76E-02	2.74E-02	1.17E-01	7.84E-02		2.22E-02
<b>Al</b>	1.57E-04	3.69E-04	2.65E-04	2.77E-04		2.07E-04
<b>Sr</b>	3.18E-04	3.36E-04	6.03E-04	4.75E-04		2.42E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz		Qtz
<b>Minor</b>			Ka Orth	Ka		
<b>Very Minor</b>						Ka

<b>Cemetery:</b>	BUNURONG MEMORIAL PARK					
<b>Sample #</b>	NT3/1	NT3/2	NT3/3	NT4/1	NT4/2	Nsand#1
<b>Sat'd/vaodse etc</b>	TRENCH	TRENCH	TRENCH	TRENCH	TRENCH	
<b>Sample Date</b>	17/12/96	17/12/96	27/02/97	27/02/97	27/02/97	27/12/97
<b>Depth</b>	2	3.1	2.2	1.7	1.4	n/a
<b>Description</b>	red-br occ grey mot sandy clay	grey, occ red-br mot fine sand	grey-br sandy silt (topsoil) with rootlets	dk-br - grey sandy silt	yel-br & lt br sandy clay	med-fine lt yel-white sand
<b>Colour</b>	7.5YR 5/6-5/8	5Y 8/1	10YR 4/2	10YR 3/1	10YR 3/2	n/a
<b>Grading</b>						
<b>&gt;-2.25</b>			0.0	0.0		
<b>-2.0</b>			11.5	15.2		
<b>-1.5</b>			34.2	33.2		
<b>-1.0</b>		0.0	49.6	44.7		
<b>-0.5</b>		3.3	60.1	56.4		0.0
<b>0.0</b>		5.8	66.9	64.5		1.3
<b>0.5</b>		7.8	72.0	71.2		34.0
<b>1.0</b>		9.2	76.5	77.7		89.7
<b>1.5</b>		10.3	80.2	83.1		99.0
<b>2.0</b>		13.1	83.4	87.8		99.4
<b>2.5</b>		40.1	88.6	92.3		99.6
<b>3.0</b>		80.2	93.4	95.6		
<b>3.5</b>		88.5	96.2	97.4		
<b>4.0</b>		92.0	97.3	98.2		
<b>&lt;4.0</b>		98.5	100.4	100.1		
<b>Field Water Content - representative %</b>						
	n/a	5	3	9	14	0
<b>USCS Classification</b>						
<b>USCS</b>	CL	SM	SP	SP	SC-CL	SW
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
		9.04E-08	6.35E-07	9.80E-07		2.06E-06
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
		8.20E-05	5.76E-04	8.88E-04		1.87E-03
<b>Chemistry</b>						
<b>EC</b>	136.9	183.1	147.5	190.1	203.6	9.4
<b>pH</b>	8.0	7.1	6.4	6.1	5.5	6.3
<b>CEC</b>	45	27	20	68	10	2
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.92E-02		1.07E-02	1.06E-02	1.72E-02	1.71E-03
<b>K</b>	1.45E-02		2.78E-03	1.53E-02	5.20E-03	
<b>Ca</b>	1.08E-01		9.93E-02	1.33E-01	1.26E-01	7.40E-02
<b>Mg</b>	3.84E-02		5.44E-02	4.22E-02	5.69E-02	2.30E-03
<b>Al</b>	2.04E-04		2.06E-04	1.68E-04	2.70E-04	2.09E-04
<b>Sr</b>	3.62E-04		4.10E-04	5.50E-04	4.18E-04	2.40E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz Ka	Qtz	Qtz
<b>Minor</b>	Ka Goe		Ka			
<b>Very Minor</b>		Ka			Ka	

<b>Cemetery:</b>	BUNURONG MEMORIAL PARK		
<b>Sample #</b>	Nsand#2		
<b>Sat'd/vaodse etc</b>			
<b>Sample Date</b>	28/02/97		
<b>Depth</b>	n/a		
<b>Description</b>	beige, coarse-med sand		
<b>Colour</b>	n/a		
<b>Grading</b>			
<b>&gt;-2.25</b>			
<b>-2.0</b>			
<b>-1.5</b>			
<b>-1.0</b>	0.0		
<b>-0.5</b>	6.5		
<b>0.0</b>	60.9		
<b>0.5</b>	86.0		
<b>1.0</b>	98.7		
<b>1.5</b>	99.7		
<b>2.0</b>			
<b>2.5</b>			
<b>3.0</b>			
<b>3.5</b>			
<b>4.0</b>			
<b>&lt;4.0</b>			
<b>Field Water Content - representative %</b>			
	0		
<b>USCS Classification</b>			
<b>USCS</b>	SW		
<b>Calculated Permeability Parameters</b>			
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>			
	4.19E-06		
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>			
	3.80E-03		
<b>Chemistry</b>			
<b>EC</b>	8.8		
<b>pH</b>	6.0		
<b>CEC</b>	10		
<b>Extracted exchangeable cations in mg/L</b>			
<b>Na</b>	1.43E-03		
<b>K</b>	4.48E-03		
<b>Ca</b>	7.16E-02		
<b>Mg</b>	1.93E-03		
<b>Al</b>	2.92E-04		
<b>Sr</b>	2.29E-04		
<b>Qualitative Mineralogical Components from XRD Analysis</b>			
<b>Major</b>			
<b>Minor</b>			
<b>Very Minor</b>			



<b>Cemetery:</b>	CARR VILLA MEMORIAL PARK					
<b>Sample #</b>	L1/1	L1/2	L1/3	L1/4	L1/5	L1/6
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	18/02/97	18/02/97	18/02/97	18/02/97	18/02/98	18/02/97
<b>Depth</b>	0.8	1.1	1.7	3.1	4.7	5.3
<b>Description</b>	firm, med br sandy clay	red-br sandy clay - clayey sand	yel-br to red yel/br occ grey red/br mot	red & yel fine sand and clayey sand	lt yel - yel-br fine clayey sand	lt grey fine sandy clay
			fine sand - clayey sand	with occ red-br Feox		occ Feox red-br mottles
<b>Colour</b>	7.5YR6/4-5/6	2.5YR 4/6	5YR 5/6	5YR 6/6-5/6	10YR 8/6-6/6	2.5Y 8/1
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>				0.0		
<b>-0.5</b>				5.9		
<b>0.0</b>				10.8		
<b>0.5</b>				15.1		
<b>1.0</b>				20.3		
<b>1.5</b>				27.1		
<b>2.0</b>				42.5		
<b>2.5</b>				69.4		
<b>3.0</b>				80.6		
<b>3.5</b>				86.0		
<b>4.0</b>				90.1		
<b>&lt;4.0</b>				98.9		
<b>Field Water Content - representative %</b>						
	17	13	11	6	9	8
<b>USCS Classification</b>						
<b>USCS</b>	CL	SC-CL	SC-CL	SP	SC-CL	CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
				7.91E-08		
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
				6.62E-05		
<b>Chemistry</b>						
<b>EC</b>	40.8	59.0	133.4	276.0	526.0	1031.0
<b>pH</b>	5.6	5.1	4.4	5.4	4.6	4.9
<b>CEC</b>	16	16	87	24	46	54
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>		4.18E-03	9.82E-03	3.93E-02	1.15E-02	6.57E-02
<b>K</b>	1.46E-03	2.02E-03	5.91E-04	2.45E-03	9.68E-05	2.13E-02
<b>Ca</b>	6.25E-02	5.46E-02	8.73E-02	9.95E-02	8.65E-02	1.79E-01
<b>Mg</b>	1.57E-02	1.02E-02	1.41E-02	3.86E-02	3.39E-02	1.13E-01
<b>Al</b>	4.12E-04	2.09E-02	1.93E-04	1.77E-04	2.11E-04	2.94E-04
<b>Sr</b>	1.99E-04	1.70E-04	2.82E-04	3.18E-04	2.55E-04	5.34E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz Ka	Qtz Ka	Qtz Ka	Qtz Ka	Ka Qtz	Qtz
<b>Minor</b>		Goe	Goe	Goe Mus		Ka
<b>Very Minor</b>	Goe Sid	Sid		Sid	Orth Mus Alb	Sid

<b>Cemetery:</b>	CARR VILLA MEMORIAL PARK					
<b>Sample #</b>	L2/1	L2/2	L3/1	L3/2	L3/3	L3/4
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	18/02/97	18/02/97	18/02/97	18/02/97	18/02/97	18/02/97
<b>Depth</b>	2.8	3.5	1.3	1.7	2.9	3.6
<b>Description</b>	yel-br clayey sand occ grey mot	yel-br fine, silty? sand	mod stiff mot red-br & grey sandy clay	grey, mot red-br, clayey sand	stiff grey sandy clay with yel-br sandy clay lenses	firm, grey clayey fine sand
<b>Colour</b>	10YR 7/6-6/8	10YR 6/6	2.5YR 4/6	2.5Y 7/1	2.5Y 6/1	2.5Y 7/1
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>				0.0		
<b>-1.0</b>				0.5	0.0	0.0
<b>-0.5</b>				11.8	7.0	3.5
<b>0.0</b>				24.3	12.8	7.4
<b>0.5</b>				36.4	17.8	10.9
<b>1.0</b>				46.7	23.8	15.4
<b>1.5</b>				54.9	32.4	22.2
<b>2.0</b>				64.8	52.1	42.0
<b>2.5</b>				77.5	74.7	72.2
<b>3.0</b>				87.4	85.8	84.8
<b>3.5</b>				92.3	90.7	90.9
<b>4.0</b>				96.5	94.0	96.0
<b>&lt;4.0</b>				101.0	100.5	103.6
<b>Field Water Content - representative %</b>						
	7	11	21	16	14	14
<b>USCS Classification</b>						
<b>USCS</b>	SC-CL	SC-CL	SC-CL	SP	SP	SP
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
				1.68E-07	1.39E-07	1.35E-07
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
				1.41E-04	1.17E-04	1.13E-04
<b>Chemistry</b>						
<b>EC</b>	403.0	213.0	120.2	145.0	267.0	373.0
<b>pH</b>	5.0	4.5	5.5	5.1	3.9	5.8
<b>CEC</b>	19	9	37	60		54
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	2.77E-02	3.44E-02	2.21E-02	1.06E-02	3.09E-02	2.25E-02
<b>K</b>	6.96E-03	7.06E-03	2.36E-03	6.18E-03	2.15E-03	1.82E-03
<b>Ca</b>	1.05E-01	8.77E-02	1.05E-01	9.31E-02	8.88E-02	1.02E-01
<b>Mg</b>	5.04E-02	4.03E-02	7.20E-02	2.62E-02	4.76E-02	4.40E-02
<b>Al</b>	3.23E-04	2.71E-04	3.15E-02	2.36E-04	1.72E-04	1.42E-04
<b>Sr</b>	3.24E-04	2.85E-04	3.81E-04	2.68E-04	2.86E-04	3.24E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz Ka	Ka Qtz	Qtz Ka	Qtz	Qtz Ka	Qtz Ka
<b>Minor</b>				Ill Orth	Orth Goe	
<b>Very Minor</b>	Sid	Sid	Goe Sid	Ka Mic	Mus2 Sid?	Mus2 Sid?

<b>Cemetery:</b>	CARR VILLA MEMORIAL PARK					
<b>Sample #</b>	L3/5	L4/1	L4/2	L4/3	L5/1	L5/2
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	18/02/97	18/02/97	18/02/97	18/02/97	19/02/97	18/02/97
<b>Depth</b>	4.8	3.5	3.9	1.8	back & sides	1.9
<b>Description</b>	yel-br with grey-red-br mot clayey sand	v stiff grey silty clay with carbonaceous material	red-br & yel-grey mot sandy clay	stiff, red-br clayey sand - sandy clay	yel-br sandy clay - clayey sand	dk red-br & grey sandy clay and clayey med sand, occ Fe pisoliths
<b>Colour</b>	10YR 6/6	5Y 7/1	2.5Y 4/6	5YR5/4 - 5/6	10YR 6/6	5YR 5/6 - 5/8
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>	0.0	0.0				
<b>-0.5</b>	4.4	17.9				
<b>0.0</b>	9.1	33.1				
<b>0.5</b>	16.6	44.1				
<b>1.0</b>	24.6	54.9				
<b>1.5</b>	33.0	62.3				
<b>2.0</b>	53.1	69.1				
<b>2.5</b>	73.9	77.0				
<b>3.0</b>	84.5	85.9				
<b>3.5</b>	91.4	90.4				
<b>4.0</b>	97.0	94.9				
<b>&lt;4.0</b>	101.2	101.4				
<b>Field Water Content - representative %</b>						
	16	16	2	15	15	8
<b>USCS Classification</b>						
<b>USCS</b>	SP	SM	CL	CL	SC-CL	SC-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
	1.32E-07	1.60E-07				
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
	1.11E-04	1.34E-04				
<b>Chemistry</b>						
<b>EC</b>	652.0	125.8	211.4	273.7	340.0	158.7
<b>pH</b>	4.2	5.1	5.5	4.3	3.9	4.1
<b>CEC</b>	41	8	93	47	39	39
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.76E-02	2.83E-02	3.11E-02	6.16E-02	1.63E-02	1.04E-02
<b>K</b>	5.69E-04	1.78E-02	6.23E-03	9.08E-03	3.06E-03	1.45E-03
<b>Ca</b>	8.58E-02	9.73E-02	5.57E-02	1.47E-01	7.26E-02	8.84E-02
<b>Mg</b>	3.86E-02	1.29E-01	1.04E-01	1.93E-01	5.44E-02	3.44E-02
<b>Al</b>	2.40E-04	3.00E-04	1.93E-04	2.74E-04	2.07E-04	2.15E-04
<b>Sr</b>	2.67E-04	3.42E-04	2.11E-04	5.05E-04	2.30E-04	2.66E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Ka	Qtz	Qtz	Qtz
	Ka		Qtz	Ka	Ka	
<b>Minor</b>		Ka		Ill	Mus	Ka
		Ill-Na			Ill	Goe
		Orth				
<b>Very Minor</b>	Sid	Sid	Orth	Goe	Pyr	Sid
			Ill	Mus	Sid	
			Sid	Sid?		

<b>Cemetery:</b>	CARR VILLA MEMORIAL PARK					
<b>Sample #</b>	L5/3	L6/1	L7/1	L7/2	L11/1	L12/1
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	18/02/97	19/02/97	19/02/97	19/02/97	24/11/97	24/11/97
<b>Depth</b>	n/a	base + sides	bot	side & bot	2.5	3.5
<b>Description</b>	grey clayey sand - sandy clay,	yel-br with yel-grey mots & red-br	mot yel br - red-br and grey sandy clay	mot yel-br and lt br clayey sand	br-yel fine sand and silty sand	silty fine sand and clayey sand
	mot red-br & rootlets	Fe concs sandy clay	& clayey sand	to sandy clay		
<b>Colour</b>	10R 4/4 &	10YR6/5-5/6	10YR 5/6 -5/8	10YR6/4	10YR 6/6-5/8	7.5Y 5/5
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>					0.0	
<b>-0.5</b>					8.1	
<b>0.0</b>					14.5	
<b>0.5</b>					21.2	
<b>1.0</b>					31.7	
<b>1.5</b>					46.0	
<b>2.0</b>					61.2	
<b>2.5</b>					73.5	
<b>3.0</b>					79.6	
<b>3.5</b>					84.1	
<b>4.0</b>					87.1	
<b>&lt;4.0</b>					98.7	
<b>Field Water Content - representative %</b>						
	13	36	16	13	17	20
<b>USCS Classification</b>						
<b>USCS</b>	SC-CL	CL	SC-CL	SC-CL	SC	SC-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
					6.76E-08	
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
					5.66E-05	
<b>Chemistry</b>						
<b>EC</b>	184.8	318.0	364.0	340.0	54.0	103.4
<b>pH</b>	4.9	5.1	5.3	4.2	5.0	6.0
<b>CEC</b>	-5	59	88	56	120	43
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.83E-02	1.08E-02	8.95E-03	1.39E-02	4.66E-03	2.44E-02
<b>K</b>	6.95E-04	1.07E-03	3.27E-03	3.02E-02	7.26E-03	1.54E-02
<b>Ca</b>	9.33E-02	1.01E-01	9.25E-02	1.55E-01	8.45E-02	9.25E-02
<b>Mg</b>	4.05E-02	3.43E-02	3.06E-02	4.60E-02	1.79E-02	3.86E-02
<b>Al</b>	1.97E-04	2.83E-04	1.26E-04	2.90E-04	1.39E-04	4.55E-04
<b>Sr</b>	2.85E-04	3.06E-04	2.83E-04	4.40E-04	2.41E-04	2.79E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Ka	Ka	Qtz	Ka	Qtz
	Ka	Qtz	Qtz		Qtz	Ka-s
	Mus2					
<b>Minor</b>		Pyr	Goe		Mus	Goe
		Orth				
		Mus				
<b>Very Minor</b>	Sid	Goe	Sid	Ka	Goe	Ana
	Pyr?	Sid		Goe	Sid	Sid
				Sid		

<b>Cemetery:</b>	CARR VILLA MEMORIAL PARK					
<b>Sample #</b>	L12/2	L13/1	L14/1	L14/2	L16/1	L16/2
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	24/11/97	24/11/97	24/11/97	24/11/97	24/11/97	24/11/97
<b>Depth</b>	4.4	2.5	3.5	5.3	2.7	4.1
<b>Description</b>	yel-br silty sand	mot yel-br & grey sandy clay to	grey and red-br mot, clayey fine sand	red-br & grey mot clayey med sand	red-br & grey mot clayey sand to	grey-red sandy clay to clayey sand
		clayey sand with minor roots			sandy clay with Feox concs	(red-br accumulation from above)
<b>Colour</b>	10YR 5/8	10YR 5/6	2.5Y 7/1 & 4.5Y6/3	10R 6/4	2.5Y 4/8	2.5Y 4/8
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>	0.0		0.0	0.0		
<b>-0.5</b>	8.9		5.8	2.9		
<b>0.0</b>	16.4		10.9	5.3		
<b>0.5</b>	23.0		15.3	7.5		
<b>1.0</b>	23.0		19.1	11.0		
<b>1.5</b>	40.1		23.4	18.2		
<b>2.0</b>	51.5		31.9	39.5		
<b>2.5</b>	68.5		59.3	71.2		
<b>3.0</b>	85.0		75.3	82.1		
<b>3.5</b>	90.9		82.5	86.8		
<b>4.0</b>	93.9		87.5	90.0		
<b>&lt;4.0</b>	102.0		99.2	98.4		
<b>Field Water Content - representative %</b>						
	14	19	27	17	20	19
<b>USCS Classification</b>						
<b>USCS</b>	SP	SC-CL	SC	SP	SC-CL	SC-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
	1.34E-07		5.33E-08	1.04E-07		
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
	1.12E-04		4.46E-05	8.70E-05		
<b>Chemistry</b>						
<b>EC</b>	179.0	70.8	57.6	45.1	45.6	68.5
<b>pH</b>	6.8	6.2	6.3	6.4	5.5	5.3
<b>CEC</b>	44	17	19	52	45	5
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	2.48E-02	7.18E-03	3.31E-02	1.49E-02	5.67E-03	8.85E-03
<b>K</b>	1.66E-03	3.11E-03	2.21E-03	9.30E-04	2.94E-04	1.13E-03
<b>Ca</b>	8.27E-02	1.13E-01	1.28E-01	7.56E-02	7.26E-02	8.63E-02
<b>Mg</b>	3.12E-02	4.37E-02	6.13E-02	2.54E-02	2.14E-02	3.71E-02
<b>Al</b>	1.63E-04	1.80E-04	2.61E-04	1.79E-04	1.46E-04	2.20E-04
<b>Sr</b>	2.62E-04	3.15E-04	3.87E-04	2.37E-04	2.24E-04	2.82E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Ill	Qtz
	Ka	Ka	Ka		Hal	Ka-s
<b>Minor</b>		Orth		Ka	Orth	Mus
		Goe		Goe		
<b>Very Minor</b>	Goe	Pyr	Sid	Mus	Ka	Sid
	Sid	Sid?		Sid	Qtz	
	Mont, Bar				Sid	

<b>Cemetery:</b>	CARR VILLA MEMORIAL PARK			
<b>Sample #</b>	L16/3	Lsand#1	Lsand#2	Lsand#3
<b>Sat'd/voidse etc</b>				
<b>Sample Date</b>	24/11/97	24/11/97	18/02/97	22/09/97
<b>Depth</b>	5.1	n/a	n/a	n/a
<b>Description</b>	yel-br sandy clay	white-grey, coarse-fine lithic qtz sand	white - lt grey coarse - fine, qtz sand	lithic quartz sand
<b>Colour</b>	5YR 5/6	n/a	n/a	n/a
<b>Grading</b>				
<b>&gt;-2.25</b>		0.0	0.0	
<b>-2.0</b>		12.7	8.0	
<b>-1.5</b>		33.5	23.7	
<b>-1.0</b>		49.2	37.8	0.0
<b>-0.5</b>		61.4	52.8	15.8
<b>0.0</b>		70.0	65.2	73.9
<b>0.5</b>		76.5	77.3	95.4
<b>1.0</b>		82.3	85.9	99.1
<b>1.5</b>		86.1	89.4	99.6
<b>2.0</b>		89.3	91.4	
<b>2.5</b>		95.0	95.4	
<b>3.0</b>		97.3	97.1	
<b>3.5</b>		98.4	97.9	
<b>4.0</b>		98.8	98.3	
<b>&lt;4.0</b>		99.5	99.2	
<b>Field Water Content - representative %</b>				
	18	0	2	n/a
<b>USCS Classification</b>				
<b>USCS</b>	SC-CL	SP	SP	SW
<b>Calculated Permeability Parameters</b>				
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>				
		1.59E-06	2.48E-06	5.57E-06
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>				
		1.33E-03	2.08E-03	4.67E-03
<b>Chemistry</b>				
<b>EC</b>	39.6	7.5	7.6	
<b>pH</b>	5.8	6.6	7.1	
<b>CEC</b>	31	1	6	
<b>Extracted exchangeable cations in mg/L</b>				
<b>Na</b>	1.06E-02	1.58E-03	1.09E-03	
<b>K</b>	9.08E-04	3.43E-03	3.82E-03	
<b>Ca</b>	9.71E-02	6.50E-02	5.24E-02	
<b>Mg</b>	2.86E-02	1.91E-03	1.80E-03	
<b>Al</b>	2.93E-04	1.46E-04	2.43E-04	
<b>Sr</b>	2.83E-04	2.03E-04	1.66E-04	
<b>Qualitative Mineralogical Components from XRD Analysis</b>				
<b>Major</b>	Qtz	Qtz	Qtz	
	Ka			
<b>Minor</b>	Goe	Orth		
	Cal			
<b>Very Minor</b>	Orth		Cal	
	Sid			

<b>Cemetery:</b>	CENTENNIAL PARK CEMETERY					
<b>Sample #</b>	C1/1	C1/2	C2/1	C2/2	C2/3	C3/1
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	21/09/96	21/09/96	20/09/96	20/09/96	20/05/96	21/09/96
<b>Depth</b>	2	3	2	4	4.8	3
<b>Description</b>	red-br pebbly sandy clay with caliche	stiff, red & yel-br sandy clay with	stiff br clay with grey and yel-br mots	firm yel-br pebbly sandy clay	v. stiff, dense br clay, occ. yel sand	firm, yel-br sandy clay
	nodules to 2 mm diam.	caliche nodules	minor caliche and charcoal		and caliche nodules	
<b>Colour</b>	5YR 5/6	7.5YR 5/6	7.5YR 4/4	10YR 4/6	7.5 YR 4/4	10YR 4/4
<b>Grading</b>						
>-2.25						
-2.0						
-1.5						
-1.0						
-0.5						
0.0						
0.5						
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0						
<4.0						
<b>Field Water Content - representative %</b>						
	2	9	16	13	10	14
<b>USCS Classification</b>						
<b>USCS</b>	CL	CL	CL-CH	CL-CH	CL	CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
<b>Chemistry</b>						
<b>EC</b>	1098	567	743	378	448	589
<b>pH</b>	9.0	7.1	6.8	8.4	8.7	8.0
<b>CEC</b>	20	58	54	17	50	6
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.71E-02	9.22E-03	2.32E-02	1.54E-02	3.67E-02	3.07E-02
<b>K</b>	2.29E-02	1.90E-02	9.82E-03	4.84E-03	1.61E-02	1.80E-02
<b>Ca</b>	2.75E-01	3.12E-01	2.43E-01	1.11E-01	4.31E-01	2.23E-01
<b>Mg</b>	9.25E-02	1.29E-01	1.04E-01	6.63E-02	1.45E-01	1.02E-01
<b>Al</b>	4.08E-04	1.88E-04	1.58E-04	2.21E-04	6.56E-04	2.65E-04
<b>Sr</b>	7.58E-04	1.01E-03	8.40E-04	3.99E-04	1.01E-03	7.57E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Qtz	Qtz
	Cal		Ka			Cal
<b>Minor</b>	Ka	Ka	Ill	Anth	Ka	Ka
	Mus	Cal	Orth		Mus	Orth
	Alb	Anorth	Cal			
<b>Very Minor</b>	Orth			Ill	Orth	Mus
				Ka	Anth	Mic
				Orth	Cal	

<b>Cemetery:</b>	CENTENNIAL PARK CEMETERY					
<b>Sample #</b>	C3/2	C4/1	C4/2	C5/1	C5/2	C5/3
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	21/09/97	21/09/96	21/09/96	20/90/96	20/09/96	20/09/96
<b>Depth</b>	2.4	9.5	11	2	4	6
<b>Description</b>	red-br sandy clay, claiche nodules	firm-stiff yel-br silty clay with caliche nodules	soft yel silty clay with grey mot	stiff, grey-br pebbly sandy clay	stiff, firm yel-grye mot sandy clay	stiff yel-grey sandy clay
<b>Colour</b>	7.5YR 6/4	10YR 6/6	2.5Y 6/6	10YR 4/3	2.5Y 6/3	2.5Y 6/2
<b>Grading</b>						
>-2.25						
-2.0						
-1.5						
-1.0						
-0.5						
0.0						
0.5						
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0						
<4.0						
<b>Field Water Content - representative %</b>						
	15	14	23	13	17	13
<b>USCS Classification</b>						
<b>USCS</b>	CL	CL-CH	CL-CH	CL-CH	CL-CH	CI-CH
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
<b>Chemistry</b>						
<b>EC</b>	368	623	953	785	833	9.99
<b>pH</b>	8.5	8.6	8.1	8.5	8.1	8.8
<b>CEC</b>	60		3	9	9	12
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	2.26E-02		2.93E-02	4.07E-02	3.25E-02	3.14E-02
<b>K</b>	8.60E-03		1.22E-02	1.31E-02	7.43E-03	8.45E-03
<b>Ca</b>	2.26E-01	2.69E-04	2.22E-01	2.79E-01	1.60E-01	1.64E-01
<b>Mg</b>	1.20E-01	3.07E-04	1.30E-01	1.64E-01	1.05E-01	1.02E-01
<b>Al</b>	1.16E-04	2.43E-04	2.56E-04	3.02E-04	2.26E-04	2.55E-04
<b>Sr</b>	1.02E-03		7.41E-04	1.27E-03	6.81E-04	6.63E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz Mus	Qtz Ill	Ill Qtz	Qtz	Qtz	Qtz
<b>Minor</b>	Anth	Ka Orth Mus	Mus Anth Cal	Ill Ka Anth	Ka Mont Ill	Ill
<b>Very Minor</b>	Cal	Anth Cal			Cal	Cal Orth



<b>Cemetery:</b>	CENTENNIAL PARK CEMETERY					
<b>Sample #</b>	C6/1	C6/2	C6/3	C7/1	C8/1	C8/2
<b>Sat'd/vaodse etc</b>				Xua		Xua
<b>Sample Date</b>	21/04/97	21/09/96	21/09/97	21/09/97	21/09/97	21/09/97
<b>Depth</b>	1.5	6.5	3.9	5	2.2	4.1
<b>Description</b>	red & yel-br sandy clay with caliche	stiff br & grey & red-br mot clay	red-br pebbly sandy clay-clayey sand	firm, yel-grey sandy clay	firm, lt br & grey mot sandy clay	firm grey sandy clay, yel mots
	nodules					& caliche nodules
<b>Colour</b>	7.5YR5/6-4/6	7.5YR 5/3-5/4	5YR5/6	2.5Y 6/3	7.5YR5/4-5/6	2.5Y 6/3
<b>Grading</b>						
<b>&gt;-2.25</b>	0.0		0.0			
<b>-2.0</b>	7.1		11.8			
<b>-1.5</b>	14.8		21.3	0.0		0.0
<b>-1.0</b>	22.7	0.0	29.9	2.0	0.0	2.0
<b>-0.5</b>	40.8	20.3	41.8	23.9	18.1	21.9
<b>0.0</b>	50.6	35.7	50.7	37.2	31.7	34.9
<b>0.5</b>	58.6	46.4	57.7	48.0	41.8	46.4
<b>1.0</b>	64.7	55.4	64.7	56.7	51.1	56.0
<b>1.5</b>	69.7	62.1	70.2	62.9	58.5	63.0
<b>2.0</b>	73.3	67.8	74.9	67.8	64.7	69.2
<b>2.5</b>	78.7	75.7	81.3	75.4	73.5	77.5
<b>3.0</b>	82.0	79.7	85.3	80.6	79.2	82.6
<b>3.5</b>	84.8	83.9	88.7	85.8	83.5	86.9
<b>4.0</b>	93.2	86.2	91.0	89.4	86.3	89.8
<b>&lt;4.0</b>	98.6	97.9	99.6	98.4	99.0	98.0
<b>Field Water Content - representative %</b>						
	18	16	10	19	20	16
<b>USCS Classification</b>						
<b>USCS</b>	CL	CL	CL	CL	CL-CH	CL-CH
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
<b>Chemistry</b>						
<b>EC</b>	227.4	358	426	462	719	850
<b>pH</b>	7.1	8.8	8.2	8.7	8.8	7.4
<b>CEC</b>	55	13	52	14		12
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.22E-02	2.36E-02	3.05E-02	5.06E-02	4.43E-02	3.23E-02
<b>K</b>	1.74E-02	9.31E-03	4.04E-03	9.68E-03	1.09E-02	2.50E-02
<b>Ca</b>	3.22E-01	1.71E-01	1.32E-01	2.26E-01	2.58E-01	1.73E-01
<b>Mg</b>	1.32E-01	1.06E-01	7.52E-02	1.07E-01	1.13E-01	1.22E-01
<b>Al</b>	1.61E-04	2.29E-04	2.12E-04	2.25E-04	2.66E-04	2.14E-04
<b>Sr</b>	1.17E-03	5.53E-04	7.42E-04	7.33E-04	8.06E-04	7.53E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz	Ill	Qtz
	Ka				Qtz	
	Mus					
<b>Minor</b>	Cal	Ka	Ka	Mus	Anth	Ill
		Alb	Anth	Cal	Mus	
		Mus			Cal	
<b>Very Minor</b>		Orth	Mont			Orth
						Cal

<b>Cemetery:</b>	CENTENNIAL PARK CEMETERY					
<b>Sample #</b>	Ca/1	Cb/1	Cb/2	Cb/3	Csand#1	Csand#2
<b>Sat'd/vaodse etc</b>						
<b>Sample Date</b>	20/09/96	21/09/96	21/09/96	21/09/96	n/a	22/09/97
<b>Depth</b>	2	2	3	4		
<b>Description</b>	lt yel-br sandy clay	red-br sandy? clay, calcrete nodules	red-br sandy clay occ pebbles	lt br pebbly sandy clay, occ pebbles	lt-br med-fine sand	lt br med-fine sand
		to 6.mm diam		to 30mm diam		
<b>Colour</b>	7.5YR 5/6	5YR 4/4	5YR 5/6-4/6	7.5YR6/6-5/6	n/a	n/a
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>					0.0	
<b>-0.5</b>					0.1	
<b>0.0</b>					22.7	
<b>0.5</b>					93.1	
<b>1.0</b>					99.3	
<b>1.5</b>					99.5	
<b>2.0</b>					99.6	
<b>2.5</b>						
<b>3.0</b>						
<b>3.5</b>						
<b>4.0</b>						
<b>&lt;4.0</b>						
<b>Field Water Content - representative %</b>						
	10	12	12	4	1	
<b>USCS Classification</b>						
<b>USCS</b>	CL-CH	CL-CH	CL	CL	SP	SW
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
					4.26E-06	
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
					4.20E-03	
<b>Chemistry</b>						
<b>EC</b>	241.5	148.9	117.1	108.3	30.8	39.7
<b>pH</b>	7.0	6.4	8.2	8.4	7.5	8.3
<b>CEC</b>	45	21	20	19	9	
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	1.74E-02		6.26E-03	7.60E-03	2.82E-03	
<b>K</b>	1.34E-02		7.46E-03	3.80E-03	1.17E-03	
<b>Ca</b>	2.17E-01	4.62E-04	1.42E-01	1.07E-01	9.51E-02	
<b>Mg</b>	7.74E-02	2.79E-04	3.51E-02	3.58E-02	7.48E-03	
<b>Al</b>	1.67E-04	1.78E-04	2.62E-04	2.24E-04	2.67E-04	
<b>Sr</b>	6.19E-04		3.26E-04	3.02E-04	3.35E-04	
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz	Qtz	Qtz	Qtz		
	Ka	Mus				
	Ill					
<b>Minor</b>	Mus	Orth	Ka	Mus		
	Cal		Orth	Orth		
			Alb			
<b>Very Minor</b>	Anorth	Mic		Rut		

<b>Cemetery:</b>	CHELTENHAM CEMETERY					
<b>Sample #</b>	H1/1	H1/2	H1/3	H1/4	H2/1	H3/1
<b>Sat'd/vaodse etc</b>			X	X		
<b>Sample Date</b>	19/09/96	19/09/96	19/09/96	19/09/96	20/09/98	19/09/96
<b>Depth</b>	1	3	5	6	2	1.5
<b>Description</b>	yel-br sandy silt, caliche nodules to 3.0 mm diam	yel-br pebbly sandy clayey silt	dk yel-br clayey silt, minor caliche nodules to 1.5 mm diam	v. soft, yel-br clayey sandy silt	dk yel-br clayey silt minor caliche nodules to 3.0 mm diam	yel & red-br sandy clay
<b>Colour</b>	7.5YR 5/8	7.5YR 4/6	7.5YR 6/4	7.5YR 5/6-5/8	7.5YR 4/3 - 4/4	7.5YR 6/4
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>						
<b>-1.0</b>						
<b>-0.5</b>						
<b>0.0</b>						
<b>0.5</b>						
<b>1.0</b>						
<b>1.5</b>						
<b>2.0</b>						
<b>2.5</b>						
<b>3.0</b>						
<b>3.5</b>						
<b>4.0</b>						
<b>&lt;4.0</b>						
<b>Field Water Content - representative %</b>						
	7	6	10	4	11	10
<b>USCS Classification</b>						
<b>USCS</b>	ML-CL	ML-CL	CL	ML-CL	ML-CL	SC-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
<b>Chemistry</b>						
<b>EC</b>	328		360	351	156	212.7
<b>pH</b>	7.8		8.7	7.7	5.9	7.8
<b>CEC</b>	41		13	24	38	9
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	8.76E-03		1.36E-02	3.32E-02	7.77E-03	3.99E-03
<b>K</b>	2.09E-02		4.58E-03	7.88E-03	1.79E-02	1.14E-02
<b>Ca</b>	2.55E-01		1.07E-01	2.03E-01	4.04E-01	2.62E-01
<b>Mg</b>	7.21E-02		4.10E-02	8.64E-02	5.94E-02	3.73E-02
<b>Al</b>	1.69E-04		4.39E-04	2.71E-04	3.57E-04	2.54E-04
<b>Sr</b>	9.83E-04		4.01E-04	8.85E-04	8.90E-04	5.52E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Qtz		Qtz	Qtz	Qtz	Ill
	Orth			Alb		Qtz
	Mus					
<b>Minor</b>	Cal			Ka	Ka	Ka, Alb
	Anorth			Ill	Ill-Na	Anth, Orth
					Alb	Mus
<b>Very Minor</b>	Alb		Mus	Mus	Orth	Ber
			Alb	Cal	Cal	Cal
				Orth, Mic		

<b>Cemetery:</b>	CHELTENHAM CEMETERY					
<b>Sample #</b>	H3/2	H3/3	H4/1	H4/2	H5/1	H6/1
<b>Sat'd/vaodse etc</b>		X	X	X		
<b>Sample Date</b>	19/09/96	19/09/96	19/09/96	19/09/96	20/09/96	20/09/96
<b>Depth</b>	3	6	4	5.5	2	4
<b>Description</b>	yel-br sandy silty clay, minor claiche	yel-br clayey silt with minor grey	stiff yel-br silty clay occ pebbles	firm dk br sandy silty clay occ gravel	yel-br sandy silt	yel-br sandy clayey silt
	nodules	rootlets & minor gravel				
<b>Colour</b>	7.5YR 5/6	7.5YR 4/6	7.5YR 5/6	5YR 4/4	7.5YR 5/8	7.5YR5/6-4/6
<b>Grading</b>						
<b>&gt;-2.25</b>						
<b>-2.0</b>						
<b>-1.5</b>	0.0					
<b>-1.0</b>	1.0					
<b>-0.5</b>	19.9					
<b>0.0</b>	32.2					
<b>0.5</b>	43.5					
<b>1.0</b>	52.9					
<b>1.5</b>	60.5					
<b>2.0</b>	67.5					
<b>2.5</b>	77.3					
<b>3.0</b>	82.8					
<b>3.5</b>	86.6					
<b>4.0</b>	89.6					
<b>&lt;4.0</b>	98.6					
<b>Field Water Content - representative %</b>						
	11	13	14	20	11	8
<b>USCS Classification</b>						
<b>USCS</b>	SC	SC-ML	ML-CL	ML-CL	SC-ML	ML-CL
<b>Calculated Permeability Parameters</b>						
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
	1.15E-07					
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
	1.16E-04					
<b>Chemistry</b>						
<b>EC</b>	202.2	346	145.9	365	561	382
<b>pH</b>	7.2	8.7	7.0	9.2	10.2	9.2
<b>CEC</b>	15	28	13	16	29	3
<b>Extracted exchangeable cations in mg/L</b>						
<b>Na</b>	7.86E-03	2.11E-02	2.21E-02	2.12E-02	2.64E-02	1.80E-02
<b>K</b>	1.29E-02	2.07E-02	2.36E-03	7.40E-03	8.75E-03	1.62E-02
<b>Ca</b>	2.50E-01	2.27E-01	1.05E-01	1.70E-01	1.85E-01	2.06E-01
<b>Mg</b>	9.19E-02	9.66E-02	7.20E-02	8.73E-02	5.85E-02	7.57E-02
<b>Al</b>	2.57E-04	3.76E-04	3.15E-02	2.58E-04	1.41E-04	2.54E-04
<b>Sr</b>	9.04E-04	8.33E-04	3.81E-04	6.59E-04	6.33E-04	6.46E-04
<b>Qualitative Mineralogical Components from XRD Analysis</b>						
<b>Major</b>	Ill	Qtz	Qtz	Ka	Qtz	Ill
	Ka		Orth	Alb		Ka
	Qtz			Qtz		Qtz
<b>Minor</b>	Mic	Alb	Mus	Mus	Orth	Anth
	Orth	Mus			Mic	Alb
					Ka	
<b>Very Minor</b>			Alb	Cal	Mus	
				Ill		

<b>Cemetery:</b>	CHELTENHAM CEMETERY		
<b>Sample #</b>	H6/2		
<b>Sat'd/vaodse etc</b>	X		
<b>Sample Date</b>	20/09/96		
<b>Depth</b>	6		
<b>Description</b>	dk yel-br clayey sandy silt		
<b>Colour</b>	7.5YR 4/6		
<b>Grading</b>			
>-2.25			
-2.0			
-1.5			
-1.0			
-0.5			
0.0			
0.5			
1.0			
1.5			
2.0			
2.5			
3.0			
3.5			
4.0			
<4.0			
<b>Field Water Content - representative %</b>			
	11		
<b>USCS Classification</b>			
<b>USCS</b>	SC-ML		
<b>Calculated Permeability Parameters</b>			
<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>			
<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>			
<b>Chemistry</b>			
<b>EC</b>	394		
<b>pH</b>	8.3		
<b>CEC</b>	13		
<b>Extracted exchangeable cations in mg/L</b>			
<b>Na</b>	1.02E-02		
<b>K</b>	5.20E-03		
<b>Ca</b>	1.44E-01		
<b>Mg</b>	5.45E-02		
<b>Al</b>	3.04E-04		
<b>Sr</b>	5.04E-04		
<b>Qualitative Mineralogical Components from XRD Analysis</b>			
<b>Major</b>	Qtz		
	Ill		
	Mus2		
<b>Minor</b>	Orth		
	Mic		
<b>Very Minor</b>	Arag		

Cemetery:	GUILDFORD CEMETERY						Cemetery:	GUILDFORD CEMETERY		
Sample #	G1/1	G1/2	G1/3	G1/4	G1/5	G1/6	Sample #	G2/1	G3/1	G3/2
Sat'd/vaodse etc					X	X	Sat'd/vaodse etc	X		X
Sample Date	13/11/96	13/11/96	13/11/96	13/11/96	13/11/96	13/11/96	Sample Date	13/11/96	13/11/96	13/11/96
Depth	1	2	2.8	3	4	6	Depth	5	2	3.5
Description	yel-br med-fine sand occ pebbles	yel-br med sand	yel-br pebbly fine sand	yel-br pebbly coarse sand	yel-br pebbly coarse sand	orange-br silty sand, occ pebbles	Description	yel-red-br clayey med sand	lt br med sand	lt br med sand
Colour	10YR 5/6	10YR 6/8	10YR 6/8	10YR 7/8	10YR 6/8	7.5YR 6/6	Colour	7.5YR 6/8	10YR 7/4	10YR 8/2
Grading							Grading			
>-2.25			0.0	0.0	0.0	0.0	>-2.25			
-2.0			42.8	13.9	2.4	3.5	-2.0			
-1.5			45.8	21.7	5.5	6.7	-1.5			
-1.0	0.0	0.0	46.5	28.3	9.6	13.1	-1.0	0.0	0.0	0.0
-0.5	0.2	0.2	47.8	39.0	23.1	24.3	-0.5	2.6	0.5	0.1
0.0	2.2	2.2	49.7	46.8	35.5	34.0	0.0	11.5	1.9	1.3
0.5	11.7	10.4	54.2	51.9	43.7	42.1	0.5	23.4	12.0	8.5
1.0	27.2	22.9	60.8	57.6	50.8	51.4	1.0	44.4	29.2	21.5
1.5	46.1	36.2	68.6	65.7	59.8	62.4	1.5	61.4	43.2	36.0
2.0	65.1	54.4	78.5	75.9	71.3	75.2	2.0	76.5	58.0	52.8
2.5	80.7	73.2	89.3	86.8	83.7	84.1	2.5	87.5	71.3	70.2
3.0	92.2	93.8	96.7	93.4	91.9	94.2	3.0	92.3	88.8	89.5
3.5	95.3	98.2	98.7	95.4	94.0	96.4	3.5	94.2	92.7	93.3
4.0	96.5	100.0	99.2	96.5	95.3	97.4	4.0	95.2	94.4	94.6
<4.0	98.3		100.2	99.3	98.6	100.1	<4.0	98.5	98.5	98.3
Field Water Content - representative %						Field Water Content - representative %				
	2	1	5	8	7	12		12	10	12
USCS Classification						USCS Classification				
USCS	SP	SP	SP	SP	SP	SP	USCS	SP-SC	SP	SP
Calculated Permeability Parameters						Calculated Permeability Parameters				
k - intrinsic permeability (Krumbein and Monk, 1942), cm <sup>2</sup>						k - intrinsic permeability (Krumbein and Monk, 1942), cm <sup>2</sup>				
	2.09E-07	1.68E-07	3.83E-07	3.24E-07	2.58E-07	2.68E-07		3.11E-07	1.51E-07	1.53E-07
K - hydraulic conductivity (after Hubbert's method), m/sec						K - hydraulic conductivity (after Hubbert's method), m/sec				
	2.03E-04	1.63E-04	3.72E-04	3.14E-04	2.50E-04	2.60E-04		3.02E-04	1.46E-04	1.48E-04
Chemistry						Chemistry				
EC	15.2	11.2	13.8	17.7	16.5	27.9	EC	22.1	16.8	17.7
pH	6.6	5.6	6.8	6.3	6.0	6.6	pH	6.2	7.0	7.5
CEC	44	9	11	27	38	24	CEC	21	36	66



			<b>Cemetery:</b>	GUILDFORD CEMETERY					
G3/3	G5/1	G6/1	<b>Sample #</b>	G6/2	G6/3	G7/1	G7/2	G8/1	G8/2
X			<b>Sat'd/vaodse etc</b>	X	X	X	X	X	X
13/11/96	14/11/96	14/11/96	<b>Sample Date</b>	14/11/96	14/11/96	14/11/96	14/11/96	14/11/96	14/11/96
6.0-6.5	4.4	2	<b>Depth</b>	3.9	5.4	2	4.2	5	5.6
lt grey clayey fine sand	grey-white med clayey sand	yel-br med. Sand	<b>Description</b>	lt br med sand	lt grey-br clayey sand; some grey-black organic mat	yel-br coarse sand	lt grey-br clayey fine sand	lt grey med-fine clayey sand with minor yel-br staining	lt grey clayey med-fine sand; with minor yel-br staining
5Y 7/1	10YR 8/2	10YR 7/6	<b>Colour</b>	2.5Y8/3	10YR7/2	2.5Y 8/3	2.5Y 8/2	5Y 8/1	5Y 8/1
			<b>Grading</b>						
			<b>&gt;-2.25</b>						
			<b>-2.0</b>						
			<b>-1.5</b>						
0.0	0.0		<b>-1.0</b>	0.0	0.0	0.0	0.0	0.0	0.0
1.5	2.3	0.0	<b>-0.5</b>	0.1	1.1	0.2	2.7	3.5	2.5
3.3	5.0	0.9	<b>0.0</b>	1.4	2.6	5.3	10.0	16.7	9.6
7.8	9.9	5.7	<b>0.5</b>	4.4	6.4	18.2	26.8	35.1	28.3
17.1	18.2	17.7	<b>1.0</b>	11.5	15.6	33.0	50.1	49.8	42.7
28.3	32.7	37.6	<b>1.5</b>	25.8	32.5	52.2	71.8	62.5	52.0
39.6	56.9	68.2	<b>2.0</b>	56.7	62.4	69.4	83.7	71.4	59.5
57.2	76.3	86.4	<b>2.5</b>	81.4	84.9	82.0	91.8	83.2	76.0
86.6	86.4	93.8	<b>3.0</b>	91.4	92.0	91.5	96.6	91.5	88.0
89.9	89.6	96.0	<b>3.5</b>	94.2	94.2	93.8	98.3	93.8	91.1
91.7	91.6	96.8	<b>4.0</b>	95.3	95.2	95.0	99.3	95.3	93.0
98.1	98.1	98.6	<b>&lt;4.0</b>	98.0	98.3	98.3	99.3	99.6	98.9
			<b>Field Water Content - representative %</b>						
16	12	1		16	13	10	13	14	17
			<b>USCS Classification</b>						
SP-SC	SP-SC	SP	<b>USCS</b>	SP-SM	SP-SC	SP	SP	SP	SP-SM
			<b>Calculated Permeability Parameters</b>						
			<b>k - intrinsic permeability (Krumbein and Monk, 1942), cm<sup>2</sup></b>						
1.28E-07	1.48E-07	2.62E-07		2.04E-07	2.51E-07	2.78E-07	4.93E-07	2.63E-07	1.61E-07
			<b>K - hydraulic conductivity (after Hubbert's method), m/sec</b>						
1.24E-04	1.43E-04	2.54E-04		1.98E-04	2.43E-04	2.70E-04	4.78E-04	2.55E-04	1.56E-04
			<b>Chemistry</b>						
28.0	28.7	19.5	<b>EC</b>	22.0	39.3	23.7	28.0	34.5	80.8
6.8	6.4	7.0	<b>pH</b>	6.4	6.7	6.6	6.1	5.4	5.1
14	36	3	<b>CEC</b>	14	22	16	26	41	23





**APPENDIX L**

**SUMMARY OF GROUNDWATER TEST RESULTS**

## Table L1. Water Sample Data

### Abbreviations and Notes

SWL – ‘standing water level’ prior to sampling, measured in depth below ground surface (metres), corrected from measurement at the top of the well collar.

n/a – the result has either been ‘not attained’ or has been rejected and is hence ‘not available’.

n/d – bacterial analyte ‘not detected’ in a specific test.

“total NO<sub>x</sub> to use” - this value has been derived from a consideration of Hach testing and commercial laboratory analyses.

“total N to use” – this value has been derived from recalculation following consideration of Hach NO<sub>2</sub>, NO<sub>3</sub>, NH<sub>4</sub> results and commercial laboratory results for Total N and Kjeldahl N.

“total P” - this value has been derived from recalculation following consideration of Hach PO<sub>4</sub> results and commercial laboratory results for Total P.

“HCO<sub>3</sub> to use” - this value has been derived from recalculation following consideration of all Hach alkalinity and commercial laboratory results for HCO<sub>3</sub> or CaCO<sub>3</sub> alkalinity.

“high TDS flag: care balance” – this flag operates if calculated TDS is greater than 1000 mg/L; at such values the validity of the ionic balance can be affected; the data was considered in the light of these results and appropriate corrections have been made where necessary. The flag ‘use%bal’ means that the normally derived ionic balance value is correct for assessing the total validity of the composition data.

“low sum an/cat tolerance” – this flag assisted in consideration of the total validity of the ionic balance calculation and allowed tolerances of up to +/- 12.5% where appropriate under several scenarios (see text for discussion); a value ‘OK high%’ applies where a tolerance >10% has been considered.

“analysis adjustments” (last entry for all columns) – meaning of abbreviations:-

DP    some results of bacterial testing have been rejected following consideration of disinfection quality control sampling which has been retrospectively applied to all samples. Individual results in the data include the word “reject”.

OC    the organic carbon analyte has adversely affected these results; all data except some derived or calculated are relevant.

- P partial analysis; not all analytes have been obtained for various reasons, some groupings or individuals missing. Major analytes (Al, B, Ca, K, Mg, Na, Si) should be viewed with caution because ionic balance cannot be confirmed; all other analyte data is useable. The term “partial anal” appears in the results tables.
- R reject the inorganic chemical analysis as a totality; some specific analyte values may be used in individual analyses; these are:-
- \* all HACH ANALYTES - NO<sub>2</sub>, NO<sub>3</sub>, NH<sub>4</sub>, PO<sub>4</sub>
  - \* commercial laboratory analyses of – Cl, SO<sub>4</sub>, TOC, Hg, Br
  - \* recalculated values for Total N and Total P
  - \* all minor ions – As, Cd, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Se, Sr, Zn.

#### Accuracy of Reported Data and Calculations

All data is reported at the level of accuracy applicable for the test undertaken or for the calculation made. Whereas individual analytes may have been sometimes measured or derived at a higher level of accuracy or with more significant figures, e.g. pH to 2 decimal places in the field, this has been adjusted where such a value would be inappropriate. ICP analyses, for instance, habitually return results of 4 or more significant figures; but this level of accuracy cannot be accepted when considered in the context of all the sampling, preparation and testing steps required to obtain any one result. A consequence of occasionally receiving results from commercial laboratories for minor analytes, is that the reporting levels are often higher than the concentration actually present in the sample, so that a zero result is returned. Results for bacterial testing e.g <1, <2, reflect dilution characteristics used in the various tests: for further analyses such results are treated as equal to zero.

BOT														
sample#	B1/1	B111/1	B1/2	B1/3	B1/4	B1/5	B2/6	B2/666	B3/1	B3/2	B3/3	B3/4	B3/5	CONT'D: sample#
date sampled	26-Mar-97	duplicate	28-May-97	1-Aug-97	28-Oct-97	10-Mar-98	11-Aug-98	11-Aug-98	25-Mar-97	29-May-97	30-Jul-97	27-Oct-97	9-Mar-98	date sampled
SWL (m)	0.70	bacterial	0.62	0.54	0.78	0.93	3.49		1.50	1.39	1.39	1.48	1.63	SWL (m)
pump rate (L/min)	0.25	nutrients	0.17	0.92	0.28	0.08	0.92		very slow	0.47	0.43	0.33	0.15	pump rate (L/min)
<b>FIELD PARAMETERS</b>														<b>FIELD PARAMETERS</b>
EC (uS/cm)	1014		1050	1315	1216	1869	367		1116	937	1158	1140	1155	EC (uS/cm)
pH	6.7		6.5	6.9	6.4	6.6	6.0		6.3	6.4	7.1	6.7	6.2	pH
Eh (mV)	-36		-37	-3	-47	-78	82		64	67	-63	-68	-74	Eh (mV)
deg C	22.5		20.1	12.4	17.0	22.4	17.5		23.5	20.9	15.3	21.7	26.6	deg C
O2 %Sat	n/a		16.6	40.7					n/a	27.7	n/a	n/a	n/a	O2 %Sat
turbid sample														turbid sample
yellow oxidation							yellow				yellow	slight	slight	yellow oxidation
H2S presence											(pungent, putrid)			H2S presence
<b>FIELD ANALYTES (mg/L)</b>														<b>FIELD ANALYTES (mg/L)</b>
CO2	101		150	50	79	360	58		106	180	?12	90	22	CO2
alkalinity as CaCO3	270		206	177	258	332	21		134	141	218	258	166	alkalinity as CaCO3
<b>HACH ANALYTES (mg/L)</b>														<b>HACH ANALYTES (mg/L)</b>
NO2 - N (for ion *3.3)	0.000		0.000	0.000	0.000	0.000	0.008		0.011	0.014	0.000	0.000	0.000	NO2 - N (for ion *3.3)
NO3 - N (for ion *4.4)	0.0		0.0	0.5	1.0	0.0	9.5		0.4	1.0	0.0	0.0	0.0	NO3 - N (for ion *4.4)
NH3 - N (for ion *1.29)	1.33		2.30	1.21	0.92	0.87	1.68		1.26	6.42	n/a	8.21	1.66	NH3 - N (for ion *1.29)
PO4(3-) (for P *0.326)	1.9		14.6	0.0	0.4	0.3	0.5		1.1	1.0	n/a	0.0	0.0	PO4(3-) (for P *0.326)
total inorganic N - Hach	1.3		2.3	1.7	1.9	0.9	11.2		1.7	7.4	0.0	8.2	1.7	total inorganic N - Hach
<b>BACTERIAL SUITE (CFU/100mL)</b>														<b>BACTERIAL SUITE (CFU/100mL)</b>
BOD (mg/L)	<2		<2	3	12	3	<2		2.0	2.0	140.0	4.0	<2	BOD (mg/L)
Total Coliforms	10	10	58	2	14	<2	6		<1	38	1	60	<2	Total Coliforms
Faecal Coliforms	2	2	20	<1		<1	<1		<1	<2	<1		<1	Faecal Coliforms
Faecal Streptococci	<1	<1	<2	<1	<1	<2	<1		<1	<2	<1	<1	<1	Faecal Streptococci
E.Coli	<1	1		<1	<1	<1					<1	<1	<1	E.Coli
Pseudomonas aeruginosa			<2	<1	<1	<2	<1			<2	<1	<1	<1	Pseudomonas aeruginosa
Clostridium perfringens/spp														Clostridium perfringens/spp
Yersinia spp.														Yersinia spp.
Salmonella spp.														Salmonella spp.
<b>STANDARD ANALYTE SUITE (mg/L)</b>														<b>STANDARD ANALYTE SUITE (m</b>
total NOx to use	0.0	0.0	0.0	0.5	1.0	0.0	9.5	0.0	0.6	1.0	0.0	0.0	0.0	total NOx to use
kjeldahl N (organic N)									1.7					kjeldahl N (organic N)
total N to use	1.3	0.7	2.3	1.7	1.9	1.1	18.0	17.0	3.5	7.4	28.0	9.2	1.7	total N to use
total P	0.6	<0.005	4.8	0.0	0.1	0.1	0.2	0.0	0.4	0.3	0.0	<0.005	0.0	total P
total organic carbon (TOC)	66.0	67.0	11.0	13.0	15.3	16.0	5.6	5.5	15.0	11.0	87.0	19.1	12.0	total organic carbon (TOC)
Cl	120.0	116.0	160.0	210.0	150.0	150.0	38.5	38.5	140.0	120.0	100.0	130.0	135.0	Cl

CONT'D: sample#	B1/1	B111/1	B1/2	B1/3	B1/4	B1/5	B2/6	B2/666	B3/1	B3/2	B3/3	B3/4	B3/5	CONT'D: sample#
SO4	13.0	12.0	22.0	70.0	81.0	130.0	22.2	22.2	130.0	88.0	30.0	71.0	135.0	SO4
total S - lab														total S - lab
HCO3 to use	329.7	0.0	251.2	340.0	420.0	404.8	25.1	0.0	162.9	171.9	380.0	314.6	202.4	HCO3 to use
CO3 - lab														CO3 - lab
Hg	<0.001		0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.001	<0.0005	<0.0005	<0.0005	<0.0005	Hg
<b>UTS - ICP ANALYTES (mg/L)</b>														<b>UTS - ICP ANALYTES (mg/L)</b>
B	0.57	0.49	0.82	2.24	0.45	0.46	0.10		0.38	0.39	1.11	0.32	0.28	B
Na	119.1	119.4	130.4	152.4	128.3	157.8	19.4		110.6	87.7	85.5	89.1	105.3	Na
Mg	24.8	25.8	27.1	31.6	39.8	62.8	4.6		28.6	21.3	21.6	29.5	28.3	Mg
Al	0.2	0.2	0.2	0.7	0.3	0.2	0.1		0.2	0.3	0.7	0.3	0.2	Al
Si	1.8	1.0	3.3	4.0	3.4	4.0	4.2		1.1	3.6	4.0	3.7	4.9	Si
K	8.7	8.9	9.0	10.3	9.9	15.5	18.0		14.8	24.8	19.8	25.3	11.5	K
Ca	64.8	64.1	71.0	84.8	102.3	206.8	29.6		83.1	79.5	73.7	99.7	91.8	Ca
Cr	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	Cr
Mn	1.94E-01	1.96E-01	1.99E-01	2.32E-01	2.27E-01	2.90E-01	6.10E-03		2.15E-01	1.48E-01	4.75E-01	3.42E-01	2.91E-01	Mn
Fe	8.39E+00	8.38E+00	6.21E+00	8.49E+00	1.04E+01	8.81E+00	8.74E-02		1.96E+00	7.60E-01	2.36E+01	1.71E+01	1.58E+01	Fe
Ni	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	Ni
Zn	2.05E-03	2.55E-03	1.60E-04	3.57E-03	7.09E-03	9.82E-03	3.72E-03		4.79E-03	5.81E-03	5.87E-03	1.12E-02	1.68E-02	Zn
Cu	6.91E-04	1.58E-02	1.01E-03	6.66E-04	0.00E+00	1.45E-03	n/a		1.50E-02	1.01E-02	7.23E-04	1.28E-03	2.21E-03	Cu
As	1.46E-04	1.33E-04	1.60E-04	1.70E-04	1.54E-04	2.65E-04	9.93E-05		1.72E-04	2.60E-04	1.70E-03	8.72E-04	1.45E-03	As
Se	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Se
Sr	3.10E-01	3.21E-01	3.10E-01	3.77E-01	4.16E-01	8.22E-01	1.90E-01		3.94E-01	3.31E-01	3.17E-01	3.90E-01	3.89E-01	Sr
Mo	6.51E-04	5.86E-04	6.83E-04	5.47E-04	8.61E-04	1.66E-02	4.12E-04		4.49E-03	4.87E-03	1.18E-02	7.32E-03	5.16E-03	Mo
Cd	6.29E-05	2.95E-05	8.89E-05	3.39E-05	2.14E-04	1.05E-04	1.67E-04		5.35E-04	5.54E-04	8.42E-05	1.33E-03	1.23E-04	Cd
Pb	2.31E-04	8.82E-04	3.76E-04	3.05E-04	4.03E-04	4.52E-04	1.16E-03		1.88E-03	2.55E-03	7.07E-04	7.66E-04	6.80E-04	Pb
F by IC - if analysed														F by IC - if analysed
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use
<b>CERTIFICATES</b>														<b>CERTIFICATES</b>
certificate numbers for	97-03-199	97-03-199	97-05-165	97-08-009	97-10-183	98-03-079	98-08-059	98-08-059	97-03-198	97-05-180	97-07-166	97-10-171	98-03-066	certificate numbers for
above analyses														above analyses
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>														<b>ELECTRONIC BALANCE (%), RA</b>
calculated TDS (mg/L)	573		570	738	726	928	226		610	541	719	655	633	calculated TDS (mg/L)
high TDS flag;care balance	use %bal		use %bal	use %bal	use %bal	use %bal	use %bal		use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag;care balance
sum cation millequivalents	11.106	11.079	12.090	14.209	14.685	23.169	3.299		11.877	10.690	10.607	13.173	12.504	sum cation millequivalents
sum anion millequivalents	9.119	3.522	9.549	12.991	12.882	13.582	2.651		9.390	8.136	9.674	10.302	9.936	sum anion millequivalents
low sum an/cat tolerance	OK high%	partial anal	OK high%	OK high%		OK high%	OK high%	partial anal	OK high%				OK high%	low sum an/cat tolerance
ionic balance % error	9.8	51.8	11.7	4.5	6.5	26.1	10.9		11.7	13.6	4.6	12.2	11.4	ionic balance % error
A = S/K (calc TDS/cond)	0.6		0.5	0.6	0.6	0.5	0.6		0.5	0.6	0.6	0.6	0.5	A = S/K (calc TDS/cond)
analysis adjustments		P				R		P		R		R		analysis adjustments

B3/6	B4/1	B4/2	B4/3	B4/4	B4/6	B5/1	B5/2	B5/3	B5/4	B5/5	B6/2	B6/3	CONT'D: sample#	B6/6	B7/1
11-Aug-98	25-Mar-97	29-May-97	30-Jul-97	27-Oct-97	10-Aug-98	25-Mar-97	28-May-97	31-Jul-97	27-Oct-97	10-Mar-98	29-May-97	31-Jul-97	date sampled	11-Aug-98	25-Mar-97
1.17	1.82	1.53	1.58	1.90	0.78	3.40	2.85	2.68	2.28	3.32	2.04	2.01	SWL (m)	1.33	1.75
1.20	0.25	0.50	0.80	0.48	0.60		0.33	1.60	0.25	0.65	0.29	1.60	pump rate (L/min)	0.86	
													<b>FIELD PARAMETERS</b>		
508	484	454	634	522	369	596	348	576	628	346	670	515	EC (uS/cm)	838	910
6.5	6.6	6	7.0	6.3	7.0	6.0	6.0	5.8	5.4	5.8	6.2	6.5	pH	6.4	6.3
80	-75	153	124	104	134	178	167	213	168	64	77	83	Eh (mV)	115	45
17.0	27.5	21	15.1	20.4	18.2	24.8	21.4	15.3	20.2	24.2	21.9	17.2	deg C	17.9	24.0
23.9	n/a	30	27.4			n/a	53.4	55.2	n/a	27.9	12.1	35.7	O2 %Sat	54.5	n/a
										highly colored			turbid sample		
						yellow	yellow		yellow/orange			yellow	yellow oxidation		
strong													H2S presence		
													<b>FIELD ANALYTES (mg/L)</b>		
38	71	65	76	52	56	34	20	84	26	n/a	221	78	CO2	214	100
186	135	104	115	112	87	49	30	12	59	40	85	53	alkalinity as CaCO3	86	178
													<b>HACH ANALYTES (mg/L)</b>		
0.166	0.020	0	0.007	0.005	0.002	0.009	0.007	0.002	0.000	0.000	0.001	0.004	NO2 - N {for ion *3.3}	0.003	0.007
5.6	0.0	3	1.5	0.0	4.2	0.9	3.2	15.3	6.4	0.1	3.5	7.5	NO3 - N {for ion *4.4}	4.2	5.7
2.44	0.58	0	1.48	0.35	0.15	n/a	0.90	0.29	0.20	0.17	0.73	0.51	NH3 - N {for ion *1.29}	0.23	1.72
2.3	2.8	1	1.0	3.4	1.4	n/a	13.7	0.5	0.1	4.6	0.9	1.7	PO4(3-) {for P *0.326}	0.9	1.1
8.2	0.6	2.9	3.0	0.4	4.4	n/a	4.1	15.6	6.6	0.3	4.3	8.0	total inorganic N - Hach	4.4	7.4
													<b>BACTERIAL SUITE (CFU/100mL)</b>		
8.0	<2	6	3.0	<2	<2	<2	<2	<2	8.0	<2	3.0	<2	BOD (mg/L)	<2	<2
40	<1	210	770	22	270	<1	<2	<1	25	<2	2	63	Total Coliforms	14	<1
<1	<1	<2	<1		<1	<1	<2	<1		<1	<2	<1	Faecal Coliforms	<1	<1
<1	<1	<2	<1	<1	4	<1	<2	<1	<1	<2	<2	<1	Faecal Streptococci	<1	<1
			<1	<1				<1	<1	<1	<1	<1	E.Coli		
<1		<2		<1	<2		<2	<1	<1	<2	<2	<1	Pseudomonas aeruginosa	<1	
													Clostridium perfringens/spp		
													Yersinia spp.		
													Salmonella spp.		
g/L)													<b>STANDARD ANALYTE SUITE (mg/L)</b>		
5.8	0.3	3	1.5	0.0	4.2	3.8	3.2	15.3	6.4	0.1	3.6	7.5	total NOx to use	4.2	8.1
	0.6												kjeldahl N (organic N)		8.1
10.0	1.5	3	3.0	0.8	4.4	4.3	7.1	19.0	11.0	1.8	4.3	8.0	total N to use	7.2	17.9
0.8	0.9	0.3	0.3	1.1	0.4	0.0	4.5	0.2	0.0	1.5	0.3	0.6	total P	0.3	0.4
10.0	11.0	7.5		9.6	7.4	16.0	6.6	7.4	14.1	8.0	11.0	11.0	total organic carbon (TOC)	11.0	13.0
50.5	44.0	59	59.0	50.0	32.3	95.0	52.0	72.0	89.0	44.0	69.0	48.0	Cl	144.0	92.0

B3/6	B4/1	B4/2	B4/3	B4/4	B4/6	B5/1	B5/2	B5/3	B5/4	B5/5	B6/2	B6/3	CONT'D: sample#	B6/6	B7/1
50.8	15.0	22	32.0	23.0	22.6	48.0	28.0	44.0	76.0	26.0	89.0	44.0	SO4	49.5	78.0
													total S - lab		
226.3	164.4	126	200.0	190.0	106.3	60.0	37.1	34.0	47.0	49.3	103.6	96.0	HCO3 to use	104.9	216.5
													CO3 - lab		
<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	Hg	<0.0005	<0.001
													<b>UTS - ICP ANALYTES (mg/L)</b>		
0.18	0.11	0.02	0.55	0.13	0.04	0.16	0.00	0.33	0.17	0.01	0.01	0.38	B	0.18	0.22
42.4	30.8	29.7	50.8	41.8	21.9	68.2	35.1	57.3	59.2	34.3	64.9	49.1	Na	85.3	73.2
8.1	12.9	9.9	12.8	13.3	5.7	9.0	6.2	9.8	12.2	6.2	18.5	10.0	Mg	12.9	20.6
0.1	0.2	0.3	0.5	0.4	0.0	0.3	0.3	0.8	0.4	0.3	0.3	0.4	Al	0.1	0.1
3.4	0.1	2.6	3.7	3.3	4.1	0.0	2.5	3.2	2.9	3.4	3.9	3.3	Si	3.1	0.0
15.1	8.1	8.4	11.2	9.2	6.0	14.2	11.5	12.3	17.0	8.0	13.2	8.6	K	13.7	23.8
34.5	48.6	51.2	66.8	55.9	35.0	30.9	22.6	33.5	45.4	24.0	49.7	31.9	Ca	65.6	75.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Cr	0.0	0.0
9.55E-02	6.73E-02	8.97E-04	3.77E-03	1.60E-02	8.76E-04	5.69E-03	2.38E-03	1.10E-02	2.78E-03	4.74E-03	1.23E-01	7.05E-02	Mn	1.74E-02	3.69E-01
5.45E-01	4.48E+00	9.18E-02	1.63E-01	2.57E-01	8.42E-02	3.20E-01	1.27E-01	9.75E-02	6.84E-01	3.05E-01	1.72E+00	2.87E+00	Fe	1.56E-01	1.94E+00
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Ni	0.0	0.0
9.17E-03	7.59E-03	7.53E-01	7.14E-01	5.20E-02	1.89E-01	2.39E-03	4.11E-03	1.90E-02	6.82E-03	7.79E-03	3.81E-03	4.89E-03	Zn	3.80E-03	8.26E-04
n/a	1.49E-02	1.18E-03	4.12E-03	7.43E-04	n/a	3.29E-03	2.07E-03	4.73E-03	1.26E-03	1.37E-03	8.38E-04	3.79E-03	Cu	n/a	1.08E-02
1.75E-04	1.84E-04	7.17E-05	1.12E-04	7.96E-05	7.68E-05	6.84E-05	5.75E-05	5.48E-05	6.25E-05	5.55E-05	4.90E-04	5.70E-05	As	3.15E-04	8.83E-05
0.00E+00	0.00E+00	0.00E+00	1.17E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.57E-04	0.00E+00	5.82E-03	0.00E+00	0.00E+00	Se	0.00E+00	0.00E+00
1.90E-01	2.14E-01	1.65E-01	2.22E-01	1.92E-01	1.37E-01	2.04E-01	1.21E-01	2.23E-01	2.70E-01	1.36E-01	2.53E-01	1.69E-01	Sr	2.69E-01	3.62E-01
2.82E-03	4.83E-04	1.06E-03	1.18E-03	8.25E-04	1.05E-03	6.08E-05	2.27E-04	1.27E-04	1.24E-04	1.57E-04	3.38E-03	1.73E-03	Mo	2.85E-03	3.40E-04
6.65E-05	5.14E-05	1.09E-03	8.68E-04	5.21E-04	3.67E-04	2.31E-05	7.19E-04	1.45E-04	1.73E-04	4.89E-05	5.23E-04	1.06E-04	Cd	9.03E-05	3.69E-05
2.23E-03	1.45E-03	1.37E-03	1.88E-03	1.13E-03	1.31E-03	1.20E-03	9.60E-04	1.09E-03	5.73E-04	8.84E-04	4.32E-04	4.00E-04	Pb	6.16E-04	1.32E-03
													F by IC - if analysed		
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	0.00E+00
													<b>CERTIFICATES</b>		
98-08-059	97-03-198	97-05-180	97-07-166	97-10-171	98-08-043	97-03-198	97-05-165	97-07-169	97-10-171	98-03-079	97-05-180	97-07-169	certificate numbers for	98-08-059	97-03-198
													above analyses		
<b>TIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALI</b>		
353	253	257	335	293	199	325	222	332	381	187	383	284	calculated TDS (mg/L)	460	542
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag;care balance	use %bal	use %bal
4.828	5.267	4.910	7.049	6.019	3.339	5.663	3.561	5.410	6.374	3.463	7.319	4.958	sum cation millequivalents	8.431	9.440
6.673	4.337	4.424	5.748	5.111	3.465	4.729	3.318	4.604	5.319	2.744	5.778	4.428	sum anion millequivalents	7.139	8.209
	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%					OK high%	OK high%	low sum an/cat tolerance	OK high%
-16.0	9.7	5.2	10.2	8.2	-1.9	9.0	3.5	8.1	9.0	11.6	11.8	5.6	ionic balance % error	8.3	7.0
0.7	0.5	0.6	0.5	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.6	A = S/K (calc TDS/cond)	0.5	0.6
R												R	analysis adjustments		



B7/2	B7/3	B7/4	B7/5	B7/6	B8/1	B8/2	B8/3	B8/4	B8/5	B8/6	CONT'D: sample#	B9/1	B9/2	B9/3	B9/4
29-May-97	31-Jul-97	27-Oct-97	9-Mar-98	11-Aug-98	25-Mar-97	29-May-97	31-Jul-97	28-Oct-97	9-Mar-98	10-Aug-98	date sampled	25-Mar-97	29-May-97	1-Aug-97	28-Oct-97
1.20	1.19	1.65	1.96	1.45	2.68	2.14	2.03	2.52	3.04	1.59	SWL (m)	2.65	2.04	1.93	2.17
0.80	0.69	0.51	0.92	1.04	0.75	0.57	0.96	0.65	0.46	0.86	pump rate (L/min)		0.44	1.15	0.95
											<b>FIELD PARAMETERS</b>				
453	515	632	1044	578	458	732	570	444	918	638	EC (uS/cm)	607	523	364	551
6.4	6.6	6.4	6.1	6.7	6.2	6.5	6.8	6.3	6.3	6.8	pH	6.3	6.4	6.7	6.2
96	126	98	53	154	138	160	170	139	64	101	Eh (mV)	160	132	151	118
21.1	16.4	19.2	22.5	16.9	24.7	21.2	15.4	18.9	24.1	16.6	deg C	23.2	21.5	15.8	18.1
5.3	16.3	n/a	14.6	62.8	15.2	28.9	11.4	n/a	10.2	79.4	O2 %Sat	25.0	22.9	58.6	n/a
											turbid sample				
											yellow oxidation				
											H2S presence				
											<b>FIELD ANALYTES (mg/L)</b>				
54	140	137	101	81	62	20	69	154	104	66	CO2	75	7	90	137
88	105	56	96	58	159	162	124	119	116	135	alkalinity as CaCO3	86	90	66	72
											<b>HACH ANALYTES (mg/L)</b>				
0.012	0.005	0.015	0.005	0.011	0.005	0.000	0.002	0.000	0.005	0.004	NO2 - N {for ion *3.3}	0.005	0.000	0.000	0.015
4.5	4.4	6.1	1.6	5.0	0.0	7.6	4.6	0.6	4.7	3.1	NO3 - N {for ion *4.4}	0.8	18.7	3.8	2.5
0.00	0.50	2.90	0.33	0.28	0.44	0.77	0.13	0.08	1.39	0.23	NH3 - N {for ion *1.29}	0.63	0.27	0.16	0.18
0.0	1.2	0.4	0.5	0.7	4.3	0.2	2.5	1.0	0.5	1.3	PO4(3-) {for P *0.326}	2.8	2.7	0.9	3.2
4.5	4.9	9.0	2.0	5.3	0.4	8.3	4.7	0.7	6.1	3.3	total inorganic N - Hach	1.4	19.0	4.0	2.7
											<b>BACTERIAL SUITE (CFU/100mL)</b>				
3.0	4.0	<2	3.0	<2	<2	4.0	<2	5.0	<2	<2	BOD (mg/L)	<2	3.0	<2	<2
22	57	1	<2	30	<1	16	12	10	<2	80	Total Coliforms	<1	2	<1	1500
<2	<1		<1	<1	<1	<2	<1		<1	<1	Faecal Coliforms	<1	<2	<1	
<2	<1	<1	<1	<1	<1	<2	<1	<1	<1	1	Faecal Streptococci	<1	<2	<1	<1
	<1	<1	<1				<1	<1	<1		E.Coli			<1	<1
<2	<1	<1	<1	<1		<2	<1	<1	<1	<1	Pseudomonas aeruginosa		<2	<1	<1
											Clostridium perfringens/spp				
											Yersinia spp.				
											Salmonella spp.				
											<b>STANDARD ANALYTE SUITE (mg/L)</b>				
4.5	4.4	6.1	1.6	5.0	1.0	7.6	4.6	0.6	4.7	3.1	total NOx to use	1.6	18.7	3.8	2.5
					1.0						kjeldahl N (organic N)	1.6			
6.1	4.9	9.0	2.3	8.9	2.5	8.3	4.7	1.0	10.0	4.4	total N to use	3.7	19.0	5.0	4.2
0.0	0.4	0.1	0.2	0.2	1.4	0.1	0.8	0.4	0.2	0.4	total P	0.9	0.9	0.3	1.0
6.0	8.7	9.0	8.5	6.4	10.0	5.0	4.8	8.7	9.8	7.0	total organic carbon (TOC)	9.1	6.0	4.7	8.8
66.0	50.0	62.0	130.0	78.0	42.0	77.0	50.0	49.0	100.0	86.0	Cl	76.0	68.0	41.0	71.0

B7/2	B7/3	B7/4	B7/5	B7/6	B8/1	B8/2	B8/3	B8/4	B8/5	B8/6	CONT'D: sample#	B9/1	B9/2	B9/3	B9/4
27.0	39.0	26.0	150.0	17.0	15.0	31.0	21.0	21.0	76.0	44.3	SO4	61.0	23.0	30.0	55.0
											total S - lab				
107.3	127.8	180.0	117.0	70.7	193.6	197.5	190.0	145.1	160.9	164.8	HCO3 to use	104.9	110.2	58.0	125.0
											CO3 - lab				
<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	Hg	<0.001	<0.0005	<0.0005	<0.0005
											<b>UTS - ICP ANALYTES (mg/L)</b>				
0.00	0.09	2.25	1.27	0.09	0.39	1.80	0.06	0.68	0.46	0.09	B	0.33	0.21	0.88	0.40
35.6	39.3	47.6	94.7	55.0	27.8	40.0	33.3	33.6	73.4	48.8	Na	52.1	40.7	29.8	56.0
7.9	7.4	16.5	27.2	7.0	8.0	11.6	8.4	8.6	21.5	9.0	Mg	12.2	10.2	6.9	12.0
0.2	0.3	0.3	0.2	0.0	0.3	0.3	0.3	0.3	0.2	0.0	Al	0.1	0.3	0.8	0.3
3.2	3.3	4.4	4.6	3.6	2.8	9.1	4.9	4.5	3.8	4.7	Si	1.5	3.2	3.2	2.9
9.2	14.0	12.4	18.7	15.0	6.2	9.7	6.7	7.0	18.6	6.7	K	10.7	9.1	7.0	9.7
42.2	47.0	59.3	83.8	36.0	53.3	104.2	72.4	55.6	78.5	81.0	Ca	50.7	52.5	30.3	48.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Cr	0.0	0.0	0.0	0.0
3.20E-02	5.55E-02	3.50E-01	5.61E-01	1.73E-02	2.48E-02	7.55E-02	2.74E-03	1.29E-02	2.94E-01	9.30E-03	Mn	1.46E-02	1.04E-02	4.31E-03	1.03E-02
3.41E-01	4.61E-01	5.42E-01	3.90E-01	8.13E-02	1.80E-01	1.44E-01	2.20E-01	1.49E-01	2.69E-01	1.27E-01	Fe	1.79E-01	1.03E-01	1.25E-01	1.71E-01
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Ni	0.0	0.0	0.0	0.0
9.31E-03	1.60E-02	3.98E-02	5.85E-03	6.42E-02	1.39E-03	4.79E-03	9.94E-03	2.99E-03	1.08E-02	2.21E-02	Zn	2.44E-03	1.79E-03	2.13E-03	1.82E-02
5.31E-03	4.42E-03	1.33E-03	1.32E-03	n/a	1.47E-03	7.87E-04	2.51E-03	1.66E-03	1.20E-03	n/a	Cu	1.64E-02	6.14E-04	1.32E-03	1.36E-03
5.39E-05	1.17E-04	1.92E-04	1.26E-04	1.36E-04	4.66E-05	3.10E-04	1.22E-04	1.21E-04	7.86E-05	9.10E-04	As	6.78E-05	6.62E-05	6.94E-05	9.55E-05
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-03	2.29E-03	2.18E-03	0.00E+00	0.00E+00	Se	0.00E+00	1.84E-04	3.86E-04	3.09E-04
1.64E-01	1.83E-01	2.15E-01	3.43E-01	1.63E-01	1.79E-01	2.76E-01	2.20E-01	1.61E-01	3.30E-01	2.08E-01	Sr	2.23E-01	1.91E-01	1.07E-01	1.91E-01
3.16E-04	4.24E-04	1.66E-03	9.10E-04	8.99E-04	8.33E-04	1.66E-03	7.32E-04	1.24E-03	1.35E-03	7.54E-04	Mo	7.29E-04	6.68E-04	1.23E-03	1.14E-03
1.52E-04	9.05E-05	2.70E-04	9.24E-05	8.13E-05	6.80E-05	1.58E-04	3.62E-05	1.13E-04	1.71E-04	9.38E-05	Cd	5.84E-05	7.48E-05	6.91E-05	2.04E-04
1.24E-03	3.37E-03	1.62E-03	7.98E-04	1.85E-03	7.36E-04	5.75E-04	4.62E-04	5.79E-04	1.17E-03	7.70E-04	Pb	1.63E-03	5.29E-04	6.16E-04	1.08E-03
											F by IC - if analysed				
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00
											<b>CERTIFICATES</b>				
97-05-180	97-07-169	97-10-171	98-03-066	98-08-059	97-03-198	97-05-180	97-07-169	97-10-183	98-03-066	98-08-043	certificate numbers for	97-03-198	97-05-180	97-08-009	97-10-183
											above analyses				
<b>QUALITY CHECK</b>											<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>				
267	284	353	579	284	262	407	303	255	491	376	calculated TDS (mg/L)	336	338	200	337
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag;care balance	use %bal	use %bal	use %bal	use %bal
4.580	5.117	6.964	11.080	5.176	4.756	8.241	5.979	5.170	9.500	7.105	sum cation millequivalents	6.147	5.520	3.663	6.152
4.504	4.669	5.685	8.841	4.092	4.807	6.599	5.365	4.272	7.393	6.310	sum anion millequivalents	5.278	5.617	3.031	5.475
OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%		low sum an/cat tolerance	OK high%		OK high%	
0.8	4.6	10.1	11.2	11.7	-0.5	11.1	5.4	9.5	12.5	5.9	ionic balance % error	7.6	-0.9	9.4	5.8
0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.6	A = S/K (calc TDS/cond)	0.6	0.6	0.5	0.6
											analysis adjustments				

<b>B999/4</b>	<b>B9/5</b>	<b>B9/6</b>	<b>B11/E</b>	<b>B11/E2*</b>	<b>B12/6</b>	<b>B12/666</b>
28-Oct-97	9-Mar-98	10-Aug-98	22-Apr-98	22-Apr-98	10-Aug-98	10-Aug-98
	2.43	1.61	1.01		1.86	
	0.72	0.77	0.43	0.44	0.84	
	585	479	554	564	826	
	6.2	6.5	5.8	5.7	6.7	
	74	142	152	132	75	
	23.0	18.8	23.0	23.5	17.0	
	12.4	67.0	n/a	n/a	33.4	
	208	60		46	53	
	70	65		25	118	
	0.005	0.003	0.002	0.000	0.007	
	1.5	2.9	0.7	0.2	0.0	
	0.46	0.29	0.12	0.08	2.46	
	1.2	0.6	0.6	0.7	0.9	
	2.0	3.2	0.8	0.3	2.5	
	5.0	<2	<2	<2	7.0	
600	<2	<2	<1	<2	160	
	<1	<1	<1	<1	<1	
<1	<1	<1	<1	<1	<1	
<1	<1		<1	<1		
<1	<1	<2	<1	<1	<2	
0.0	1.5	2.9	0.7	0.2	0.0	0.0
2.7	3.1	5.2	0.8	0.6	2.8	2.6
0.0	0.4	0.2	0.2	0.2	0.3	0.0
	7.9	9.7	6.9	6.8	13.0	13.0
	66.0	60.0	82.0	80.0	150.0	149.0

B999/4	B9/5	B9/6	B11/E	B11/E2*	B12/6	B12/666
	24.0	43.2	105.0	105.0	34.0	66.3
	85.3	79.5	38.0	29.9	143.9	140.0
<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
0.26	0.19	0.15	0.24	0.16	0.13	0.12
55.6	50.7	47.3	47.2	49.6	101.7	99.4
11.8	9.9	7.9	10.0	10.8	10.1	10.3
0.3	0.3	0.1	0.2	0.2	0.0	0.0
2.7	4.4	2.3	7.5	3.5	5.6	5.6
9.5	9.2	10.4	3.6	3.6	29.3	28.3
47.9	61.5	32.6	37.4	39.1	32.5	32.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.00E-02	2.79E-02	1.66E-02	6.50E-03	5.88E-03	8.64E-03	8.34E-03
1.36E-01	2.74E-01	8.82E-02	1.46E-01	1.34E-01	9.82E-02	9.56E-02
0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.01E-02	4.30E-03	1.60E-02	6.54E-03	4.60E-03	2.43E-01	2.41E-01
2.05E-03	9.15E-04	n/a	5.70E-03	2.23E-03	n/a	n/a
7.54E-05	7.44E-05	1.56E-04	7.09E-05	6.36E-05	2.20E-04	2.09E-04
0.00E+00	0.00E+00	4.94E-03	9.44E-03	6.06E-03	3.89E-03	1.64E-03
1.90E-01	2.00E-01	1.48E-01	1.60E-01	1.55E-01	3.90E-01	3.87E-01
1.23E-03	5.16E-04	2.13E-03	1.59E-03	1.50E-03	5.69E-03	5.64E-03
1.52E-04	3.63E-05	9.72E-05	8.10E-04	3.29E-04	1.72E-04	1.56E-04
1.31E-03	7.74E-04	9.59E-04	6.02E-04	5.51E-04	1.60E-03	1.55E-03
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
97-10-183	98-03-066	98-08-043	98-04-175	98-04-175	98-08-043	98-08-043
	284	269	320	315	450	
	use %bal	use %bal	use %bal	use %bal	use %bal	
	6.413	4.643	4.880	5.127	7.822	
	3.908	4.121	5.191	4.969	7.328	
partial anal	OK high%	OK high%		OK high%	OK high%	partial anal
	24.3	6.0	-3.1	1.6	3.3	
	0.5	0.6	0.6	0.6	0.5	
P	R					P

WOR													WOR	
sample#	W1/1	W1/2	W1/3	W1/4	W1/5	W1/6	W2/1	W2/2	W2/3	W2/4	W2/5	W2/6	sample#	W3/1
date sampled	10-Apr-97	5-Jun-97	29-Jul-97	3-Nov-97	16-Mar-98	14-Jul-98	10-Apr-97	5-Jun-97	29-Jul-97	3-Nov-97	16-Mar-98	14-Jul-98	date sampled	10-Apr-97
SWL (m)	1.42	1.10	1.06	1.24	1.96	0.98	0.95	0.75	0.74	1.00	1.77	1.08	SWL (m)	0.60
pump rate (L/min)		1.00	3.33	2.22	1.15	1.00		1.00	0.96	1.90	1.41	0.62	pump rate (L/min)	0.55
<b>FIELD PARAMETERS</b>													<b>FIELD PARAMETERS</b>	
EC (uS/cm)	337	311	316	278	399	260	375	356	250.4	167.5	142.3	189.8	EC (uS/cm)	390
pH	6.2	6.3	7.1	6.1	6.3	6.3	6.4	6.3	5.8	5.5	4.9	5.3	pH	10.8
Eh (mV)	37	175	236	115	-89	-170	122	170	198	181	104	-19	Eh (mV)	36
deg C	21.8	19.1	15.1	17.1	21.4	15.5	21.0	18.1	14.7	17.6	20.7	15.4	deg C	21.6
O2 %Sat	27.5	21.4	32.1	n/a	7.0	3.1	23.5	29.2	47.2			14.0	23.3	44.3
turbid sample													turbid sample	
yellow oxidation				initially	some								yellow oxidation	
H2S presence						H2S							H2S presence	
<b>FIELD ANALYTES (mg/L)</b>													<b>FIELD ANALYTES (mg/L)</b>	
CO2	70	27	59	76	190	68	59	61	71	52	190	61	CO2	0
alkalinity as CaCO3	82	98	74	45	119	116	104	104	118	10	7	12	alkalinity as CaCO3	
<b>HACH ANALYTES (mg/L)</b>													<b>HACH ANALYTES (mg/L)</b>	
NO2 - N {for ion *3.3}	0.010	0.002	0.002	0.001	0.000	0.000	0.002	0.003	0.003	0.001	0.003	0.003	NO2 - N {for ion *3.3}	0.024
NO3 - N {for ion *4.4}	0.0	0.1	0.0	0.0	0.3	3.0	0.5	0.2	0.1	0.0	0.2	0.3	NO3 - N {for ion *4.4}	0.5
NH3 - N {for ion *1.29}	0.19	0.02	0.09	0.00	0.51	0.42	0.06	0.00	0.02	0.00	0.02	0.12	NH3 - N {for ion *1.29}	0.00
PO4(3-) {for P *0.326}	0.0	0.5	0.9	0.0	0.0	0.8	0.1	0.2	0.1	0.0	0.0	0.0	PO4(3-) {for P *0.326}	0.0
total inorganic N - Hach	0.2	0.1	0.1	0.0	0.8	3.4	0.6	0.2	0.2	0.0	0.2	0.4	total inorganic N - Hach	0.5
<b>BACTERIAL SUITE (CFU/100mL)</b>													<b>BACTERIAL SUITE (CFU/100mL)</b>	
BOD (mg/L)	<2	3	<2	<2	<2	<2	2	<2	2	<2	<2	<2	BOD (mg/L)	2.0
Total Coliforms	4	10	>700	<1	1800	2200	18	<2	<1	<1	1	<1	Total Coliforms	6
Faecal Coliforms	<2	2	<1		310	345	<2	<2	<1		<1	<1	Faecal Coliforms	<2
Faecal Streptococci	2	20	<1	<1	244	44	<2	<2	<1	<1	<1	<1	Faecal Streptococci	<2
E.Coli		<2	<1	<1	310			<2	<1	<1	<1	<1	E.Coli	
Pseudomonas aeruginosa	<2	<2	<1	<1	<1	<1	<2	<2	<1	<1	<1	<1	Pseudomonas aeruginosa	<1
Clostridium perfringens/spp													Clostridium perfringens/spp	
Yersinia spp.													Yersinia spp.	
Salmonella spp.													Salmonella spp.	
<b>STANDARD ANALYTE SUITE (mg/L)</b>													<b>STANDARD ANALYTE SUITE (mg/L)</b>	
total NOx to use	0.0	0.1	0.0	0.0	0.3	3.0	0.5	0.2	0.1	0.0	0.2	0.3	total NOx to use	0.5
kjeldahl N (organic N)													kjeldahl N (organic N)	
total N to use	0.3	0.3	0.2	0.2	1.1	3.4	0.6	0.6	0.2	0.1	0.2	0.4	total N to use	0.5
total P	0.0	0.2	0.3	<0.005	0.1	0.3	0.0	0.1	0.0	<0.005	0.0	<0.005	total P	0.0
total organic carbon (TOC)	8.8	2.1	0.9	3.6	9.4	3.7	7.4	1.0	0.7	3.1	0.8	0.6	total organic carbon (TOC)	7.5
Cl	22.0	20.0	23.0	21.0	19.7	16.0	21.0	24.0	23.0	21.0	20.5	21.0	Cl	24.0

CONT'D: sample#	W1/1	W1/2	W1/3	W1/4	W1/5	W1/6	W2/1	W2/2	W2/3	W2/4	W2/5	W2/6	CONT'D: sample#	W3/1
SO4	15.0	32.0	29.0	27.0	15.3	16.0	29.0	41.0	28.0	21.0	19.4	22.0	SO4	23.0
total S - lab													total S - lab	
HCO3 to use	100.0	119.5	90.2	54.9	144.8	141.4	126.8	126.8	60.0	11.8	8.8	14.6	HCO3 to use	0.0
CO3 - lab													CO3 - lab	8.8
Hg	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	Hg	<0.001
<b>UTS - ICP ANALYTES (mg/L)</b>													<b>UTS - ICP ANALYTES (mg/L)</b>	
B	0.31	0.05	0.17	0.07	0.14	0.03	0.18	0.04	0.12	0.05	0.09	8.18	B	0.11
Na	17.0	18.5	17.5	19.9	18.0	11.4	17.0	20.0	18.7	17.0	16.5	17.2	Na	19.0
Mg	5.6	6.2	6.2	5.8	6.5	5.7	3.3	6.1	4.6	5.0	4.4	4.6	Mg	0.6
Al	0.2	0.2	0.3	0.2	0.3	0.0	0.2	0.3	0.3	0.3	0.2	0.0	Al	0.9
Si	3.8	4.2	3.5	3.8	6.4	3.5	3.4	4.3	3.8	2.9	4.2	3.9	Si	4.7
K	10.2	6.8	5.1	6.8	14.6	6.2	12.9	10.1	5.9	4.2	2.2	3.5	K	16.0
Ca	30.8	37.6	36.3	31.7	49.7	27.2	32.8	41.8	19.7	7.6	4.0	13.6	Ca	27.8
Cr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Cr	0.0
Mn	9.78E-02	1.49E-02	8.58E-03	1.44E-01	5.10E-02	4.12E-01	2.97E-02	2.57E-02	1.53E-02	2.56E-02	3.67E-02	1.16E-02	Mn	2.89E-03
Fe	1.10E+00	5.21E-02	1.04E-01	7.67E-01	9.64E-01	2.76E+00	1.57E-01	5.71E-02	5.20E-02	1.71E-01	3.44E-01	4.55E-02	Fe	1.16E-01
Ni	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Ni	0.0
Zn	2.04E-02	2.91E-03	7.30E-03	2.96E-02	3.68E-03	3.38E-03	1.94E-02	2.18E-03	2.72E-03	6.65E-03	1.29E-02	5.60E-03	Zn	2.15E-02
Cu	1.80E-02	1.40E-03	2.14E-02	1.13E-03	3.62E-03	n/a	2.14E-02	1.46E-03	4.59E-03	1.84E-03	1.55E-03	n/a	Cu	2.32E-02
As	7.48E-05	3.01E-05	6.32E-05	6.56E-05	2.05E-04	1.44E-04	2.72E-05	2.62E-05	5.56E-05	3.02E-05	3.70E-05	1.41E-04	As	5.39E-05
Se	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Se	0.00E+00
Sr	9.65E-02	1.02E-01	9.34E-02	7.99E-02	1.36E-01	9.53E-02	1.53E-01	1.28E-01	6.34E-02	3.34E-02	2.13E-02	4.26E-02	Sr	2.15E-01
Mo	6.04E-04	2.88E-04	3.24E-04	1.90E-04	1.09E-03	1.96E-04	3.63E-04	8.83E-05	4.12E-05	3.02E-05	1.69E-05	8.59E-04	Mo	9.38E-04
Cd	3.31E-04	5.61E-05	3.21E-04	2.25E-04	2.99E-05	6.58E-05	3.76E-04	4.76E-05	7.41E-05	1.52E-04	1.11E-04	2.39E-04	Cd	3.00E-04
Pb	5.41E-03	3.75E-04	9.83E-04	1.70E-03	1.20E-03	6.05E-04	5.95E-03	3.16E-04	6.36E-04	5.86E-04	6.26E-04	4.78E-04	Pb	5.00E-03
F by IC - if analysed													F by IC - if analysed	
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00
<b>CERTIFICATES</b>													<b>CERTIFICATES</b>	
certificate numbers for	97-04-075	97-06-036	97-07-160	97-11-007	98-03-130	98-07-079	97-04-075	97-06-036	97-07-160	97-11-007	98-03-130	98-07-079	certificate numbers for	97-04-075
above analyses													above analyses	
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>	
calculated TDS (mg/L)	158	179	162	145	207	167	183	205	131	88	77	103	calculated TDS (mg/L)	135
high TDS flag:care balance	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag:care balance	use %bal
sum cation millequivalents	3.084	3.398	3.254	3.157	4.273	2.613	3.019	3.755	2.360	1.674	1.377	1.912	sum cation millequivalents	2.779
sum anion millequivalents	2.572	3.210	2.761	2.055	3.272	3.338	3.313	3.631	2.229	1.224	1.142	1.312	sum anion millequivalents	2.239
low sum an/cat tolerance	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance	OK high%
ionic balance % error	9.0	2.8	8.2	21.1	13.3	-12.2	-4.6	1.7	2.9	15.5	9.3	18.6	ionic balance % error	10.8
A = S/K (calc TDS/cond)	0.47	0.58	0.51	0.52	0.52	0.64	0.49	0.57	0.52	0.52	0.54	0.54	A = S/K (calc TDS/cond)	0.35
analysis adjustments				R									analysis adjustments	R

											WOR				
W3/3	W3/5	W3/6	W4/1	W4/2	W4/3	W4/4	W4/6	W5/1	W5/2	W5/3	sample#	W5/4	W5/5	W6/1	W6/2
30-Jul-97	17-Mar-98	15-Jul-98	11-Apr-97	5-Jun-97	29-Jul-97	3-Nov-97	15-Jul-98	11-Apr-97	5-Jun-97	30-Jul-97	date sampled	4-Nov-97	17-Mar-98	10-Apr-97	4-Jun-97
0.71	1.62	0.67	2.54	2.39	2.09	2.66	1.68	1.59	1.00	0.94	SWL (m)	1.08	1.54	0.87	0.18
2.00	0.72	0.64		1.00	1.00	0.80	0.77		0.60	1.71	oily film	0.80	1.39		0.52
<b>FIELD PARAMETERS</b>															
517	178.4	294	922	697	509	481	1205	274	235.5	292	EC (uS/cm)	261	257	684	475
7.1	5.3	5.8	6.0	5.5	6.2	6	5.6	5.3	5.0	5.8	pH	5.5	5.2	6.6	6.2
126	100	74	166	160	146	66	83	110	213	97	Eh (mV)	65	-11	-134	10
13.1	21.5	15.9	21.6	20.9	18.1	17	18.4	24.3	18.7	13.9	deg C	19.0	24.0	23.1	17.3
20.3	1.4	13.2	33.0	32.4	31.0		24.3	10.4	1.4	13.7	O2 %Sat		0.8	6.9	2.3
											turbid sample				
											yellow oxidation	yellow		yellow	yellow/orange
											H2S presence				
<b>FIELD ANALYTES (mg/L)</b>															
58	62	165	180	30	48	21	100	52	46	19	CO2	9	76	26	46
172	14	49	91	34	1	25	130	36	0	68	alkalinity as CaCO3	16	14	210	130
<b>HACH ANALYTES (mg/L)</b>															
0.001	0.002	0.008	0.001	0.000	0.001	0	0.000	0.000	0.002	0.000	NO2 - N {for ion *3.3}	0.001	0.001	0.000	0.000
0.3	0.7	0.3	0.4	0.2	0.7	2	0.4	0.1	1.3	0.0	NO3 - N {for ion *4.4}	1.4	1.0	0.0	0.0
0.01	0.14	0.00	0.00	0.39	0.20	1	0.16	2.62	0.57	2.00	NH3 - N {for ion *1.29}	1.72	2.44	4.72	2.63
0.1	0.2	0.3	0.0	0.0	0.0	0	0.4	0.0	0.0	0.0	PO4(3-) {for P *0.326}	0.0	0.3	0.7	0.6
0.3	0.9	0.3	0.4	0.6	0.9	2.9	0.6	2.7	1.9	2.0	total inorganic N - Hach	3.1	3.4	4.7	2.6
<b>BACTERIAL SUITE (CFU/100mL)</b>															
<2	<2	<2	21.0	3.0	5.0	4	5.0	10.0	3.0	4.0	BOD (mg/L)	9.0	3.0	10.0	16.0
226	<1	<1	<2	2	<1	<1	<1	<2	<2	<1	Total Coliforms	<1	<1	10	10
<1	<1	<1	<2	<2	<1		<1	<2	<2	<1	Faecal Coliforms		<1	<2	2
<1	<1	<1	<2	<2	<1	<1	<1	<2	<2	<1	Faecal Streptococci	<1	<1	<2	<2
<1	<1			<2	<1	<1			<2	<1	E.Coli	<1	<1		
<1	<1	<1	<2	<2	<1	<1	<1	<2	<2	<1	Pseudomonas aeruginosa	<1	<1	4	<2
											Clostridium perfringens/spp				
											Yersinia spp.				
											Salmonella spp.				
<b>STANDARD ANALYTE SUITE (mg/L)</b>															
0.3	0.7	0.3	0.4	0.2	0.7	2	0.4	0.1	1.3	0.0	total NOx to use	1.4	1.0	0	0
											kjeldahl N (organic N)			4.7	2.6
0.3	0.9	0.3	0.4	0.6	0.9	3	0.6	2.7	1.9	2.0	total N to use	3.1	3.4	0.2	0.2
0.0	0.1	0.1	0.0	0.0	0.0	<0.005	0.1	<0.005	0.0	0.0	total P	0.0	0.1	12.0	8.0
0.4	0.7	0.7	19.0	2.0	3.0	9.8	4.7	9.2	2.0	1.6	total organic carbon (TOC)	11.0	1.8		
25.0	23.3	23.0	170.0	130.0	85.0	80	260.0	25.0	26.0	24.0	Cl	23.0	24.6	39.0	41.0

W3/3	W3/5	W3/6	W4/1	W4/2	W4/3	W4/4	W4/6	W5/1	W5/2	W5/3	CONT'D: sample#	W5/4	W5/5	W6/1	W6/2
28.0	20.7	24.0	72.0	77.0	57.0	50	85.0	56.0	51.0	54.0	SO4	55.0	56.2	17.0	41.0
											total S - lab				
209.7	16.6	59.7	110.9	41.9	25.0	31	159.0	43.9	0.0	45.0	HCO3 to use	19.1	16.5	256.0	158.0
											CO3 - lab				
<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	Hg	0.0005	<0.0005	<0.001	<0.0005
											<b>UTS - ICP ANALYTES (mg/L)</b>				
0.04	0.06	0.05	0.11	0.04	0.04	2.12	0.14	0.43	0.66	2.16	B	0.71	0.17	0.20	0.28
22.7	20.5	19.6	69.5	84.8	67.5	61.1	134.4	30.5	30.3	27.6	Na	26.7	26.6	32.9	32.9
5.9	3.9	3.9	9.0	8.1	5.5	4.5	17.0	2.9	3.9	5.4	Mg	4.5	2.7	8.7	6.4
0.3	0.2	0.0	0.2	0.3	0.2	0.2	0.0	0.3	0.3	0.8	Al	0.3	0.2	0.2	0.4
3.8	4.1	4.3	4.0	6.2	5.1	5.5	5.7	1.9	3.4	3.4	Si	2.2	2.2	7.0	8.4
4.1	2.9	6.2	22.6	25.8	15.3	8.8	24.6	1.3	0.8	1.5	K	1.0	0.4	4.6	1.7
82.4	6.8	26.8	30.0	24.6	13.6	9.9	32.5	2.3	4.4	6.5	Ca	3.4	1.5	66.1	51.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Cr	0.0	0.0	0.0	0.0
3.71E-02	2.21E-01	2.98E-02	2.95E-02	9.48E-02	2.04E-01	5.88E-01	9.21E-02	1.18E-01	1.18E-02	1.68E-02	Mn	3.31E-02	1.21E-01	1.88E-01	6.54E-02
1.94E-01	1.87E+00	1.80E-01	2.37E-01	5.43E+00	2.47E+00	2.50E+01	3.51E+00	2.23E+01	8.25E+00	2.24E+01	Fe	2.47E+01	2.70E+01	2.73E+01	1.15E+01
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Ni	0.0	0.0	0.0	0.0
5.70E-03	2.62E-02	6.78E-03	1.32E-02	4.89E-03	8.69E-03	6.63E-02	8.89E-03	3.25E-02	5.02E-03	2.44E-03	Zn	6.55E-03	1.08E-02	1.85E-02	6.13E-02
3.49E-03	5.77E-03	n/a	1.36E-02	8.28E-04	5.27E-03	4.33E-04	n/a	2.46E-02	2.18E-03	8.47E-04	Cu	1.67E-04	2.40E-03	2.10E-02	3.70E-04
5.83E-05	4.86E-05	5.24E-05	7.06E-05	3.35E-05	6.40E-05	1.91E-04	1.37E-04	3.15E-04	1.27E-04	3.06E-04	As	4.08E-04	5.24E-04	4.10E-04	3.67E-04
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Se	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.55E-01	3.21E-02	8.76E-02	1.91E-01	1.43E-01	7.93E-02	5.05E-02	1.78E-01	2.16E-02	3.01E-02	3.11E-02	Sr	2.59E-02	1.43E-02	2.22E-01	1.99E-01
2.17E-04	0.00E+00	1.55E-04	1.69E-04	2.13E-05	2.22E-05	1.54E-03	1.26E-04	3.98E-04	2.80E-04	5.49E-04	Mo	4.33E-04	0.00E+00	3.76E-04	2.70E-04
1.07E-04	1.35E-04	9.89E-05	2.87E-04	1.02E-04	1.22E-04	5.53E-04	1.05E-04	6.35E-04	1.07E-04	3.67E-05	Cd	4.44E-04	8.61E-05	4.19E-04	1.14E-03
6.20E-04	2.23E-03	2.88E-04	3.27E-03	4.55E-04	1.22E-03	1.08E-03	3.54E-04	7.61E-03	7.99E-04	5.70E-04	Pb	5.88E-04	7.38E-04	6.75E-03	5.13E-04
											F by IC - if analysed				
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00
											<b>CERTIFICATES</b>				
97-07-166	98-03-139	98-07-094	97-04-084	97-06-036	97-07-160	97-11-007	98-07-094	97-04-084	97-06-036	97-07-166	certificate numbers for	97-11-018	98-03-139	97-04-075	97-06-011
											above analyses				
<b>ALYSIS VALIDITY CHECK</b>											<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>				
262	96	136	445	385	269	282	637	182	139	176	calculated TDS (mg/L)	173	164	342	280
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag:care balance	use %bal	use %bal	use %bal	use %bal
5.729	1.726	2.681	5.874	6.501	4.586	4.729	9.632	2.733	2.248	3.045	sum cation millequivalents	2.766	2.625	6.906	5.204
4.748	1.418	2.159	8.139	5.972	4.041	3.951	11.755	2.599	1.888	2.540	sum anion millequivalents	2.207	2.212	5.673	4.619
OK high%	OK high%	OK high%	OK high%	OK high%	OK high%		OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance	OK high%	OK high%	OK high%	
9.4	9.8	10.8	-16.2	4.2	6.3	9.0	-9.9	2.5	8.7	9.0	ionic balance % error	11.2	8.5	9.8	6.0
0.51	0.54	0.46	0.48	0.55	0.53	0.59	0.53	0.66	0.59	0.60	A = S/K (calc TDS/cond)	0.66	0.64	0.50	0.59
			R								analysis adjustments				



								WOR							
W6/3	W6/4	W6/5	W666/5	W6/6	W7/1	W7/2	W7/3	sample#	W7/4	W7/5	W7/6	W8/1	W8/2	W8/3	W8/4
29-Jul-97	3-Nov-97	16-Mar-98	16-Mar-98	15-Jul-98	11-Apr-97	5-Jun-97	30-Jul-97	date sampled	4-Nov-97	16-Mar-98	15-Jul-98	11-Apr-97	3-Jun-97	29-Jul-97	3-Nov-97
0.15	0.37	1.40		0.16	1.04	0.71	0.67	SWL (m)	0.82	2.00	0.51	2.01	0.95	0.92	1.05
1.00	0.80	0.88		1.00		1.00	2.00	pump rate (L/min)	0.83	1.42	0.55		0.80	1.00	0.89
								<b>FIELD PARAMETERS</b>							
440	472	498		397	390	338	324	EC (uS/cm)	225.1	273	219.3	171	124.1	137.9	109.8
7.4	6.5	6.5		6.0	6.5	6.4	6.7	pH	6.1	6.0	5.5	5.8	5.5	6.4	5.9
-34	-88	-103		-65	51	126	202	Eh (mV)	107	-21	36	176	215	185	146
14.0	20.7	22.9		13.7	17.9	18.9	13.8	deg C	18.1	22.6	16.9	22.0	19.6	15.3	17.7
14.2		7.5		3.5	17.9	28.0	33.2	O2 %Sat		7.9	27.2	43.0	49.9	46.8	
								turbid sample							
	initially							yellow oxidation							
slight	minor	faint		minor				H2S presence							
								<b>FIELD ANALYTES (mg/L)</b>							
23	16	75		42	56	51	74	CO2	62	n/a	28	60	24	46	52
102	142	144		88	110	90	83	alkalinity as CaCO3	41	75	35	15	5	5	4
								<b>HACH ANALYTES (mg/L)</b>							
0.003	0.000	0.000		0.003	0.004	0.001	0.000	NO2 - N {for ion *3.3}	0.002	0.000	0.003	0.000	0.002	0.001	0.003
1.2	3.5	0.8		0.6	0.0	0.4	0.4	NO3 - N {for ion *4.4}	0.7	0.6	0.3	0.1	0.5	0.1	0.3
2.85	3.45	3.51		2.54	0.15	0.05	0.05	NH3 - N {for ion *1.29}	0.00	0.11	0.00	0.03	0.01	0.00	0.00
0.9	0.3	0.4		0.3	0.8	0.6	0.8	PO4(3-) {for P *0.326}	0.0	0.0	0.4	0.4	0.0	0.0	0.0
4.0	7.0	4.3	0.0	3.1	0.2	0.5	0.5	total inorganic N - Hach	0.7	0.7	0.3	0.2	0.5	0.1	0.3
								<b>BACTERIAL SUITE (CFU/100mL)</b>							
6.0	13.0	<2		7.0	110.0	<2	<2	BOD (mg/L)	4.0	2.0	<2	4.0	<2	5.0	4.0
>500	<1	<1	<1	10	<2	<2	510	Total Coliforms	<1	<1	<1	<2	<2	<1	<1
<1		<1	<1	1	<2	<2	<1	Faecal Coliforms		<1	<1	<2	<2	<1	
<	<1	<1	<1	<1	<2	<2	<1	Faecal Streptococci	<1	<1	<1	<2	<2	<1	<1
<1	<1	<1	<1	<1	<2	<2	<1	E.Coli	<1	<1				<1	<1
<1	<1	<1	<1	<1	<2	<2	<1	Pseudomonas aeruginosa	<1	<1	<1	<2	<2	<1	<1
								Clostridium perfringens/spp							
								Yersinia spp.							
								Salmonella spp.							
1.172	3.5	0.79	0	0.593				<b>STANDARD ANALYTE SUITE (mg/L)</b>							
					0.0	0.4	0.4	total NOx to use	0.7	0.6	0.3	0.1	0.5	0.1	0.3
4.0	7.0	4.3	3.3	3.1				kjeldahl N (organic N)							
0.3	0.2	0.1	0.0	0.1	0.2	0.5	0.5	total N to use	0.7	0.7	0.3	0.2	0.5	0.1	0.3
3.5	8.6	2.6		2.7	0.3	0.2	0.3	total P	0.0	0.0	0.1	0.1	<0.005	0.0	<0.005
					21.0	1.0	0.1	total organic carbon (TOC)	6.7	1.0	0.6	9.4	<0.005	2.1	6.4
37.0	38.0	34.2		39.0	21.0	34.0	21.0	Cl	23.0	22.1	23.0	19.0	20.0	18.0	17.0

W6/3	W6/4	W6/5	W666/5	W6/6	W7/1	W7/2	W7/3	CONT'D: sample#	W7/4	W7/5	W7/6	W8/1	W8/2	W8/3	W8/4
28.0	24.0	18.1		26.0	25.0	22.0	27.0	SO4	22.0	24.8	24.0	16.0	15.0	12.0	10.0
								total S - lab							
124.4	173.1	175.6	0.0	107.8	134.1	110.2	120.0	HCO3 to use	49.5	91.7	42.4	18.3	6.0	24.0	4.9
								CO3 - lab							
<0.0005	<0.0005	<0.0005		<0.0005	<0.001	<0.0005	<0.0005	Hg	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005
								<b>UTS - ICP ANALYTES (mg/L)</b>							
0.52	0.34	1.07		0.05	0.15	0.20	0.33	B	0.22	0.21	0.06	0.08	0.10	0.19	0.10
27.3	31.8	33.3		27.7	32.5	27.3	22.9	Na	22.2	27.5	23.5	13.6	13.3	12.5	12.8
6.3	6.2	6.4		5.8	4.1	3.7	3.6	Mg	2.9	2.9	2.5	2.4	2.7	3.2	2.9
0.4	0.2	0.2		0.0	0.3	0.3	0.4	Al	0.2	0.2	0.0	0.2	0.3	0.3	0.3
6.6	8.3	9.3		4.8	6.1	8.9	6.3	Si	7.0	9.2	6.0	2.3	4.3	3.7	3.4
1.7	1.5	2.5		0.8	19.9	9.0	2.7	K	1.4	1.4	4.5	6.9	2.8	5.0	1.5
39.6	43.1	41.6		27.3	38.0	35.6	35.0	Ca	22.5	23.9	15.6	9.5	6.1	7.2	3.4
0.0	0.0	0.0		0.0	0.0	0.0	0.0	Cr	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.79E-02	7.39E-02	5.07E-01		4.05E-02	4.74E-02	6.97E-02	8.80E-03	Mn	8.46E-03	6.36E-02	4.99E-03	1.16E-02	1.56E-02	8.88E-03	7.51E-03
1.63E+01	2.75E+01	2.90E+01		1.32E+01	2.57E-01	1.96E-01	1.01E-01	Fe	1.38E-01	1.83E+00	4.36E-02	8.71E-02	2.34E-02	3.20E-02	7.50E-02
0.0	0.0	0.0		0.0	0.0	0.0	0.0	Ni	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.92E-03	6.09E-03	1.23E-02		3.05E-03	1.47E-03	2.80E-03	3.25E-03	Zn	3.33E-02	3.74E-03	5.13E-03	1.63E-02	2.19E-03	3.15E-03	1.69E-02
6.92E-04	0.00E+00	4.77E-04		n/a	1.00E-03	1.20E-03	4.67E-03	Cu	3.69E-03	2.89E-03	n/a	1.98E-02	6.44E-04	3.45E-03	1.31E-03
2.93E-04	4.12E-04	4.35E-04		2.73E-04	3.91E-05	5.95E-05	5.98E-05	As	3.28E-05	6.97E-05	3.93E-05	1.42E-05	1.80E-05	4.63E-05	2.35E-05
0.00E+00	0.00E+00	0.00E+00		0.00E+00	4.99E-04	7.75E-04	8.21E-04	Se	6.62E-04	0.00E+00	5.65E-04	6.81E-04	4.72E-04	2.43E-03	1.04E-03
1.70E-01	1.61E-01	1.58E-01		1.62E-01	2.48E-01	1.93E-01	1.82E-01	Sr	1.14E-01	1.46E-01	9.27E-02	5.88E-02	3.23E-02	3.40E-02	1.89E-02
1.84E-04	2.87E-04	3.67E-04		1.16E-04	2.72E-04	2.57E-04	1.61E-04	Mo	1.86E-04	1.30E-04	6.76E-05	1.17E-04	6.75E-05	5.68E-05	5.44E-05
8.64E-05	3.78E-04	2.98E-05		5.30E-05	5.23E-05	1.68E-04	1.67E-04	Cd	2.67E-04	4.73E-05	8.30E-05	2.98E-04	8.33E-05	8.94E-05	2.47E-04
7.93E-04	3.98E-04	5.59E-04		2.32E-04	1.84E-04	1.72E-04	4.30E-04	Pb	6.28E-04	2.55E-04	2.90E-04	6.11E-03	1.97E-04	5.05E-04	9.09E-04
								F by IC - if analysed							
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
								<b>CERTIFICATES</b>							
97-07-160	97-11-007	98-03-130	98-03-130	98-07-094	97-04-084	97-06-036	97-07-166	certificate numbers for	97-11-018	98-03-130	98-07-094	97-04-084	97-06-011	97-07-160	97-11-007
								above analyses							
								<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>							
237	291	270		206	226	191	173	calculated TDS (mg/L)	132	157	119	88	69	75	61
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag;care balance	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal
4.569	5.344	5.428		3.724	4.212	3.548	3.168	sum cation millequivalents	2.396	2.771	2.126	1.472	1.211	1.332	1.033
3.775	4.668	4.288		3.460	3.337	3.270	3.176	sum anion millequivalents	1.964	2.682	1.878	1.191	1.011	1.160	0.786
OK high%		OK high%	partial anal	OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%
9.5	6.8	11.7		3.7	11.6	4.1	-0.1	ionic balance % error	9.9	1.6	6.2	10.6	9.0	6.9	13.6
0.54	0.62	0.54		0.52	0.58	0.57	0.53	A = S/K (calc TDS/cond)	0.59	0.57	0.54	0.52	0.56	0.54	0.55
			P					analysis adjustments							

W8/5	W9/2	W9/3	W9/4	W9/6	W/1P
17-Mar-98	5-Jun-97	29-Jul-97	4-Nov-97	15-Jul-98	10-Apr-97
1.64	1.18	1.07	1.40	1.14	
0.36		1.00	0.45	0.89	
1070	192.2	188.9	192.6	213	
5.1	5.5	5.4	5.3	4.5	
82	72	207	121	125	
23.6	20.5	15.1	17.9	17.2	
6.1	46.7	17.7		30.4	
	slightly				
84	22	36	38	103	
7	2	nil	2	nil	
0.002	0.000	0.003	0.000	0.002	
0.4	0.0	0.0	0.1	0.2	
0.04	n/a	0.06	0.00	0.00	
0.2	n/a	1.1	0.6	0.1	
0.4	0.0	0.1	0.1	0.2	0.0
<2	<2	8.0	19.0	4.0	
<1	44	158	1	<1	2
<1	2	<1		<1	
<1	2	<1	1	<1	
<1	<2	<1	<1		
<1	<2	<1	<1	<1	
					0
0.4	0.0	0.0	0.1	0.2	
					0.0
0.4	0.2	0.1	0.1	0.2	
0.1	0.0	0.4	0.2	0.0	
0.5	0.6	2.9	6.4	1.6	
17.0	24.0	34.0	37.0	41.0	

W8/5	W9/2	W9/3	W9/4	W9/6	W/1P
9.4	28.0	22.0	22.0	24.0	
9.0	2.4	10.0	2.4	0.0	0.0
<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
0.13	0.06	0.08	0.10	0.07	
13.8	24.8	23.9	28.8	27.9	
2.7	4.3	4.9	5.5	5.6	
0.2	0.4	0.2	0.3	0.0	
4.4	4.0	3.4	3.6	3.1	
1.6	1.6	0.5	0.5	0.4	
3.2	4.8	2.8	3.2	3.1	
0.0	0.0	0.0	0.0	0.0	
6.37E-02	2.24E-02	9.26E-03	8.07E-03	4.96E-03	
3.35E-01	5.68E-01	1.29E-01	1.66E-01	2.54E-02	
0.0	0.0	0.0	0.0	0.0	
1.72E-02	1.63E-01	1.69E-01	1.52E-01	1.35E-01	
7.08E-03	2.51E-03	6.93E-03	1.67E-03	n/a	
2.27E-05	3.55E-05	5.32E-05	2.92E-05	4.30E-05	
0.00E+00	0.00E+00	2.60E-03	2.67E-03	1.64E-03	
1.92E-02	3.50E-02	2.11E-02	2.02E-02	2.34E-02	
7.02E-05	3.11E-05	1.84E-05	2.19E-05	1.83E-05	
1.65E-04	1.84E-04	1.58E-04	2.80E-04	2.08E-04	
6.89E-04	2.67E-03	4.35E-03	4.79E-03	9.01E-03	
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
98-03-139	97-06-036	97-07-160	97-11-018	98-07-094	97-04-075
59	95	101	110	108	
use %bal	use % bal	use % bal	use % bal	use % bal	use %bal
1.058	1.774	1.630	1.910	1.844	
0.855	1.300	1.617	1.569	1.670	
OK high%	OK high%	OK high%	OK high%	OK high%	partial anal
10.6	15.4	0.4	9.8	4.9	
0.05	0.50	0.53	0.57	0.51	
	R				P

MEL													
sample #	M2/1	M2/2	M2/3	M2/4	M2/5	M2/6	M2/7	M3/4	M3/5	M5/5	M6/1	M6/7	M7/1
date sampled	1-Apr-97	17-Jun-97	22-Jul-97	2-Oct-97	13-Feb-98	16-Apr-98	28-Oct-98	2-Oct-97	13-Feb-98	13-Feb-98	1-Apr-97	28-Oct-98	1-Apr-97
SWL (m)	2.41	2.75	2.84	2.67	2.66	2.77	2.33	2.63	2.60	2.74	2.45	2.05	2.90
pump rate (L/min)		0.33	0.40	vslow		1.00	1.04	vslow		v slow		0.92	
<b>FIELD PARAMETERS</b>													
EC (uS/cm)	2176	2240	2200	2122	1745	2059	2018	1476	1312	1232	5060	1530	6280
pH	6.9	6.8	6.8	7.1	6.8	6.7	6.8	8	6.9	6.5	7.1	7.3	7.2
Eh (mV)	-28	-100	-72	-32	-92	50	80	-47	-35	-62	-139	30	-111
deg C	23.1	17.4	15.3	16.4	21.0	19.9	15.5	18	23.0	21.2	23.5	17.0	22.6
O2 %Sat		14.1	39.2	24.8	3.0	10.2	15.2	13				2.1	
turbid sample								vdirty	v dirty				dirty
yellow oxidation	minor	yellow	yellow	light straw	yellow	light straw	light straw			minor	slight	light straw	probably
H2S presence		some											
<b>FIELD ANALYTES (mg/L)</b>													
CO2	390	n/a	n/a	56	n/a	n/a	38	n/a	n/a	n/a	120	67	n/a
alkalinity as CaCO3	595	610	550	682	760	762	704	n/a	680	390	830	409	n/a
<b>HACH ANALYTES (mg/L)</b>													
NO2 - N (for ion *3.3)	0.003	0.000	0.000	0.004	0.000	0.000	0.002	n/a	n/a	0.000	0.002	0.000	0.000
NO3 - N (for ion *4.4)	0.0	1.3	1.1	0.0	0.4	0.0	3.7	n/a	n/a	0.0	0.0	0.0	0.0
NH3 - N (for ion *1.29)	0.61	n/a	n/a	n/a	<0.1	0.08	n/a	n/a	0.10	<0.1	n/a	n/a	n/a
PO4(3-) (for P *0.326)	4.2	n/a	n/a	n/a	<0.02	0.0	n/a	0	0.3	<0.02	n/a	n/a	n/a
total inorganic N - Hach	0.6	1.3	1.1	0.0	0.4	0.1	3.7	0.0	0.1	0.0	0.0	0.0	0.0
<b>BACTERIAL SUITE (CFU/100mL)</b>													
BOD (mg/L)	>13	5	6	12	1	2	1	53	>140	9.0	<2	2.0	nd
Total Coliforms	238	0	0	3	0	1	0	5		>200 est	2	41	2
Faecal Coliforms													
Faecal Streptococci	0	0	0	0	0	0	0			38	0	0	0
E.Coli	0	0	0	0	0	0	0	0		nd	0	0	0
Pseudomonas aeruginosa	0	0	0	0	0	0	0			9	0	0	0
Clostridium perfringens/spp	0	0	0		0					0	0		0
Yersinia spp.													
Salmonella spp.													
<b>STANDARD ANALYTE SUITE (mg/L)</b>													
total NOx to use	0.0	1.3	1.1	0.0	0.4	0.1	3.7	0	0.0	0.5	0.0	0.1	0.0
kjeldahl N (organic N)	1.2	1.3	1.2	1.2	1.0	1.0	0.8	3	7.3	1.0	1.2	0.5	1.7
total N to use	1.8	2.6	2.3	1.2	1.5	1.1	4.5	3	7.4	1.6	1.2	0.6	1.7
total P	1.4	0.0	0.1	0.1	<0.05	0.0	0.1	1.1	2.2	<0.05	<0.05	<0.05	0.1
total organic carbon (TOC)	77.0	30.0	27.0	26.0	37.0	22.0	23.0	32	28.0	18.0	11.0	11.0	35.0
Cl	61.0	61.0	55.0	54.0	53.0	52.0	49.0	35	39.0	62.0	780.0	120.0	960.0

CONT'D: sample#	M2/1	M2/2	M2/3	M2/4	M2/5	M2/6	M2/7	M3/4	M3/5	M5/5	M6/1	M6/7	M7/1
SO4	450.0	320.0	310.0	300.0	270.0	250.0	270.0	110	180.0	130.0	270.0	88.0	720.0
total S - lab													
HCO3 to use	725.4	743.7	880.0	831.5	926.6	929.0	858.3	732	829.1	475.5	1011.9	498.7	n/a
CO3 - lab				0.0				<1					
Hg	<0.00005	<0.00005	<0.00005	<0.00005	0.00023	0.00014	0.00011	insufficient	0.00075	0.00014	<0.000050	0.00026	<0.000050
<b>UTS - ICP ANALYTES (mg/L)</b>													
B	0.45	0.61	0.50	1.14	0.56	0.32	0.39		0.63	0.48	0.74	2.37	0.62
Na	492.0	499.6	523.6	639.3	651.8	511.3	511.1		415.9	271.9	992.7	316.5	1528.9
Mg	9.8	12.2	12.7	13.8	12.3	9.6	9.3		43.7	12.5	59.5	30.7	96.8
Al	0.3	0.4	0.4	0.5	0.6	0.4	0.3		23.8	0.4	0.4	0.5	0.3
Si	7.2	10.9	10.8	12.2	12.6	8.1	8.1		45.7	8.3	6.7	10.2	5.9
K	19.3	7.6	6.9	5.8	3.7	3.8	11.8		17.0	17.1	11.6	8.1	7.2
Ca	17.3	18.9	19.2	17.6	14.1	12.5	12.1		17.5	20.9	30.0	38.1	40.9
Cr	4.05E-03	3.17E-03	2.64E-03	5.37E-03	1.94E-03	4.85E-03	5.46E-03		3.95E-02	1.74E-03	1.77E-02	3.49E-03	2.20E-02
Mn	6.62E-02	1.50E-01	1.58E-01	1.23E-01	8.55E-02	1.40E-01	3.15E-02		4.82E-01	7.43E-02	4.27E-01	1.38E-01	4.00E-01
Fe	1.24E+00	8.48E+00	6.76E+00	5.50E+00	4.91E+00	6.39E+00	1.26E+00		1.99E+01	1.79E+00	3.31E+00	1.33E+00	2.45E+00
Ni	2.18E-03	2.03E-03	2.79E-03	2.99E-03	2.14E-03	3.07E-03	2.06E-03		2.67E-02	2.97E-03	3.09E-03	2.56E-03	3.91E-03
Zn	6.04E-03	3.54E-03	8.81E-03	1.42E-02	8.16E-03	8.31E-03	7.57E-03		1.49E-01	1.72E-02	5.36E-03	3.09E-03	5.50E-03
Cu	1.03E-02	9.97E-04	1.41E-02	4.85E-03	3.74E-03	6.98E-03	n/a		7.71E-02	6.67E-03	1.65E-02	n/a	4.53E-03
As	1.46E-03	2.74E-03	3.23E-03	2.73E-03	2.09E-03	4.08E-03	8.61E-04		1.16E-03	4.99E-04	1.13E-03	6.74E-04	1.85E-03
Se	0.00E+00	0.00E+00	0.00E+00	5.70E-04	0.00E+00	3.47E-02	0.00E+00		0.00E+00	6.38E-04	2.87E-04	7.38E-04	1.95E-03
Sr	1.39E-01	1.06E-01	1.02E-01	8.72E-02	6.51E-02	9.75E-02	5.99E-02		2.30E-01	1.01E-01	3.09E-01	1.96E-01	4.58E-01
Mo	3.61E-03	2.12E-03	2.08E-03	2.14E-03	1.63E-03	2.03E-03	1.23E-03		8.54E-05	1.56E-03	3.63E-03	1.68E-03	1.78E-03
Cd	2.91E-04	7.99E-05	1.07E-04	3.44E-04	9.41E-05	5.82E-05	1.05E-04		1.87E-03	2.83E-04	7.88E-04	1.37E-04	7.39E-05
Pb	1.29E-02	1.12E-03	2.18E-03	1.98E-03	1.70E-03	1.40E-03	1.19E-03		1.58E-01	3.66E-03	2.58E-03	6.41E-04	1.10E-03
F by IC - if analysed													
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E-01	0.00E+00
<b>CERTIFICATES</b>													
certificate numbers for	C9703042	9705474	9706484	9708450	9802131	9803919	9810333	9708450	C9801573	9802131	C9703042	9810333	C9703042
above analyses	9703375	C9705532	C9706488	C9708452	C9801573	C9803918	C9810325	C9708452		C9801573	9703375	C9810325	9703375
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>													
calculated TDS (mg/L)	1448	1293	1352	1430	1456	1271	1278		1216	749	2596	839	
high TDS flag:care balance	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS		high TDS	use %bal	high TDS	use %bal	
sum cation millequivalents	23.693	24.219	25.249	30.222	30.412	24.036	23.980		26.363	14.454	50.035	18.511	
sum anion millequivalents	23.113	20.666	22.507	21.398	22.328	21.900	21.735		18.447	12.249	44.211	13.474	
low sum an/cat tolerance	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	OK high%		OK high%	OK high%	partial anal
ionic balance % error	1.2	7.9	5.7	17.1	15.3	4.7	4.9		17.7	8.3	6.2	15.7	
A = S/K (calc TDS/cond)	0.67	0.58	0.61	0.67	0.83	0.62	0.63		0.93	0.61	0.51	0.55	
analysis adjustments				R	R			P	R			R	P

SPR														SPR
sample #	S1/4	S1/5	S1/7	S2/2	S2/4	S2/5	S2/7	S3/1	S3/2	S3/4	S4/2	S4/4	S4/5	sample #
date sampled	2-Oct-97	11-Feb-98	28-Oct-98	24-Jul-97	2-Oct-97	10-Feb-98	27-Oct-98	17-Jun-97	24-Jul-97	2-Oct-97	25-Jul-97	2-Oct-97	14-Feb-98	date sampled
SWL (m)	1.36	4.34	0.75	3.85	2.56	4.30	3.80	0.60	1.58	1.04	3.43	0.84	3.48	SWL (m)
pump rate (L/min)	0.72	1.94	1.20	1.20	1.00	1.33	1.00	0.50	1.00	1.33	1.00	1.20	0.40	pump rate (L/min)
<b>FIELD PARAMETERS</b>														<b>FIELD PARAMETERS</b>
EC (uS/cm)	459	474	525	933	576	583	558	895	789	608	2204	1074	1203	EC (uS/cm)
pH	7.1	6.3	6.3	6.8	7.0	6.1	5.9	6.7	6.7	6.9	6.3	7.5	7	pH
Eh (mV)	243	77	127	187	232	28	9	92	160	123	153	-85	-105	Eh (mV)
deg C	14.8	17.5	15.6	16.8	14.6	17.4	15.2	16.9	15.3	14.0	17.2	14.7	19	deg C
O2 %Sat	48.8	7.0	5.2	50.1	63.8	15.6	46.8	3.9	11.7	21.3	8.8	14.1	2	O2 %Sat
turbid sample														turbid sample
yellow oxidation											slight	slight	yellow	yellow oxidation
H2S presence														H2S presence
<b>FIELD ANALYTES (mg/L)</b>														<b>FIELD ANALYTES (mg/L)</b>
CO2	16	110	105	45	120	130	57	38	47	21	87	58	n/a	CO2
alkalinity as CaCO3	50	80	86	94	64	80	38	140	149	127	122	231	350	alkalinity as CaCO3
<b>HACH ANALYTES (mg/L)</b>														<b>HACH ANALYTES (mg/L)</b>
NO2 - N (for ion *3.3)	0.004	0.002	0.000	0.010	0.002	0.002	0.004	0.029	0.010	0.011	0.056	0.000	0	NO2 - N (for ion *3.3)
NO3 - N (for ion *4.4)	1.4	0.7	0.0	14.1	0.4	1.7	3.3	23.4	12.5	6.1	0.6	0.0	2	NO3 - N (for ion *4.4)
NH3 - N (for ion *1.29)	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.18	0.01	0.00	0.22	0.27	0	NH3 - N (for ion *1.29)
PO4(3-) (for P *0.326)	0.3	1.3	0.4	0.8	0.1	1.6	0.6	2.5	1.6	1.2	1.4	1.6	<0.02	PO4(3-) (for P *0.326)
total inorganic N - Hach	1.4	0.7	0.0	14.1	0.4	1.8	3.3	23.6	12.5	6.1	0.9	0.3	1.9	total inorganic N - Hach
<b>BACTERIAL SUITE (CFU/100mL)</b>														<b>BACTERIAL SUITE (CFU/100mL)</b>
BOD (mg/L)	5	5	4	<1	1	3.0	<1	3.0	1.0	<1	9.0	6.0	6	BOD (mg/L)
Total Coliforms	6	0	35	3	1	5	0	~2400	260	580	>241920	~2400	7	Total Coliforms
Faecal Coliforms														Faecal Coliforms
Faecal Streptococci	0	0	0	0	0	0	0	22	2	2	0	0	0	Faecal Streptococci
E.Coli	0	0	0	0	0	0	0	10	0	1	0	0	0	E.Coli
Pseudomonas aeruginosa	0	0	0	0	0	0	0	0	0	32	0	0	0	Pseudomonas aeruginosa
Clostridium perfringens/spp				0				0	0		0			Clostridium perfringens/spp
Yersinia spp.														Yersinia spp.
Salmonella spp.														Salmonella spp.
<b>STANDARD ANALYTE SUITE (mg/L)</b>														<b>STANDARD ANALYTE SUITE (m</b>
total NOx to use	1.7	1.7	0.0	16.0	0.8	2.5	3.3	23.4	14.0	8.5	1.7	0.0	2	total NOx to use
kjeldahl N (organic N)	0.3	0.3	0.2	0.6	0.4	0.4	0.2	0.5	0.5	0.4	1.3	0.9	1	kjeldahl N (organic N)
total N to use	2.0	2.0	0.2	17.0	1.2	3.0	3.5	24.1	15.0	8.9	3.2	1.2	3	total N to use
total P	0.1	0.4	0.1	0.3	0.0	0.5	0.2	0.8	0.5	0.4	0.5	0.5	<0.05	total P
total organic carbon (TOC)	3.0	18.0	6.0	<1	5.0	18.0	3.0	<1	<1	2.0	30.0	24.0	100	total organic carbon (TOC)
Cl	70.0	75.0	55.0	110.0	74.0	81.0	88.0	62.0	64.0	42.0	390.0	88.0	120	Cl

CONT'D: sample#	S1/4	S1/5	S1/7	S2/2	S2/4	S2/5	S2/7	S3/1	S3/2	S3/4	S4/2	S4/4	S4/5	CONT'D: sample#
SO4	74.0	35.0	53.0	86.0	66.0	72.0	67.0	59.0	54.0	48.0	290.0	100.0	100	SO4
total S - lab														total S - lab
HCO3 to use	90.0	97.5	104.9	114.6	104.0	98.0	46.6	170.7	181.7	195.0	180.0	378.0	427	HCO3 to use
CO3 - lab	0.0				0.0						<1	0.0		CO3 - lab
Hg	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0	Hg
<b>UTS - ICP ANALYTES (mg/L)</b>														<b>UTS - ICP ANALYTES (mg/L)</b>
B	0.42	0.03	0.33	0.07	0.26	0.36	0.19	0.03	0.02	0.19	0.00	0.00	0.19	B
Na	71.9	80.2	74.5	133.7	96.7	98.8	77.8	128.9	130.0	122.7	545.4	197.7	253.3	Na
Mg	7.9	7.1	8.0	11.6	9.4	7.7	5.8	8.0	7.1	7.3	15.7	19.0	20.9	Mg
Al	0.3	0.2	0.2	0.3	0.3	0.2	0.3	0.5	0.3	0.4	0.4	0.3	0.3	Al
Si	9.4	10.7	9.4	8.0	10.9	12.1	17.4	7.3	7.5	9.1	12.5	5.2	7.2	Si
K	6.1	3.1	2.9	31.2	3.9	2.5	5.9	3.7	3.6	2.4	3.1	6.9	1.9	K
Ca	23.1	40.7	37.1	28.2	26.8	51.0	16.0	16.3	19.2	18.8	7.4	26.0	53.9	Ca
Cr	5.46E-04	2.81E-03	1.04E-03	1.25E-03	4.66E-04	1.32E-03	8.72E-04	8.48E-04	1.12E-03	1.17E-03	8.10E-03	1.28E-03	3.84E-03	Cr
Mn	4.28E-03	5.66E-03	4.21E-02	1.20E-02	2.58E-03	2.25E-03	2.14E-03	7.85E-03	7.22E-03	3.41E-03	6.60E-02	2.92E-02	9.86E-02	Mn
Fe	6.19E-02	3.56E-02	2.27E-01	5.32E-02	5.77E-02	1.73E-01	1.76E-01	4.23E-02	5.31E-02	6.87E-02	1.06E-01	8.78E-01	1.19E+01	Fe
Ni	5.83E-04	5.75E-04	1.38E-03	1.05E-03	5.81E-04	5.82E-04	8.14E-04	5.11E-04	6.31E-04	4.59E-04	1.76E-03	1.02E-03	1.36E-03	Ni
Zn	7.97E-03	4.08E-03	6.66E-03	1.92E-03	1.24E-02	6.58E-03	6.10E-03	2.52E-03	2.35E-03	7.27E-03	4.68E-03	6.14E-03	9.39E-03	Zn
Cu	3.03E-03	2.13E-03	n/a	1.48E-03	2.33E-03	1.25E-03	n/a	2.18E-03	2.22E-03	3.17E-03	5.05E-03	1.59E-03	3.92E-03	Cu
As	5.48E-05	6.26E-05	1.55E-04	1.04E-04	7.56E-05	1.14E-04	1.19E-04	5.70E-05	8.19E-05	7.17E-05	2.04E-04	2.32E-04	6.04E-04	As
Se	2.23E-03	0.00E+00	0.00E+00	8.47E-04	2.11E-03	5.91E-04	6.12E-03	0.00E+00	1.18E-03	0.00E+00	0.00E+00	1.75E-03	0.00E+00	Se
Sr	7.65E-02	6.85E-02	7.07E-02	1.29E-01	8.75E-02	7.32E-02	4.48E-02	6.17E-02	5.40E-02	4.26E-02	2.98E-02	1.18E-01	9.92E-02	Sr
Mo	1.60E-04	1.24E-04	1.74E-04	4.08E-04	1.13E-04	1.10E-03	1.90E-04	3.24E-04	2.34E-04	2.89E-04	2.08E-04	2.61E-04	7.18E-04	Mo
Cd	1.72E-04	4.65E-05	1.16E-04	3.00E-05	1.74E-04	6.28E-05	1.56E-04	3.16E-05	2.32E-05	1.15E-04	6.17E-05	1.89E-05	2.93E-05	Cd
Pb	3.78E-03	6.52E-03	7.74E-04	1.29E-02	5.72E-03	2.82E-03	2.11E-03	7.90E-03	5.18E-03	3.38E-03	1.13E-02	4.18E-04	1.14E-03	Pb
F by IC - if analysed														F by IC - if analysed
Br value to use	0.00E+00	0.00E+00	1.50E-01	0.00E+00	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use
<b>CERTIFICATES</b>														<b>CERTIFICATES</b>
certificate numbers for	9708450	9801464	9810360	9706554	9708450	9801464	9810333	9705474	9706554	9708450	C9706582	9708450	9801464	certificate numbers for
above analyses	C9708452	C9801478	C9810359	C9706553R	C9708452	C9801478	C9810325	C9705532	C9706553R	C9708452	9706579	C9708452	C9801478	above analyses
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>														<b>ELECTRONIC BALANCE (%), RA</b>
calculated TDS (mg/L)	312	320	292	525	342	397	316	457	422	372	1383	633	861	calculated TDS (mg/L)
high TDS flag;care balance	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS	use %bal	use %bal	high TDS flag;care balance
sum cation millequivalents	5.123	6.205	5.863	9.013	6.456	7.581	4.847	7.252	7.330	6.988	25.536	11.727	15.959	sum cation millequivalents
sum anion millequivalents	5.100	4.532	4.405	7.797	5.193	5.563	4.944	7.517	6.846	5.853	20.107	10.810	12.583	sum anion millequivalents
low sum an/cat tolerance			OK high%	OK high%				OK high%	OK high%	OK high%		OK high%		low sum an/cat tolerance
ionic balance % error	0.2	15.6	14.2	7.2	10.8	15.4	-1.0	-1.8	3.4	8.8	11.9	4.1	11.8	ionic balance % error
A = S/K (calc TDS/cond)	0.68	0.68	0.56	0.56	0.59	0.68	0.57	0.51	0.53	0.61	0.63	0.59	0.72	A = S/K (calc TDS/cond)
analysis adjustments		R	R			R								analysis adjustments



													SPR		
S4/6	S4/7	S5/1	S5/2	S5/4	S5/7	S8/1	S8/2	S888/2	S8/4	S8/5	S8/6	S8/7	sample #	S9/1	S9/2
17-Apr-98	28-Oct-98	20-Jun-97	22-Jul-97	3-Oct-97	28-Oct-98	20-Jun-97	22-Jul-97		3-Oct-97	7-Feb-98	14-Apr-98	28-Oct-98	date sampled	20-Jun-97	25-Jul-97
4.40	0.68	3.53	3.71	3.05	2.61	4.22	4.18		3.78	4.33	4.41	3.24	SWL (m)	11.43	11.38
1.20	0.24	0.40		1.33	1.09	0.48	0.71		0.96	0.38	1.00	0.50	pump rate (L/min)	bailed	bailed
<b>FIELD PARAMETERS</b>															
1261	1131	263	246.6	241.4	276	180.5	186.8		169	170.3	185.9	150.1	EC (uS/cm)	432	429
6.6	7.0	6.3	5.9	5.6	6.2	5.2	5.2		4.9	5.2	5.0	4.5	pH	4.4	5.1
-140	-71	-51	-6	228	140	162	177		238	185	142	156	Eh (mV)	233	264
18.0	15.7	15.2	15.1	14.2	15.2	17.5	15.6		15.1	18.8	17.3	15.9	deg C	16.7	14.3
16.6	1.7	10.1	14.1	69.8	61.9	28.1	25.1		27.0	44.2	45.7	31.5	O2 %Sat		
						slight			dirty	initially dirty			turbid sample	silty	silty
yellow	yellow								orange				yellow oxidation		
		minor											H2S presence		
<b>FIELD ANALYTES (mg/L)</b>															
n/a	207	21	23	54	16	45	42		n/a	28	138	49	CO2	n/a	n/a
287	307	51	22	44	37	30	15		n/a	2	0	nil	alkalinity as CaCO3	n/a	n/a
<b>HACH ANALYTES (mg/L)</b>															
0.000	0.000	0.000	0.000	0.002	0.004	0.002	0.003		0.001	0.001	0.002	0.004	NO2 - N {for ion *3.3}		0.002
1.2	0.0	0.0	0.0	2.2	1.5	0.0	0.0		0.2	0.1	0.3	0.0	NO3 - N {for ion *4.4}		3.5
0.30	n/a	0.63	0.91	0.00	0.00	0.27	0.00		0.00	0.00	0.00	0.11	NH3 - N {for ion *1.29}		0.00
0.0	n/a	2.6	7.1	1.6	1.2	3.5	0.1		0.0	0.0	0.0	3.9	PO4(3-) {for P *0.326}		0.3
1.5	0.0	0.6	0.9	2.2	1.5	0.3	0.0	0.0	0.2	0.1	0.3	0.1	total inorganic N - Hach	0.0	3.5
<b>BACTERIAL SUITE (CFU/100mL)</b>															
8.0	5.0	nd	4.0	2.0	1.0	nd	2.0		6.0	<1	50.0	2.0	BOD (mg/L)	nd	2.0
1733	42	0	0	30	3	7	3	0	0	0	0	1	Total Coliforms	~2400	345
Faecal Coliforms															
0	0	0	0	0	0	0	0	0	0	0	0	0	Faecal Streptococci	2	6
0	0	0	0	0	0	0	0	0	0	0	0	0	E.Coli	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	Pseudomonas aeruginosa		0
		0	0			0	0	0		0			Clostridium perfringens/spp		
													Yersinia spp.		
													Salmonella spp.		
<b>STANDARD ANALYTE SUITE (mg/L)</b>															
1.2	<0.01	0.0	0.2	3.4	1.5	0.1	0.1	0.0	0.2	0.2	0.3	0.3	total NOx to use	5.2	5.1
1.0	1.1	0.2	0.4	0.2	<0.1	0.1	0.2		0.1	0.1	0.1	<0.1	kjeldahl N (organic N)	<0.010	1.1
2.5	1.1	0.9	1.5	3.6	1.5	0.5	0.3	0.0	0.3	0.3	0.4	0.4	total N to use	5.5	6.2
<0.05	0.1	0.8	2.3	0.5	0.4	1.1	0.2		0.6	<0.05	0.1	1.3	total P	0.2	0.2
30.0	15.0	4.0	3.0	2.0	4.0	2.0	<1		2.0	<1	3.0	2.0	total organic carbon (TOC)	2.0	6.0
120.0	91.0	44.0	40.0	45.0	32.0	43.0	43.0		41.0	43.0	49.0	38.0	Cl	96.0	95.0

S4/6	S4/7	S5/1	S5/2	S5/4	S5/7	S8/1	S8/2	S888/2	S8/4	S8/5	S8/6	S8/7	CONT'D: sample#	S9/1	S9/2
77.0	96.0	3.2	3.2	6.4	14.0	3.9	4.1		3.7	3.0	5.0	3.0	SO4	14.0	16.0
													total S - lab		
349.9	374.3	61.9	59.0	21.0	45.1	37.1	18.3	0.0	10.0	2.4	0.0	0.0	HCO3 to use	0.0	4.3
													CO3 - lab		<1
0.00006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005		<0.00005	<0.00005	0.00008	<0.00005	Hg	<0.00005	<0.00005
													<b>UTS - ICP ANALYTES (mg/L)</b>		
0.91	0.19	0.05	2.25	0.10	0.09	0.60	0.86		0.07	0.12	0.13	0.06	B	0.28	0.45
231.3	149.0	37.2	38.9	45.6	30.1	29.5	34.2		36.1	36.0	30.8	25.0	Na	69.4	72.0
18.7	34.5	4.7	4.5	3.1	6.5	1.8	1.8		1.8	1.5	1.4	1.2	Mg	6.0	5.8
0.3	0.2	0.4	1.2	0.5	0.3	0.4	0.6		0.3	0.3	0.2	0.2	Al	0.4	0.6
23.6	7.2	18.2	20.0	19.1	5.1	23.5	23.7		24.2	24.8	29.2	21.1	Si	9.1	9.3
2.2	6.6	1.0	1.8	1.7	7.6	0.6	0.8		0.0	0.5	0.0	4.9	K	0.1	0.5
25.4	59.5	7.8	9.4	5.3	14.3	2.2	3.7		1.7	3.5	1.4	1.4	Ca	2.8	4.0
5.30E-03	2.50E-03	7.78E-04	1.09E-03	3.75E-04	8.24E-04	7.07E-04	6.72E-04		2.92E-04	7.46E-04	1.50E-03	5.84E-04	Cr	2.23E-03	1.42E-03
1.07E-01	1.01E-01	8.42E-02	7.30E-02	4.56E-03	5.54E-03	6.00E-02	6.12E-02		4.13E-02	3.93E-02	3.71E-02	1.14E-02	Mn	8.55E-03	5.42E-03
9.12E+00	4.55E+00	8.85E+00	7.85E+00	4.87E-02	1.22E-01	6.04E-01	4.90E-01		1.64E-01	1.60E-01	7.36E-02	1.09E-02	Fe	1.19E-01	1.61E-02
1.30E-03	2.08E-03	6.16E-04	6.64E-04	6.96E-04	2.30E-03	6.90E-03	8.12E-03		1.24E-02	1.24E-02	1.20E-02	6.56E-03	Ni	6.71E-03	6.36E-03
3.76E-03	6.51E-03	2.17E-03	3.15E-03	9.27E-03	1.06E-02	1.07E-02	1.30E-02		2.49E-02	2.92E-02	2.50E-02	1.38E-02	Zn	1.20E-02	9.13E-03
4.52E-04	n/a	9.50E-04	1.01E-03	8.88E-03	n/a	2.16E-03	4.96E-03		6.02E-03	9.26E-03	1.28E-02	n/a	Cu	1.31E-02	1.02E-02
7.57E-04	3.07E-04	6.87E-04	6.37E-04	4.18E-05	4.96E-05	4.06E-04	3.17E-04		1.28E-04	1.61E-04	1.25E-04	8.32E-05	As	1.43E-04	1.40E-04
0.00E+00	6.24E-03	0.00E+00	0.00E+00	2.29E-03	2.67E-04	0.00E+00	0.00E+00		1.45E-03	3.58E-03	0.00E+00	3.38E-03	Se	0.00E+00	0.00E+00
1.05E-01	1.81E-01	3.01E-02	2.24E-02	1.66E-02	7.00E-02	9.31E-03	8.38E-03		3.90E-03	7.04E-03	7.12E-03	5.34E-03	Sr	1.75E-02	1.54E-02
1.08E-03	3.18E-04	1.45E-04	6.50E-04	6.65E-06	1.60E-04	3.49E-04	2.24E-04		0.00E+00	2.16E-04	6.63E-05	3.66E-05	Mo	2.04E-04	9.83E-05
6.60E-05	1.42E-04	2.19E-05	5.79E-05	1.93E-04	1.35E-04	1.07E-04	1.31E-04		2.55E-04	4.68E-04	2.40E-04	1.49E-04	Cd	2.18E-04	1.18E-04
1.87E-04	3.26E-04	7.56E-04	6.05E-04	5.03E-03	5.47E-04	5.70E-04	5.74E-04		9.93E-04	7.70E-04	5.61E-04	1.23E-03	Pb	5.43E-03	1.41E-02
													F by IC - if analysed		
0.00E+00	5.70E-01	0.00E+00	0.00E+00	0.00E+00	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-01	Br value to use	0.00E+00	0.00E+00
													<b>CERTIFICATES</b>		
C9803937	9810360	9705635	9706484	9708541	9810360	9705635	9706484	9706484	9708541	9801307	9803751	9810360	certificate numbers for	9705635	C9706582
9804031	C9810359	C9705637	C9706488	C9708480	C9810359	C9705637	C9706488		C9708480	C9801306	C9803753	C9810359	above analyses	C9705637	9706579
<b>TIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY</b>		
696	626	161	170	154	140	129	123		118	115	122	103	calculated TDS (mg/L)	223	237
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag;care balance	use %bal	use %bal
13.307	12.648	2.824	3.060	2.603	2.789	1.641	1.924		1.843	1.919	1.550	1.415	sum cation millequivalents	3.710	3.890
10.810	10.772	2.404	2.386	1.954	2.079	2.011	1.602		1.412	1.325	1.508	1.284	sum anion millequivalents	3.000	3.341
OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance	OK high%	OK high%
10.4	8.0	8.0	12.4	14.2	14.6	-10.2	9.1		13.2	18.3	1.4	4.8	ionic balance % error	10.6	7.6
0.55	0.55	0.61	0.69	0.64	0.51	0.72	0.66		0.70	0.68	0.66	0.68	A = S/K (calc TDS/cond)	0.52	0.55
				R	R			P		R			analysis adjustments		

S9/5	S9/6	S10/2	S10/5	S10/6	S12/5	S12/52*	S12/6	S12/62*
10-May-98	14-Apr-98	25-Jul-97	8-Feb-98	14-Apr-98	8-Feb-98	8-Feb-98	14-Apr-98	14-Apr-98
11.44	11.49	13.80	13.89	13.93	23.59	23.59	23.85	23.85
waterra hand g	grundfos		1.56	0.60	2.22	1.31	11.11	11.11
404	418	7320	6720	6330	3620	3600	3520	3590
4.7	4.3	5.4	5.7	5.8	5.7	5.7	5.8	5.7
143	169	236	192	151	201	144	158	141
18.2	17.6	14.7	18.0	16.5	18.7	18.5	16.2	16.8
48.7	58.6		49.0	36.3	24.1	26.3		29.8
		slight						
n/a	n/a	n/a	186	64	5	6	54	121
2	3	n/a	30	41	276	339	24	53
0.008	0.004	0.002	0.000	0.010	0.015	0.008	0.017	0.004
3.2	3.9	0.1	0.0	0.0	3.5	2.2	1.5	1.7
0.01	0.00	0.01	0.45	0.47	0.00	0.00	0.00	0.00
<0.02	0.0	0.5	1.4	2.6	0.0	0.0	0.8	0.2
3.3	3.9	0.1	0.5	0.5	3.6	2.2	1.5	1.7
4.0	85.0	3.0	7.0	55.0	8.0	4.0	85.0	85.0
24000	161	0	1046	16(reject)	2419	2419	291	14
0	0	20	10	0	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	0	0	124	74	26	0
0		0	0		0	0		
4.9	5.4	0.3	0.3	0.3	3.6	2.4	2.4	2.3
0.5	0.1	0.5	0.1	0.1	0.3	0.1	0.2	0.1
5.4	5.5	0.8	0.9	0.8	3.9	2.5	2.6	2.4
<0.05	0.0	2.4	0.5	0.8	<0.05	<0.05	0.3	0.1
<1	1000.0	1.0	5.0	16.0	3.0	3.0	630.0	54.0
95.0	99.0	2400.0	2300.0	2300.0	1100.0	1100.0	1100.0	1100.0

S9/5	S9/6	S10/2	S10/5	S10/6	S12/5	S12/52*	S12/6	S12/62*
16.0	15.0	100.0	96.0	100.0	40.0	40.0	40.0	40.0
2.0	3.7	58.5	36.5	49.7	336.5	413.3	28.8	64.4
		<1						
0.00009	<0.00005	<0.00005	<0.00005	0.00014	<0.00006	<0.00005	0.0001	0.00008
0.09	0.09	0.18	0.06	0.06	0.07	0.06	0.05	0.03
77.1	66.8	1167.6	1191.1	1143.0	663.3	655.7	624.1	613.9
5.8	5.8	233.7	252.2	239.3	115.9	118.2	110.8	109.9
0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
9.2	13.4	8.0	7.8	9.5	6.9	6.8	9.4	7.0
0.5	0.0	4.8	2.7	4.7	3.5	3.6	6.6	6.5
5.1	2.1	32.7	59.6	30.4	21.6	21.6	10.9	10.5
2.02E-03	5.87E-03	3.62E-02	3.14E-02	6.73E-02	2.18E-02	2.36E-02	4.17E-02	4.58E-02
5.91E-03	7.02E-03	8.51E-02	2.17E-02	2.59E-02	1.07E-02	8.42E-03	6.13E-03	4.99E-03
8.65E-02	2.53E-01	6.39E-02	6.59E-02	8.01E-02	8.01E-02	4.45E-02	6.61E-02	4.67E-02
2.08E-02	3.08E-02	1.04E-02	8.09E-03	1.00E-02	5.51E-03	4.56E-03	4.07E-03	3.41E-03
1.36E-02	8.97E-03	1.70E-02	1.31E-02	1.22E-02	3.70E-02	5.94E-02	1.95E-02	1.41E-02
2.18E-03	6.87E-02	5.71E-03	6.45E-03	1.34E-02	4.97E-03	3.24E-03	2.06E-02	1.31E-02
1.28E-04	2.24E-04	6.68E-04	5.01E-04	1.19E-03	3.86E-04	4.15E-04	7.06E-04	7.66E-04
1.81E-03	0.00E+00	1.31E-03	0.00E+00	0.00E+00	2.82E-03	3.92E-03	6.89E-04	5.65E-03
1.80E-02	1.96E-02	4.40E-01	3.97E-01	4.03E-01	1.81E-01	1.84E-01	1.87E-01	1.72E-01
1.09E-04	3.44E-04	1.25E-04	2.09E-04	2.72E-04	3.12E-04	3.76E-04	1.60E-04	9.01E-05
3.57E-04	6.28E-04	1.31E-04	1.19E-04	4.75E-04	1.19E-04	9.21E-05	1.04E-03	2.04E-04
2.93E-03	3.85E-03	2.61E-03	1.39E-03	2.16E-03	4.30E-04	3.75E-04	6.39E-04	3.84E-04
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9801464	9803751	C9706582	9801307	9803751	9801307	9801307	9803751	9803751
C9801478	C9803753	9706579	C9801306	C9803753	C9801306	C9801306	C9803753	C9803753
<b>QTY CHECK</b>								
232	1227	3984	3935	3871	2112	2133	2556	1979
use %bal	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS
4.134	3.532	71.817	75.674	71.121	39.589	39.448	37.010	36.460
3.276	3.442	70.768	67.522	67.862	37.631	38.791	32.468	33.046
OK high%	OK high%	OK high%	%<5 req'd	OK high%	OK high%	OK high%	OK high%	OK high%
11.6	1.3	0.7	5.7	2.3	2.5	0.8	6.5	4.9
0.57	2.93	0.54	0.59	0.61	0.58	0.59	0.73	0.55
	OC			DP				

NEW														NEW
sample #	N1/2	N1/3	N1/5	N1/6	N1/7	N2/2	N2/3	N2/5	N2/6	N2/7	N3/3	N3/5	N7/2	sample #
date sampled	19-Jun-97	24-Jul-97	9-Feb-98	16-Apr-98	28-Oct-98	19-Jun-97	24-Jul-97	9-Feb-98	15-Apr-98	28-Oct-98	24-Jul-97	11-Feb-98	19-Jun-97	date sampled
SWL (m)	3.63	4.51	3.61	3.78	3.67	2.85	2.85	3.09	3.21	3.22	3.65	3.45	4.91	SWL (m)
pump rate (L/min)	0.44	0.71	1.03	0.50	0.54	0.80	0.86	0.58	0.53	0.70	0.80		0.75	pump rate (L/min)
<b>FIELD PARAMETERS</b>														<b>FIELD PARAMETERS</b>
EC (uS/cm)	7820	7630	6350	6060	5200	3880	1781	6030	6000	4940	10850	9800	13320	EC (uS/cm)
pH	6.6	6.3	6.4	6.5	6.5	6.7	6.3	6.3	6.3	6.3	6.3	6.5	6.5	pH
Eh (mV)	140	116	39	104	56	141	188	55	109	30	137	28	144	Eh (mV)
deg C	17.4	15.7	18.2	18.4	17.8	16.1	14.6	18.0	17.6	16.8	15.8	18.6	17.2	deg C
O2 %Sat	39.5	8.8	10.7	18.8	17.4	66.6	70.5	28.3	23.0	24.4	3.2	4.4	9.5	O2 %Sat
turbid sample	minor		initially	initially										slight
yellow oxidation									initially grey	initially black				yellow oxidation
H2S presence										initially	hint			H2S presence
<b>FIELD ANALYTES (mg/L)</b>														<b>FIELD ANALYTES (mg/L)</b>
CO2	155	230	223	217	142	90	46	186	260	136	122	227	170	CO2
alkalinity as CaCO3	122	170	183	141	102	82	58	92	165	89	200	139	170	alkalinity as CaCO3
<b>HACH ANALYTES (mg/L)</b>														<b>HACH ANALYTES (mg/L)</b>
NO2 - N (for ion *3.3)	0.001	0.000	0.000	0.005	0.009	0.000	0.002	0.003	0.003	0.002	0.003	0.003	0.003	NO2 - N (for ion *3.3)
NO3 - N (for ion *4.4)	0.0	0.0	0.0	0.0	n/a	0.0	0.0	0.1	0.0	n/a	0.0	0.3	0.0	NO3 - N (for ion *4.4)
NH3 - N (for ion *1.29)	0.23	0.00	0.09	0.23	0.08	0.00	0.00	0.04	0.13	0.00	0.00	0.08	0.67	NH3 - N (for ion *1.29)
PO4(3-) (for P *0.326)	3.7	0.3	1.5	2.7	3.1	0.4	0.0	0.2	1.1	0.0	0.1	0.0	6.3	PO4(3-) (for P *0.326)
total inorganic N - Hach	0.2	0.0	0.1	0.2	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.4	0.7	total inorganic N - Hach
<b>BACTERIAL SUITE (CFU/100mL)</b>														<b>BACTERIAL SUITE (CFU/100mL)</b>
BOD (mg/L)	2		7	<2	<1	3	3	2.0	<5	2.0	1.0	3.0	1.0	BOD (mg/L)
Total Coliforms	~2400	10	59	14	0	1	2	5	167	147	0	36	816	Total Coliforms
Faecal Coliforms														Faecal Coliforms
Faecal Streptococci	26	0	0	0	0	0	0	2	0	0	0	0	4	Faecal Streptococci
E.Coli	0	0	0	0	0	0	0	0	0	0	0	0	0	E.Coli
Pseudomonas aeruginosa	0	0	0	0	0	0	0	0	0	0	0	0	0	Pseudomonas aeruginosa
Clostridium perfringens/spp	0	0	nd			0	0	nd			0	0	0	Clostridium perfringens/spp
Yersinia spp.														Yersinia spp.
Salmonella spp.														Salmonella spp.
<b>STANDARD ANALYTE SUITE (mg/L)</b>														<b>STANDARD ANALYTE SUITE (m</b>
total NOx to use	0.1	0.0	0.2	0.5	n/a	0.1	0.1	0.1	0.0	n/a	0.0	0.3	0.0	total NOx to use
kjeldahl N (organic N)	0.1	0.3	0.2	0.1	<0.1	0.2	0.3	0.2	0.1	0.2	<0.1	0.1	0.2	kjeldahl N (organic N)
total N to use	0.4	0.3	0.5	0.8	0.7	0.3	0.4	0.4	0.3	0.2	0.1	0.5	0.9	total N to use
total P	1.2	0.1	0.5	0.9	1.0	0.0	<0.05	<0.05	<0.005	<0.05	0.1	<0.05	2.1	total P
total organic carbon (TOC)	0.0	0.0	1.0	1.0	2.0	<1	<1	2.0	3.0	3.0	<1	43.0	<1	total organic carbon (TOC)
Cl	2300.0	2300.0	2200.0	1900.0	1800.0	1200.0	510.0	1900.0	2500.0	1800.0	3500.0	3500.0	4400.0	Cl

CONT'D: sample#	N1/2	N1/3	N1/5	N1/6	N1/7	N2/2	N2/3	N2/5	N2/6	N2/7	N3/3	N3/5	N7/2	CONT'D: sample#
SO4	210.0	210.0	200.0	210.0	220.0	95.0	72.0	140.0	190.0	130.0	240.0	230.0	230.0	SO4
total S - lab														total S - lab
HCO3 to use	148.7	207.3	223.1	171.9	124.4	100.0	70.7	112.2	201.2	108.5	243.8	169.5	207.3	HCO3 to use
CO3 - lab														CO3 - lab
Hg	<0.00005	<0.00005	0.00006	0.00017	0.00007	<0.00005	<0.00005	0.00054	0.00015	<0.00005	0.00006	0.00008	0.0005	Hg
<b>UTS - ICP ANALYTES (mg/L)</b>														<b>UTS - ICP ANALYTES (mg/L)</b>
B	0.13	2.31	0.36	0.44	1.94	0.09	0.79	0.15	0.19	0.77	0.58	0.19	0.13	B
Na	1420.7	1393.6	1256.3	1145.1	1126.2	564.2	308.1	1007.4	1245.0	904.2	1793.8	1369.7	2265.6	Na
Mg	146.9	145.3	127.4	112.2	103.0	81.9	49.9	196.4	224.7	144.5	275.5	292.3	369.8	Mg
Al	0.4	0.8	0.2	0.2	0.4	0.4	0.5	0.2	0.2	0.2	0.5	0.2	0.4	Al
Si	8.0	10.0	8.5	19.5	7.8	9.0	6.5	6.5	13.5	5.7	9.7	8.6	8.3	Si
K	0.7	1.5	0.5	0.9	1.4	0.3	0.6	0.3	1.1	3.1	1.3	0.5	1.4	K
Ca	55.0	59.7	97.6	43.0	46.3	31.2	19.7	143.4	91.4	70.7	129.1	254.5	161.0	Ca
Cr	2.80E-02	2.94E-02	2.58E-02	5.61E-02	1.95E-03	1.24E-02	7.89E-03	2.41E-02	6.76E-02	1.93E-03	4.47E-02	4.16E-02	3.69E-02	Cr
Mn	1.55E-02	1.54E-02	8.41E-03	8.49E-03	4.27E-03	4.77E-03	2.84E-03	1.05E-02	1.51E-02	1.35E-02	1.68E-02	1.74E-02	3.25E-02	Mn
Fe	3.42E-01	3.17E-01	3.70E-01	2.92E-01	4.66E-01	5.73E-02	5.05E-02	1.46E-01	2.93E-01	5.27E-01	3.08E-01	2.68E-01	6.11E-01	Fe
Ni	2.11E-03	2.04E-03	2.12E-03	2.36E-03	1.85E-03	1.87E-03	1.38E-03	4.33E-03	6.22E-03	3.63E-03	5.43E-03	6.17E-03	8.17E-03	Ni
Zn	2.70E-03	2.79E-03	2.56E-02	5.00E-03	5.66E-03	1.70E-03	3.11E-03	5.12E-03	1.09E-02	7.47E-03	3.58E-03	1.86E-02	7.45E-03	Zn
Cu	8.67E-04	1.51E-03	6.54E-04	3.24E-03	n/a	8.55E-04	1.19E-03	1.09E-03	3.97E-03	n/a	3.16E-03	1.81E-03	1.23E-03	Cu
As	1.19E-03	1.13E-03	7.35E-04	1.12E-03	7.70E-04	3.36E-04	2.57E-04	4.89E-04	1.28E-03	7.31E-04	1.24E-03	8.88E-04	1.29E-03	As
Se	0.00E+00	0.00E+00	4.97E-04	1.39E-02	6.88E-04	0.00E+00	3.88E-03	4.74E-04	1.38E-02	1.44E-03	0.00E+00	4.01E-04	0.00E+00	Se
Sr	5.31E-01	5.66E-01	5.04E-01	5.09E-01	4.26E-01	3.31E-01	2.07E-01	7.69E-01	1.10E+00	6.44E-01	1.28E+00	1.16E+00	1.35E+00	Sr
Mo	3.75E-04	9.41E-04	7.67E-04	1.11E-03	1.52E-03	2.71E-04	3.83E-04	4.25E-04	6.95E-04	5.37E-04	4.71E-04	4.66E-04	2.44E-04	Mo
Cd	4.21E-05	5.40E-05	5.76E-05	9.42E-05	1.63E-04	3.35E-05	9.15E-05	1.25E-04	3.97E-04	9.21E-05	8.49E-05	7.20E-05	5.30E-05	Cd
Pb	9.92E-05	1.85E-04	1.27E-04	2.74E-04	5.36E-04	1.13E-04	1.56E-04	3.37E-04	4.08E-04	3.57E-04	2.80E-04	2.28E-04	2.84E-04	Pb
F by IC - if analysed														F by IC - if analysed
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.70E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.20E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use
<b>CERTIFICATES</b>														<b>CERTIFICATES</b>
certificate numbers for	9705599	9706554	9801383	9803919	9810397	9705599	9706554	9801383	9803849	9810397	9706554	9801464	9705599	certificate numbers for
above analyses	C9705610	C9706553	C9801387	C9803918	C9810417	C9705610	C9706553	C9801387	C9803848	C9810417	C9706553R	C9801478	C9705610	above analyses
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>														<b>ELECTRONIC BALANCE (%), RA</b>
calculated TDS (mg/L)	4210	4213	3990	3511	3373	2025	1000	3446	4356	3114	6055	5773	7535	calculated TDS (mg/L)
high TDS flag;care balance	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS flag;care balance
sum cation millequivalents	76.732	75.712	70.068	61.265	59.897	32.894	18.569	67.188	77.294	54.889	107.269	96.403	137.197	sum cation millequivalents
sum anion millequivalents	71.810	72.662	69.930	60.874	58.082	37.481	17.045	58.367	77.814	55.789	107.732	106.322	132.509	sum anion millequivalents
low sum an/cat tolerance	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance
ionic balance % error	3.3	2.1	0.1	0.3	1.5	-6.5	4.3	7.0	-0.3	-0.8	-0.2	-4.9	1.7	ionic balance % error
A = S/K (calc TDS/cond)	0.54	0.55	0.63	0.58	0.65	0.52	0.56	0.57	0.73	0.63	0.56	0.59	0.57	A = S/K (calc TDS/cond)
analysis adjustments														analysis adjustments

													NEW		
N7/3	N7/5	N7/6	N7/7	N8/2	N8/3	N8/5	N8/6	N8/7	NT1/1	NT1/2	NT1/3	NT1/5	sample #	NT1/6	NT1/7
23-Jul-97	9-Feb-98	15-Apr-98	28-Oct-98	18-Jun-97	23-Jul-97	9-Feb-98	15-Apr-98	28-Oct-98	2-Apr-97	18-Jun-97	23-Jul-97	9-Feb-98	date sampled	15-Apr-98	28-Oct-98
4.83	5.04	5.24	5.11	5.23	4.96	5.11	5.23	5.33		0.66	0.66	0.66	SWL (m)	0.64	0.64
1.40	1.00	0.70	0.44	0.40	0.50	1.05	0.69	0.46		1.00	low	0.55	pump rate (L/min)	0.60	1.40
<b>FIELD PARAMETERS</b>															
13560	12270	12480	11380	11500	11570	10350	9700	9950	1528	1652	1632	1746	EC (uS/cm)	1475	1534
5.9	6	6.3	6.4	6.4	6.1	7.0	6.5	6.5	10.5	9.4	9.2	7.2	pH	8.1	6.9
124	2	117	104	-18	15	-8	42	25	-254	-108	-300	-108	Eh (mV)	-195	-130
16.3	17	16.6	17.8	17.2	15.6	16.6	16.9	17.0	19.6	11.3	13.8	21.9	deg C	19.1	16.9
4.1	0	17.7	5.0	56.1	28.8	29.7	33.0	31.2		23.2	n/a		O2 %Sat		2.5
													turbid sample		Fe pieces
									yellow	yellow	yellow	green/black	yellow oxidation	yell-green	yellow
													H2S presence		
<b>FIELD ANALYTES (mg/L)</b>															
109	319	247	190	105	83	290	70	79	nil	n/a	n/a	n/a	CO2		n/a
169	152	140	154	160	186	164	141	188	170	n/a	250	300	alkalinity as CaCO3	250	n/a
<b>HACH ANALYTES (mg/L)</b>															
0.001	0	0.000	0.003	0.005	0.008	0.005	0.004	0.001	0.000	0.000	0.000	n/a	NO2 - N {for ion *3.3}	0.000	n/a
0.9	0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	n/a	NO3 - N {for ion *4.4}	0.0	n/a
0.50	2	1.29	0.74	0.52	0.61	1.11	0.77	0.48	n/a	n/a	n/a	2.40	NH3 - N {for ion *1.29}	3.30	2.60
1.5	3	0.0	1.8	5.0	5.6	5.3	0.0	0.1	n/a	n/a	n/a	0.0	PO4(3-) {for P *0.326}	n/a	0.0
1.4	1.6	1.3	0.7	0.5	0.6	1.1	1.2	0.6	n/a	n/a	n/a	2.4	total inorganic N - Hach	3.3	2.6
<b>BACTERIAL SUITE (CFU/100mL)</b>															
	<1	<5	2.0	<25	3.0	2.0	<5	<1	15.0	12.0	12.0	11.0	BOD (mg/L)	<5	6.0
114	17	4	0	365	461	1	0	1	1	29	0	9	Total Coliforms	0	99
													Faecal Coliforms		
0	0	0	0	4	0	0	0	0	210	0	0	0	Faecal Streptococci	0	0
0	0	0	0	0	0	0	0	0	0	1	0	0	E.Coli	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	Pseudomonas aeruginosa	0	0
0	nd			0	0	nd			0	0	0		Clostridium perfringens/spp		
													Yersinia spp.		
													Salmonella spp.		
<b>STANDARD ANALYTE SUITE (mg/L)</b>															
0.9	<0.01	<0.003	<0.01	0.0	0.0	<0.01	0.4	<0.01	0.0	0.0	0.0	n/a	total NOx to use	<0.003	n/a
0.2	0	0.3	<0.1	6.8	0.3	0.3	0.2	<0.1	8.4	8.7	6.6	4.0	kjeldahl N (organic N)	5.4	4.8
1.6	2	0.3	0.8	7.3	0.9	1.5	1.4	0.5	8.4	8.7	6.6	6.4	total N to use	8.8	7.5
0.5	0.9	0.1	0.6	1.6	1.8	<0.05	0.0	0.1	0.2	0.2	0.1	<0.05	total P	0.0	0.1
<1	<1	68.0	2.0	4.0	<1	<1	65.0	1.0	78.0	75.0	61.0	93.0	total organic carbon (TOC)	43.0	42.0
4400.0	4800	4500.0	4600.0	3700.0	3700.0	3800.0	3600.0	4000.0	260.0	260.0	250.0	230.0	Cl	190.0	240.0

N7/3	N7/5	N7/6	N7/7	N8/2	N8/3	N8/5	N8/6	N8/7	NT1/1	NT1/2	NT1/3	NT1/5	CONT'D: sample#	NT1/6	NT1/7	
240.0	230	260.0	230.0	250.0	260.0	250.0	260.0	260.0	90.0	50.0	64.0	120.0	SO4	140.0	120.0	
													total S - lab			
205.8	185	170.7	187.8	195.1	226.8	200.0	171.9	229.2	207.0	n/a	304.8	365.8	HCO3 to use	260.0	280.0	
									170.0				CO3 - lab			
0.00014	<0.00005	0.00012	<0.00005	0.00021	<0.00005	0.00028	0.00037	0.00005	<0.000050	<0.00005	<0.00005	<0.00005	Hg	<0.00005	0.00008	
													<b>UTS - ICP ANALYTES (mg/L)</b>			
0.40	0.16	0.16	0.37	1.92	0.26	0.16	0.62	0.33	0.31	0.44	0.09	0.09	B	0.06	0.14	
2233.0	2265.2	2255.1	2053.4	2025.8	1904.6	1984.0	1749.2	1750.6	280.9	339.9	293.0	382.0	Na	264.3	289.5	
361.7	381.1	372.9	299.9	315.7	304.5	332.4	282.9	259.3	1.6	13.0	9.9	25.6	Mg	13.3	17.5	
0.4	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	5.3	0.8	0.9	1.1	Al	2.1	0.2	
9.6	8.8	13.6	6.3	12.5	9.9	9.3	25.2	6.6	5.2	7.8	6.7	8.0	Si	9.4	4.9	
1.4	0.8	2.3	10.6	1.4	1.4	0.7	1.0	11.1	16.9	13.2	13.1	6.0	K	13.4	10.3	
168.1	343.5	175.7	184.5	140.5	143.8	289.3	133.6	164.8	54.5	35.8	31.7	93.9	Ca	48.1	41.1	
5.47E-02	5.20E-02	1.01E-01	5.34E-02	3.17E-02	4.53E-02	4.48E-02	5.17E-02	4.22E-02	5.71E-03	3.85E-03	5.86E-03	7.02E-03	Cr	7.39E-03	3.57E-03	
3.34E-02	3.54E-02	4.02E-02	3.92E-02	6.27E-02	6.03E-02	5.62E-02	4.44E-02	4.88E-02	2.66E-03	7.60E-02	7.69E-02	1.57E-01	Mn	9.80E-02	1.56E-01	
6.78E-01	9.11E-01	1.13E+00	7.88E-01	1.24E+00	1.30E+00	1.07E+00	7.88E-01	1.04E+00	4.12E-01	3.88E+00	3.19E+00	9.88E+00	Fe	5.87E+00	1.13E+01	
9.01E-03	7.42E-03	1.04E-02	0.00E+00	1.14E-02	1.02E-02	8.82E-03	7.51E-03	7.77E-04	1.59E-02	7.76E-03	7.04E-03	6.75E-03	Ni	8.35E-03	7.70E-03	
6.80E-03	1.29E-02	1.15E-02	2.11E-02	1.05E-02	8.67E-03	6.95E-03	5.53E-03	3.66E-02	2.46E-03	2.04E-03	1.36E-03	1.05E-02	Zn	3.91E-03	9.05E-03	
3.09E-03	9.52E-04	8.48E-03	n/a	7.05E-04	1.13E-03	1.03E-03	1.86E-03	n/a	1.72E-02	1.28E-03	1.56E-03	7.77E-04	Cu	4.21E-03	n/a	
1.67E-03	1.51E-03	2.63E-03	1.38E-03	1.60E-03	1.61E-03	1.51E-03	1.58E-03	1.61E-03	1.18E-03	1.42E-03	1.21E-03	1.35E-03	As	1.19E-03	8.74E-04	
0.00E+00	0.00E+00	7.71E-03	2.59E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.36E-01	2.57E-03	0.00E+00	2.46E-04	9.50E-03	Se	2.57E-02	5.23E-03	
1.62E+00	1.48E+00	1.93E+00	2.14E+00	1.18E+00	1.44E+00	1.28E+00	1.14E+00	1.88E+00	2.25E-01	1.50E-01	1.67E-01	2.65E-01	Sr	2.99E-01	2.29E-01	
3.42E-04	2.50E-04	6.04E-04	6.19E-03	8.86E-04	3.69E-04	3.21E-04	8.57E-04	3.20E-03	3.09E-02	1.60E-02	1.77E-02	1.41E-02	Mo	1.63E-02	1.00E-02	
6.79E-05	2.63E-05	4.56E-04	0.00E+00	8.86E-05	8.58E-05	8.21E-05	1.85E-04	3.97E-04	6.22E-04	6.25E-05	1.14E-04	1.09E-04	Cd	1.06E-04	2.09E-04	
4.03E-04	2.32E-04	3.82E-04	2.17E-03	4.67E-04	3.46E-04	1.62E-04	4.22E-04	4.22E-03	5.40E-03	8.70E-04	3.88E-04	5.08E-04	Pb	6.92E-04	1.43E-03	
													F by IC - if analysed			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	1.70E+00	
													<b>CERTIFICATES</b>			
9706525	9801383	9803849	9810397	9705541	9706525	9801383	9803849	9810397	9703105	9705541	9706525	9801383	certificate numbers for	9803849	9810397	
C9706524	C9801387	C9803848	C9810417	C9705554	C9706524	C9801387R	C9803848	C9810417	C9703075	C9705554	C9706524	C9801387R	above analyses	C9803848	C9810417	
<b>TIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALI</b>			
7511	8120	7724	7474	6571	6432	6758	6197	6556	1085			888	1149	calculated TDS (mg/L)	874	927
high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS flag;care balance	use %bal	use %bal
135.467	147.262	137.802	123.627	121.293	115.273	128.277	106.191	106.136	16.114			15.700	24.214	sum cation millequivalents	16.020	16.964
132.602	143.319	135.156	137.690	112.938	113.685	115.848	109.818	122.020	18.267			13.381	14.983	sum anion millequivalents	12.536	14.072
OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	OK high%	OK high%		low sum an/cat tolerance		
1.1	1.4	1.0	-5.4	3.6	0.7	5.1	-1.7	-7.0	-6.3			8.0	23.6	ionic balance % error	12.2	9.3
0.55	0.66	0.62	0.66	0.57	0.56	0.65	0.64	0.66	0.71			0.54	0.66	A = S/K (calc TDS/cond)	0.59	0.60
										P		R		analysis adjustments		



NT2/2	NT2/3	NT2/5	NT2/6	NT2/7	NT4/2	NT4/3	NT4/5	NT4/6
18-Jun-97	23-Jul-97	9-Feb-98	15-Apr-98	29-Oct-98	18-Jun-97	23-Jul-97	11-Feb-98	16-Apr-98
0.49	0.51	0.52	0.42	0.96	0.52	0.58	1.60	1.87
1.00	1.33	1.30	1.04	1.00	1.00	0.71	1.60	1.09
1914	1631	1815	1787	1727	1382	1449	1409	1330
7.5	6.2	6.7	6.6	6.6	6.4	5.8	6.4	6.4
-132	-110	-118	-139	-128	-53	-56	-111	-116
15.7	13.3	19.4	18.1	15.4	15.8	13.4	21.3	18.7
4.6	1.6		11.4	n/a	13.9	n/a	1.3	9.9
yellow	yellow	dk yellow	yell/green		yellow	yellow	yellow	yellow
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	460	730	690	n/a	n/a	520	550	380
0.000	0.000	n/a	0.000	n/a	0.000	0.000	n/a	0.000
0.0	5.7	n/a	n/a	n/a	0.0	0.0	n/a	0.0
n/a	n/a	6.20	n/a	6.80	n/a	n/a	5.00	0.37
n/a	n/a	0.1	<0.003	<0.02	n/a	n/a	<0.02	0.0
0.0	5.7	6.2	0.0	6.8	0.0	0.0	5.0	0.4
11.0	12.0	8.0	5.0	11.0	12.0	20.0	8.0	<2
~2400	~2400	2400	61310	16	~2400	1658	24000	345
0	0	0	19	0	62	2	2	0
0	0	0	1	0	225	5	9	0
0	0	0	0	0	230	0	18	0
0	0				0	0		
0.0	5.7	n/a	n/a	n/a	1.1	2.2	n/a	0.4
14.0	10.0	11.0	13.0	12.0	0.5	13.0	11.0	10.0
14.0	10.0	17.2	13.0	18.8	1.6	15.0	16.8	10.7
0.3	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1
140.0	120.0	110.0	320.0	78.0	150.0	120.0	190.0	54.0
190.0	170.0	150.0	150.0	160.0	90.0	100.0	120.0	140.0

NT2/2	NT2/3	NT2/5	NT2/6	NT2/7	NT4/2	NT4/3	NT4/5	NT4/6
51.0	44.0	11.0	24.0	290.0	53.0	37.0	36.0	82.0
n/a	560.8	890.0	841.3	960.0	n/a	634.0	670.6	463.3
<0.00005	<0.00005	<0.00005	0.00006	0.00005	0.00056	0.00023	<0.00005	0.00005
0.26	0.07	1.08	0.04	0.10	0.16	0.81	0.37	0.08
245.4	209.3	249.1	135.2	270.7	104.2	103.9	137.9	137.8
57.2	50.4	58.4	31.9	55.1	55.7	61.5	57.6	48.4
0.8	1.1	0.4	0.3	0.2	0.7	0.9	0.4	0.3
12.5	11.8	11.1	5.7	8.4	13.2	13.5	13.5	11.7
13.6	13.4	5.7	10.4	16.9	17.9	16.6	6.7	13.6
78.1	73.4	141.3	45.6	91.6	102.9	116.1	186.4	84.8
1.40E-02	1.33E-02	1.32E-02	1.95E-02	1.27E-02	8.38E-03	9.49E-03	1.12E-02	1.36E-02
n/a	n/a	3.10E-01	3.89E-01	1.76E+00	n/a	n/a	3.10E-01	3.89E-01
8.40E+01	6.46E+01	9.69E+01	1.70E+01	7.26E+01	4.42E+01	7.71E+01	7.61E+01	1.70E+01
9.22E-03	7.75E-03	5.29E-03	7.48E-03	0.00E+00	1.98E-02	1.43E-02	5.68E-03	7.88E-03
3.48E-03	3.45E-03	3.59E-03	8.31E-03	1.16E-02	6.46E-03	7.45E-03	4.58E-03	8.37E-03
1.85E-03	1.08E-03	7.23E-04	2.99E-03	n/a	4.30E-03	2.90E-03	9.23E-04	8.11E-03
4.07E-03	3.25E-03	3.49E-03	5.22E-03	2.21E-03	2.65E-03	2.34E-03	3.74E-03	4.22E-03
0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E-01	0.00E+00	0.00E+00	0.00E+00	9.00E-03
4.37E-01	4.26E-01	4.21E-01	5.84E-01	4.88E-01	4.63E-01	5.02E-01	4.02E-01	4.96E-01
1.10E-03	8.29E-04	1.63E-03	8.21E-04	3.13E-03	1.52E-03	9.90E-04	1.05E-03	1.02E-03
7.54E-05	2.36E-05	2.53E-05	5.76E-05	0.00E+00	7.74E-05	7.06E-05	2.27E-05	3.75E-05
3.69E-03	1.69E-03	4.75E-04	6.53E-04	1.59E-03	4.66E-03	6.01E-03	8.47E-04	6.38E-04
0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9705541	9706525	9801383	9803849	9810397	9705541	9706525	9801464	9803919
C9705554	C9706524	C9801387R	C9803848	C9810417	C9705554	C9706524	C9801478	C9803918
<b>QUALITY CHECK</b>								
	1034	1278	1147	1527		974	1175	828
high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	use %bal	high TDS	use %bal
	19.702	26.802	11.700	24.446		18.662	23.346	15.234
	15.311	19.050	18.519	26.524		13.982	15.125	13.250
partial anal	OK high%	OK high%	OK high%	OK high%	partial anal		OK high%	
	12.5	16.9	-22.6	-4.1		14.3	21.4	7.0
	0.63	0.70	0.64	0.88		0.67	0.83	0.62
P		R	R		P	R	R	

LAU														LAU
sample #	L2/1	L2/2	L222/2	L2/3	L2/4	L2/5	L2/6	L3/1	L333/1	L3/2	L3/3	L3/4	L3/5	sample #
date sampled	15-Jun-97	20-Jul-97	20-Jul-97	5-Oct-97	23-Nov-97	29-Mar-98	26-Oct-98	15-Jun-97	15-Jun-97	20-Jul-97	5-Oct-97	23-Nov-97	29-Mar-97	date sampled
SWL (m)	1.20	1.10		0.96	1.08	1.82	1.06	4.81		1.98	0.89	1.53	2.48	SWL (m)
pump rate (L/min)	0.33	2.20		1.04	1.13	1.50	1.25	1.42		0.50	1.20	1.11	1.57	pump rate (L/min)
<b>FIELD PARAMETERS</b>														<b>FIELD PARAMETERS</b>
EC (uS/cm)	2580	1185		1303	1566	2596	1085	7280		1553	1341	1520	1882	EC (uS/cm)
pH	5.2	5.4		5.9	6.4	5.9	5.6	4.4		5.8	6.1	6.8	6.3	pH
Eh (mV)	-39	-64		-47	-34	-155	-94	63		-53	119	39	-135	Eh (mV)
deg C	16.8	13.9		13.2	15.1	16.6	14.5	16.3		14.6	12.7	18.5	19.0	deg C
O2 %Sat	1.9	2.9		1.2	3.3	3.7	3.0	1.9		9.1	27.5	7.2	6.5	O2 %Sat
turbid sample	minor													turbid sample
yellow oxidation	yellow			yellow		minor					slight	slight	yellow	yellow oxidation
H2S presence		strong		slight	high initially									H2S presence
<b>FIELD ANALYTES (mg/L)</b>														<b>FIELD ANALYTES (mg/L)</b>
CO2	74	24		10	20	21	22	70		16	19	9	n/a	CO2
alkalinity as CaCO3	15	60		14	nil	56	57	nil		29	5	23	35	alkalinity as CaCO3
<b>HACH ANALYTES (mg/L)</b>														<b>HACH ANALYTES (mg/L)</b>
NO2 - N (for ion *3.3)	0.001	0.000	0.050	0.014	0.000	0.008	0.001	0.000		0.005	0.057	0.019	0.000	NO2 - N (for ion *3.3)
NO3 - N (for ion *4.4)	0.0	0.6	1.3	2.0	0.4	3.2	1.6	0.0		6.6	n/a	3.8	0.0	NO3 - N (for ion *4.4)
NH3 - N (for ion *1.29)	1.32	0.93	0.80	0.73	0.70	3.25	0.29	1.64		0.76	0.29	0.28	1.86	NH3 - N (for ion *1.29)
PO4(3-) (for P *0.326)	10.0	8.4	5.6	2.7	2.0	1.8	0.4	15.1		9.4	1.8	2.2	n/a	PO4(3-) (for P *0.326)
total inorganic N - Hach	1.3	1.5	2.2	2.7	1.1	6.4	1.9	1.6		7.3	0.3	4.1	1.9	total inorganic N - Hach
<b>BACTERIAL SUITE (CFU/100mL)</b>														<b>BACTERIAL SUITE (CFU/100mL)</b>
BOD (mg/L)	3	15	16	<2.0	<2	<2	<2	50	50	60	2	<2	<2	BOD (mg/L)
Total Coliforms	51 reject	<1	<1	<1	<1	<2	3	160 reject	190 reject	<1	<2	6	<2	Total Coliforms
Faecal Coliforms	25 reject	<1	<1	<1	<1	<2		120 reject	140 reject	<2	<2	<1	<2	Faecal Coliforms
Faecal Streptococci	<1	<1	<1	<1	<1	<2	2	30 reject	2 reject	158	<2	<1	<2	Faecal Streptococci
E.Coli	20 reject	<1	<1	<1	<1	<2	<1	10 reject	91 reject	<2	<2	<1	<2	E.Coli
Pseudomonas aeruginosa	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<2	<1	<2	Pseudomonas aeruginosa
Clostridium perfringens/spp		0	0			15				0			0	Clostridium perfringens/spp
Yersinia spp.	<1	<1	<1					<1	n/d	<1				Yersinia spp.
Salmonella spp.	n/d	n/d	n/d					n/d	n/d	n/d				Salmonella spp.
<b>STANDARD ANALYTE SUITE (mg/L)</b>														<b>STANDARD ANALYTE SUITE (m</b>
total NOx to use	0.0	0.6	1.4	2.0	0.4	3.2	1.6	0.0	0.0	6.6	0.1	3.8	0.0	total NOx to use
kjeldahl N (organic N)				0.0	0.0	0.0	0.1				0.5	0.5	<1	kjeldahl N (organic N)
total N to use	3.0	1.5	2.2	2.7	1.1	6.4	2.0	2.8	2.2	7.3	0.8	4.6	2.4	total N to use
total P	3.3	2.7	1.8	0.9	0.7	0.6	0.1	4.9	0.8	3.1	0.6	0.7	0.0	total P
total organic carbon (TOC)	10.0	8.0	20.0	5.0	4.0	0.0	3.0	14.0		11.0	5.0	5.1		total organic carbon (TOC)
Cl	828.9	380.4	353.3	373.0	454.0	860.0	330.0	2430.0	2504.0	430.0	357.0	371.0	565.0	Cl

CONT'D: sample#	L2/1	L2/2	L222/2	L2/3	L2/4	L2/5	L2/6	L3/1	L333/1	L3/2	L3/3	L3/4	L3/5	CONT'D: sample#
SO4	21.0	12.0	140.0	9.8	14.7	13.0	9.0	98.0		12.0	26.0	38.0	30.0	SO4
total S - lab	7.5	5.3	4.6					31.7	31.5	7.6				total S - lab
HCO3 to use	18.0	73.2	n/a	30.5	28.0	68.3	69.5	0.0	n/a	35.4	26.8	53.6	90.2	HCO3 to use
CO3 - lab														CO3 - lab
Hg	<0.001			0.0001	0.001	<0.0005	0.00014	<0.001	<0.001	<0.001	0.00018	0.0005	<0.0005	Hg
<b>UTS - ICP ANALYTES (mg/L)</b>														<b>UTS - ICP ANALYTES (mg/L)</b>
B	0.56	0.05	2.28	0.69	0.47	0.27	1.01	0.26	0.17	0.96	0.36	0.23	0.14	B
Na	434.9	273.9	262.7	252.0	306.8	469.1	217.0	1294.8	1287.0	223.5	231.4	278.5	313.1	Na
Mg	34.8	19.4	19.9	19.1	24.8	38.7	16.4	174.6	171.7	26.4	22.9	23.5	30.5	Mg
Al	0.6	0.5	1.2	0.4	0.7	0.3	0.4	1.0	1.0	0.6	0.3	0.3	0.5	Al
Si	14.7	8.2	10.9	8.3	13.2	12.6	9.8	37.9	38.3	6.3	4.7	1.4	8.9	Si
K	6.3	6.7	7.2	4.1	4.9	2.5	6.7	4.0	4.1	48.6	17.5	36.0	7.7	K
Ca	8.7	4.2	6.8	5.0	5.5	8.3	10.9	16.9	16.5	19.1	22.0	18.9	19.0	Ca
Cr	9.78E-03	8.66E-03	8.95E-03	1.96E-03	4.80E-03	1.01E-02	1.83E-03	2.27E-02		9.22E-03	1.01E-03	6.04E-03	1.13E-02	Cr
Mn	1.50E-01	6.61E-02	7.09E-02	5.07E-02	4.51E-02	1.24E-01	2.78E-02	4.77E-02		9.77E-02	6.51E-02	8.28E-02	2.85E-01	Mn
Fe	1.01E+01	9.97E+00	1.09E+01	1.49E+01	1.42E+01	3.94E+01	6.28E+00	1.36E+01	2.06E+01	9.49E-01	2.66E-01	5.52E-01	1.87E+01	Fe
Ni	1.61E-02	7.61E-03	8.13E-03	6.98E-03	5.13E-03	9.12E-03	4.44E-03	5.74E-02		5.03E-03	1.96E-03	1.54E-03	7.88E-03	Ni
Zn	1.72E-02	6.60E-03	6.06E-03	8.85E-03	5.07E-03	5.65E-03	5.90E-03	9.79E-02		9.05E-03	1.30E-01	5.00E-01	9.12E-03	Zn
Cu	2.77E-03	4.33E-04	2.16E-04	1.10E-03	3.00E-04	1.56E-03	n/a	1.14E-03		5.80E-04	1.17E-03	7.67E-04	1.82E-03	Cu
As	4.32E-04	3.69E-04	4.20E-04	3.05E-04	1.89E-04	4.69E-04	2.94E-04	5.25E-04		2.20E-04	1.82E-04	1.20E-04	5.85E-04	As
Se	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		9.26E-04	3.85E-03	0.00E+00	0.00E+00	Se
Sr	6.14E-02	3.34E-02	3.44E-02	2.61E-02	3.03E-02	3.89E-02	4.61E-02	1.14E-01		9.84E-02	1.09E-01	8.66E-02	1.08E-01	Sr
Mo	3.35E-04	6.29E-05	1.91E-04	3.66E-04	2.81E-04	3.31E-04	3.99E-04	1.22E-04		1.87E-04	2.73E-04	2.55E-04	2.77E-04	Mo
Cd	2.17E-04	1.37E-05	2.25E-05	1.52E-04	8.27E-05	3.01E-05	6.22E-05	1.94E-04		4.62E-05	1.46E-04	1.37E-04	4.49E-05	Cd
Pb	1.29E-03	6.70E-04	6.84E-04	9.89E-04	4.72E-04	2.38E-04	3.55E-04	2.51E-03		2.83E-03	2.48E-03	2.98E-03	2.06E-03	Pb
F by IC - if analysed				0.00E+00	0.00E+00						0.00E+00	0.00E+00		F by IC - if analysed
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use
<b>CERTIFICATES</b>														<b>CERTIFICATES</b>
certificate numbers for	97.683	97.808	97.808	97.1084	97.124	42338-42343	C9810274	97.683	97.683	97.808	97.1084	97.124	42338-42343	certificate numbers for
above analyses	9701020W	C9706465	C9706465	C9708523	97-11-188	98-04-034	C9810539	9701020W	9701020W	C9706465	C9708523	97-11-188	98-04-034	above analyses
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>														<b>ELECTRONIC BALANCE (%), RA</b>
calculated TDS (mg/L)	1400	768		719	862	1501	649	4112		833	704	817	1041	calculated TDS (mg/L)
high TDS flag;care balance	high TDS	use %bal	use %bal	use %bal	use %bal	high TDS	use %bal	high TDS	high TDS	use %bal	use %bal	use %bal	high TDS	high TDS flag;care balance
sum cation millequivalents	22.906	14.368		13.526	16.416	25.749	11.797	72.360		14.251	13.558	15.993	18.133	sum cation millequivalents
sum anion millequivalents	24.432	12.488		11.455	13.666	25.932	10.947	71.068		13.722	11.112	12.475	18.042	sum anion millequivalents
low sum an/cat tolerance	OK high%		partial anal	OK high%	OK high%	OK high%		OK high%	partial anal	OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance
ionic balance % error	-3.2	7.0		8.3	9.1	-0.4	3.7	0.9		1.9	9.9	12.4	0.3	ionic balance % error
A = S/K (calc TDS/cond)	0.54	0.65		0.55	0.55	0.58	0.60	0.56		0.54	0.53	0.54	0.55	A = S/K (calc TDS/cond)
analysis adjustments	DP		P					DP	P, DP					analysis adjustments

													LAU			
L3/6	L4/1	L4/2	L4/3	L4/4	L4/5	L4/6	L5/1	L5/2	L5/3	L5/4	L5/6	L6/1	sample #	L6/2	L6/3	
26-Oct-98	15-Jun-97	20-Jul-97	5-Oct-97	23-Nov-97	29-Mar-98	25-Oct-98	16-Jun-97	21-Jul-97	5-Oct-97	25-Nov-97	26-Oct-98	16-Jun-97	date sampled	21-Jul-97	5-Oct-97	
0.80	0.77	0.29	0.52	0.96	2.17	0.57	0.18	0.22	0.51	0.88	0.12	0.18	SWL (m)	0.16	0.49	
0.88	2.00	2.40	1.62	1.57	1.20	1.20	3.00	0.80	2.18	1.00	1.04	1.00	pump rate (L/min)	1.00	1.71	
<b>FIELD PARAMETERS</b>																
1527	1252	1324	1173	1202	1247	995	2608	2590	1758	2374	2379	4030	EC (uS/cm)	3990	4680	
6.4	6.4	6.5	6.7	7.1	6.5	6.6	5.6	5.8	6.2	7.7	6.0	4.1	pH	3.9	4.5	
-23	136	72	51	9	-120	52	6	-1	-84	13	-85	367	Eh (mV)	344	166	
13.8	14.4	12.9	12.1	14.7	17.8	13.0	11.3	9.7	13.3	21.3	16.2	13.2	deg C	10.2	13.9	
9.1	3.7	26.6	18.8	2.3	2.4	7.0	2.0	4.3	9.6	0.8	3.9	15.2	O2 %Sat	5.2	11.0	
	minor	minor											turbid sample			
	minor			minor	minor					minor	light		yellow oxidation			
							slight						H2S presence			
<b>FIELD ANALYTES (mg/L)</b>																
81	90	84	32	10	34	72	40	18	26	<10	55	50	CO2	60	70	
52	238	161	209	176	132	185	5	13	45	31	11	nil	alkalinity as CaCO3	nil	nil	
<b>HACH ANALYTES (mg/L)</b>																
0.008	0.064	0.048	0.008	0.029	0.005	0.350	0.000	0.000	0.000	n/a	0.000	0.002	NO2 - N {for ion *3.3}	0.003	0.004	
5.8	4.6	8.0	n/a	1.3	0.9	1.9	0.0	1.2	n/a	n/a	1.2	2.5	NO3 - N {for ion *4.4}	0.0	n/a	
0.14	1.46	0.66	0.83	0.99	0.93	0.50	0.18	0.15	0.51	n/a	0.39	0.22	NH3 - N {for ion *1.29}	0.23	0.76	
0.1	18.7	3.9	2.4	3.2	3.4	1.3	0.0	1.1	1.7	n/a	0.7	0.0	PO4(3-) {for P *0.326}	0.4	0.5	
5.9	6.1	8.7	0.8	2.3	1.9	2.8	0.2	1.3	0.5	0.0	1.6	2.7	total inorganic N - Hach	0.2	0.8	
<b>BACTERIAL SUITE (CFU/100mL)</b>																
4.0	30.0	14.0	4.0	2.0	<2	<2	31.0	22.0	2.0	3.0		10.0	BOD (mg/L)	3.0	<2.0	
<1	130 reject	<1	<2	3	<2	<1	210 reject	6	<2	37		50 reject	Total Coliforms	2	<1	
	97 reject	<1	<2	<1	<2		130 reject	3	<2	<1		44 reject	Faecal Coliforms	3	<1	
5	110 reject	41	<2	<1	<2	<1	38 reject	5 reject	<2	<1		1 reject	Faecal Streptococci	<1	<1	
<1	90 reject	<1	<2	<1	<2	<1	110 reject	3	<2	<1		21 reject	E.Coli	3	<1	
<1	<1	<1	<2	<1	<2	<1	<1	<1	<2	<1		<1	Pseudomonas aeruginosa	<1	<1	
		0			75			0					Clostridium perfringens/spp	0		
	<1	<1					<1	<1				<1	Yersinia spp.	<1		
	n/d	n/d					n/d	n/d				n/d	Salmonella spp.	n/d		
<b>STANDARD ANALYTE SUITE (mg/L)</b>																
8.2	4.7	8.0	0.0	1.3	0.9	2.7	0.0	1.2	0.0	n/a	1.2	2.5	total NOx to use	0.0	0.0	
0.2			1.5	2.2	<1	1.1			0.0	0.0			kjeldahl N (organic N)		<1.0	
8.5	6.1	8.7	2.3	4.5	4.4	4.3	1.4	1.3	0.5	0.0	1.6	2.7	total N to use	1.4	0.8	
<0.05	6.1	1.3	0.8	1.1	1.1	0.4	0.3	0.4	0.6	0.0	0.2	0.3	total P	0.3	0.2	
6.0	14.0	17.0	28.0	20.0		11.0	7.0	10.0	10.0	7.4		10.0	total organic carbon (TOC)	6.0	4.0	
400.0	185.5	145.2	147.0	180.0	221.0	140.0	892.5	817.0	522.0	700.0	770.0	1333.0	Cl	1264.6	1570.0	

L3/6	L4/1	L4/2	L4/3	L4/4	L4/5	L4/6	L5/1	L5/2	L5/3	L5/4	L5/6	L6/1	CONT'D: sample#	L6/2	L6/3
53.0	72.0	4.7	84.0	85.0	100.0	63.0	4.0	2.9	6.9	3.5	n/a	7.0	SO4	8.1	5.7
	25.5	37.0					1.9	1.6				3.1	total S - lab	3.4	
63.4	290.2	196.3	353.6	304.8	256.0	225.6	5.6	16.3	54.9	53.6	13.4	0.0	HCO3 to use	0.0	0.0
													CO3 - lab		
<0.004	<0.001	<0.001	<0.00005	<0.0005	<0.0005	0.00009	<0.001	<0.001	0.00005	0.0005	n/a	<0.001	Hg	<0.001	0.00005
													<b>UTS - ICP ANALYTES (mg/L)</b>		
0.73	0.21	0.37	0.20	0.25	0.12	0.65	0.11	0.19	0.15	0.27	0.64	0.08	B	0.13	0.10
315.0	130.1	135.6	138.8	187.2	190.8	192.9	474.0	435.9	346.6	506.2	251.9	681.8	Na	664.7	855.1
24.9	35.8	44.0	49.2	47.5	32.4	34.2	53.0	52.0	37.7	56.1	44.4	73.7	Mg	74.5	103.6
0.3	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	4.6	Al	6.8	4.7
6.0	9.2	7.1	7.4	1.6	9.4	7.8	3.4	2.2	4.0	0.0	5.5	5.6	Si	5.1	5.6
7.4	42.4	26.7	23.7	19.1	12.4	7.2	2.0	2.2	2.1	2.1	6.4	4.1	K	2.6	4.3
23.1	67.2	60.1	64.0	55.4	31.3	38.8	9.7	8.2	7.5	5.9	12.6	31.6	Ca	25.0	33.0
2.06E-03	3.67E-03	2.41E-03	2.80E-03	2.74E-03	4.34E-03	2.40E-03	1.13E-02	8.43E-03	1.98E-03	8.16E-03	2.22E-03	1.67E-02	Cr	1.34E-02	9.30E-04
6.78E-02	4.86E-02	1.25E-01	5.82E-01	4.51E-01	4.90E-01	3.58E-01	1.12E-01	9.86E-02	1.50E-01	1.08E-01	9.66E-02	6.91E-01	Mn	n/a	7.63E-01
4.18E+00	2.30E-01	1.84E-01	8.02E-01	9.49E-01	4.40E+00	2.23E+00	1.30E+00	3.67E+00	9.00E+00	1.67E+01	1.15E+01	8.03E-01	Fe	1.83E+00	1.45E+01
2.49E-03	3.18E-03	2.40E-03	3.68E-03	3.41E-03	3.63E-03	2.88E-03	5.04E-03	5.89E-03	6.54E-03	8.656E-03	8.52E-03	1.80E-02	Ni	1.77E-02	2.83E-02
6.97E-03	3.93E-03	3.86E-03	8.65E-03	6.57E-03	1.27E-02	5.68E-03	9.18E-03	7.46E-03	9.68E-03	4.81E-03	4.43E-03	4.09E-02	Zn	3.09E-02	5.94E-02
n/a	2.45E-03	1.15E-03	2.05E-03	1.12E-03	1.06E-03	n/a	8.17E-04	3.28E-04	2.50E-03	2.74E-04	n/a	5.65E-03	Cu	1.97E-03	1.83E-03
2.84E-04	1.27E-04	1.12E-04	1.66E-04	1.73E-04	2.75E-04	1.34E-04	2.47E-04	2.23E-04	3.13E-04	3.95E-04	4.64E-04	3.38E-04	As	2.84E-04	3.75E-04
5.26E-03	8.33E-04	0.00E+00	8.61E-04	0.00E+00	0.00E+00	0.00E+00	6.56E-04	0.00E+00	0.00E+00	0.00E+00	5.92E-03	5.35E-04	Se	0.00E+00	0.00E+00
1.78E-01	3.15E-01	2.65E-01	2.71E-01	2.17E-01	1.60E-01	2.44E-01	8.24E-02	8.39E-02	7.07E-02	6.88E-02	9.64E-02	2.17E-01	Sr	1.84E-01	2.78E-01
4.86E-04	3.42E-04	2.59E-04	3.77E-04	3.94E-04	4.10E-04	3.88E-04	9.95E-05	9.65E-05	2.14E-04	2.02E-04	3.42E-04	8.11E-05	Mo	3.48E-05	4.17E-05
9.29E-05	1.13E-04	4.23E-05	1.03E-04	1.88E-04	3.66E-05	5.11E-05	4.37E-05	4.26E-05	2.85E-04	1.69E-04	5.17E-05	3.30E-04	Cd	2.81E-04	3.49E-04
2.47E-03	1.10E-03	1.14E-03	8.45E-04	7.60E-04	1.49E-03	3.36E-04	1.56E-03	9.47E-04	3.36E-04	3.58E-04	4.19E-04	3.04E-03	Pb	2.67E-03	3.15E-03
				0.00E+00						0.00E+00			F by IC - if analysed		
7.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+00	0.00E+00	Br value to use	0.00E+00	0.00E+00
													<b>CERTIFICATES</b>		
C9810274	97.683	97.808	97.1084	97.124	42338-42343	C9810274	97.683	97.808	97.1084	97.1246	C9810274	97.683	certificate numbers for	97.808	97.1084
C9810539	9701020W	C9706465	C9708523	97-11-188	98-04-034	C9810539	9701020W	C9706465	C9708523	97-11-188	C9810539	9701020W	above analyses	C9706465	C9708523
<b>TIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY</b>		
902	722	563	704	747	731	612	1457	1348	973	1321		2165	calculated TDS (mg/L)	2066	2605
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS	high TDS	use %bal	high TDS	high TDS	high TDS	high TDS flag;care balance	high TDS	high TDS
17.290	13.212	13.305	14.010	15.454	13.104	13.476	25.620	23.889	19.011	27.619		37.964	sum cation millequivalents	37.207	48.582
13.927	12.410	8.105	11.768	12.038	12.687	9.227	25.353	23.496	15.822	20.698		37.924	sum anion millequivalents	35.856	44.424
		OK high%					OK high%	OK high%	OK high%	OK high%	partial anal	OK high%	low sum an/cat tolerance	OK high%	OK high%
10.8	3.1	24.3	8.7	12.4	1.6	18.7	0.5	0.8	9.2	14.3		0.1	ionic balance % error	1.8	4.5
0.59	0.58	0.43	0.60	0.62	0.59	0.62	0.56	0.52	0.55	0.56		0.54	A = S/K (calc TDS/cond)	0.52	0.56
	DP	R				R	DP	DP		R	P	DP	analysis adjustments		

											LAU				
L6/5	L6/6	L7/1	L7/2	L7/3	L7/4	L7/5	L7/6	L13/5	L13/6	L15/6	sample #	L16/6	LP/1	LP/2	LP/3
30-Mar-98	26-Oct-98	16-Jun-97	20-Jul-97	5-Oct-97	23-Nov-97	29-Mar-98	26-Oct-98	29-Mar-98	25-Oct-98	25-Oct-98	date sampled	25-Oct-98	15-Jun-97	20-Jul-97	5-Oct-97
1.26	0.98	0.21	0.18	0.37	0.74	0.73	0.38	1.91	1.83	0.58	SWL (m)	5.02			
2.18	0.96	1.00	0.95	1.76	2.14	2.50	1.50	0.78	0.96	0.68	pump rate (L/min)	0.85			
											<b>FIELD PARAMETERS</b>				
4410	3720	4830	4700	4590	4680	4240	4180	234	447	325	EC (uS/cm)	215.7	123.4	121	150.1
4.9	4.4	5.5	5.8	6.0	6.9	6.1	5.9	6.1	6.8	7.5	pH	6.1	7.4	7.8	7.5
18	126	-88	-97	-97	-92	-137	-95	-69	-92	-162	Eh (mV)	-147	151	89	97
21.0	15.4	13.0	9.7	12.4	15.0	18.5	13.3	16.7	12.6	14.0	deg C	13.7	8.5	6.8	
31.9	6.3	2.8	4.7	11.5	0.8	6.1	3.9	9.2	3.2	3.1	O2 %Sat	2.7	25.6	47.2	70.8
											turbid sample	minor			
			minor	light	minor	minor					yellow oxidation				
					some			slight		minor	H2S presence				
											<b>FIELD ANALYTES (mg/L)</b>				
16	193	19	103	12	8	13	57	36	36	30	CO2	<10	27	20	n/a
nil	nil	37	7	39	39	44	43	86	179	81	alkalinity as CaCO3	35	38	26	n/a
											<b>HACH ANALYTES (mg/L)</b>				
n/a	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	NO2 - N {for ion *3.3}	0.000	0.004	0.001	0.000
n/a	0.4	0.0	1.1	n/a	0.3	2.3	3.1	1.6	0.0	0.9	NO3 - N {for ion *4.4}	3.7	1.9	0.8	0.0
n/a	0.37	4.04	3.11	2.82	0.15	3.08	4.38	2.24	5.50	0.37	NH3 - N {for ion *1.29}	0.67	0.49	0.34	0.12
n/a	0.0	0.0	1.2	1.4	0.7	0.7	0.5	0.7	2.7	0.5	PO4(3-) {for P *0.326}	0.3	2.3	1.0	0.0
0.0	0.7	4.0	4.2	2.8	0.5	5.4	7.5	3.8	5.5	1.3	total inorganic N - Hach	4.4	2.3	1.1	0.1
											<b>BACTERIAL SUITE (CFU/100mL)</b>				
		100.0	40.0	4.0	3.0	6.0		<2	4.0	<2	BOD (mg/L)	<2	23.0	1.0	5.0
		4 reject	<1	<1	<1	<2		<2	2	53	Total Coliforms	5	200 reject	9	<2
		2 reject	<1	<1	<1	<2		<2			Faecal Coliforms		110 reject	9	<2
		<1	18 reject	<1	<1	<2		<2	1	6	Faecal Streptococci	<1	110 reject	39	<2
		<1	<1	<1	<1	<2		<2	<1	6	E.Coli	<1	110 reject	9	<2
		<1	<1	<1	<1	<2		<2	<1	<1	Pseudomonas aeruginosa	5	<1	<1	<2
		0				75		21			Clostridium perfringens/spp			0	
		<1	<1								Yersinia spp.		n/d	<1	
		n/d	n/d								Salmonella spp.		n/d	n/d	
											<b>STANDARD ANALYTE SUITE (m)</b>				
n/a	0.4	0.0	1.1	0.0	0.3	2.3	3.1	1.584	0	0.88	total NOx to use	3.68	1.854	0.801	0
				1.2	1.3	1.3		5.9	7.8	1.6	total N to use	0.2			0.0
											kjeldahl N (organic N)	4.6	2.3	1.3	0.1
n/a	0.7	4.0	4.2	4.0	1.8	6.7	7.5	0.2	0.9	0.2	total N to use	0.1	0.8	0.3	0.0
		0.4	0.4	0.5	0.2	0.2	0.2				total P	4.0	7.0	6.0	4.0
		16.0	16.0	8.0	9.6						total organic carbon (TOC)				
1450.0	1300.0	1642.0	1364.0	1510.0	1510.0	1450.0	1600.0	14.0	16.0	16.0	Cl	25.0	11.9	11.6	15.0

L6/5	L6/6	L7/1	L7/2	L7/3	L7/4	L7/5	L7/6	L13/5	L13/6	L15/6	CONT'D: sample#	L16/6	LP/1	LP/2	LP/3
14.0	n/a	6.0	28.0	6.5	3.0	7.3	n/a	7.2	5.0	11.0	SO4	25.0	5.0	6.4	6.6
		2.3									total S - lab		1.8		
0.0	0.0	45.2	8.5	65.8	76.8	79.2	52.4	146.3	218.2	98.8	HCO3 to use	42.1	46.3	31.9	55.0
											CO3 - lab				
<0.0005		<0.001	<0.001	0.00009	0.0015	<0.0005		<0.0005	<0.00005	<0.00005	Hg	<0.00008	<0.001	<0.001	0.00021
											<b>UTS - ICP ANALYTES (mg/L)</b>				
0.12	0.60	0.04	0.12	2.11	0.19	0.06	1.93	0.11	0.81	0.39	B	0.18	0.85	0.08	0.70
753.1	291.5	842.9	789.6	795.1	1005.1	786.0	813.5	14.7	28.2	56.3	Na	62.5	11.9	10.9	14.2
86.2	64.5	86.7	83.7	83.7	103.2	84.9	78.7	17.4	21.2	10.0	Mg	1.7	4.2	4.0	4.7
2.4	2.1	0.4	0.4	0.4	0.4	0.2	0.5	0.2	0.4	0.3	Al	0.3	0.3	0.3	0.3
6.7	6.4	6.2	5.5	6.5	0.0	5.5	6.2	2.7	4.1	4.2	Si	17.6	3.5	0.8	1.3
4.1	6.7	1.3	1.1	1.0	1.2	1.5	9.8	2.9	12.0	11.6	K	5.8	3.5	3.1	2.7
26.4	21.1	13.9	12.4	11.2	10.1	9.2	13.7	10.6	24.4	42.3	Ca	4.3	11.2	11.0	13.9
1.48E-02	1.32E-02	1.63E-02	1.44E-02	2.47E-03	1.48E-02	1.65E-02	2.02E-02	8.91E-04	1.49E-04	8.07E-04	Cr	1.53E-03	2.19E-04	3.87E-04	3.70E-04
2.94E-01	9.59E-01	4.39E-01	n/a	7.37E-01	5.81E-01	3.79E-01	5.43E-01	2.94E-01	3.37E+00	3.06E-01	Mn	9.23E-02	8.46E-02	1.86E-02	2.51E-02
6.41E+01	7.16E+00	1.97E+01	1.77E+01	7.88E+01	9.53E+01	9.64E+01	9.34E+01	1.31E+01	5.75E+01	1.86E+00	Fe	1.77E+01	2.10E-01	2.94E-01	3.75E-01
2.44E-02	1.96E-02	1.65E-02	1.48E-02	1.55E-02	1.10E-02	5.68E-03	0.00E+00	2.52E-03	0.00E+00	1.33E-03	Ni	2.93E-03	8.86E-04	6.05E-04	5.69E-04
2.49E-02	5.68E-02	1.18E-02	6.98E-03	1.45E-02	1.55E-02	3.43E-03	1.23E-01	1.06E-02	1.52E-02	3.40E-03	Zn	5.67E-03	2.84E-03	4.26E-03	5.10E-03
3.19E-04	n/a	5.23E-04	1.28E-04	2.29E-04	1.76E-04	6.56E-04	n/a	2.95E-04	n/a	n/a	Cu	n/a	1.63E-03	4.68E-04	6.16E-04
5.40E-04	3.86E-03	5.47E-04	4.11E-04	5.87E-04	3.94E-04	5.71E-04	1.52E-03	1.45E-04	6.25E-04	1.00E-04	As	1.76E-04	1.28E-04	2.96E-05	8.47E-05
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.87E-01	0.00E+00	3.72E-01	0.00E+00	Se	0.00E+00	0.00E+00	0.00E+00	1.47E-03
1.95E-01	2.45E-01	1.22E-01	1.11E-01	1.12E-01	1.03E-01	8.03E-04	1.21E-01	7.23E-02	1.36E-01	1.74E-01	Sr	1.25E-02	3.69E-02	3.46E-02	4.12E-02
2.80E-05	5.99E-02	8.92E-05	6.38E-05	1.48E-03	1.19E-04	1.09E-05	1.07E-02	3.95E-05	6.07E-03	2.22E-04	Mo	1.14E-04	8.82E-04	2.86E-05	4.25E-04
9.46E-05	5.94E-05	2.31E-05	1.75E-05	1.22E-04	1.72E-04	2.36E-05	0.00E+00	1.89E-05	0.00E+00	5.07E-05	Cd	5.32E-05	9.54E-05	1.44E-05	1.22E-04
1.23E-03	7.56E-03	1.61E-04	3.74E-04	1.52E-03	1.36E-03	6.24E-04	2.72E-03	4.61E-04	4.24E-03	2.85E-04	Pb	8.57E-04	3.66E-04	2.90E-04	3.11E-04
					0.00E+00						F by IC - if analysed				
0.00E+00	3.90E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.10E+00	0.00E+00	1.10E-01	9.00E-02	Br value to use	1.30E-01	0.00E+00	0.00E+00	0.00E+00
											<b>CERTIFICATES</b>				
98-04-034	C9810274	97.683	97.808	97.1084	97.124	42338-42343	C9810274	42338-42343	C9810274	C9810274	certificate numbers for	C9810274	97.683	97.808	97.1084
	C9810539	9701020W	C9706465	C9708523	97-11-188	98-04-034	C9810539	98-04-034	C9810539	C9810539	above analyses	C9810539	9701020W	C9706465	C9708523
<b>QUALITY CHECK</b>											<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>				
		2672	2340	2549	2779	2502		169	307	208	calculated TDS (mg/L)	201	91	74	87
	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	use %bal	use %bal	use %bal	high TDS flag;care balance	use %bal	use %bal	use %bal	use %bal
		45.572	42.782	45.123	56.211	45.377		3.327	6.998	5.810	sum cation millequivalents	3.938	1.584	1.495	1.823
		47.187	39.316	43.855	43.963	42.543		3.079	4.231	5.821	sum anion millequivalents	5.345	1.404	1.073	1.462
partial anal	partial anal	OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	OK high%		OK high%	low sum an/cat tolerance	OK high%	OK high%	OK high%	OK high%
		-1.7	4.2	1.4	12.2	3.2		3.9	24.6	-0.1	ionic balance % error	-15.2	6.0	16.4	11.0
		0.55	0.50	0.56	0.59	0.59		0.72	0.69	0.64	A = S/K (calc TDS/cond)	0.93	0.73	0.61	0.58
P	P	DP	DP				P		R		analysis adjustments	R	DP	R	



LP/4	LP/5	LP/6
23-Nov-97	29-Mar-98	25-Oct-98
142.1	173.6	118.6
7.5	7.6	9.1
71	-20	-51
24.3	16.8	17.5
54.9	40.0	79.9
25	7	n/a
28	67	56
0.002	0.006	0.002
0.3	0.7	0.9
0.15	0.19	0.12
0.7	0.0	0.6
0.5	0.9	1.0
2.0	7.0	6.0
110	10	58
140	16	
140	14	12
87	8	14
<1	<2	<1
	1100	
0.322	0.746	0.882
<1	1.3	0.4
0.5	2.2	1.4
0.2	0.1	0.2
5.6		9.0
13.0	14.0	10.0

LP/4	LP/5	LP/6
3.6	8.7	6.0
48.8	62.2	68.3
0.005	<0.0005	<0.00005
0.21	0.09	0.16
16.0	15.6	26.1
5.1	6.9	4.2
0.3	0.2	0.3
0.0	0.4	1.4
2.2	6.6	11.3
9.0	13.9	11.1
3.87E-04	4.62E-04	4.20E-04
2.61E-02	6.03E-02	1.12E-02
8.43E-01	4.19E-01	4.81E-01
4.67E-04	1.06E-03	6.71E-04
7.69E-03	5.85E-03	3.01E-03
6.83E-04	9.91E-04	n/a
4.08E-05	6.08E-05	5.54E-05
0.00E+00	5.74E-05	0.00E+00
3.85E-01	4.82E-02	3.39E-02
7.87E-05	6.34E-05	1.66E-04
6.85E-05	4.07E-05	2.91E-05
3.95E-04	3.50E-04	2.87E-04
0.00E+00		
0.00E+00	0.00E+00	<0.02
97.124	42338-42343	C9810274
97-11-188	98-04-034	C9810539
79	102	115
use %bal	use %bal	use %bal
1.710	2.162	2.384
1.286	1.648	1.608
OK high%	OK high%	OK high%
14.1	13.5	19.4
0.56	0.59	0.97
R		R

CEN														CEN
sample #	C1/3	C1/4	C1/5	C2/1	C2/2	C2/3	C2/4	C3/1	C3/2	C3/3	C3/4	C3/5	C4/1	sample #
date sampled	29-Jun-97	24-Sep-97	22-Feb-98	17-Oct-96	14-Feb-97	29-Jun-97	24-Sep-97	17-Oct-96	14-Feb-97	29-Jun-97	24-Sep-97	22-Feb-98	17-Oct-96	date sampled
SWL (m)	3.79	3.24	3.80	1.75	2.26	2.39	2.04	1.43	2.13	2.08	1.69	2.26	2.64	SWL (m)
pump rate (L/min)		0.67	0.32			0.50	0.88			0.80	0.88	1.14		pump rate (L/min)
<b>FIELD PARAMETERS</b>														
EC (uS/cm)	7220	6800	6200	7470	7780	7060	6890	8660	8770	8080	7750	6970	19520	EC (uS/cm)
pH	7.3	7.1	7.2	7.0	7.0	7.1	7.1	6.9	7.0	7.1	7.1	7.2	6.7	pH
Eh (mV)	3	134	80		320	88	149		182	84	166	180		Eh (mV)
deg C	17.8	20.6	25.3	18.6	23.1	19.6	19.7	19.2	25.1	19.5	18.6	23.6	22.5	deg C
O2 %Sat	27.2	38.1	5.8	5.9	10.4	3.4	18.6	81.9	39.9	13.2	18.2	43.9	64.3	O2 %Sat
turbid sample			some			initially				turbid	dirty initially			turbid sample
yellow oxidation														yellow oxidation
H2S presence														H2S presence
<b>FIELD ANALYTES (mg/L)</b>														
CO2	n/a	n/a	n/a	580	340	180	254	463	436	n/a	330	290	630	CO2
alkalinity as CaCO3	n/a	n/a	721	710	684	597	607	716	720	760	740	690	640	alkalinity as CaCO3
<b>HACH ANALYTES (mg/L)</b>														
NO2 - N (for ion *3.3)	0.000	0.000	0.001	0.000	0.002	0.020	0.000	0.005	0.009	0.000	0.000	0.000	0.013	NO2 - N (for ion *3.3)
NO3 - N (for ion *4.4)	0.0	0.6	0.5	n/a	0.1	0.6	0.0	n/a	0.8	0.0	0.0	0.0	n/a	NO3 - N (for ion *4.4)
NH3 - N (for ion *1.29)	0.01	0.37	0.07	n/a	0.27	0.18	0.27	0.48	0.53	0.50	0.47	0.53	1.70	NH3 - N (for ion *1.29)
PO4(3-) (for P *0.326)	0.0	3.6	0.0	2.2	1.0	0.8	2.1	2.0	1.9	3.5	2.1	3.1	1.9	PO4(3-) (for P *0.326)
total inorganic N - Hach	0.0	1.0	0.6	0.0	0.4	0.8	0.3	0.5	1.4	0.5	0.5	0.5	1.7	total inorganic N - Hach
<b>BACTERIAL SUITE (CFU/100mL)</b>														
BOD (mg/L)	40	8	19	21	<2	<2	2.0	<2	<2	2.0	n/a	4.0	4.0	BOD (mg/L)
Total Coliforms	>180	2	1	140	0	0	0	80 reject	0	>180	3	0	0	Total Coliforms
Faecal Coliforms	25			0	0	0		0	0	0			0	Faecal Coliforms
Faecal Streptococci	8	0	0	0	0	0	0	0	0	0	0	0	0	Faecal Streptococci
E.Coli		0	0				0				0	0		E.Coli
Pseudomonas aeruginosa	<10	0	0			0	0			0	0	0		Pseudomonas aeruginosa
Clostridium perfringens/spp														Clostridium perfringens/spp
Yersinia spp.														Yersinia spp.
Salmonella spp.														Salmonella spp.
<b>STANDARD ANALYTE SUITE (mg/L)</b>														
total NOx to use	0.0	0.6	0.5	0.0	0.1	0.6	0.0	0.0	0.8	0.0	0.0	0.0	0.0	total NOx to use
kjeldahl N (organic N)	0.6	0.4	0.2	0.3	0.4	0.2	0.3	0.3	0.4	0.3	0.2	0.1	0.4	kjeldahl N (organic N)
total N to use	0.7	1.4	0.8	0.3	0.7	1.0	0.5	0.8	1.7	0.8	0.7	0.6	2.1	total N to use
total P	0.1	0.1	0.0	0.7	0.4	0.3	0.7	0.7	0.6	1.2	0.7	1.0	0.6	total P
total organic carbon (TOC)	27.0	6.0	8.5	9.6	2.7	4.3	3.0	2.8	2.7	4.6	27.2	3.5	3.6	total organic carbon (TOC)
Cl	1750.0	1730.0	1580.0		727.0	1750.0	1750.0		2216.8	2010.0	n/a	1880.0		Cl

CONT'D: sample#	C1/3	C1/4	C1/5	C2/1	C2/2	C2/3	C2/4	C3/1	C3/2	C3/3	C3/4	C3/5	C4/1	CONT'D: sample#
SO4	261.0	244.0	246.0		130.6	245.0	238.0		218.4	263.0	n/a	265.0		SO4
total S - lab														total S - lab
HCO3 to use	901.0	850.0	879.1	865.6	833.9	854.0	823.0	873.0	877.8	926.6	902.2	841.3	780.3	HCO3 to use
CO3 - lab														CO3 - lab
Hg	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001		Hg
<b>UTS - ICP ANALYTES (mg/L)</b>														<b>UTS - ICP ANALYTES (mg/L)</b>
B	2.01	1.51	1.80		0.42	1.10	1.08	1.19	0.51	1.22	1.08	1.35	2.69	B
Na	1273.1	1249.9	1201.8		279.5	1109.3	1199.8	1324.2	575.6	1354.8	1371.0	1291.5	4805.9	Na
Mg	151.3	147.3	144.2		35.9	153.3	162.1	186.6	75.1	194.4	195.4	180.5	1310.2	Mg
Al	0.9	0.5	0.4		0.1	0.3	0.2	2.9	0.1	0.4	0.2	0.2	5.6	Al
Si	14.1	12.9	14.4		1.6	12.3	13.5	19.6	3.1	13.5	12.9	13.7	35.9	Si
K	7.1	5.6	6.4		1.2	5.9	5.8	11.9	3.5	8.7	8.6	8.9	67.7	K
Ca	153.3	157.9	145.5		30.3	160.3	179.7	191.5	55.4	171.5	180.1	169.1	891.5	Ca
Cr	1.70E-02	3.61E-03	1.68E-02		8.72E-03	1.69E-02	3.02E-03	4.85E-02	1.39E-02	1.92E-02	2.40E-03	1.74E-02	9.43E-02	Cr
Mn	2.73E-01	2.48E-01	1.13E-01		8.52E-02	2.90E-01	3.20E-01	4.75E-01	2.29E-01	2.58E-01	2.29E-01	4.30E-01	1.73E-01	Mn
Fe	4.19E-01	7.29E-01	6.12E-01		7.95E-02	2.72E-01	4.84E-01	7.53E-01	1.20E-01	3.34E-01	6.09E-01	2.78E-01	1.36E+00	Fe
Ni	5.00E-03	3.87E-03	2.39E-03		1.27E-03	4.52E-03	3.66E-03	7.15E-03	2.69E-03	5.69E-03	4.47E-03	4.45E-03	1.26E-02	Ni
Zn	9.52E-03	2.70E-02	1.64E-02		2.16E-03	2.77E-03	1.97E-02	2.71E-03	1.10E-02	6.58E-03	1.89E-02	1.22E-02	2.06E-02	Zn
Cu	1.48E-03	1.52E-03	1.81E-03		4.82E-03	1.07E-03	1.82E-03	1.45E-03	1.20E-03	2.38E-03	9.69E-04	1.00E-03	1.19E-02	Cu
As	5.17E-04	6.63E-04	4.43E-04		1.63E-04	4.69E-04	5.13E-04	1.30E-03	3.59E-04	5.12E-04	5.71E-04	4.19E-04	3.11E-03	As
Se	0.00E+00	0.00E+00	0.00E+00		1.30E-03	0.00E+00	0.00E+00	0.00E+00	3.70E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Se
Sr	1.16E+00	1.32E+00	1.32E+00		3.33E-01	1.15E+00	1.33E+00	1.83E+00	6.96E-01	1.38E+00	1.54E+00	1.44E+00	2.10E+00	Sr
Mo	2.30E-03	1.89E-03	1.25E-03		2.97E-04	3.54E-04	5.51E-04	0.00E+00	5.56E-04	5.69E-04	6.68E-04	1.02E-03	6.37E-04	Mo
Cd	2.14E-04	2.20E-04	1.29E-04		2.23E-04	3.45E-05	2.36E-04	2.42E-05	2.50E-05	8.79E-05	1.45E-04	4.63E-05	2.25E-04	Cd
Pb	1.35E-03	5.65E-04	1.47E-03		1.16E-04	6.26E-04	1.39E-03	9.23E-04	3.55E-04	1.40E-03	1.37E-03	8.69E-05	1.21E-02	Pb
F by IC - if analysed														F by IC - if analysed
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use
<b>CERTIFICATES</b>														<b>CERTIFICATES</b>
certificate numbers for	89712767	14436	R002622	89620155	89703396	89712768	14436	809620153	89703397	89712769	14436	R002622	89620156	certificate numbers for
above analyses	49709001	89718625				497090002	89718627			49709003	89718627			above analyses
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>														<b>ELECTRONIC BALANCE (%), RA</b>
calculated TDS (mg/L)	4023	3921	3723		1564	3807	3905		3530	4420		4174		calculated TDS (mg/L)
high TDS flag;care balance	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS flag;care balance
sum cation millequivalents	75.800	74.654	71.664		16.699	69.103	74.738		34.149	83.837		79.804		sum cation millequivalents
sum anion millequivalents	69.569	67.974	64.137		36.936	68.536	67.878		81.590	77.475		72.438		sum anion millequivalents
low sum an/cat tolerance	OK high%	OK high%	OK high%	partial anal	OK high%	OK high%	OK high%	partial anal	OK high%	OK high%	partial anal	OK high%	partial anal	low sum an/cat tolerance
ionic balance % error	4.3	4.7	5.5		-37.7	0.4	4.8		-41.0	3.9		4.8		ionic balance % error
A = S/K (calc TDS/cond)	0.56	0.58	0.60		0.20	0.54	0.57		0.40	0.55		0.60		A = S/K (calc TDS/cond)
analysis adjustments				P	R			P, DP	R		P		P	analysis adjustments

													CEN		
C4/2	C4/3	C444/3	C4/4	C4/5	C5/1	C5/2	C5/3	C5/4	C5/5	C5/7	C7/4	C7/5	sample #	C7/7	C8/4
14-Feb-97	29-Jun-97	29-Jun-97	24-Sep-97	22-Feb-98	17-Oct-96	14-Feb-97	29-Jun-97	24-Sep-97	22-Feb-98	1-Oct-98	25-Sep-97	22-Feb-98	date sampled	1-Oct-98	24-Sep-97
3.14	3.14		2.83	1.91	6.25	1.96	2.14	1.54	1.75	1.52	1.11	1.65	SWL (m)	1.32	1.78
	0.60		0.92	0.75				1.04	0.24	0.44	1.09	0.92	pump rate (L/min)	0.65	1.14
													<b>FIELD PARAMETERS</b>		
22520	20940	20570	21590	17050	23050	22250	25580	22150	20680	19880	9480	8830	EC (uS/cm)	8930	12090
6.8	6.8	6.9	6.9	7.0	6.8	7.1	7.1	7.2	7.2	7.0	7.2	7.0	pH	6.9	7.4
118	183	174	246	159		519	119	514	195	461	194	100	Eh (mV)	45	353
23.2	19.7	19.7	20.9	21.3	20.2	22.6	20.3	24.7	22.5	19.1	17.4	22.2	deg C	18.4	17.5
34.8	10.3	9.2	26.3	26.9	29.4	13.4	9.9	1.8	n/a	15.4	88.6	1.3	O2 %Sat	-0.3	70.3
													turbid sample		
													yellow oxidation	minor initially	
													H2S presence		
													<b>FIELD ANALYTES (mg/L)</b>		
640	282		97	410	750	660	320	460	408	486	352	430	CO2	323	300
700	590		460	302	1010	970	850	1125	526	904	772	374	alkalinity as CaCO3	754	1115
													<b>HACH ANALYTES (mg/L)</b>		
0.005	0.021	0.026	0.003	0.002	0.000	0.015	0.006	0.001	0.001	0.054	0.001	0.001	NO2 - N {for ion *3.3}	0.000	0.003
1.8	0.4	0.8	1.4	1.7	n/a	5.6	2.1	5.0	5.1	0.0	0.0	4.0	NO3 - N {for ion *4.4}	0.0	2.1
0.80	0.46	0.61	n/a	0.82	0.95	0.75	2.68	n/a	0.35	0.00	0.26	0.76	NH3 - N {for ion *1.29}	0.03	1.77
1.9	0.9	1.3	1.2	0.5	0.5	1.2	0.6	1.2	0.6	0.0	0.0	0.5	PO4(3-) {for P *0.326}	0.0	0.3
2.6	0.9	1.5	1.4	2.5	1.0	6.4	4.8	5.0	5.5	0.1	0.3	4.8	total inorganic N - Hach	0.0	3.9
													<b>BACTERIAL SUITE (CFU/100mL)</b>		
16.0	3.0	2.0	9.0	1.2	47.0	3.0	5.0	5.0	15.0	11.0	5.0	<2	BOD (mg/L)	<2	2.0
20	0	0	0	1	0	0	15	0	0	0	770	0	Total Coliforms	0	>2400
2	0	0			0	0	0						Faecal Coliforms		
0	0	0	0	0		0	3	0	0	0	75	0	Faecal Streptococci	0	90
			0	0				0	0	0	23	0	E.Coli	0	3
	0	0	0	0			0	0	0	0	0	0	Pseudomonas aeruginosa	0	0
													Clostridium perfringens/spp		
													Yersinia spp.		
													Salmonella spp.		
													<b>STANDARD ANALYTE SUITE (mg/L)</b>		
1.8	0.4	0.9	1.4	1.7	0.0	5.6	2.1	5.0	5.1	0.1	0.2	4.0	total NOx to use	0.0	2.1
0.9	0.6	0.6	0.9	0.2	0.4	0.3	0.4	0.7	0.4	1.1	0.5	0.3	kjeldahl N (organic N)	0.3	1.7
3.5	1.5	2.0	3.6	2.7	1.4	6.7	5.2	6.8	5.9	1.1	1.0	5.1	total N to use	0.3	5.6
0.6	0.3	0.4	0.4	0.2	0.2	0.4	0.2	0.4	0.2	0.0	0.0	0.2	total P	0.1	0.1
16.0	4.9	4.5	5.8	5.8	15.6	2.6	5.0	4.2	7.7	7.2	5.4	4.2	total organic carbon (TOC)	3.6	9.6
7755.4	6650.0	6800.0	6940.0	6390.0		5071.4	8800.0	8190.0	7540.0	7750.0	2510.0	2500.0	Cl	2610.0	3470.0

C4/2	C4/3	C444/3	C4/4	C4/5	C5/1	C5/2	C5/3	C5/4	C5/5	C5/7	C7/4	C7/5	CONT'D: sample#	C7/7	C8/4
601.9	571.0	588.0	530.0	611.0		406.9	844.0	610.0	649.0	650.0	n/a	327.0	SO4	326.0	325.0
													total S - lab		
853.5	719.3	818.0	781.0	368.2	1231.4	1182.6	1036.3	1110.0	641.3	1102.2	941.2	456.0	HCO3 to use	919.3	1359.4
													CO3 - lab		
0.0002	0.0006	0.0007	<0.0001	0.0001		0.0001	<0.0001	<0.0001	0.0009	0.0049	<0.0001	0.0002	Hg	0.0006	<0.0001
													<b>UTS - ICP ANALYTES (mg/L)</b>		
2.16	1.84	1.87	2.91	2.09	5.99	3.33	4.35	4.45	4.05	4.92	1.84	2.72	B	2.06	1.87
3289.2	3049.7	3136.3	3180.5	3023.0	6958.6	4281.7	4428.4	4332.5	4017.7	3882.8	1639.4	1568.7	Na	1666.0	2137.4
934.5	770.5	818.0	913.6	815.4	1661.5	924.2	1041.2	975.3	985.4	663.1	251.4	226.6	Mg	279.9	328.0
0.2	0.3	0.4	0.5	0.2	0.4	0.2	0.4	0.5	0.3	0.1	0.2	0.2	Al	0.1	0.2
8.1	13.4	13.2	18.3	15.4	15.8	6.8	10.3	14.1	11.5	9.1	18.0	17.4	Si	15.1	15.5
40.9	33.8	34.0	40.3	34.9	58.2	27.8	31.3	30.8	28.4	25.1	15.7	9.3	K	10.4	24.2
495.5	520.9	523.3	611.5	541.0	581.0	253.2	340.8	346.9	317.7	323.8	217.8	199.1	Ca	216.5	206.9
7.56E-02	6.16E-02	6.31E-02	3.78E-03	5.63E-02	8.61E-02	8.10E-02	7.12E-02	4.14E-03	6.10E-02	4.55E-02	4.01E-03	2.63E-02	Cr	2.31E-02	4.47E-03
1.70E-01	8.37E-02	8.48E-02	3.68E-01	9.31E-02	6.08E-01	1.22E-01	8.52E-01	3.11E-02	4.67E-02	2.37E-02	2.16E-01	2.77E-01	Mn	4.71E-01	4.25E-01
1.03E+00	9.69E-01	1.00E+00	1.68E+00	7.84E-01	6.77E-01	1.05E+00	6.96E-01	1.02E+00	7.05E-01	8.17E-01	5.86E-01	4.03E-01	Fe	8.45E-01	4.64E-01
1.33E-02	1.15E-02	1.16E-02	1.08E-02	8.71E-03	1.15E-02	8.96E-03	1.00E-02	7.16E-03	6.37E-03	4.34E-03	5.67E-03	5.76E-03	Ni	4.49E-03	6.80E-03
1.24E-02	1.88E-02	1.92E-02	2.60E-02	3.04E-02	1.85E-02	1.51E-02	3.41E-03	2.65E-02	1.34E-02	7.22E-03	1.25E-02	1.72E-02	Zn	7.57E-03	1.30E-02
1.59E-02	1.20E-02	1.29E-02	1.76E-03	2.66E-03	2.52E-03	3.45E-03	2.13E-03	9.98E-04	5.69E-03	n/a	8.53E-04	3.54E-03	Cu	n/a	9.91E-04
2.62E-03	2.48E-03	2.58E-03	2.43E-03	1.84E-03	2.34E-03	2.61E-03	2.21E-03	1.69E-03	1.48E-03	1.08E-03	1.46E-03	1.13E-03	As	1.74E-03	1.58E-03
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Se	0.00E+00	0.00E+00
4.01E+00	3.83E+00	3.91E+00	5.06E+00	4.94E+00	1.48E+00	5.02E+00	>1.7	4.91E+00	2.35E+00	1.40E+00	2.73E+00	2.34E+00	Sr	2.46E+00	2.88E+00
1.25E-03	6.97E-04	6.98E-04	1.14E-03	1.54E-03	1.98E-03	1.69E-03	1.37E-03	1.72E-03	2.07E-03	9.69E-04	2.49E-03	2.26E-03	Mo	8.28E-04	2.47E-03
3.21E-03	2.02E-04	1.94E-04	2.47E-04	7.12E-04	1.64E-04	2.42E-04	7.75E-05	1.81E-04	3.25E-04	2.91E-04	1.11E-04	1.11E-04	Cd	2.77E-04	1.28E-04
1.36E-03	4.00E-03	3.88E-03	3.45E-03	7.37E-02	1.26E-03	1.53E-03	3.96E-04	1.45E-03	9.27E-03	3.64E-03	7.21E-03	5.27E-03	Pb	4.71E-04	2.35E-03
													F by IC - if analysed		
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	0.00E+00
													<b>CERTIFICATES</b>	R010275	
89703398	89712770	89712772	14436	R002622		89703399	89712771	14436	R002622	R010275	89718682		certificate numbers for		14436
	49709004	49709006	89718628				49709005	89718629					above analyses		89718630
<b>TIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALI</b>		
13523	11930	12277	12593	11611		11508	15964	15009	13858	13786		5071	calculated TDS (mg/L)	5521	7116
high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS flag;care balance	high TDS	high TDS
245.963	223.147	230.934	245.307	226.710		275.873	296.419	287.019	272.586	240.345		97.201	sum cation millequivalents	106.677	131.148
245.484	211.334	217.576	219.745	199.154		171.354	282.973	262.322	237.108	250.231		85.107	sum anion millequivalents	95.484	127.097
OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	OK high%	low sum an/cat tolerance	OK high%	OK high%
0.1	2.7	3.0	5.5	6.5		23.4	2.3	4.5	7.0	-2.0		6.6	ionic balance % error	5.5	1.6
0.60	0.57	0.60	0.58	0.68		0.52	0.62	0.68	0.67	0.69		0.57	A = S/K (calc TDS/cond)	0.62	0.59
					P	R					P		analysis adjustments		

C8/5	C8/7
22-Feb-98	1-Oct-98
1.91	1.34
1.33	0.41
12330	11760
7.1	7.0
136	-128
21.9	16.8
11.2	1.6
	minor
384	310
446	794
0.010	<0.005
5.6	0.0
2.01	0.90
1.1	0.0
7.6	0.9
2.0	9.0
0	0
0	0
0	0
0	0
5.6	0.0
1.1	1.3
8.7	2.2
0.4	0.0
8.0	10.7
3880.0	3820.0

C8/5	C8/7
370.0	372.0
543.8	968.1
0.0001	<0.0001
2.26	2.39
2462.2	2352.5
383.6	422.2
0.2	0.1
16.7	12.4
19.4	18.6
219.1	225.4
3.31E-02	3.21E-02
3.33E-01	3.94E-02
4.18E-01	1.37E+00
6.36E-03	6.22E-03
8.97E-03	3.81E-03
3.06E-03	n/a
1.40E-03	2.00E-03
0.00E+00	0.00E+00
2.74E+00	1.40E+00
1.44E-03	8.09E-04
1.04E-04	9.65E-05
1.90E-03	2.24E-04
0.00E+00	0.00E+00
R002622	R010275
<b>DITY CHECK</b>	
7629	7654
high TDS	high TDS
150.342	148.956
126.503	131.374
OK high%	OK high%
8.6	6.3
0.62	0.65



HEL														HEL
sample #	H1/2	H1/3	H1/5	H1/6	H1/7	H2/1	H2/2	H2/3	H2/7	H3/1	H3/2	H3/3	H3/5	sample #
date sampled	30-Jun-97	23-Sep-97	23-Feb-98	27-Jul-98	1-Oct-98	12-Feb-97	30-Jun-97	23-Sep-97	2-Oct-98	12-Feb-97	30-Jun-97	23-Sep-97	23-Feb-98	date sampled
SWL (m)	4.54	4.31	4.41	4.30	4.02	4.27	4.60	4.38	3.95	4.44	4.72	4.50	4.57	SWL (m)
pump rate (L/min)	in stages	0.13		0.16	0.37		0.30	0.60	0.70		0.43	0.51	v low	pump rate (L/min)
<b>FIELD PARAMETERS</b>														<b>FIELD PARAMETERS</b>
EC (uS/cm)	4310	4110	3780	3090	3460	1820	1595	1512	1329	4140	3820	3660	3610	EC (uS/cm)
pH	7.8	7.8	7.6	7.5	7.5	7.4	7.4	7.3	6.3	7.6	7.9	7.7	7.5	pH
Eh (mV)	138	130	27	142	150	230	159	179	145	114	177	163	10	Eh (mV)
deg C	20.3	22.7	n/a	28.2	20.9	24.1	21.6	21.0	20.5	25.9	20.9	21.6	23.8	deg C
O2 %Sat	n/a	n/a		n/a	32.8	46.2	59.4	30.8	55.4	20.2	6.9	35.1	7.4	O2 %Sat
turbid sample						slightly		slightly	slightly				dirty	turbid sample
yellow oxidation														yellow oxidation
H2S presence														H2S presence
<b>FIELD ANALYTES (mg/L)</b>														<b>FIELD ANALYTES (mg/L)</b>
CO2	n/a	n/a	n/a	290	294	n/a	186	135	157	210	150	n/a	280	CO2
alkalinity as CaCO3	n/a	n/a	926	880	884	n/a	294	351	289	960	770	n/a	804	alkalinity as CaCO3
<b>HACH ANALYTES (mg/L)</b>														<b>HACH ANALYTES (mg/L)</b>
NO2 - N (for ion *3.3)	0.004	0.000	0.003	0.003	1.070	0.006	0.005	0.009	0.013	0.005	0.010	0.002	0.007	NO2 - N (for ion *3.3)
NO3 - N (for ion *4.4)	0.0	0.4	1.2	0.9	19.0	1.9	4.7	11.4	27.7	2.1	1.2	11.4	1.2	NO3 - N (for ion *4.4)
NH3 - N (for ion *1.29)	0.59	0.01	0.03	0.11	0.01	0.26	0.53	0.00	0.00	0.16	0.23	0.00	0.36	NH3 - N (for ion *1.29)
PO4(3-) (for P *0.326)	0.0	0.0	0.2	0.0	0.0	3.2	0.0	0.0	0.0	1.5	3.0	0.0	3.2	PO4(3-) (for P *0.326)
total inorganic N - Hach	0.6	0.4	1.2	1.1	20.1	2.2	5.2	11.4	27.7	2.3	1.4	11.4	1.6	total inorganic N - Hach
<b>BACTERIAL SUITE (CFU/100mL)</b>														<b>BACTERIAL SUITE (CFU/100mL)</b>
BOD (mg/L)	15	7	18	4	13	<2	16	2	3.0	<2	8.0	5.0	7.0	BOD (mg/L)
Total Coliforms	>180	2000	55	79	2	<2	0	0	1	1	0	120	1600	Total Coliforms
Faecal Coliforms	1					<2	0			0	0			Faecal Coliforms
Faecal Streptococci	0	0	0	1	0	0	0	0	0	0	0	0	0	Faecal Streptococci
E.Coli		0	0	0	0			0	0			0	0	E.Coli
Pseudomonas aeruginosa	<10	0	0	17	30		12	0	13		3	40	0	Pseudomonas aeruginosa
Clostridium perfringens/spp														Clostridium perfringens/spp
Yersinia spp.														Yersinia spp.
Salmonella spp.														Salmonella spp.
<b>STANDARD ANALYTE SUITE (mg/L)</b>														<b>STANDARD ANALYTE SUITE (m</b>
total NOx to use	19.1	19.7	20.5	19.5	20.1	23.8	26.6	25.0	27.7	19.7	20.2	18.7	18.4	total NOx to use
kjeldahl N (organic N)	0.8	0.5	0.6	0.2	0.1	0.6	0.0	0.0	0.0	0.2	0.2	0.3	0.2	kjeldahl N (organic N)
total N to use	20.5	20.2	21.1	19.9	20.3	24.7	27.1	25.1	27.7	20.1	20.6	19.0	19.0	total N to use
total P	0.3	0.1	0.1	0.0	0.0	1.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	total P
total organic carbon (TOC)	28.0	2.7	2.4	1.7	8.1	3.2	21.2	1.3	3.0	1.4	4.4	1.5	1.7	total organic carbon (TOC)
Cl	622.0	590.0	555.0	474.0	428.0	168.6	107.0	101.0	78.0	563.0	541.0	515.0	540.0	Cl

CONT'D: sample#	H1/2	H1/3	H1/5	H1/6	H1/7	H2/1	H2/2	H2/3	H2/7	H3/1	H3/2	H3/3	H3/5	CONT'D: sample#
SO4	184.0	186.0	193.0	184.0	169.0	71.3	62.9	65.2	87.4	179.3	157.0	150.0	161.0	SO4
total S - lab														total S - lab
HCO3 to use	1360.0	1060.0	1130.0	1072.9	1077.8	n/a	529.0	518.0	352.4	1391.0	938.8	948.0	980.2	HCO3 to use
CO3 - lab														CO3 - lab
Hg	0.0001	0.0005	0.0001	0.088	<0.0001	<0.0001	<0.0001	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	Hg
<b>UTS - ICP ANALYTES (mg/L)</b>														<b>UTS - ICP ANALYTES (mg/L)</b>
B	3.17	3.12	3.09	2.93	3.92	0.69	2.24	2.05	2.25	1.97	2.87	4.79	2.85	B
Na	904.8	924.2	800.4	505.7	817.5	85.2	255.0	261.9	235.0	691.8	821.5	753.3	800.6	Na
Mg	68.3	74.8	66.9	59.6	75.5	9.8	37.2	39.3	49.3	39.3	50.6	48.9	52.4	Mg
Al	0.6	0.6	0.3	0.2	0.2	0.7	0.5	0.6	0.3	0.3	0.5	1.1	0.3	Al
Si	13.9	13.1	12.0	13.9	14.2	1.2	12.3	11.3	12.3	3.6	12.4	13.9	10.9	Si
K	13.4	13.4	13.9	9.7	16.0	2.5	9.8	9.5	13.6	8.5	10.9	10.3	11.2	K
Ca	33.4	36.8	32.5	26.4	36.7	8.8	51.4	52.6	76.9	14.7	24.6	26.8	25.5	Ca
Cr	8.95E-03	1.21E-02	1.53E-02	1.60E-02	7.80E-03	1.41E-03	3.18E-03	4.27E-03	3.00E-03	1.65E-02	1.21E-02	1.21E-02	1.48E-02	Cr
Mn	1.76E-02	7.01E-03	3.68E-03	4.77E-03	2.90E-03	5.61E-04	1.14E-03	1.34E-03	8.27E-04	6.77E-03	1.28E-03	5.80E-03	1.64E-03	Mn
Fe	1.96E-01	5.00E-01	2.12E-01	1.80E-01	2.71E-01	1.17E-01	1.08E-01	2.88E-01	3.99E-01	1.89E-01	8.85E-02	6.33E-01	2.40E-01	Fe
Ni	1.18E-03	1.59E-03	8.41E-04	1.14E-03	6.28E-04	5.04E-04	1.26E-03	1.23E-03	9.33E-04	1.81E-03	5.75E-04	1.15E-03	5.52E-04	Ni
Zn	4.49E-03	1.78E-02	1.54E-02	3.31E-02	3.50E-03	2.22E-03	4.02E-03	3.77E-03	3.89E-03	1.15E-02	3.62E-03	1.14E-02	5.41E-03	Zn
Cu	1.81E-03	7.69E-03	1.55E-03	n/a	n/a	2.90E-03	1.09E-03	0.00E+00	n/a	1.72E-02	4.27E-03	1.42E-03	1.06E-03	Cu
As	1.82E-04	2.31E-04	1.68E-04	3.29E-04	2.04E-04	0.00E+00	9.73E-05	9.16E-05	8.99E-05	2.19E-04	1.66E-04	3.63E-04	1.93E-04	As
Se	1.10E-02	2.64E-02	2.46E-02	1.01E-02	2.51E-02	1.63E-02	4.14E-02	7.08E-02	3.90E-02	2.49E-02	9.90E-03	2.33E-02	2.40E-02	Se
Sr	4.88E-01	5.92E-01	5.11E-01	4.50E-01	4.76E-01	1.21E-01	5.52E-01	5.92E-01	5.81E-01	3.56E-01	3.78E-01	4.58E-01	4.72E-01	Sr
Mo	3.29E-03	3.39E-03	4.21E-03	5.21E-03	3.69E-03	1.96E-04	1.20E-03	1.38E-03	1.21E-03	4.30E-03	4.35E-03	5.16E-03	6.13E-03	Mo
Cd	2.10E-04	5.09E-04	1.76E-04	8.22E-04	1.20E-04	2.88E-04	4.35E-05	7.68E-05	3.67E-04	3.23E-04	1.29E-04	1.61E-04	2.17E-04	Cd
Pb	9.92E-04	2.62E-03	1.53E-03	6.98E-03	6.78E-04	1.07E-04	4.42E-04	2.07E-04	3.29E-04	2.35E-03	6.89E-04	9.09E-04	8.40E-04	Pb
F by IC - if analysed										7.37E+00				F by IC - if analysed
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use
<b>CERTIFICATES</b>														<b>CERTIFICATES</b>
certificate numbers for	89712775	15209	R002622	R008949	R010275	100397	89712776	15209	R010275	100397	89712777	15209	R002622	certificate numbers for
above analyses	49709040						49709041				49709042			above analyses
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>														<b>ELECTRONIC BALANCE (%), RA</b>
calculated TDS (mg/L)	2526	2372	2239	1808	2103		891	864	818	2176	2103	2001	2095	calculated TDS (mg/L)
high TDS flag;care balance	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	use %bal	use %bal	use %bal	high TDS	high TDS	high TDS	high TDS	high TDS flag;care balance
sum cation millequivalents	47.116	48.629	42.361	28.504	44.061		17.080	17.577	18.522	34.337	41.492	38.551	40.778	sum cation millequivalents
sum anion millequivalents	43.668	37.918	38.287	34.854	34.683		13.332	13.506	11.762	42.998	34.098	33.998	34.838	sum anion millequivalents
low sum an/cat tolerance	OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	OK high%			OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance
ionic balance % error	3.8	12.4	5.1	-10.0	11.9		12.3	13.1	22.3	-11.2	9.8	6.3	7.9	ionic balance % error
A = S/K (calc TDS/cond)	0.59	0.58	0.59	0.59	0.61		0.56	0.57	0.62	0.53	0.55	0.55	0.58	A = S/K (calc TDS/cond)
analysis adjustments						P				R				analysis adjustments

													HEL		
H3/6	H3/7	H4/5	H4/7	H5/1	H5/2	H5/3	H5/5	H5/7	H6/1	H6/2	H6/3	H6/6	sample #	H6/7	H7/1
27-Jul-98	2-Oct-98	23-Feb-98	2-Oct-98	12-Feb-97	1-Jul-97	23-Sep-97	23-Sep-98	2-Oct-98	12-Feb-97	30-Jun-97	23-Sep-97	27-Jul-98	date sampled	2-Oct-98	13-Feb-97
4.47	4.18	3.96	3.55	3.81	4.15	3.95	3.97	3.56	4.13	4.53	4.27	4.18	SWL (m)	3.99	4.06
0.54	0.42		0.27		1.00	0.25	0.45	0.38		0.92	0.65	0.50	pump rate (L/min)	0.63	
<b>FIELD PARAMETERS</b>															
3000	3460	2670	1663	3770	3610	3360	3120	3150	6200	5580	5290	3980	EC (uS/cm)	4500	1738
7.5	7.3	8	7.5	7.6	7.6	7.9	7.6	7.7	7.8	7.6	7.6	7.5	pH	7.6	7.5
140	110	42	109	208	150	162	35	117	199	59	150	146	Eh (mV)	114	137
730.2	23.5	28	20.3	23.6	20.9	20.9	23.5	20.6	24.0	21.8	21.2	28.5	deg C	22.8	27.2
33.4	4.1	n/a	n/a	22.9	33.0	48.3	11.4	17.7	7.9	5.8	21.4	?127.3	O2 %Sat	1.1	39.1
						cloudy							turbid sample		
													yellow oxidation		
													H2S presence		
<b>FIELD ANALYTES (mg/L)</b>															
291	237	n/a	179	220	170	n/a	254	214	170	262	325	348	CO2	282	260
784	806	n/a	452	960	495	n/a	658	512	760	728	774	802	alkalinity as CaCO3	758	378
<b>HACH ANALYTES (mg/L)</b>															
0.000	0.006	0	0.000	0.006	0.003	0.000	0.002	0.000	0.002	0.001	0.034	0.002	NO2 - N {for ion *3.3}	0.740	0.003
2.2	18.9	3	12.9	0.0	4.0	6.1	1.1	22.4	0.0	0.4	0.6	0.0	NO3 - N {for ion *4.4}	5.2	0.0
0.23	0.01	0	0.00	0.41	0.17	0.00	0.16	0.01	0.49	0.11	0.09	0.22	NH3 - N {for ion *1.29}	0.01	0.27
2.0	0.0	0	0.0	6.2	2.4	0.0	2.0	0.0	7.0	1.3	1.4	0.0	PO4(3-) {for P *0.326}	0.0	4.4
2.4	18.9	2.9	12.9	0.4	4.2	6.1	1.3	22.4	0.5	0.5	0.7	0.2	total inorganic N - Hach	6.0	0.3
<b>BACTERIAL SUITE (CFU/100mL)</b>															
13.0	3.0	>19	13.0	<2	<2	7.0	6.0	<2	<2	2.0	3.0	7.0	BOD (mg/L)	4.0	<2
270	0	0	0		17	2	6	0		0	2	4	Total Coliforms	0	0
					0					0			Faecal Coliforms		0
0	0	0	0		0	0	0	0		0	0	0	Faecal Streptococci	0	0
0	0	0	0			0	0	0			0	0	E.Coli	0	
220	19	0	56		0	0	3	63		0	1	7	Pseudomonas aeruginosa	14	
													Clostridium perfringens/spp		
													Yersinia spp.		
													Salmonella spp.		
<b>STANDARD ANALYTE SUITE (mg/L)</b>															
19.1	18.9	13	12.9	13.3	21.9	23.0	19.8	22.4	7.1	6.9	6.7	5.2	total NOx to use	6.0	0.0
0.2	0.1	0	0.0		0.2	0.3	0.0	0.0	0.4	0.3	0.3	0.3	kjeldahl N (organic N)	0.2	0.2
19.6	19.0	13	12.9	13.7	22.3	23.3	20.0	22.4	8.0	7.3	7.1	5.7	total N to use	6.2	0.5
0.0	0.0	0.1	0.0	2.1	0.9	0.1	0.7	0.0	2.3	0.4	0.5	0.0	total P	0.0	1.4
1.9	2.4	9	4.2	1.3	3.3	2.3	1.7	1.7	1.9	3.5	1.8	4.4	total organic carbon (TOC)	3.2	1.6
530.0	498.0	160	108.0	213.6	576.0	496.0	482.0	487.0	448.4	1120.0	1060.0	953.0	Cl	930.0	52.5

H3/6	H3/7	H4/5	H4/7	H5/1	H5/2	H5/3	H5/5	H5/7	H6/1	H6/2	H6/3	H6/6	CONT'D: sample#	H6/7	H7/1
170.0	164.0	86	62.6	52.2	165.0	170.0	134.0	145.0	88.4	255.0	250.0	170.0	SO4	230.0	22.0
													total S - lab		
955.9	982.7	1000	551.1	1170.4	798.0	782.0	802.2	624.2	926.6	887.6	943.7	977.8	HCO3 to use	924.2	460.9
													CO3 - lab		
0.0011	<0.0001	0	<0.0001	0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0009	Hg	<0.0001	<0.0001
													<b>UTS - ICP ANALYTES (mg/L)</b>		
2.93	3.70	1.25	4.20	2.22	3.37	3.91	4.45	4.83	0.89	2.82	3.06	2.96	B	3.77	1.66
768.4	827.5	192.3	391.3	592.0	679.4	658.9	601.1	719.3	419.1	958.0	919.6	535.5	Na	960.8	268.8
54.9	61.7	15.7	38.3	51.5	65.5	61.2	54.5	69.5	59.0	139.6	132.4	144.9	Mg	143.5	60.9
0.1	0.2	0.3	0.3	0.5	0.3	0.4	0.2	0.2	0.3	0.4	0.2	0.0	Al	0.1	0.4
12.3	12.1	3.2	10.4	3.7	11.1	11.5	11.4	10.6	2.1	13.2	12.7	13.6	Si	12.2	4.6
11.9	15.4	5.5	15.7	9.1	11.7	11.0	10.5	16.2	6.0	16.9	15.5	11.7	K	20.6	16.8
23.5	31.6	9.7	20.9	23.1	36.7	36.5	32.5	39.7	25.0	75.8	77.9	71.2	Ca	74.5	32.7
2.49E-02	1.35E-02	3.01E-03	3.34E-03	2.03E-02	1.23E-02	1.08E-02	1.27E-02	1.23E-02	2.25E-02	2.47E-02	2.30E-02	3.47E-02	Cr	2.81E-02	3.64E-03
2.35E-03	2.86E-03	2.03E-03	1.49E-03	5.27E-03	1.23E-03	5.54E-03	1.58E-03	1.97E-03	1.01E-02	4.08E-02	3.90E-02	2.68E-02	Mn	2.89E-02	4.90E-02
1.68E-01	2.67E-01	1.91E-01	3.14E-01	2.63E-01	9.94E-02	7.05E-02	3.18E-01	3.78E-01	2.04E-01	1.46E-01	1.73E-01	1.73E-01	Fe	2.85E-01	1.19E-01
8.79E-04	5.68E-04	2.52E-04	4.49E-04	1.18E-03	8.73E-04	1.22E-03	8.36E-04	6.43E-04	1.87E-03	1.91E-03	2.13E-03	2.06E-03	Ni	1.19E-03	1.14E-03
6.78E-03	2.38E-03	3.36E-03	2.57E-03	1.72E-03	1.05E-03	1.07E-02	9.96E-03	3.39E-03	7.65E-03	1.99E-03	2.63E-02	8.39E-03	Zn	2.85E-03	6.08E-03
n/a	n/a	9.09E-04	n/a	1.09E-02	7.86E-04	1.56E-03	1.75E-03	n/a	6.40E-03	8.95E-04	9.34E-04	n/a	Cu	n/a	1.08E-02
3.62E-04	7.86E-05	4.86E-05	1.29E-04	1.52E-04	1.66E-04	2.89E-04	2.38E-04	1.90E-04	2.29E-04	2.67E-04	4.24E-04	4.98E-04	As	2.93E-04	4.83E-05
1.32E-02	1.96E-02	8.50E-03	1.35E-02	1.21E-02	9.80E-03	3.04E-02	2.40E-02	2.80E-02	1.99E-02	0.00E+00	2.07E-02	1.11E-02	Se	3.54E-02	8.93E-03
4.27E-01	4.54E-01	1.31E-01	3.03E-01	5.89E-01	6.05E-01	6.37E-01	5.75E-01	5.76E-01	4.72E-01	1.02E+00	1.27E+00	9.43E-01	Sr	1.03E+00	6.05E-01
5.09E-03	4.92E-03	2.45E-03	7.55E-03	3.63E-03	3.51E-03	4.86E-03	6.27E-03	4.97E-03	9.19E-04	2.42E-03	3.46E-03	3.18E-03	Mo	3.66E-03	3.62E-03
2.23E-04	1.01E-04	8.22E-05	1.55E-04	0.00E+00	3.32E-05	2.01E-04	4.67E-04	1.46E-04	1.48E-04	1.01E-04	8.68E-05	1.58E-04	Cd	1.27E-04	6.34E-04
2.00E-03	4.76E-04	4.53E-04	4.42E-04	9.26E-04	3.30E-04	1.59E-03	1.42E-03	4.89E-04	2.05E-03	4.95E-04	1.82E-04	1.18E-03	Pb	3.50E-04	9.67E-04
													F by IC - if analysed		7.30E-01
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	0.00E+00
													<b>CERTIFICATES</b>		
R008949	R010275	R002622	R010275	100397	49709094	49713505	R002622	R010275	100397	89712778	15209	R008949	certificate numbers for	R010275	100397
					59705648					49709043			above analyses		
<b>TIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALI</b>		
2056	2106	956	939	1502	1980	1874	1752	1847	1480	2989	2901	2342	calculated TDS (mg/L)	2793	663
high TDS	high TDS	use %bal	use %bal	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS	high TDS flag;care balance	high TDS	use %bal
39.466	43.087	10.331	21.668	31.484	37.145	35.867	32.585	39.464	24.571	57.449	55.248	39.118	sum cation millequivalents	57.896	18.841
34.379	34.911	22.896	14.298	26.492	33.123	30.781	29.677	28.579	29.899	51.521	50.664	46.450	sum anion millequivalents	46.596	9.670
OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	OK high%	low sum an/cat tolerance	OK high%	OK high%
6.9	10.5	-37.8	20.5	8.6	5.7	7.6	4.7	16.0	-9.8	5.4	4.3	-8.6	ionic balance % error	10.8	32.2
0.69	0.61	0.36	0.56	0.40	0.55	0.56	0.56	0.59	0.24	0.54	0.55	0.59	A = S/K (calc TDS/cond)	0.62	0.38
		R	R					R					analysis adjustments		R

H7/3	H7/5	H7/6	H7/7
24-Jul-97	23-Feb-98	27-Jul-98	1-Oct-98
4.19	4.23	4.08	3.88
0.25	0.50	0.21	0.36
1230	1155	853	1034
7.5	7.5	7.5	7.4
234	29	134	98
19.5	23.2	21.4	20.0
42.8	34.3	21.4	9.0
210	185	185	220
354	358	309	387
0.003	0.002	0.001	0.000
0.4	0.4	0.0	0.1
0.06	0.13	0.08	0.00
0.6	1.8	0.0	0.0
0.5	0.5	0.1	0.1
4.0	5.0	3.0	3.0
4	140	19	0
1	0	0	0
0	0	0	0
0	0	15	4
0.4	0.4	0.1	6.0
0.2	0.2	0.2	0.2
0.7	0.8	0.4	6.2
0.2	0.6	0.0	0.0
1.6	1.2	0.9	1.6
83.0	53.0	32.0	43.0

H7/3	H7/5	H7/6	H7/7
87.0	49.2	42.2	35.1
431.6	436.5	376.7	471.8
<0.0001	<0.0001	0.0048	<0.0001
2.40	2.45	1.76	2.17
202.6	205.3	124.0	199.2
41.2	39.7	45.0	53.5
0.2	0.2	0.0	0.3
10.6	11.8	11.5	11.5
12.2	12.6	11.0	18.0
35.0	35.0	30.8	45.4
6.01E-03	2.26E-03	2.55E-03	3.44E-03
2.24E-03	3.36E-03	9.33E-03	2.87E-03
1.06E-01	2.99E-01	7.77E-02	3.66E-01
7.67E-04	7.01E-04	1.10E-03	6.88E-04
1.14E-02	5.47E-03	4.16E-03	4.37E-03
1.03E-03	1.08E-03	n/a	n/a
1.40E-04	1.34E-04	9.39E-05	1.30E-04
1.60E-02	5.34E-03	0.00E+00	1.30E-02
4.48E-01	3.98E-01	3.78E-01	4.32E-01
2.97E-03	3.70E-03	2.79E-03	3.15E-03
1.64E-04	3.59E-04	2.47E-04	1.36E-04
6.96E-04	7.43E-04	5.14E-04	4.72E-04
0.00E+00	0.00E+00	0.00E+00	0.00E+00
15209	R002622	R008949	R010275
<b>DITY CHECK</b>			
661	599	459	633
use %bal	use %bal	use %bal	use %bal
14.306	14.325	10.936	15.856
11.274	9.759	7.956	9.684
OK high%	OK high%	OK high%	
11.9	19.0	15.8	24.2
0.54	0.52	0.54	0.61
	R	R	R

GUI														GUI
sample #	G1/1	G1/2	G1/3	G1/4	G1/5	G1/7	G2/1	G2/4	G2/7	G3/6	G3/7	G4/2	G84/2	sample #
date sampled	15-Nov-96	10-Feb-97	3-Jul-97	26-Sep-97	24-Feb-98	25-Sep-98	15-Nov-97	26-Sep-97	25-Sep-98	23-Jul-98	25-Sep-98	11-Feb-97	duplicate of	date sampled
SWL (m)	3.00	4.00	4.84	3.31	5.34	3.36	3.00	3.30	3.38	3.65	2.75	2.85		SWL (m)
pump rate (L/min)			<0.1	0.25	in stages	0.42		0.37	0.46	v low	0.27			pump rate (L/min)
<b>FIELD PARAMETERS</b>														<b>FIELD PARAMETERS</b>
EC (uS/cm)	903	1040	1127	603	965	466	266.8	267	261	366	312	607		EC (uS/cm)
pH	7.3	7.1	7.0	6.3	6.2	5.7	5.8	6.1	5.6	6.0	5.9	5.8		pH
Eh (mV)	142		15	220	84	112	211	217	134	60	150	226		Eh (mV)
deg C	17.5	28.2	15.9	19.5	n/a	20.5	19.6	19.0	19.5	20.8	20.1	26.5		deg C
O2 %Sat	29.3	43.2	n/a	29.4	n/a	18.8	11.7	68.8	74.7	n/a	56.3	40.8		O2 %Sat
turbid sample														turbid sample
yellow oxidation	minor													yellow oxidation
H2S presence														H2S presence
<b>FIELD ANALYTES (mg/L)</b>														<b>FIELD ANALYTES (mg/L)</b>
CO2	68	70	n/a	45	n/a	39	41	23	37	29	26	64		CO2
alkalinity as CaCO3	134	127	n/a	32	n/a	21	16	8	78	20	21	17		alkalinity as CaCO3
<b>HACH ANALYTES (mg/L)</b>														<b>HACH ANALYTES (mg/L)</b>
NO2 - N (for ion *3.3)	0.315	0.023	0.100	0.002	0.002	0.011	0.047	0.005	0.002	0.019	0.009	0.000		NO2 - N (for ion *3.3)
NO3 - N (for ion *4.4)	6.3	1.7	0.4	1.9	0.4	12.9	7.9	6.8	9.5	17.0	16.6	32.2		NO3 - N (for ion *4.4)
NH3 - N (for ion *1.29)	0.74	0.45	0.28	0.10	0.15	0.10	0.02	0.29	0.00	0.33	0.22	0.00		NH3 - N (for ion *1.29)
PO4(3-) (for P *0.326)	n/a	1.6	0.0	1.6	0.0	0.8	0.4	4.9	0.0	3.9	0.0	1.0		PO4(3-) (for P *0.326)
total inorganic N - Hach	7.4	2.2	0.8	2.0	0.6	13.0	8.0	7.1	9.5	17.3	16.8	32.2	0.0	total inorganic N - Hach
<b>BACTERIAL SUITE (CFU/100mL)</b>														<b>BACTERIAL SUITE (CFU/100mL)</b>
BOD (mg/L)	n/a	<5	22	<5	n/a	<5	n/a	<5	<5	5.0		<5	<5	BOD (mg/L)
Total Coliforms		8	n/a	0	0	0		0	0	0	0	<10	<10	Total Coliforms
Faecal Coliforms		0	n/a	0	0	0		0	0	0	0	<10	<10	Faecal Coliforms
Faecal Streptococci		0	n/a	0	0	0		0	0	0	0	<10	<10	Faecal Streptococci
E.Coli				0	0	0		0	0	0	0			E.Coli
Pseudomonas aeruginosa				0	0	0		0	0	0	0			Pseudomonas aeruginosa
Clostridium perfringens/spp														Clostridium perfringens/spp
Yersinia spp.														Yersinia spp.
Salmonella spp.														Salmonella spp.
<b>STANDARD ANALYTE SUITE (mg/L)</b>														<b>STANDARD ANALYTE SUITE (m</b>
total NOx to use	6.6	1.7	0.5	1.9	0.4	12.9	7.9	6.8	9.5	17.0	16.6	32.2	0.0	total NOx to use
kjeldahl N (organic N)														kjeldahl N (organic N)
total N to use	7.4	4.2	1.0	3.3	0.9	13.0	8.0	9.3	11.0	24.0	18.0	45.0	43.0	total N to use
total P		0.5	0.0	0.5	0.0	0.3	0.1	1.6	<0.005	1.3	0.0	0.3	<0.005	total P
total organic carbon (TOC)		73.0	58.0	20.0	28.0	7.0		6.0	3.0	5.0	5.0	20.0	15.0	total organic carbon (TOC)
Cl		133.5	160.0	100.0	150.0	70.0		30.0	30.0	20.0	20.0	33.1		Cl

CONT'D: sample#	G1/1	G1/2	G1/3	G1/4	G1/5	G1/7	G2/1	G2/4	G2/7	G3/6	G3/7	G4/2	G84/2	CONT'D: sample#
SO4		66.0	95.0	43.0	65.0	28.0		10.0	9.0	9.0	8.0	<1		SO4
total S - lab														total S - lab
HCO3 to use	163.4	154.8	244.0	64.6	83.0	25.4	19.5	29.3	95.1	24.3	26.0	20.5	20.0	HCO3 to use
CO3 - lab														CO3 - lab
Hg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005	<0.0005		<0.0005	<0.0005	<0.0005	Hg
<b>UTS - ICP ANALYTES (mg/L)</b>														<b>UTS - ICP ANALYTES (mg/L)</b>
B	0.18	0.33	0.10	0.54	0.07	0.24	0.17	0.30	0.18	0.08	0.19	0.24		B
Na	100.8	92.0	130.0	97.7	177.2	72.17	27.7	29.9	39.8	21.0	33.5	22.8		Na
Mg	13.8	13.0	12.0	9.7	13.5	14.50	7.9	8.8	13.1	16.3	19.7	22.7		Mg
Al	0.2	0.3	0.1	0.5	0.2	0.20	0.1	0.3	0.2	0.1	0.2	0.2		Al
Si	9.4	4.9	10.0	11.1	11.3	7.97	3.7	4.4	4.8	7.7	8.7	4.9		Si
K	5.2	2.5	4.8	2.8	5.6	5.22	2.5	2.8	5.9	10.2	12.1	11.7		K
Ca	69.0	35.0	49.0	12.9	16.7	8.63	8.1	6.8	7.0	11.9	12.6	22.3		Ca
Cr	5.26E-03	3.18E-03		8.53E-04	8.14E-03	1.17E-03	1.84E-03	3.75E-04	7.60E-04	1.06E-03	5.98E-04	4.19E-03		Cr
Mn	1.40E-02	4.45E-02	6.20E-02	1.60E-02	5.74E-02	1.13E-02	8.91E-03	2.51E-03	2.25E-03	7.74E-03	3.81E-03	2.95E-03		Mn
Fe	1.34E-01	3.58E-01	2.70E-01	8.65E-02	9.62E-01	2.39E-01	1.75E-02	2.45E-02	1.51E-01	1.02E-01	2.05E-01	7.67E-02		Fe
Ni	2.52E-03	1.94E-03	6.00E-03	3.20E-03	5.07E-03	3.78E-03	8.47E-04	9.37E-04	7.20E-04	1.26E-03	7.74E-04	2.10E-03		Ni
Zn	2.43E-02	5.63E-02	3.20E-01	2.36E-01	2.11E-01	1.53E-01	4.16E-02	4.30E-02	1.18E-02	3.64E-02	2.06E-02	2.58E-02		Zn
Cu	1.83E-02	1.85E-02	9.10E-03	5.40E-03	6.04E-03	n/a	2.10E-03	3.99E-03	n/a	n/a	n/a	5.17E-03		Cu
As	1.63E-04	0.00E+00		1.14E-04	2.30E-04	7.71E-05	3.79E-05	8.94E-05	4.07E-05	5.35E-05	3.76E-05	2.36E-05		As
Se	0.00E+00	0.00E+00		9.61E-04	3.65E-03	1.00E-03	0.00E+00	0.00E+00	1.47E-03	4.49E-03	1.28E-03	9.53E-03		Se
Sr	2.99E-01	1.60E-01		5.90E-02	9.92E-02	4.41E-02	6.31E-02	4.99E-02	5.69E-02	7.28E-02	5.57E-02	2.00E-01		Sr
Mo	2.48E-03	5.26E-04		5.32E-04	6.99E-04	1.37E-04	0.00E+00	2.41E-04	5.81E-05	2.43E-04	8.74E-05	2.78E-04		Mo
Cd	3.57E-04	1.88E-02		7.15E-04	3.24E-03	1.98E-04	8.99E-04	3.13E-04	1.53E-04	2.39E-04	2.47E-04	3.82E-04		Cd
Pb	2.95E-03	1.51E-02	1.00E-02	7.20E-03	1.19E-02	1.35E-03	3.11E-04	4.92E-04	4.27E-04	1.39E-03	4.93E-04	1.22E-03		Pb
F by IC - if analysed														F by IC - if analysed
Br value to use	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E-01	0.00E+00	0.00E+00	1.30E-01	2.00E-01	1.90E-01	0.00E+00	0.00E+00	Br value to use
<b>CERTIFICATES</b>						W98/017576		W98/017577	RN064050	RN076849				<b>CERTIFICATES</b>
certificate numbers for		W97/001681	W97/010882	976512W	W98/002907	RN076849		976513W	RN076849		987309W	W97/001743	W97/001747	certificate numbers for
above analyses		7005367U	97/23656	W97/017263	98/006358	987307W		W97/017264	987308W	W98/012511	98/080942	7005471N	7005471N	above analyses
<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>														
calculated TDS (mg/L)		504	626	341	507	278		154	197	212	203	328		calculated TDS (mg/L)
high TDS flag:care balance		use %bal	use %bal	use %bal	use %bal	use %bal		use %bal	use %bal	use %bal	use %bal	use %bal		high TDS flag:care balance
sum cation millequivalents		6.957	9.250	5.830	9.866	4.936		2.492	3.343	3.151	4.074	4.302		sum cation millequivalents
sum anion millequivalents		7.851	10.527	4.960	6.974	3.950		2.174	3.284	2.504	2.360	3.584		sum anion millequivalents
low sum an/cat tolerance	partial anal	OK high%	OK high%	OK high%	OK high%		partial anal	OK high%	OK high%	OK high%	OK high%	OK high%	partial anal	low sum an/cat tolerance
ionic balance % error		-6.0	-6.5	8.1	17.2	11.1		6.8	0.9	11.4	26.6	9.1		ionic balance % error
A = S/K (calc TDS/cond)		0.49	0.56	0.56	0.53	0.60		0.58	0.76	0.58	0.65	0.54		A = S/K (calc TDS/cond)
analysis adjustments	P					R		P					P	analysis adjustments



													GUI		
G4/3	G4/4	G4/7	G5/2	G5/3	G5/4	G555/4	G5/5	G5/6	G5/7	G6/2	G6/3	G6/4	sample #	G6/5	G6/7
2-Jul-97	27-Sep-97	25-Sep-98	10-Feb-97	2-Jul-97	26-Sep-97		24-Feb-98	23-Jul-98	29-Jul-97	10-Feb-97	2-Jul-97	27-Sep-97	date sampled	24-Feb-98	28-Sep-97
3.21	2.28	2.68	1.89	2.19	1.62	sample	2.64	2.49	3.66	3.59	4.13	3.27	SWL (m)	3.23	3.63
0.70	0.58	0.66		0.33	0.72		0.60	0.63	0.80		0.19	0.57	pump rate (L/min)	stages	0.48
													<b>FIELD PARAMETERS</b>		
300	492	330	667	352	216.3		569	545	244.6	1061	736	635	EC (uS/cm)	796	975
6.1	6	5.8	5.8	5.8	5.8		5.8	5.7	5.5	6.8	6.5	6.5	pH	6.5	6.0
202	387	176	174	218	295		41	128	129	38	126	88	Eh (mV)	68	111
22.2	19	18.9	28.9	19.8	17.3		24.3	18.6	18.2	25.1	19.4	18.4	deg C	23.3	19.6
38.3	86	51.0	11.2	7.4	21.0		2.8	36.1	36.6	20.6	32.6	30.8	O2 %Sat	n/a	39.6
			minor							minor			turbid sample		
				minor	minor				some				yellow oxidation		
													H2S presence		
													<b>FIELD ANALYTES (mg/L)</b>		
24	32	36	77	30	30		35	38	n/a	64	62	34	CO2	47	46
20	8	15	12	14	5		25	18	13	80	67	62	alkalinity as CaCO3	47	38
													<b>HACH ANALYTES (mg/L)</b>		
0.003	0	0.003	0.013	0.022	0.015		0.012	0.013	0.000	0.005	0.001	0.002	NO2 - N {for ion *3.3}	0.004	0.002
16.7	37	30.7	23.7	13.3	3.6		6.9	10.8	4.1	10.4	0.0	0.4	NO3 - N {for ion *4.4}	0.7	2.0
0.28	0	0.09	0.50	0.31	n/a		0.08	0.23	0.07	1.00	0.10	0.00	NH3 - N {for ion *1.29}	0.02	0.18
3.6		1.0	4.7	3.3	<0.005		0.0	1.7	<0.005	12.0	1.7	<0.005	PO4(3-) {for P *0.326}	0.0	1.8
17.0	37.0	30.8	24.2	13.6	3.6		7.0	11.0	4.1	11.4	0.1	0.4	total inorganic N - Hach	0.7	2.2
													<b>BACTERIAL SUITE (CFU/100mL)</b>		
<5	<5	<5	<5	<5	6.0	<5	<5	<5	<5	<5	<5	<5	BOD (mg/L)	5.0	8.0
0	0	0	8	0	0		0	0	0	6	0	0	Total Coliforms	0	0
0	0	0	0	0	0		0	0	0	0	0	0	Faecal Coliforms	0	0
0	0	0	0	0	0		0	0	0	0	0	0	Faecal Streptococci	0	0
0	0	0	0	0	0		0	0	0	0	0	0	E.Coli	0	0
0	11	14		0	0		0	0	0		1	0	Pseudomonas aeruginosa	1	0
							n/d						Clostridium perfringens/spp		
							n/d		n/d				Yersinia spp.		
							n/d		n/d				Salmonella spp.		
													<b>STANDARD ANALYTE SUITE (mg/L)</b>		
16.7	37	30.7	23.7	13.3	3.6	0.0	6.9	10.8	4.1	10.4	0.0	0.4	total NOx to use	0.7	2.0
													kjeldahl N (organic N)		
19.5	37	30.8	35.0	18.1	9.0	8.5	8.3	18.0	11.0	11.4	0.3	0.4	total N to use	0.9	2.2
1.2	0.0	0.3	1.6	1.1	0.0	0.0	<0.005	0.6	0.0	3.9	0.6	0.0	total P	<0.005	0.6
4.0	6	5.0	23.0	13.0	22.0	21.0	7.0	10.0	21.0	30.0	16.0	14.0	total organic carbon (TOC)	9.0	12.0
20.0	40	60.0	31.1	30.0	20.0	20.0	80.0	80.0	20.0	103.6	130.0	150.0	Cl	130.0	220.0

G4/3	G4/4	G4/7	G5/2	G5/3	G5/4	G555/4	G5/5	G5/6	G5/7	G6/2	G6/3	G6/4	CONT'D: sample#	G6/5	G6/7
9.0	12	9.0	<1	21.0	17.0	15.0	35.0	25.0	13.0	28.9	44.0	80.0	SO4	58.0	65.0
													total S - lab		
15.8	16	17.9	14.0	17.1	21.9		30.2	21.5	16.0	97.4	81.9	75.1	HCO3 to use	57.1	46.3
													CO3 - lab		
<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	Hg	<0.0005	<0.0005
													<b>UTS - ICP ANALYTES (mg/L)</b>		
1.90	0.22	0.12	0.11	0.64	0.14		0.07	0.03	1.79	0.07	0.29	0.10	B	1.07	0.56
14.2	23.0	33.3	40.3	33.5	18.3		72.9	51.6	24.8	64.5	85.0	79.1	Na	100.8	143.9
13.0	21.2	17.5	23.0	9.3	7.1		17.4	15.2	10.3	10.2	14.2	11.9	Mg	11.9	19.7
0.5	0.3	0.2	0.3	0.6	1.5		0.3	0.0	0.8	0.2	0.5	0.2	Al	0.4	0.2
8.7	6.6	5.7	6.3	6.3	5.9		5.3	4.4	7.2	3.3	8.3	6.8	Si	8.5	8.4
14.3	17.8	13.9	11.6	4.0	1.8		7.2	2.8	3.2	1.2	1.6	1.1	K	2.3	3.3
11.9	26.7	16.1	43.9	16.1	13.7		23.2	19.2	16.4	27.8	37.6	34.3	Ca	35.8	51.6
4.94E-04	3.19E-04	8.72E-04	2.09E-03	6.00E-04	4.89E-04		3.47E-03	2.35E-03	7.19E-04	3.09E-03	2.15E-03	6.69E-04	Cr	2.04E-03	2.33E-03
3.62E-04	6.92E-03	3.49E-03	1.13E-03	3.38E-04	1.02E-03		2.65E-03	1.54E-03	1.31E-03	8.03E-03	6.30E-03	7.54E-03	Mn	2.82E-03	2.45E-03
6.05E-02	6.05E-02	2.26E-01	8.36E-02	1.24E-02	4.31E-02		5.84E-02	4.25E-02	2.50E-01	1.70E-01	1.49E-02	1.65E-01	Fe	3.14E-01	2.25E-01
4.77E-04	9.02E-04	2.26E-03	1.23E-03	5.46E-04	5.66E-04		4.67E-04	7.13E-04	8.18E-04	1.35E-03	1.10E-03	1.13E-03	Ni	1.07E-03	1.27E-03
6.20E-03	1.23E-02	1.08E-02	6.54E-03	5.83E-03	1.12E-02		8.79E-03	3.99E-03	9.76E-03	1.23E-02	1.47E-02	4.79E-02	Zn	1.88E-02	3.89E-02
3.80E-03	2.74E-03	n/a	2.60E-03	8.09E-03	1.33E-02		1.76E-03	n/a	n/a	3.52E-03	1.13E-03	1.49E-03	Cu	1.90E-03	n/a
1.81E-04	4.16E-05	3.20E-05	0.00E+00	1.00E-04	4.21E-05		6.54E-05	7.76E-05	2.38E-04	0.00E+00	9.81E-05	9.51E-05	As	1.20E-04	1.04E-04
0.00E+00	2.61E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	2.53E-03	2.36E-04	0.00E+00	0.00E+00	1.76E-03	Se	2.63E-03	8.07E-04
1.07E-01	2.70E-01	1.16E-01	1.55E-01	4.59E-02	4.24E-02		8.73E-02	6.42E-02	5.18E-02	1.56E-01	1.82E-01	1.73E-02	Sr	1.60E-01	2.96E-01
1.06E-03	9.97E-05	9.84E-06	5.47E-05	3.53E-04	8.13E-05		9.43E-05	1.35E-04	1.08E-03	2.65E-04	5.02E-04	1.88E-04	Mo	1.04E-03	3.98E-04
3.44E-04	1.94E-04	1.21E-04	1.66E-04	3.84E-04	1.35E-04		1.26E-04	1.63E-04	1.15E-04	4.80E-03	1.31E-04	2.51E-04	Cd	1.84E-04	1.23E-04
5.81E-04	7.74E-04	1.30E-03	8.73E-05	1.76E-03	2.05E-03		1.66E-03	7.56E-04	1.15E-03	4.48E-04	2.31E-04	6.66E-04	Pb	5.06E-04	5.66E-04
													F by IC - if analysed		
0.00E+00	0.00E+00	1.80E-01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	3.50E-01	7.00E-02	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	1.00E+00
		W98/017579							W98/017703				<b>CERTIFICATES</b>		W98/017704
974293W	976537W	RN076849	W97/001682	974294W	976515W	W97/017266	98/006358	RN064050	98/081215	W97/001683	974295W	976538W	certificate numbers for	W98/002941	98/081215
W97/010811	W97/017386	987310W	7005367U	W97/010812	W97/017265		981629W	W98/012512	RN076850	7005367U	W97/010813	W97/017387	above analyses	98/006527	RN076850
<b>TIOS, AND ANALYSIS VALIDITY CHECK</b>													<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALI</b>		
186	309	293	330	218	153		294	291	170	368	375	411	calculated TDS (mg/L)	386	556
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag;care balance	use %bal	use %bal
2.723	4.576	4.086	6.206	3.217	2.283		5.986	4.547	2.928	5.166	6.854	6.190	sum cation millequivalents	7.270	10.595
2.310	4.256	4.405	2.937	2.613	1.532		3.972	3.993	1.395	6.235	5.980	7.159	sum anion millequivalents	5.861	8.646
OK high%		OK high%	OK high%	OK high%	OK high%	partial anal	OK high%	OK high%	OK high%	OK high%	OK high%		low sum an/cat tolerance	OK high%	
8.2	3.6	-3.8	35.8	10.4	19.7		20.2	6.5	35.5	-9.4	6.8	-7.3	ionic balance % error	10.7	10.1
0.62	0.63	0.89	0.50	0.62	0.71		0.52	0.53	0.69	0.35	0.51	0.65	A = S/K (calc TDS/cond)	0.48	0.57
			R		R	P	R		R	R			analysis adjustments		

G7/2	G14/2	G7/3	G777/3	G7/4	G7/6	G7/7	G8/2	G8/3	G8/4	G8/5	GUI	G888/5	G8/6	G8/7
											sample #			
11-Feb-97	11-Feb-97	3-Jul-97	3-Jul-97	27-Sep-97	23-Jul-98	29-Sep-97	11-Feb-97	2-Jul-97	27-Sep-97	24-Feb-98	date sampled	24-Feb-98	23-Jul-98	24-Sep-98
2.71	duplicate	3.85		2.33	3.44	2.58	3.50	3.84	2.99	4.13	SWL (m)	second	4.16	3.27
		0.50		0.28	0.54	0.66	0.33	0.25	0.38	0.13	pump rate (L/min)	sample	v low	0.68
											<b>FIELD PARAMETERS</b>			
611		764	745	559	642	298	449	300	777	386	EC (uS/cm)		414	667
6.0		6.1	6.1	6.0	5.6	5.5	6.4	6.5	6.5	6.2	pH		5.8	6.3
223		-37	-47	205	123	143	164	163	180	134	Eh (mV)		-53	17
27.4		20.8	20.7	22.3	20.5	20.6	n/a	20.8	19.7	26.3	deg C		19.0	19.5
30.5		36.1	33.0	93.9	30.3	32.1	62.8?	18.3	30.9	n/a	O2 %Sat		n/a	1.7
		minor		minor			some			some	turbid sample			
										minor	yellow oxidation			
		minor									H2S presence			
											<b>FIELD ANALYTES (mg/L)</b>			
66		58		52	45	34	71	22	54	47	CO2		29	72
35		41	41	17	23	11	61	56	73	40	alkalinity as CaCO3		73	131
											<b>HACH ANALYTES (mg/L)</b>			
0.005		0.004	0.005	0.004	0.107	0.010	0.195	0.046	0.156	0.094	NO2 - N {for ion *3.3}		0.000	0.010
3.3		4.2	2.8	21.4	13.4	10.5	9.2	13.5	12.9	23.3	NO3 - N {for ion *4.4}		1.6	15.7
0.38		2.82	2.92	0.17	0.21	0.07	0.24	0.03	0.17	0.02	NH3 - N {for ion *1.29}		0.21	0.09
5.0		4.0	4.5	0.0	2.3	1.2	5.5	0.6	<0.005	0.0	PO4(3-) {for P *0.326}		0.0	0.6
3.7	0.0	7.1	5.7	21.6	13.7	10.6	9.7	13.6	13.2	23.4	total inorganic N - Hach	0.0	1.8	15.8
											<b>BACTERIAL SUITE (CFU/100mL)</b>			
<5	<5	14.0	<5	6.0	<5	<5	<5	<5	<5	<5	BOD (mg/L)		<5	8.0
<10	<10	0	0	0	0	0	<10	0	0	0	Total Coliforms	0	0	0
<10	<10	0	0	0	0	0	<10	0	0	0	Faecal Coliforms	0	0	0
<10	<10	<2	0	0	0	0	<10	<2	0	0	Faecal Streptococci	0	0	0
											E.Coli	0	0	0
		<2	0	0	0	0		<2	0	0	Pseudomonas aeruginosa	0	10	0
											Clostridium perfringens/spp	putyricum detected)		
											Yersinia spp.			
											Salmonella spp.			
											<b>STANDARD ANALYTE SUITE (mg/L)</b>			
3.3	0.0	4.2	2.8	21.4	13.5	10.5	9.4	13.5	13.1	23.4	total NOx to use	0.0	1.6	15.7
											kjeldahl N (organic N)			
5.0	5.1	7.1	6.2	23.0	17.0	11.0	9.7	13.6	13.2	47.0	total N to use	0.0	1.8	16.0
1.6	0.0	1.3	1.5	0.0	0.8	0.0	1.8	0.2	0.0	0.0	total P		0.2	0.2
20.0	26.0	19.0	21.0	14.0	7.0	5.0	33.0	22.0	25.0	8.0	total organic carbon (TOC)		13.0	20.0
37.1		140.0	140.0	70.0	90.0	30.0	31.9	30.0	110.0	10.0	Cl		50.0	50.0

G7/2	G14/2	G7/3	G777/3	G7/4	G7/6	G7/7	G8/2	G8/3	G8/4	G8/5	CONT'D: sample#	G888/5	G8/6	G8/7
14.3		62.0	55.0	37.0	40.0	27.0	13.1	19.0	46.0	11.0	SO4		31.0	32.0
											total S - lab			
42.9	43.0	50.2	50.0	43.9	28.3	13.3	74.0	87.8	134.1	30.8	HCO3 to use	0.0	88.8	159.7
											CO3 - lab			
<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	Hg		<0.0005	<0.0005
											<b>UTS - ICP ANALYTES (mg/L)</b>			
0.05		0.15	0.08	0.10	0.03	0.34	0.08	0.12	2.11	0.17	B		0.07	0.28
63.1		90.5	91.6	51.7	57.8	21.7	31.6	32.06	69.2	15.98	Na		32.4	56.0
18.4		25.1	25.3	26.5	21.6	16.1	22.1	29.60	47.9	14.94	Mg		19.9	62.1
0.3		0.7	1.8	0.3	0.0	0.3	0.4	1.31	0.3	0.50	Al		0.1	0.2
4.1		4.9	5.4	3.9	3.8	5.3	8.7	10.80	9.4	5.56	Si		5.7	12.3
6.2		9.1	9.1	7.7	9.2	7.7	4.2	6.23	3.6	4.01	K		6.6	6.4
12.9		8.8	8.7	14.7	10.8	8.6	11.5	11.28	19.4	4.97	Ca		5.9	14.0
3.13E-03		2.58E-03	2.55E-03	9.83E-04	3.38E-03	1.02E-03	1.86E-03	7.37E-04	9.06E-04	3.14E-04	Cr		2.12E-03	1.28E-03
3.00E-03		6.98E-04	1.62E-04	1.58E-03	1.51E-03	1.38E-03	1.01E-02	4.55E-03	3.90E-03	5.02E-03	Mn		1.88E-02	4.48E-03
3.59E-02		9.03E-01	9.42E-01	1.01E-01	7.22E-02	1.39E-01	8.72E-02	1.11E-02	3.17E-01	1.67E-01	Fe		5.36E+00	9.43E-01
1.15E-03		8.07E-04	5.83E-04	6.82E-04	5.19E-04	4.45E-04	1.43E-03	6.67E-04	9.01E-04	5.89E-04	Ni		1.21E-03	7.48E-04
3.14E-02		1.22E-02	8.25E-03	7.36E-02	8.04E-03	5.75E-03	3.36E-02	1.18E-02	1.98E-02	1.85E-02	Zn		2.53E-02	2.80E-02
1.74E-02		1.90E-03	6.56E-04	2.39E-03	n/a	n/a	2.83E-03	1.12E-03	1.41E-03	2.84E-03	Cu		n/a	n/a
0.00E+00		9.45E-05	7.57E-05	5.37E-05	8.53E-05	8.55E-05	0.00E+00	1.98E-05	2.15E-04	4.80E-05	As		1.70E-04	7.77E-05
0.00E+00		0.00E+00	0.00E+00	0.00E+00	7.98E-04	0.00E+00	0.00E+00	0.00E+00	1.42E-03	0.00E+00	Se		0.00E+00	0.00E+00
4.77E-02		4.94E-02	4.79E-02	5.88E-02	5.53E-02	2.89E-02	4.57E-02	4.47E-02	7.33E-02	3.18E-02	Sr		2.11E-02	4.67E-02
6.47E-05		1.82E-04	1.26E-04	1.28E-04	1.66E-04	2.28E-04	2.22E-04	1.62E-04	1.58E-03	3.17E-04	Mo		1.99E-04	2.93E-04
2.34E-03		8.87E-05	3.31E-05	4.12E-04	1.52E-04	6.97E-05	1.26E-03	1.59E-04	2.61E-04	6.98E-04	Cd		1.11E-04	8.66E-05
9.73E-04		8.96E-04	4.53E-04	1.12E-03	3.66E-04	5.95E-04	3.80E-04	6.44E-04	8.48E-04	6.88E-04	Pb		2.61E-03	6.39E-04
											F by IC - if analysed			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E-01	7.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Br value to use	0.00E+00	1.40E-01	2.00E-01
						W98/017705					<b>CERTIFICATES</b>			W98/017706
W97/001744	W97/001746	974328W	974330W	976539W	RN064050	98/081215	W97/001745	974296W	976540W	98/006358	certificate numbers for	981631w	RN064050	98/081215
7005471N	7005471N	97/23607	97/23607	W97/017388	W98/012513	RN076850	7005471N	W97/010814	W97/017389	981630W	above analyses		W98/012514	RN076850
<b>QUALITY CHECK</b>											<b>ELECTRONIC BALANCE (%), RATIOS, AND ANALYSIS VALIDITY CHECK</b>			
219		415	409	336	323	172	232	254	443	276	calculated TDS (mg/L)		215	386
use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	use %bal	high TDS flag;care balance	use %bal	use %bal	use %bal
5.120		6.994	7.172	5.403	5.091	2.936	3.933	4.702	8.070	2.339	sum cation millequivalents		3.718	8.475
2.443		6.491	6.256	4.984	4.904	2.419	3.231	3.661	7.185	2.678	sum anion millequivalents		3.642	5.853
OK high%	partial anal	OK high%	OK high%		OK high%	OK high%	OK high%	OK high%	OK high%		low sum an/cat tolerance	partial anal	OK high%	
35.4		3.7	6.8	4.0	1.9	9.7	9.8	12.4	5.8	-6.8	ionic balance % error		1.0	18.3
0.36		0.54	0.55	0.60	0.50	0.58	0.52	0.85	0.57	0.72	A = S/K (calc TDS/cond)		0.52	0.58
R	P										analysis adjustments	P		R

**APPENDIX M**  
**SUMMARY OF USA COURT REPORTS**

Table M1. USA Federal and State Court Cases Concerning Cemeteries and Ground and Surface Waters

Date Ref.	Jurisdiction	Case And Ref. #1	Concerns And Findings	Expert Testimony
December, 1860, decided	Supreme Court Of North Carolina, Raleigh	Henry S. Clark V. David Lawrence, Trustee. [No number in Original] [59 N.C. 83; 1860 N.C. Lexis 20; 6 Jones Eq. 83]	Clark's property has well 35 ft and 72 ft downhill from cemetery in sands and gravel; interments 3 ft from boundary fence at depths 3 – 4 ft Limited interments at present but objection to further burials pursued. Insufficient evidence of likely groundwater pollution; case allowed to be retried if this is available	
November Term, 1864	Supreme Court Of Indiana	The City of Greencastle v. Hazelett. [ 23 Ind. 186]	Likely injury to homeowner's well and springs by new cemetery establishment. No satisfactory proof and application of law regarding surface streams not applicable to underground streams.	1 x Professor of Geology
December, 1880, decided	Supreme Court Of Alabama	Kingsbury v. Flowers. [No Number In Original] <b>65 Ala. 479; 1880 Ala. Lexis 81</b>	Kingsbury seeks to restrain Flowers from future burials in private cemetery alleges nearby wells – about 188 ft and 272 ft at an elevation of 4-5ft lower, where water level is at 26 ft will be affected. Already has a diversionary drian for surface water; insufficient evidence	
October 16, 1888, adopted	Supreme Court of Texas	Jacob Jung et al. v. J. C. Neraz No. 6013 <i>71 Tex. 396; 9 S.W. 344; 1888 Tex. Lexis 1156</i>	Landholder seeks to restrain Roman Catholic Church from establishing a graveyard on adjoining land because of likely pollution of wells; failed because cemetery not yet established	
June 30, 1881, submitted October 5, 1881, decided	Supreme Court Of Michigan	Uriah Upjohn v. The Board of Health of the Township of Richland et al. [no number in original] 46 Mich. 542; 9 N.W. 845; 1881 Mich.	Location of cemetery will affect drinking water wells; complained off act was not a public nuisance and was partly coerced by plaintiff; there is likely to be some effect but plaintiff has a more closely located barnyard of greater effect; evidence needed of subsurface water movement	Various professors and physicians

January 20, 1896	Supreme Court Of Illinois	George D. Barrett et al. V. The Mount Greenwood Cemetery Association et al. 159 Ill. 385; 42 N.E. 891; 1896 Ill.	Sewers – subsoil drains to be constructed under a cemetery, particularly swampy areas and drained into nearby brook used for iceworks 4 miles from it and affecting other nearby land. Held that a likelihood of pollution by decomposing bodies exists. Comprehensive analytical statements made by legal fraternity.	Bacteriologist
February 23, 1899, filed	Supreme Court Of Nebraska	Jesse L Lowe et al., Appellees, v. Prospect Hill Cemetery Association, Appellant, et al. No. 8654. 58 neb. 94; 78 n.w. 488; 1899 neb. Subsequent Appeal No. 14,188.	Extension to longterm cemetery challenged because of likely pollution to wells and other matters. Cemetery on crest of hill with all-round drainage to below. Considerable conflict over nature of the soil – eventually held to be a highly porous clay/loess, not dry. Physicians evidence that previous disease probably traceable to the old cemetery infecting wells. Development prohibited.	3 x medical doctors/scientists and probably other scientists.
December 6, 1905, filed	Supreme Court Of Nebraska	75 Neb. 85; 106 N.W. 429; 1905 Neb.		
July 11, 1900	Supreme Court Of Pennsylvania	Wahl v. Methodist Episcopal Cemetery Association of Williamstown No. 17 197 Pa. 197; 46 A. 913	4 yo cemetery with 79 interments said to cause pollution to neighbours' wells - 1 of these at 100ft. Pollution by decomposition products could not be proved, in fact most evidence supported the concept of water improvement due to the tended grounds of the cemetery; underlying geology not properly considered. (This is an important case with useful deductive reasoning - but suffers from lack of adequate hydrogeological knowledge.)	2 x medical doctors - 1 had done limited percolation tests, 1 x minister with experiences of wells in cemeteries
June 3, 1903	Supreme Court Of Nebraska	Elvina Braasch et al., Appellants, V. Cemetery Association of The Evangelical Lutheran Christ Society Of Norfolk, Nebraska, et al., Appellees. No. 12,829. 69 Neb. 300; 95 N.W. 646	New cemetery in elevated position about 100 ft above land with wells in clayey loess; 570 ft to nearest well from cemetery boundary, land slope 20°, wells draw water from gravelly and sandy layer at about 23 - 25ft depth; dismissed "technical" evidence not well regarded	2 x medical doctors - 1 attempted expertise in hydrology

October 29, 1904, decided  January 29, 1908, decided	Court Of Civil Appeals Of Texas  Supreme Court Of Texas	J. T. Elliott, et al., v. W. S. Ferguson, et al. [no number in original] 37 Tex. Civ. App. 40; 83 S.W. 56; 1904 Tex. App. Subsequent Appeal No. 1788 101 Tex. 317; 107 S.W. 51; 1908 Tex.	Proposed cemetery located on a hill with underlying sandy and gravelly soils; groundwater said to become polluted; evidence insufficient; location of effected lands not properly established; evidence not clear-cut as to effects	1 physician and a water supply contractor
October, 1906, decided	Supreme Court Of Iowa, Des Moines	Henry N. Payne et al., V. Town Of Wayland, Appellant. 131 Iowa 659; 109 N.W. 203; 1906	Proposed enlargement of existing cemetery between two drainage lines. Claim of potential pollution of springs, streams and wells if interment allowed. Soils are shallow 4' with 8/10" black loam over sandy clay. Some interpretation errors in perched water tables. Potential nuisance allowed.	Scientific evidence
January 28, 1908, decided	Court Of Appeals Of Kentucky	Long v. Louisville & Nashville R. R. Co. [No Number In Original] 128 Ky. 26; 107 S.W. 203; 1908 Ky. Lexis 27	Buried cattle carcass in railway easement pollutes spring/well of adjacent landholder at 70 ft downhill; question of negligence and compensation to be retried	
May 27, 1910, original opinion filed	Supreme Court Of Minnesota	Adelia Nelson V. Swedish Evangelical Lutheran Cemetery Association Nos. 16,550 - (69) 111 Minn. 149; 126 N.W. 723; 1910 Minn	Soil of the locality is composed of a porous, unstratified, clayey deposit – loess, containing sand and gravel lenses, but upper parts generally impervious; water abstracted from about 40ft in a well 150ft from cemetery ; controversy as to whether formation was actually glacial till	Geologists and physicians
September 13, 1910	Supreme Court Of Oklahoma	Clinton Cemetery Association Et al. V. Mcattee. No. 1398. 27 Okla. 160; 111 P.	Development of new slightly elevated land - subsurface and surface drainage said to influence drinking well located 182ft from nearest burial which was already at least 36 years old (no previous ill effects reported); action dismissed - demurrer allowed	



January 18, 1912, decided	Supreme Court Of Alabama	Bellview Cemetery Co. v. McEvers. [No Number In Original] <i>174 Ala. 457; 57 So. 375; 1912 Ala. Lexis 10</i>	Appeal against action by landholder to prevent establishment of cemetery because of possible injury. proposed cemetery land is topographically higher and said to be "swampy and of quagmire nature". Disallowed	
April 12, 1911	Supreme Court Of Georgia	Harper et al. V. City Of Nashville et al. 136 Ga. 141; 70 S.E. 1102	Location of a cemetery said to cause effect on surface and underground waters of neighbour and affect drinking wells; dismissed	
July 18, 1916	Supreme Court Of Missouri, Division Two	W. C. Mullins V. Mount Saint Mary's Cemetery Association et al; Appellant. 268 Mo. 691; 187 S.W. 1169	Sewerage costs for the cemetery were commensurate with others in the area; the need for the works in part being occasioned by the existence of the cemetery - the sewers removing excess runoff	
July 30, 1918	Supreme Court Of Oklahoma	City Of Tulsa et al. V. Purdy. No. 8991 73 Okla. 98; 174 P. 759	Location of an elevated cemetery extension said to cause effect on surface and underground waters of neighbour and affect drinking wells; nearest interment about 100 ft.; good groundwater source; apparent location akin to drainage basin; quantifiable damage - not an equity issue	
November 22, 1922, argued	Supreme Judicial Court Of Massachusetts	Mary A. Manning v. Woodlawn Cemetery Corporation [no number in original] 245 Mass. 250; 139 N.E. 830; 1923 Mass.	Cemetery operators had channeled stormwater into a pond which overflowed into ditches emptying onto a neighbour's land causing a nuisance	
January 22, 1923	Supreme Court Of Arkansas	McDaniel v. Forrest Park Cemetery Company 156 Ark. 571; 246 S.W. 874	Seepage of decomposition products would ruin drinking wells on adjacent land; not proved the soil is probably too impervious to at least 15ft; subsurface flow direction not established (no distances given); probable injury not proved	3 x Professors of Geology, State Sanitary Engineer, Drainage Engineer, Bacteriologist
Feb. 23, 1923, decided	Court Of Civil Appeals Of Texas, San Antonio	Farb et al. v. Theis et al. No. 6965 250 S.W. 290; 1923 Tex. App.	Proposed cemetery extension claimed to contribute polluted groundwaters to a nearby stream used for drinking and stock water; insufficient evidence presented – assertions not sufficient	

April 14, 1927	Court Of Appeals Of Tennessee, Western Section	E. A. Reid, et al. v. Memphis Memorial Park. 5 Tenn. App. 105; 1927 Tenn. App.	Complainants tried to stop cemetery development adjoining their lands (54.25 acres total) because said to pollute groundwater. Soil loess – impervious red clay. Wells located 85ft deep at 100 ft (nearest) others deeper than 200 ft at 250ft, 600ft and 1500 ft distances. Evidence claimed contamination risk up to ½ mile radius. 25ft buffer zone designed into plans. Case dismissed no evidence of likely pollution. Very lengthy argument by many expert witnesses; some conflicting.	Geologists x 2 or more, Bacteriologists, sanitary Engineer, Mining Engineer/Geologist, State Hydrologist, State Chief Chemist/Bacteriologist, cemetery Landscape Architect
April 16, 1927	Court Of Appeals Of Georgia	Fairview Cemetery Co. v. Wood et al. 17672. 36 Ga. App. 709; 138 S.E. 88	New cemetery in soils above fractured limestone hosting springs leading to surface drainage, streams, wells and springs used for drinking water, 200 ft to nearest burial from stream, disposition of strata unknown; evidence regarded as " vague, uncertain, and conjectural to show any actual present contamination of the water"; original orders reversed	2 x physicians
February 13, 1929	Supreme Court Of North Carolina	Board Of Health Of Buncombe County, The City Of Asheville et al. v. R. J. Lewis And Lewis Memorial Park Company. 196 N.C. 641; 146 S.E. 592	New cemetery in located on the 14 - 16 square mile watershed of Beaverdam Creek, which flows through Beaverdam Valley and is part of township water supply, is not a nuisance	
September 8, 1930	Supreme Court Of Washington, Department Two	E. O. Hite et al., Appellants, v. Cashmere Cemetery Association et al., Respondents. Samuel Reid, Appellant, v. Cashmere Cemetery Association et al., Respondents No. 22434 158 Wash. 421; 290 P. 1008	Extension to cemetery by joining two land tracts which also contain water wells, alleged pollution; 20ft downward percolation in sandy soils and 200-300ft lateral percolation required, dry climate; dismissed - no equity for nuisance	

September 12, 1930	Supreme Court Of California	Kenneth Carter et al., Appellants, v. A. H. Chotiner et al., Respondents L. A. No. 10526 210 Cal. 288; 291 P. 577; 1930 Cal.	Location of a cemetery on neighbouring land said that it will cause well pollution; existence of cesspools close to wells noted; no nuisance or pollution threat proved despite consideration of land slope, soil thickness etc. 40ft buffer zone enforced around inside edge of cemetery; conflicting hydrogeological evidence	Sets of experts on either side presented technical arguments of equal weight
July 11, 1933	Supreme Court Of Georgia	Hall et al. v. Moffett et al. No. 9308. 177 Ga. 300; 170 S.E. 192	New private cemetery, no evidence to support contention of injurious to health; dismissed	
March 11, 1948, decided	Supreme Court Of South Carolina	Young et al. v. Brown 16058 212 S.C. 156; 46 S.E.2d 673; 1948 S.C.	Large tract of land in semi-rural area to be converted to cemetery. Not a nuisance per se reaffirmed ; proof of likelihood of groundwater pollution would also be needed to prevent any such developments.	
Argued January 3, 1949	The Supreme Court Of Pennsylvania	Young et al., Appellants, v. St. Martin's Church et al 361 Pa. 505; 64 A.2d 814; 1949 Pa.	Neighbourhood seeks to prevent establishment of churchyard in area of residential character. One reason is potential contamination of springs: this cause dismissed.	
July 11, 1951	Court Of Civil Appeals Of Texas, San Antonio	Jones et al. v. Highland Memorial Park No. 12266 242 S.W.2d 250; 1951 Tex. App.	Proposed cemetery on ground with high watertable (2.5 – 6 ft); neighbours have nearby, shallow water wells (approx 11 ft deep); insufficient evidence to prove likely effect; stormwater also runs off adversely but likely to be unpolluted	
June 19, 1953	Court Of Appeals Of Kentucky	McCaw et al. v Harrison et al. [no number in original] 259 S.W.2d 457; 1953 Ky.	Cemetery development over cavernous limestone, shallow soils, stock and drinking water abstracted from this formation well at 500 ft from cemetery. Boundary; opposing technical argument – plaintiff's representatives allege that 50ft is sufficient sanitary distance; development allowed	an eminent Geologist, a Pathologist, Embalmer, and a Cemetery Manager; a Civil Engineer, specializing in sanitary engineering, and a Professor of Bacteriology

June 1, 1959, Opinion delivered	Supreme Court Of Arkansas	North Hill Memorial Gardens v. Hicks No. 5-1882 230 Ark. 787; 326 S.W.2d 797; 1959	Neighbours try to prevent establishment of cemetery on grounds that activities will pollute groundwater and runoff; expert testimony that the cemetery plots would not contaminate the wells and that the surface drainage is away from the houses which border the cemetery.	Sanitary Engineers for the State Health Department
April 12, 1965, decided	Supreme Court Of Mississippi	O. D. Lauck, D.B.A. Meridian Memorial Park Cemetery v Gilbert No. 43226 252 Miss. 371; 173 So. 2d 626; 1965 Miss.	Cemetery wrongfully obstructed drainage ditch from land above causing flooding above; ordered to maintain drains and pay damages	Civil Engineer- re drainage
March 10, 1972	United States District Court For The Middle District of Tennessee, Nashville Division	Woodlawn Memorial Park Of Nashville, Inc. v. L & N Railroadco., Inc. Civ. A. No. 5060 377 F. Supp. 932	Flooding of cemetery due to alteration of lands and drainage by nearby railroad and developments; concluded that cemetery drainage was inadequate for the storm event; action dismissed	
June 4, 1973	Court Of Appeals Of Missouri, Kansas City District	Jack Genova, Respondent, v. City Of Kansas City, Missouri, Appellant No. 25947 497 S.W.2d 555	Cemetery failed to maintain its drainage lines so that when an exceptionally heavy rainfall occurred a neighbour's land was flooded.	

Notes to Table M1

#1. the legal reference cited refers to that from the bibliographic database Lexis-Nexis (1999 and 2001)

#2. where imperial units were originally used in the legal arguments these have been maintained; for conversion to metric units: 1 ft = 0.3048 m, 1 square mile = 2.59 km