

MGT LABMARK ANALYTICAL LISTS AND METHODS

Target Compounds	MGT LabMark Method	Methodology Summary
Heavy Metals		
Arsenic	LM-LTM-MET-3100	0.5 g digested in nitric/hydrochloric acid. Analysis b ICP-MS
Cadmium		
Chromium		
Copper		
Nickel		
Lead		
Zinc		
Mercury	LM-LTM-MET-3100	0.5 g digested in nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.
Polycyclic Aromatic Hydrocarbons (PAHs)		
Naphthalene	E007.2	8-10 g soil extracted with 20 mL DCM /Acetone/ Hexane (10:45:45). Analysis by GC-MS.
Fluorene		
Phenanthrene		
Anthracene		
Acenaphthylene		
Acenaphthene		
Fluoranthene		
Pyrene		
Benz(a)anthracene		
Chrysene		
Benzo(b) & (k)fluoranthene		
Benzo(a)pyrene		
Indeno(1.2.4-cd)pyrene		
Dibenzo(a,h)anthracene		
Benzo(g,h,i)perylene		
BTEX Compounds		
Benzene	E029.2/E016.2	8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/MSD or by P&T/GC/FID/MSD.
Toluene		
Chlorobenzene		
Ethylbenzene		
Meta- & para-Xylene		
Ortho-Xylene		
Total Petroleum Hydrocarbons		
C6-C9 Fraction	E029.2/E016.2	8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/MSD or by P&T/GC/FID/MSD.
C10-C14 Fraction	E006.2	8 – 10 g soil extracted with 20 mL DCM /Acetone /Hexane (10:45:45). Analysis by GC/FID.
C15-C28 Fraction		
C29-C36 Fraction		
Organochlorine Pesticides (OCP)		
alpha-BHC	E013.2	8-10g soil extracted with 20 mL hexane/acetone (1:1). Analysis by GC/dual ECD.
HCB		
beta-BHC & gamma-BHC		
delta-BHC		
Heptachlor		
Aldrin		
Heptachlor epoxide		
Endosulfan 1		

Target Compounds	MGT LabMark Method	Methodology Summary
Trans-Chlordane		
Cis-Chlordane		
methoxychlor		
4.4'-DDE		
Dieldrin		
Endrin		
Endosulfan 11		
4.4'-DDD		
Endosulfan sulfate		
4.4'-DDT		
Organophosphorus Pesticides (OPP)		
Dichlorvos	E014.2	8-10 g soil extracted with 20mL hexane/acetone (1:1). Analysis by GC/MSD.
Mevinphos		
Demeton		
Ethoprop		
Monocrotophos		
Phorate		
Dimethoate		
Diazinon		
Disulfoton		
Methyl parathion		
Ronnel		
Fenitrothion		
Malathion		
Chlorpyrifos		
Fenitrothion		
Fenthion		
Parathion		
Stirofos		
Azinophos methyl		
Coumaphos		
Inorganic Analytes		
Weak Acid Dissociable Cyanide	E040.2/E054.2	Caustic soil extraction, Acetate distillate collected in sodium hydroxide. Analysis by colour.
Ammonia	E036.1/E050.1	The water sample is filtered and ammonia by colourimetry using the indophenol method (ref APHA 21 st Edition 2006)
Cyanide	E040.1/E054.1	Strong acid distrillate collected in sodium hydroxide. Analysis by colour.
Sulphate	E042.2/E045.2	1:5 water extraction. Determination by colour and/or ion chromatography.
Polychlorinated Biphenyls (PCB)		
Arochlor 1016	E013.2	8-10g soil extracted with 20mL DCM/Acetone/Hexane. Analysis by GC/dual ECD.
Arochlor 1232		
Arochlor 1242		
Arochlor 1248		
Arochlor 1254		
Arochlor 1260		

ALS ANALYTICAL LISTS AND METHODS

Target Compounds	ALS Method	Methodology Summary
Heavy Metals		
Arsenic	EG005T/ EG020A-F	Solid matrix: APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES Appropriate acid digestion of the soil is followed by analysis by ICPAES. Water matrix: (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis followed by ICPMS.
Cadmium		
Chromium		
Copper		
Nickel		
Lead		
Zinc		
Mercury	EG035T/ EG035F	Solid matrix: 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Appropriate acid digestion followed by reduction of ionic mercury to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. Water matrix: 3550, APHA 21st ed. 3112 Hg – B. Samples are .45 um filtered prior to oxidation of any organic mercury with a bromated/bromide reagent. Then reduction of ionic mercury to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve
Polycyclic Aromatic Hydrocarbons (PAHs)		
Naphthalene	EP075(SIM)	Soil Matrix: In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis. Water Matrix: USEPA SW 846 - 3510B) 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for (USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve.
Fluorene		
Phenanthrene		
Anthracene		
Acenaphthylene		
Acenaphthene		
Fluoranthene		
Pyrene		
Benz(a)anthracene		
Chrysene		
Benzo(b) & (k)fluoranthene		
Benzo(a)pyrene		
Indeno(1.2.4-cd)pyrene		
Dibenzo(a.h)anthracene		
Benzo(g.h.l)perylene		
Monocyclic Aromatic Hydrocarbons		
Benzene	EP074A	Extraction of Solids: (USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS. USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.
Toluene		
Ethylbenzene		
Meta- & para-Xylene		
Ortho-Xylene		
Styrene		
Isopropylbenzene		
n-propylbenzene		
1,3,5-trimethylbenzene		
Sec-Butylbenzene		

Target Compounds	ALS Method	Methodology Summary
1,2,4-Trimethylbenzene		
Tert-Butylbenzene		
p-isopropyltoluene		
n-Butylbenzene		
Total Petroleum Hydrocarbons (TPH)		
C6-C9 Fraction	EP080	USEPA SW 846 - 8260B. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Extraction of Solids: (USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
C10-C14 Fraction	EP071	USEPA SW 846 - 8015A. Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. Solid matrix extraction: In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis. Water matrix extraction: USEPA SW 846 - 3510B 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract.
C15-C28 Fraction		
C29-C36 Fraction		
Other Analytes		
Cyanide	EK026G	Sample are distilled with a weak organic acid, converting selected CN species to HCN. The distillates are analysed for CN by Discrete Analyser.
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	Ahern et al 2004 - a suspension peroxide oxidation method following the 'sulfur trail' by determining the level of 1M KCL extractable sulfur and the sulfur level after oxidation of soil sulphides. The 'acidity trail' is followed by measurement of TAA, TPA and TSA. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Asbestos	EA200 ASB-SOL	AS 4964 - 2004 Method for the qualitative identification of asbestos in bulk samples
Ammonia	EK055G	APHA 21st ed., 4500 NH3+-G. Ammonia is determined by direct colourimetry by Seal Discrete Analyser.
Sulphate	ED040T	In-house. Total Sulphate is determined off a HCl digestion by ICPAES as S, and reported as SO4
Phenol		
Phenol	EP075(SIM)	Soil Matrix: In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and
2-Chlorophenol		
2-Methylphenol		
3-&4-Methylphenol		
2-Nitrophenol		

Target Compounds	ALS Method	Methodology Summary
2,4-Dimethylphenol		concentrated (by KD) to the desired volume for analysis. Water Matrix: USEPA SW 846 - 3510B) 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis.
2,4-Dichlorophenol		
2,6-Dichlorophenol		
4-Chloro3-methylphenol		
2,4,6-Trichlorophenol		
2,4,5-Trichlorophenol		
Pentachlorophenol		(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration
Organochlorine Pesticides (OCP)		
alpha-BHC	EP075I	USEPA SW846 – 8270B. extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve.
HCB		
beta-BHC & gamma-BHC		
delta-BHC		
Heptachlor		
Aldrin		
Heptachlor epoxide		
Endosulfan 1		
Trans-Chlordane		
Cis-Chlordane		
methoxychlor		
4,4'-DDE		
Dieldrin		
Endrin		
Endosulfan 11		
4,4'-DDD		
Endosulfan sulfate		
4,4'-DDT		
Organophosphorus Pesticides (OPP)		
Dichlorvos	EP075J	USEPA SW846 – 8270B. extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve.
Dimethoate		
Diazinon		
Chlorpyrifos-methyl		
Malathion		
Fenthion		
Chlorpyrifos		
Pirimphos-ethyl		
Chlorofenvinphos		
Ethion		
Polychlorinated Biphenyls (PCB)		
Arochlor 1016		
Arochlor 1232		
Arochlor 1242		
Arochlor 1248		
Arochlor 1254		
Arochlor 1260		
Chlorinated Hydrocarbons		
1,3-Dichlorobenzene	EP075G	USEPA SW846 – 8260B. Extracts are analysed by purge and trap, capillary GC/MS. Quantification is by comparison against a
1,4-Dichlorobenzene		
1,2-Dichlorobenzene		

Target Compounds	ALS Method	Methodology Summary
Hexachloroethane		calibration curve.
1,2,4-Trichlorobenzene		
Hexachloropropylene		
Hexachlorobutadiene		
Hexachlorocyclopentadiene		
Pentachlorobenzene		
Hexachlorobenzene		
Volatile Organic Compounds (VOCs)		
Vinyl Acetate	EP074	USEPA SW846 – 8260B. Extracts are analysed by purge and trap, capillary GC/MS. Quantification is by comparison against a calibration curve.
2-Butanone (MEK)		
4-Methyl-2-pentanone (MIBK)		
2-Hexanone (MBK)		
Carbon disulfide		
2,2-Dichloropropane		
1,2-Dichloropropane		
cis-1,3-Dichloropropylene		
trans-1,3-Dichloropropylene		
Dichlorodifluoromethane		
Chloromethane		
Vinyl chloride		
Bromomethane		
Chloroethane		
Trichlorofluoromethane		
1,1-Dichloroethene		
Iodomethane		
trans-1,2-Dichloroethene		
1,1-Dichloroethane		
cis-1,2-Dichloroethene		
1,1,1-Trichloroethane		
1,1-Dichloropropylene		
Carbon Tetrachloride		
1,2-Dichloroethane		
Trichloroethene		
Dibromomethane		
1,1,2-Trichloroethane		
1,3-Dichloropropane		
Tetrachloroethene		
1,1,1,2-Tetrachloroethane		
trans-1,4-Dichloro-2-butene		
cis-1,4-Dichloro-2-butene		
1,1,2,2-Tetrachloroethane		
1,2,3-Trichloropropane		
Pentachloroethane		
1,2-Dibromo-3-chloropropane		
Chlorobenzene		
Bromobenzene		
2-Chlorotoluene		
4-Chlorotoluene		
1,2,3-Trichlorobenzene		
Chloroform		
Bromodichloromethane		
Dibromochloromethane		
Bromoform		

Target Compounds	ALS Method	Methodology Summary
Semi-Volatile Organic Compounds (SVOCs)		
Dimethyl phthalate	EP075	USEPA SW846 – 8270B. Extracts are analysed by capillary GC/MS. Quantification is by comparison against a calibration curve.
Diethyl phthalate		
Di-n-butyl phthalate		
Butyl benzyl phthalate		
bis(2-ethylhexyl) phthalate		
Di-n-octylphthalate		
N-Nitrosomethylethylamine		
N-Nitrosodiethylamine		
N-Nitrosopyrrolidine		
N-Nitrosomorpholine		
N-Nitrosodi-n-propylamine		
N-Nitrosopiperidine		
N-Nitrosodibutylamine		
N-Nitrosodiphenyl & Diphenylamine		
Methapyrilene		
2-Picoline		
Acetophenone		
Nitrobenzene		
Isophorone		
2,6-Dinitrotoluene		
2,4-Dinitrotoluene		
1-Naphthylamine		
4-Nitroquinoline-N-oxide		
5-Nitro-o-toluidine		
Azobenzene		
1,3,5-Trinitrobenzene		
Phenacetin		
4-Aminobiphenyl		
Pentachloronitrobenzene		
Pronamide		
Dimethylaminoazobenzene		
Chlorobenzilate		
Bis(2-chloroethyl) ether		
Bis(2-chloroethoxy) methane		
4-Chlorophenyl phenyl ether		
4-Bromophenyl phenyl ether		
Aniline		
4-Chloroaniline		
2-Nitroaniline		
3-Nitroaniline		
Dibenzofuran		
4-Nitroaniline		
Carbazole		
3,3'-Dichlorobenzidine		

SGS ANALYTICAL LISTS AND METHODS

Target Compounds	SGS Method	Methodology Summary
Heavy Metals		
Arsenic	AN318 / SEP-015	Water sample is digested with nitric acid at 105 degrees C for total metals analysed by ICPMS. Determination of elements at trace levels in waters by ICP-MS.
Cadmium		
Chromium		
Copper		
Nickel		
Lead		
Zinc		
Mercury	SEM-005	Determination of elements at trace levels in waters by ICP-MS.
Polycyclic Aromatic Hydrocarbons (PAHs)		
Naphthalene	SEO-030	Determination by GC/MS following extraction with DCM or DCM/acetone.
Fluorene		
Phenanthrene		
Anthracene		
Acenaphthylene		
Acenaphthene		
Fluoranthene		
Pyrene		
Benz(a)anthracene		
Chrysene		
Benzo(b) & (k)fluoranthene		
Benzo(a)pyrene		
Indeno(1.2.4-cd)pyrene		
Dibenzo(a,h)anthracene		
Benzo(g,h,i)perylene		
BTEX Compounds		
Benzene	SEO-018	Determination by purge and trap/ GC with MS detection.
Toluene		
Ethylbenzene		
Meta- & para-Xylene		
Ortho-Xylene		
Total Petroleum Hydrocarbons (TPH)		
C6-C9 Fraction	SEO-017	Determination by purge and trap GC with FID and PID.
C10-C14 Fraction	SEO-020	Determination by GC following extraction with DCM/acetone for solids and DCM for liquids.
C15-C28 Fraction		
C29-C36 Fraction		
Other Analytes		
Ammonia	SEI-037	Determined by colourimetric method using discrete analyser
Phenol		
Phenol	SEI-066	Determined by colourimetric method using discrete analyser, following steam distillation.
2-Chlorophenol		
2-Methylphenol		
3-&4-Methylphenol		
2-Nitrophenol		
4-Nitrophenol		
2,4-Dimethylphenol		
2,4-Dichlorophenol		

Target Compounds	SGS Method	Methodology Summary
2,6-Dichlorophenol		
4-Chloro3-methylphenol		
2,4,6-Trichlorophenol		
2,4,5-Trichlorophenol		
Pentachlorophenol		
2,3,4,5-Tetrachlorophenol		
2,4-Dinitrophenol		

Appendix E:

**Proposed Risk Based Remediation Criteria
(SSTCs) and
Marine Water Quality Criteria (MWQC)**

TABLE T1
SOIL REMEDIATION CRITERIA
VMP/BLOCK 4 REMEDIAL ACTION PLAN
BARANGAROO, NSW

SOIL REMEDIATION CRITERIA		
CoPC	SRC	Land Use Scenario
Relevant Site Area	VMP Area - Unsaturated Soil	
Relevant Land Use Scenarios	mg/kg	Scenarios 1 and 2
Benzene	380	SSTC (Scenario 2)
TPH C ₁₀ -C ₁₄ aliphatic	54,000	SSTC (Scenario 2)
TPH C ₁₀ -C ₁₄ aromatic		
TPH C ₁₅ -C ₂₈ aliphatic	72,000	SSTC (Scenario 2)
TPH C ₁₅ -C ₂₈ aromatic		
TPH C ₂₉ -C ₃₆ aliphatic	21,000	SSTC (Scenario 2)
TPH C ₂₉ -C ₃₆ aromatic		
CPAH**	67	SSTC (Scenario 2)

Notes:

All soil criteria in mg/kg

SSTC - Site Specific Target Criteria

TPH - Total Petroleum Hydrocarbons

CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene;

Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene;

Dibenz(a,h)anthracene; Indeno(1,2,3-c,d)pyrene)

Land Use Scenarios:

Scenario 1: Paved Recreation

Scenario 2: Intrusive Maintenance Worker

TABLE T2
GROUNDWATER REMEDIATION CRITERIA
VMP/BLOCK 4 REMEDIAL ACTION PLAN
BARANGAROO, NSW

	GROUNDWATER REMEDIATION CRITERIA			
CoPC	GRC	VMP Remediation Works	GRC	Block 4 Development Works
Relevant Site Area(s)	VMP Area		Block 4	
Relevant Land Use Scenarios	mg/L	VMP Scenarios 1 and 2	mg/L	Development Scenarios 1 and 2
Acenaphthylene	47	SSTC ^{VMP} (Scenario 2)	80	SSTC ^{DEV} (Scenario 1)
Aniline			180000	SSTC ^{DEV} (Scenario 1)
Benzene	2.1	SSTC ^{VMP} (Scenario 2)	7.7	SSTC ^{DEV} (Scenario 1)
Ethylbenzene			750	SSTC ^{DEV} (Scenario 1)
Fluorene			13	SSTC ^{DEV} (Scenario 1)
2-methylnaphthalene			4.5	SSTC ^{DEV} (Scenario 1)
3&4-methylphenol			130	SSTC ^{DEV} (Scenario 1)
Naphthalene	1.3	SSTC ^{VMP} (Scenario 2)	0.24	SSTC ^{DEV} (Scenario 1)
Phenanthrene			5.8	SSTC ^{DEV} (Scenario 1)
Styrene			840	SSTC ^{DEV} (Scenario 1)
Toluene			4,000	SSTC ^{DEV} (Scenario 1)
Ammonia	150	SSTC ^{VMP} (Scenario 2)	630	SSTC ^{DEV} (Scenario 1)
TPH C ₆ -C ₉ aliphatic			7,300	SSTC ^{DEV} (Scenario 1)
TPH C ₁₀ -C ₁₄ aliphatic	17	SSTC ^{VMP} (Scenario 2)	1.8	SSTC ^{DEV} (Scenario 1)
TPH C ₁₀ -C ₁₄ aromatic				
TPH C ₁₅ -C ₂₈ aliphatic	220	SSTC ^{VMP} (Scenario 2)		
TPH C ₁₅ -C ₂₈ aromatic				
TPH C ₂₉ -C ₃₆ aliphatic	250	SSTC ^{VMP} (Scenario 2)		
TPH C ₂₉ -C ₃₆ aromatic				
1,2,4-trimethylbenzene			22	SSTC ^{DEV} (Scenario 1)
Xylenes (total)			176	SSTC ^{DEV} (Scenario 1)
CPAH**	1	SSTC ^{VMP} (Scenario 2)		

Notes:

All groundwater criteria in mg/L
SSTC - Site Specific Target Criteria
TPH - Total Petroleum Hydrocarbons
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a)pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-c,d)pyrene)

VMP Land Use Scenarios:

SSTC^{VMP} Scenario 1: Public area with concrete/hardstand paving
SSTC^{VMP} Scenario 2: Short term intrusive maintenance worker

Development Scenarios:

SSTC^{DEV} Scenario 1: Lower Basement
SSTC^{DEV} Scenario 2: Upper Basement

The selected MWQC are summarised in **Table 1** below.

Table 1 Marine Water Quality Criteria

Analyte	Criteria (µg/L)	Source
Low MW PAHs		
Acenaphthene	5.8	CCME (1999) Freshwater Guideline
Acenaphthylene	5.8	Adopted criteria for Acenaphthene as surrogate
Anthracene	0.1 ^a	ANZECC (2000) 99% Marine Water Trigger Value (0.01 µg/L) identified to be lower than LOR.
Fluorene	3	CCME (1999) Freshwater Guideline
Naphthalene	70	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability
Phenanthrene	0.6 ^a	ANZECC (2000) 99% Marine Water Trigger Value
Other Organics		
Phenol	400	ANZECC (2000) 95% Marine Water Trigger Value
Petroleum Hydrocarbons		
Benzene	700	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability
Ethylbenzene	80	ANZECC (2000) 95% Fresh Water Trigger Value, low reliability
Toluene	180	ANZECC (2000) 95% Marine Water Trigger Value, low reliability
Xylene (m & p)	75	ANZECC (2000) 95% Marine Water Trigger Value, low reliability for <i>m</i> -xylene.
Xylene (o)	350	Adoption of the ANZECC (2000) 95% Marine Water Trigger Value, low reliability for xylene (o).
TPH C ₆ - C ₉	110	CCME (2008a) Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil – Table B-9 values for TPH C ₆ to C ₉ and C ₈ ⁺ to C ₁₀ . Criteria calculated from a weighted average assuming a Coal Tar composition of 25% aliphatic and 75% aromatic components
TPH C ₁₀ - C ₁₄	40	CCME (2008a) Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil – Table B-9 values for TPH C ₁₀ to C ₁₄ and C ₁₂ ⁺ to C ₁₆ . Criteria calculated from a weighted average assuming a Coal Tar composition of 25% aliphatic and 75% aromatic components
TPH C ₁₅ -C ₂₈	100	No guidelines values available, therefore the standard laboratory Limit of Reporting (LOR) has been adopted.
TPH C ₂₉ -C ₃₆	50	No guidelines values available, therefore the standard LOR has been adopted.
Ammonia		
Ammonia as N	4,830	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability

Notes: (a) It is noted that these MWQC are less than the laboratory standard LOR. The laboratory standard LOR will be adopted in place of the MWQC where: (i) analysis of these chemicals is required; or, (ii) where the MWQC are considered in derivation of risk based criteria.

Appendix F:

Contaminant Mass Calculations

Table F1 & F2 mass removal calcs 12Mar2013.xls

TABLE F2 - POST REMEDIATION SITE CONDITIONS (ZONE 1 AND 2)
CONTAMINANT MASS CALCULATIONS
VMP REMEDIATION EXTENT
LEND LEASE

		% Reduction Achieved	CoPC	Ave conc (mg/kg)	Estimated volume (m3)	Weight (T)	Weight (kg)	Total contaminant mass (mg/kg)	Total contaminant mass (kg)
Zone 1 - eastern fill materials after contaminant mass reduction	Zone 1 - Block 4 fill materials to be remediated	100%	Naphthalene	0	43,000	86,000	86,000,000	0	0
		100%	TPH C10 - C14	0	43,000	86,000	86,000,000	0	0
	Zone 1 - Block 5 fill materials to be remediated	90%	Naphthalene	6.4	23,200	46,400	46,400,000	296,960,000	297
		90%	TPH C10 - C14	26.2	23,200	46,400	46,400,000	1,215,680,000	1,216
	Zone 1 - Hickson Road fill materials to be remediated	90%	Naphthalene	119.0	15,800	31,600	31,600,000	3,760,400,000	3,760
		90%	TPH C10 - C14	595.6	15,800	31,600	31,600,000	18,820,960,000	18,821
		Total	Naphthalene	-	82,000	164,000	164,000,000	4,057,360,000	4,057
Zone 2 - western fill materials		Total	TPH C10 - C14	-	82,000	164,000	164,000,000	20,036,640,000	20,037
			Naphthalene	1	62,800	125,600	125,600,000	102,992,000	103
			TPH C10 - C14	27	62,800	125,600	125,600,000	3,391,200,000	3,391

TABLE F3 - SUMMARY OF CURRENT ZONE 1 TO 4 CONDITIONS
CONTAMINANT MASS CALCULATIONS
VMP REMEDIATION EXTENT
LEND LEASE

		CoPC	Ave conc (mg/kg)	Estimated volume (m3)	Weight (T)	Weight (kg)	Total contaminant mass (mg/kg)	Total contaminant mass (kg)	% of Total mass (Zone 1 to 4)
Zone 1 - Onsite within Remediation Area	Zone 1 - Block 4 fill materials to be remediated	Naphthalene	809	43,000	86,000	86,000,000	69,574,000,000	69,574	53.5%
		TPH C10 - C14	2,621	43,000	86,000	86,000,000	225,406,000,000	225,406	42.6%
	Zone 1 - Block 5 fill materials to be remediated	Naphthalene	64	23,200	46,400	46,400,000	2,969,600,000	2,970	2.3%
		TPH C10 - C14	262	23,200	46,400	46,400,000	12,156,800,000	12,157	2.3%
	Zone 1 - Hickson Road fill materials to be remediated	Naphthalene	1,190	15,800	31,600	31,600,000	37,604,000,000	37,604	28.9%
		TPH C10 - C14	5,956	15,800	31,600	31,600,000	188,209,600,000	188,210	35.6%
	Totals	Naphthalene	801	82,000	164,000	164,000,000	131,364,000,000	110,148	84.8%
	Totals	TPH C10 - C14	3,163	82,000	164,000	164,000,000	518,732,000,000	425,772	80.5%
Zone 2 - Onsite within upper fill outside Remediation Area		Naphthalene	0.8	51,600	103,200	103,200,000	82,560,000	83	0.1%
		TPH C10 - C14	26	51,600	103,200	103,200,000	2,683,200,000	2,683	0.5%
Zone 2 - Onsite within lower fill outside Remediation Area		Naphthalene	9.3	11,200	22,400	22,400,000	208,320,000	208	0.2%
		TPH C10 - C14	79	11,200	22,400	22,400,000	1,769,600,000	1,770	0.3%
Zone 2 - Onsite within marine sediments outside Remediation Area		Naphthalene	120	10,120	20,240	20,240,000	2,428,800,000	2,429	1.9%
		TPH C10 - C14	394	10,120	20,240	20,240,000	7,974,560,000	7,975	1.5%
Zone 3 - Offsite upper fill within 20m of Declaration Area		Naphthalene	5.5	53,920	107,840	107,840,000	593,120,000	593	0.5%
		TPH C10 - C14	61	53,920	107,840	107,840,000	6,578,240,000	6,578	1.2%
Zone 3 - Offsite lower fill within 20m of Declaration Area		Naphthalene	41	8,800	17,600	17,600,000	721,600,000	722	0.6%
		TPH C10 - C14	38	8,800	17,600	17,600,000	668,800,000	669	0.1%
Zone 3 - Offsite marine sediments within 20m of Declaration Area		Naphthalene	474	9,960	19,920	19,920,000	9,442,080,000	9,442	7.3%
		TPH C10 - C14	2,502	9,960	19,920	19,920,000	49,839,840,000	49,840	9.4%
Zone 4 - Offsite upper fill outside 20m of Declaration Area		Naphthalene	1.2	309,920	619,840	619,840,000	743,808,000	744	0.6%
		TPH C10 - C14	30	309,920	619,840	619,840,000	18,595,200,000	18,595	3.5%
Zone 4 - Offsite lower fill outside 20m of Declaration Area		Naphthalene	22	50,400	100,800	100,800,000	2,217,600,000	2,218	1.7%
		TPH C10 - C14	25	50,400	100,800	100,800,000	2,520,000,000	2,520	0.5%
Zone 4 - Offsite marine sediments outside 20m of Declaration Area		Naphthalene	17.0	99,400	198,800	198,800,000	3,379,600,000	3,380	2.6%
		TPH C10 - C14	64.0	99,400	198,800	198,800,000	12,723,200,000	12,723	2.4%

Sub-total - Zone 3 & 4 mass within offsite fill materials	Naphthalene	3.3%
	TPH C10 - C14	5.4%
Sub-total - Zone 3 & 4 mass within marine sediments (max 5m	Naphthalene	9.9%
	TPH C10 - C14	11.8%

Total Zone 1 to 4 mass (kg):	Naphthalene	129,965
In fill and marine sediments	TPH C10 - C14	529,125

Total Zone 1 to 4 mass (kg):	Naphthalene	114,715
In fill material only	TPH C10 - C14	458,587

Current mass in Zone 2 to 4 marine sediments	Naphthalene	15,250	11.7%
	TPH C10 - C14	70,538	13.3%

TABLE F4 - SUMMARY OF ZONE 1 TO 4 CONDITIONS (POST-REMEDIATION)
CONTAMINANT MASS CALCULATIONS
VMP REMEDIATION EXTENT
LEND LEASE

		CoPC	Ave conc (mg/kg)	Estimated volume (m3)	Weight (T)	Weight (kg)	Total contaminant mass (mg/kg)	Total contaminant mass (kg)	% of Total mass (Zone 1 to 4)
Zone 1 - Onsite within Remediation Area	Zone 1 - Block 4 fill materials to be remediated	Naphthalene	0	0	0	0	0	0	0.0%
		TPH C10 - C14	0	0	0	0	0	0	0.0%
	Zone 1 - Block 5 fill materials to be remediated	Naphthalene	6.4	23,200	46,400	46,400,000	296,960,000	297	1.2%
		TPH C10 - C14	26.2	23,200	46,400	46,400,000	1,215,680,000	1,216	1.0%
	Zone 1 - Hickson Road fill materials to be remediated	Naphthalene	119.0	15,800	31,600	31,600,000	3,760,400,000	3,760	15.8%
		TPH C10 - C14	595.6	15,800	31,600	31,600,000	18,820,960,000	18,821	15.3%
	Totals	Naphthalene		39,000				4,057	17.0%
	Totals	TPH C10 - C14		39,000				20,037	16.2%
Zone 2 - Onsite within upper fill outside Remediation Area		Naphthalene	0.8	51,600	103,200	103,200,000	82,560,000	83	0.3%
		TPH C10 - C14	26	51,600	103,200	103,200,000	2,683,200,000	2,683	2.2%
Zone 2 - Onsite within lower fill outside Remediation Area		Naphthalene	9.3	11,200	22,400	22,400,000	208,320,000	208	0.9%
		TPH C10 - C14	79	11,200	22,400	22,400,000	1,769,600,000	1,770	1.4%
Zone 2 - Onsite within marine sediments outside Remediation Area		Naphthalene	120	10,120	20,240	20,240,000	2,428,800,000	2,429	10.2%
		TPH C10 - C14	394	10,120	20,240	20,240,000	7,974,560,000	7,975	6.5%
Zone 3 - Offsite upper fill within 20m of Declaration Area		Naphthalene	5.5	53,920	107,840	107,840,000	593,120,000	593	2.5%
		TPH C10 - C14	61	53,920	107,840	107,840,000	6,578,240,000	6,578	5.3%
Zone 3 - Offsite lower fill within 20m of Declaration Area		Naphthalene	41	8,800	17,600	17,600,000	721,600,000	722	3.0%
		TPH C10 - C14	38	8,800	17,600	17,600,000	668,800,000	669	0.5%
Zone 3 - Offsite marine sediments within 20m of Declaration Area		Naphthalene	474	9,960	19,920	19,920,000	9,442,080,000	9,442	39.5%
		TPH C10 - C14	2,502	9,960	19,920	19,920,000	49,839,840,000	49,840	40.4%
Zone 4 - Offsite upper fill outside 20m of Declaration Area		Naphthalene	1.2	309,920	619,840	619,840,000	743,808,000	744	3.1%
		TPH C10 - C14	30	309,920	619,840	619,840,000	18,595,200,000	18,595	15.1%
Zone 4 - Offsite lower fill outside 20m of Declaration Area		Naphthalene	22	50,400	100,800	100,800,000	2,217,600,000	2,218	9.3%
		TPH C10 - C14	25	50,400	100,800	100,800,000	2,520,000,000	2,520	2.0%
Zone 4 - Offsite marine sediments outside 20m of Declaration Area		Naphthalene	17.0	99,400	198,800	198,800,000	3,379,600,000	3,380	14.2%
		TPH C10 - C14	64.0	99,400	198,800	198,800,000	12,723,200,000	12,723	10.3%

Sub-total - Zone 3 & 4 mass within offsite fill materials	Naphthalene	17.9%
	TPH C10 - C14	23.0%
Sub-total - Zone 3 & 4 mass within marine sediments (max 5m	Naphthalene	53.7%
	TPH C10 - C14	50.7%

Total Zone 1 to 4 mass (kg):	Naphthalene	23,875
In fill and marine sediments	TPH C10 - C14	123,389

Total Zone 1 to 4 mass (kg):	Naphthalene	8,624
In fill material only	TPH C10 - C14	52,852

Residual mass remaining in Zone 2 to 4 marine sediments	Naphthalene	15,250	63.9%
	TPH C10 - C14	70,538	57.2%

Appendix G:

ENVIRON Letter “Review of Block 5 and Hickson Road Pilot Test, S-ISCO and SEPR, Barangaroo” dated 13 October 2010