Celtic

Design and Construct Remediation

MERTON STREET DEPOT
MERTON STREET, BANBURY
OXFORDSHIRE

R1456/11/3999

QUANTITATIVE RISK ASSESSMENT REPORT

DRAFT

MARCH 2011

Client:	**Grundon Waste Management Limited**
Report Number:	**R1456/11/3999**
Report Title:	**Merton Street Depot** **Quantitative Risk Assessment Report**
Report Status:	**Draft**
Author(s): **(Signature and Date)**	**C. Mardle** ______________________________
Project Manager: **(Signature and Date)**	**C. Mardle** ______________________________
QA Approved: **(Signature and Date)**	**J. Owens** ______________________________

CONTENTS

TABLES

APPENDICES

1.0 INTRODUCTION

CELTIC Technologies Limited (Celtic) has been commissioned by Grundon Waste Management Limited (Grundon) to undertake detailed quantitative risk assessment on a 2.5 hectare area of land (the 'site') located off Merton Street, Banbury, Oxfordshire.

The site has a long history of industrial use, including a gasworks, a steel fabrication facility, a waste transfer depot & a scrap yard, and is to be redeveloped for residential end-use under the Town and Country Planning Regime.

The brief for the works was to undertake a both human health and groundwater risk assessments to provide the technical basis for developing soils remedial/verification criteria and groundwater monitoring criteria for use in during future remediation works. The risk assessments in their entirety specific to human health and groundwater are included as Appendix A and Appendix B, respectively.

The finalised development plan was not available at the time of report preparation, so the risk assessment considers a generalised residential scheme including high-density apartment dwellings, low-density dwellings with gardens, communal soft & hard landscaping areas and associated parking & access roads.

The proposed remediation works focus on the source areas identified by Celtic in the Outline Remediation Strategy Report, 6140-154**,** with the targets assisting in identifying the extent of contaminated soil, NAPL, perched water and groundwater and for the verification of the remediation works. The remediation works are likely to comprise excavation of underground structures and their contents. Unacceptably contaminated soils are likely to be treated for re-use on site under a materials management plan (MMP) or disposed of to a suitably licensed facility. Any perched water and NAPL discovered during the remediation works are likely to be treated on-site and disposed to foul sewer.

2.0 SITE SUMMARY

2.1 Site Setting

The 2.5 hectare site is situated on the eastern side of Banbury, off Merton Street. The site postcode is OX16 4RN and OS site coordinates are SP 465402. The site location is presented in Appendix A, Drawing D1456/3999/A1, with the current site layout included as Drawing D1456/3999/A2.

The site is surrounded by the following land uses:

- To the north – commercial properties, with residential properties beyond;
- To the west – commercial properties and a railway line;
- To the south – commercial properties and grassland; and
- To the east – commercial properties and grassland, with residential properties and allotments beyond.

The site is located approximately 180 m north of the River Cherwell at its closest point and is within an Environment Agency defined area at risk of flooding from rivers or sea without defences.

2.2 Redeveloped Site Use

2.2.1 Development Layout

The site is to be redeveloped for residential end-use under planning consent.

As the detailed development plan was not available at the time of writing, the risk assessment considers a generalised residential scheme including high-density apartment dwellings, low-density dwellings with gardens, communal soft & hard landscaping areas and associated parking & access roads. It is anticipated that final finished site levels will remain similar to existing site levels.

2.3 Site History Summary

Historic information is provided in the 1999 AEAT report and the 2002 Waterman report. The site has had a long industrial use including a gasworks, a steel fabrication facility, a waste transfer depot and a scrap yard.

Gas works Use 1880s to c. 1950/60s

- The western & southwestern areas of the site were originally developed as a gasworks before 1886, with the gasworks expanding during the 1930s and 1940s.
- Historical plans indicate that the gasworks had a rail link that crossed the central and western areas of the site.

- Although it is unclear when the gasworks was decommissioned, it is likely to have been after 1955.
- Historical maps indicate that prior to 1978 some of the gasworks structures had been removed, although one gasholder and other buildings remained. It is likely that demolition of above-ground gasworks structures was undertaken to ground level and that below-ground structures remain in place.

Post c. 1950/60s: Scrap metal, waste transfer facility & disused/vacant

- The identified site uses in 1999
  - Northern & eastern areas: storage of scrap metal and building materials;
  - Central area: operational factory & offices and hardstanding storage area, with evidence of fly tipping and burning; and
  - Southern area: derelict land covered in vegetation.
- The identified site uses in 2002
  - Northern & eastern area: Grundon waste transfer facility;
  - Central area, southwest boundary: Friswell Blackbushe Steels Limited; and
  - Southern area: - derelict land.
- Pre-redevelopment site uses in 2011
  - Central area: commercial offices; and
  - Remainder of site: disused and vacant.

The previous intrusive investigations identified the following evidence of historical site use:

- Remnants of below ground gasworks structures and foundations in the former gasworks area, including the gasworks house, tar and liquor wells, retort house, CWG plant & purifier and miscellaneous storage tanks.
- A below ground fuel storage tank located in the northern part of the site in the area of the former waste transfer facility.
- Scrap metal and asbestos have been recorded in the made ground in the former scrap metal storage area.

Adjacent off-site land uses generally comprise commercial and open space areas. Beyond the commercial areas to the north and east are residential houses with a hospital to the east. Residential areas associated with the suburbs of Banbury are located beyond the commercial areas to the north and west.

Other off-site developments included two sewage works to the west and a railway engineering shed to the south, developed before the 1920s. An industrial estate was developed to the west before 1978 and a further industrial estate was developed to the east before 1994.

2.4 Geology & Hydrogeology

2.4.1 Published Geology

The BGS Geology of Britain viewer (scale 1:50,000) and BGS on-line database indicate that the site is underlain by bedrock comprising the Jurassic Charmouth Mudstone Formation (formerly the Lower Lias). These strata typically comprise laminated shales and mudstones with sandy limestones and nodular beds in some areas. The Charmouth Mudstone Formation is expected to be at least 200 m thick and is underlain by the Blue Lias.

Although the BGS Geology of Britain viewer (scale 1:50,000) does not identify superficial deposits being directly present beneath the site, the BGS data does indicate the presence of alluvium superficial deposits (clay, silt, sand and gravel) immediately to the south and west of the site that are associated with the River Cherwell floodplain. The presence of alluvium beneath the site (overlying bedrock) has been confirmed by the site investigation works (see following section), despite alluvium being absent on the BGS maps.

2.4.2 Identified Geology and Hydrogeology

The identified general sequence beneath the site is between 0.3 to 3.3 m of made ground, over between 3.3 to 4.3 m of alluvium, over a substantial thickness of the Charmouth Mudstone Formation. The identified site geology is summarised in Table 1.

Table 1 - Summary of Site Geology

Depth mbgl	Geology	Description
Thicknesses generally in the range 0.3 and 3.3 m	Made Ground	Generally comprising clays with brick, demolition rubble. Scrap metal and wooden railway sleepers were identified in the eastern part of the site. An isolated area of asbestos-like material was identified on the eastern boundary.
Thicknesses generally in the range 3.3 to 4.3 m	Alluvium	Typically comprises two distinct types of deposit: silty sandy clay and flint gravel with a clay matrix.
Encountered between 4.3 to 5.8 mbgl	Charmouth Mudstone Formation	Laminated grey clay

Shallow installations recorded groundwater levels within the natural superficial deposits ranging between 1.2 m and 1.7 mbgl. Groundwater monitoring indicates a general southerly groundwater gradient and flow towards the River Cherwell.

Shallow perched water was recorded at the following locations at depths of between 0.4 and 1 mbgl:

- Associated with made ground in the area of the former tar & liquor well, CWG holder, CWG plant and retort house;
- Associated with made ground in the area of the former gas purifier;

- Associated with made ground in the area of the former waste transfer station, in the northern part of the site;
- Associated with made ground in the area of the former scrap yard, on the eastern site boundary; and
- Associated with made ground in the southern part of the site.

2.5 Identified Historical Sources

2.5.1 Historical Primary Sources

The following historical primary sources have been identified based on encountered ground conditions, historical use and identified elevated concentrations of contamination:

- Former tar & liquor well, CWG holder, CWG plant and retort house; and
  - Located in the northwest area of the site
  - Soils contain elevated levels of total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAH) and cyanide
- Former coal gas purifier.
  - Located in the middle southwestern corner of the site
  - Soils contain hydrocarbon and tar seepages

2.5.2 Historical Secondary Sources

The following secondary soil sources have been identified based on encountered ground conditions and identified elevated concentrations of contamination:

- Soil hotspots in the northeastern, central and eastern parts of the site; and
  - Located in the area of the former waste transfer station and scrap yard
  - Soils contain elevated levels of PAHs
- Soil hotspots in the southern part of the site.
  - Former historical use unknown
  - Soils contain elevated levels of PAHs

The following secondary perched water and groundwater sources have been identified based on elevated concentrations of contamination:

- Associated with the former tar & liquor well, CWG holder, CWG plant and retort house;
  - Located in the northwest area of the site
  - Perched water & groundwater contain elevated levels of TPH, PAH, BTEX and phenol
- Associated with the former scrap yard;
  - Located in the central and eastern part of the site

- Groundwater contains elevated levels of TPH, PAH, BTEX and phenol as isolated occurrences

- Associated with the former waste transfer station; and
  - Located in the northern part of the site
  - Groundwater contains elevated levels of TPH, BTEX, phenol and organic solvents (including chlorinated solvents) as isolated occurrences
- An area in the southern part of the site.
  - Former historical use unknown
  - Groundwater contains elevated levels of PAH and phenol as isolated occurrences

2.5.3 Evidence of NAPL Sources

Indications of LNAPL (light non-aqueous phase liquid) were identified by the previous intrusive investigations (AEAT report indicates measurable thicknesses of NAPL and sheens on groundwater) in the following areas:

- The former tar & liquor well, CWG holder, CWG plant and retort house located in the northwest area of the site; however, no NAPL thicknesses were provided in the report; and
- The former coal gas purifier located in the west central area of the site; however, no NAPL thicknesses were provided in the report.

The presence of DNAPL (dense non-aqueous phase liquid) has not been identified on the site.

The following additional lines of evidence are available for the locations where traces (sheens on groundwater) and measureable LNAPL may be present:

Groundwater

- AEAT TP1 located in the area of the former tar & liquor well, CWG holder, CWG plant and retort house: elevated levels of PAHs in soils. Indications of LNAPL are consistent with site data;
- AEAT TP2 located in the area of the former tar & liquor well, CWG holder, CWG plant and retort house: elevated levels of TPH and PAHs in soils. Indications of LNAPL are consistent with site data;
- AEAT TP6 located in the area of the former tar & liquor well, CWG holder, CWG plant and retort house: elevated levels of PAHs in soils. Indications of LNAPL are consistent with site data;
- AEAT TP18 located in the area of the Grundon waste transfer depot in the northern part of the site: elevated levels of PAHs in soils and BTEX in groundwater. Indications of LNAPL are consistent with site data;

- AEAT TPs 27 & 27A located in the area of the former tar & liquor well, CWG holder, CWG plant and retort house: elevated levels of PAHs in soils. Indications of LNAPL are consistent with site data; and
- WE WS9 located in the southwest corner of the former gasworks site, in the area of the former coal gas purifier: no analytical data.

Based on the available lines of evidence and the expected remediation measures that will be targeting source areas, it is not expected that significant residual LNAPL will remain at the site. On this basis, the risk assessment will consider any trace residual LNAPL to be part of the soil source term.

2.6 Potential Post Development Sources

The generated human health and groundwater modelling outputs will provide the technical basis for developing soils remedial/verification criteria and groundwater monitoring criteria for the following purposes:

- Delineation of the extent of impacted soils requiring treatment;
- Verification of excavations;
- Verification of the effectiveness of treatment;
- Establishment of the suitability of treated materials for re-use on site;
- To provide the technical basis for reuse targets adopted in the MMP; and
- To provide groundwater monitoring criteria.

Solis and groundwater remediation verification criteria will be proposed following an additional phase of targeted site investigation works, the justification and outline scope for which will be provided later in this document.

3.0 HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment is presented in its entirety as Appendix B, with this section of the report providing a summary of the main findings.

3.1 Depth Dependant Sources

Following the identification of potential contamination sources at the site during previous site investigations at concentrations that may pose of potential risk to human health, the following depth profiles were considered in assessing the potential risk to future site users following redevelopment of the site for residential use:

- Softstanding & garden cover layer: the cover layer in these soft areas will comprise verified imported material or verified site won materials reused under the site materials management plan (MMP). The cover layer will be at least 0.6 m thick and no treated materials will be used in the cover layer. The specification and verification of the cover layer will be undertaken separately and materials in the cover layer are not considered as a source by the risk assessment.
- Transition zone: this depth profile is expected to extend to a depth of 1.5 m below final finished site levels (FFL). The transition zone may comprise in-situ soils, verified imported soils/materials, site-won soils reused under the MMP and treated materials reused under the MMP.
- Deep soils: this depth profile is present below the transition zone, i.e. at depths greater than 1.5 mbgl below FFL. The deep soil zone may comprise in-situ soils proven to not require treatment, verified imported soils/materials, site won soils reused under the MMP and treated materials reused under the MMP.

The selected health protective targets for the deep soils (>1.5 mbgl) may also be used to determine the vertical/lateral extent of deeper excavations and for the verification of the sides/base of deeper final excavations.

Boundary zones have also been considered to address the risks associated with potential lateral migration of VOC vapours onto adjacent land. Soils and groundwater in these zones are considered to represent potential sources for VOC vapours that could migrate to off-site receptors and as such, the selected health protective targets used in these areas should also be protective of these potential off-site receptors.

The depth dependant sources and boundary zones are illustrated in Figure A of Appendix B.

3.2 Qualitative Risk Assessment and Conceptual Model

The qualitative source-pathways-receptor risk assessment identified the following substances of concern:

- TPH, BTEX & MTBE;
- 16 PAHs;
- Phenols;
- Arsenic, cadmium, chromium, copper, lead, inorganic mercury, vanadium, zinc;
- Free cyanide (as easily liberatable cyanide) and total cyanide; and
- *Residual LNAPL (which will be treated as part of the soil source term).*

The conceptual model illustrating the source-pathway-receptor linkage for these contaminants is included as Figure A of Appendix B.

Potential risks to human health have been identified for on-site users following residential redevelopment due to the presence of VOC vapours in outdoor environments. A similar risk has been identified with respect to off-site human health receptors, although this potential risk is present in both indoor and outdoor environments, assuming the absence of vapour protection in the existing off-site commercial buildings.

Following the identification of this potential risk, quantitative risk assessment has been undertaken in order to fully quantify this risk, and aid in the generation of remedial targets for the protection of human health.

3.3 Detailed Quantitative Risk Assessment

The outputs of the modelling undertaken indicate the level of contaminants allowable to be protective of human health, and therefore may be considered as human health based remedial targets for those soils and waters. However, the requirement to also be protective of controlled waters means that these outputs are not proposed remedial targets in themselves. Proposed remedial targets will be generated based on the modelling outputs of the human health and groundwater risk assessments, pragmatism and professional experience, with these proposed remedial targets then presented to the regulatory authorities for approval. However in view of the existing data gaps identified, the generation of proposed remedial targets will be undertaken at a later date once these data gaps have been filled.

The model outputs can however be used as in indication as to where remedial measures will be required. It should be born in mind that the proposed remedial targets may be lower that the model outputs for aesthetic reasons, and therefore the extent of remediation required may be greater than the model outputs indicate. Model outputs for the identified depth dependant sources and boundary zones for soils and groundwaters are summarised in the following tables.

Table 2 - Summary of Human Health Model Outputs: Soils (mg/kg)

Substance	Residential Indoor air Transition Zone	Residential Indoor air Deep Soils (>1.5mbgl)	Residential Outdoor air Transition Zone	Residential Outdoor air Deep Soils (>1.5mbgl)	Commercial Indoor air Boundary Zone	Commercial Outdoor air Boundary Zone
TPH Aliphatics C5-C6	55	124	9,170	22,900	9,210	>100,000
TPH Aliphatics C6-C8	130	300	22,400	55,900	22,500	>100,000
TPH Aliphatics C8-C10	36	79	5,870	14,700	5,840	>100,000
TPH Aliphatics C10-C12	170	390	29,100	72,700	28,900	>100,000
TPH Aliphatics C12-C16	1,480	3,280	>100,000	>100,000	>100,000	>100,000
TPH Aromatics C5-C7	310	715	54,200	>100,000	41,700	>100,000
TPH Aromatics C7-C8	720	1,700	>100,000	>100,000	94,800	>100,000
TPH Aromatics C8-C10	45	100	7,540	18,900	9,780	>100,000
TPH Aromatics C10-C12	250	555	41,100	>100,000	53,400	>100,000
TPH Aromatics C12-C16	2,780	6,110	>100,000	>100,000	>100,000	>100,000
TPH Aromatics C16-C21	53,400	>100,000	>100,000	>100,000	>100,000	>100,000
Benzene	0.3	0.7	55	137	40	1,400
Toluene	720	1,700	>100,000	>100,000	94,800	>100,000
Ethylbenzene	190	460	36,300	90,800	25,100	>100,000
Xylenes	60	146	11,400	28,600	8,650	>100,000
MTBE	85	198	>100,000	>100,000	11,100	>100,000
Phenols	990	1,060	97,000	>100,000	>100,000	>100,000
Acenaphthene	4,110	9,280	>100,000	>100,000	>100,000	>100,000
Acenaphthylene	3,950	8,650	>100,000	>100,000	>100,000	>100,000
Benzo-a-anthracene	12	16	5,830	14,600	2,290	>100,000
Fluorene	5,310	11,400	>100,000	>100,000	>100,000	>100,000
Naphthalene	2	4	3,520	8,800	270	>100,000

Table 3 - Summary of Human Health Model Outputs: Groundwater (mg/l)

Substance	Residential on-site		Commercial off-site	
	Indoor air Groundwater	Outdoor air Groundwater	Indoor air Boundary Zone Groundwater	Outdoor air Boundary Zone Groundwater
TPH Aliphatics C5-C6	4	>10,000	510	>10,000
TPH Aliphatics C6-C8	3	7,920	390	>10,000
TPH Aliphatics C8-C10	0.1	300	15	9,450
TPH Aliphatics C10-C12	0.09	190	9	6,090
TPH Aliphatics C12-C16	0.03	70	3	2,290
TPH Aromatics C5-C7	300	>10,000	>10,000	>10,000
TPH Aromatics C7-C8	330	>10,000	>10,000	>10,000
TPH Aromatics C8-C10	3	6,880	440	>10,000
TPH Aromatics C10-C12	9	>10,000	1,340	>10,000
TPH Aromatics C12-C16	30	>10,000	4,610	>10,000
TPH Aromatics C16-C21	90	>10,000	>10,000	>10,000
Benzene	0.3	650	27	>10,000
Toluene	339	>10,000	>10,000	>10,000
Ethylbenzene	40	>10,000	4,360	>10,000
Xylenes	15	>10,000	1,400	>10,000
MTBE	760	>10,000	>10,000	>10,000
Phenols	1,340	>10,000	>10,000	>10,000
Acenaphthene	480	>10,000	>10,000	>10,000
Acenaphthylene	560	>10,000	>10,000	>10,000
Benzo[a]anthracene	0.03	18	5	470
Fluorene	470	>10,000	>10,000	>10,000
Naphthalene	1	2,810	150	>10,000

3.4 Comparison to Measured Conditions

In the absence of detailed TPH analysis only a partial comparison of the existing site investigation data can be made against the model outputs. In order to identify potential areas of the site where remediation may be required, the most conservative model outputs have been compared to the data that is currently available.

Model outputs generated for the residual indoor air transition zone have been tentatively compared to existing soils data, with a number of locations within and adjacent to the more northerly area of the former gasworks showing soil concentrations in excess of these model outputs. Additionally, the extreme northern area of the former gasworks land shows a greater degree of contaminant loading and to a greater depth, as indicated by values of BTEX contaminants far in excess of the majority of model outputs.

The extent of remedial works required suggested by the generation of these model outputs is consistent with the Proposed Remediation Areas including in our previous Outline Remediation Strategy Report (ref. 6140-154).

Model outputs generated to be protective of residual indoor air have been tentatively compared to existing groundwater data. Groundwater samples taken from trial pits indicate a widespread groundwater issue in this areas, however grab samples from trial pits taken immediately after the disturbance of the ground are unlikely to be reflective of true groundwater concentrations at the site. Concentrations at monitoring wells installed across the wider site area show exceedances for predominantly benzene in several locations, however the requirement for groundwater treatment in order to be protective of human health should be reviewed on completion of additional investigative works.

4.0 GROUNDWATER RISK ASSESSMENT

The groundwater risk assessment is presented in its entirety as Appendix C, with this section of the report providing a summary of the main findings.

4.1 Potential Contaminants of Concern

The main contaminants of concern are considered to be elevated concentrations of some organic compounds, in particular PAHs, associated with the former gas works usage. However, for the present study a wider range has been considered for completeness as follows:

- Metals
- BTEX Compounds
- Other TPH Fractions
- PAH Compounds
- Phenols
- Cyanide and Ammonia

Higher recorded groundwater contaminant concentrations were generally observed in the northern and central site areas. The following PAH compounds have been reported at concentrations that are significantly above their respective solubilities:

- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)flouranthene
- Benzo(k)flouranthene
- Benzo(ghi)perylene
- Chrysene
- Dibenzo(ah-ac)anthracene
- Indeno(123-cd)pyrene

This suggests that the test samples have been compromised by the presence of non-aqueous phase liquids and so the measured concentrations are not reflective of the true dissolved phase concentrations. However, this data can be used to identify where non-aqueous phase liquids are most likely to be identified and so can be used in the development of the remedial strategy where removal of free product as a residual source term would be recommended.

4.2 Development of the Extended Conceptual Model

An understanding of the pattern of groundwater flow beneath the site and between the site and the discharge points is important in the assessment of risks associated with the groundwater pathway. Although estimates may be made based on hydraulic gradient and estimated hydraulic conductivity of the site subsoils, modelling of the catchment area as a whole using a ‘water balance’ approach as detailed in Appendix C can allow a higher degree of confidence when estimating flow volumes. Modelling the catchment areas as a whole reduces the uncertainties concerning model boundary conditions.

A plan view numerical model of flow within the local catchment area has been developed, with measured surface water levels suggesting that they are reasonably consistent with groundwater levels within site area. Therefore local groundwater flow conditions may be adequately modelled by a consideration of conditions within the local surface water catchment area. Potential infiltration rates for the catchment area have also been considered.

Particle tracking analysis has been used to derive predicted flow paths from various areas of the site associated with pure advective transport. The results of this suggest that eventual discharge of groundwater emanating from the site areas would be to the River Cherwell. Based on the flow paths and absence of significant groundwater concentrations in the south-east of the site, potentially contaminated groundwater from the site area is not likely to discharge to the small stream to the east.

Groundwater below the site is considered to be a potential receptor due to the presence of the Terrace Gravel below the site. Geological mapping indicates this strata to be absent, however site investigations have proven its presence. The site does not lie within any groundwater source protection zones and there are no licensed groundwater abstractions within influencing distance. The surface water system, in particular the River Cherwell, is also considered a potential receptor should any significant sources of contamination be present on site.

Given the current land use between the site and the River Cherwell and the proximity of the site to the river, it is highly unlikely that there would be the development of any groundwater abstraction downstream of the site in the future, certainly for potable purposes. Therefore, the critical controlled water receptor should strictly be considered to be the River Cherwell at more than 200 m from the site. Nevertheless a compliance point 50 m downstream from the site within the Secondary Aquifer will also be considered to allow protection of the River Cherwell and reasonable protection of the shallow Secondary Aquifer.

4.3 Detailed Quantitative Risk Assessment

The outputs of the modelling undertaken indicate the level of contaminants allowable to be protective of the identified controlled waters receptors, and therefore may be considered as groundwater remedial targets for soils, leachates and waters. However, if groundwater remediation targets are to be proposed, the requirement to also be protective of human health means that the following outputs would not constitute proposed remedial targets in themselves.

The model outputs can however be used as in indication of whether remedial measures will be required. Derived model outputs are summarised in the following tables. For those contaminants where a potential risk as identified, but the model output exceeds the solubility of that compound for soils, pore water and groundwater, these have been excluded from the following tables, which are presented in full in Appendix C.

Table 4 - Summary of Groundwater Model Outputs: 50m to Compliance

Substance	RTM Remedial Target Concentrations		
	Level 3 Soil (mg/kg)	Level 3 Pore Water (mg/l)	Level 3 Groundwater (mg/l)
Benzene	0.528	0.605	0.296
Toluene	110	49.3	24.1
m-Xylene	ES	ES	176
o-Xylene	ES	ES	106
p-Xylene	ES	ES	125
Naphthalene	70.9	10.7	5.24
Acenaphthalene	3.87	0.153	0.0748
Acenaphthene	ES	ES	2
Phenol	4.96	10.9	5.35
TPH Aliphatic C5-C6	ES	ES	22.9
TPH Aromatic C8-C10	473	29.4	14.4
TPH Aromatic C10-C12	109	4.33	2.12
Arsenic	1,240	0.297	0.145
Cadmium	0.807	0.00148	0.000724
Copper	741	0.166	0.0813
Chromium	853	0.119	0.0581
Lead	392	0.0428	0.0209
Inorganic Mercury	0.127	0.000296	0.000145
Nickel	670	0.119	0.0581
Selenium	2.97	0.0592	0.029
Zinc	8,700	0.744	0.364
Water Soluble Boron	120	11.8	5.79
Easily Lib. Cyanide	6,840	339	166
Total Cyanide	3.61×10^{17}	2.4×10^{15}	1.18×10^{15}
Ammonia	24.6	30.1	14.7

ES - Target exceeds solubility

Table 5 - Summary of Groundwater Model Outputs: 200m to Compliance

Substance	RTM Remedial Target Concentrations		
	Level 3 Soil (mg/kg)	Level 3 Pore Water (mg/l)	Level 3 Groundwater (mg/l)
Benzene	6.02	6.9	3.38
Acenaphthalene	45.5	1.8	0.881
Phenol	317	699	342
Arsenic	2,480	0.591	0.289
Cadmium	1.61	0.00294	0.00144
Copper	1,480	0.331	0.162
Chromium	1,700	0.237	0.116
Lead	782	0.0854	0.0418
Inorganic Mercury	0.253	0.000589	0.000288
Nickel	1330	0.237	0.116
Selenium	5.91	0.118	0.0576
Zinc	17,400	1.49	0.727
Water Soluble Boron	239	23.5	11.5
Easily Lib. Cyanide	5,760,000	285,000	140,000
Total Cyanide	1.5×10^{21}	1.02×10^{19}	5×10^{18}
Ammonia	249	306	150

ES - Target exceeds solubility

For full details and justification of the adopted parameters for groundwater risk modelling, please refer to Appendix C.

4.4 Comparison to Measured Conditions

With regard to the more stringent Case 1 model outputs, and leaving aside ammonia which is generally elevated throughout the site, only the following substances show any exceedences with respect to derived remedial targets using January 1999 groundwater monitoring data:

- Nickel
- Selenium
- Benzene
- Acenaphthalene

In each case, the area of exceedence is very small in relation to the assumed source area (200 m by 200 m) therefore it is not considered that these local exceedences would merit a site groundwater remediation scheme, provided any residual soil sources that are present above the water table are removed.

Substances that are present in measured groundwater concentrations above their solubility can be used as an indication of the location and potential extent of potential free product. These areas are considered a potential ongoing source of contamination due to the presence, or inferred presence, or free product and are located largely in the northern site area, with some also recorded in more central areas. As such, it would be prudent to include a degree of recovery of free product from these areas in any remedial strategy that is developed for the site.

5.0 DATA GAPS

While reasonably extensive site investigations have been previously been carried out at the site, there remain a few gaps in the currently available data with respect to the production of a detailed remedial strategy under current best practise. This section outlines additional work required to fill these gaps, however a scope for supplementary site investigation works and the associated costs can be presented once a development plan has been provided.

5.1 Investigative Locations

The site has good coverage with respect to trail pits and boreholes, particularly in the more contaminated areas of the former gasworks. However, current downgradient boreholes which have been installed as monitoring wells could be supplemented in order to provide a more accurate representation of groundwater concentrations as water is leaving the site. Monitoring well locations would be recommended along the southern and western site boundary.

Supplementary site investigation locations would also allow for the recovery of additional soils and groundwater samples, as discussed below, and allow further refinement of the areas identified as requiring remediation.

In addition to the above, very high levels of PAHs have been recorded in approximately half of the groundwater monitoring locations above the solubility of the individual PAH. This is likely to be attributed to the presence of non-aqueous phase liquids in the soils through which the wells are screened. The installation of a small number of additional wells that effectively isolate any non-aqueous phase from the response zone of the well would provide a better reflection of actual groundwater quality and a more reliable impression of the actual downgradient impact to groundwater.

5.2 Soils Analysis

The most recent soil sampling at the site was undertaken in 2002, and although the analytical suite was expanded from the previous phase of site investigation there are still a number of analytes that would be included as best practice if the works were to be completed more recently. While an increase in the list of analytes would allow further delineation and characterisation of the contamination, which would be a benefit in designing and implementing the most appropriate remedial strategy, the data would also be required to complete the risk assessment process and aid in the proposition of remedial targets to the regulators. Additional analytes would include:

- **Speciated Total Petroleum Hydrocarbons (with carbon banding and aliphatic / aromatic split.** This would be required to prove compliance with the proposed human health targets, confirm the absence of a widespread groundwater contamination issue and also aid in characterising the soils for treatment and allow appropriate design of the treatment.

- **Methyl Tertiary Butyl Ether.** This would be required to prove compliance with the proposed human health targets and confirm the absence of a widespread groundwater contamination issue.
- **Soil Organic Matter.** To further support the input parameters of the groundwater risk assessment the site-specific properties of the sand and gravel aquifer should be verified as far as is reasonably practical. This data may also aid in removing a degree of conservatism from the groundwater model, and therefore may have a notable impact on the proposed remedial targets.

5.3 Groundwater Monitoring and Analysis

More recent analytical results and on-site groundwater monitoring would be required to support previous site investigation groundwater data. While it is unlikely that the extent of the impact to groundwater and the groundwater regime itself will have changed significantly since the last site investigation, the data gained should be in support of the proposed remedial strategy and the conclusion that there is not a widespread groundwater issue across the site. Additional data with respect to groundwater concentrations would be used to strengthen the argument that there is no requirement for groundwater remediation at the site with the exception of localised removal of free product where identified.

Monitoring could include sampling the existing wells, developing and sampling addition wells as described above and expanding the analytical suite to include those analytes which were previously excluded from the list, such as speciated TPH and MTBE.

6.0 PROPOSED OUTLINE REMEDIAL STRATEGY

The risk assessments have indicated that the contamination identified at the site to date presents a potential risk to both soils and groundwater. Risks to human health, notwithstanding the requirements of a clean cover system over the site, are presented by organic contamination and in particular the more volatile components of the identified organic contamination at the site.

The previously issued remediation strategy document is still considered the most economical to achieve the remediation criteria with respect to cost. Cost savings would be realised on this strategy with the following additional data (as previously presented):

- Further refinement of hotspot sizes in areas shown in the 'proposed remediation areas' drawing
- Confirmation of dissolved phase impact in groundwater
- Final development layout and levels

6.1 Source Area Treatment

On-site treatment using bio-remediation technology is proposed as the most suitable remedial option for the site, with this technology capable of reducing the observed contaminant soil concentrations to within acceptable levels for the site.

Due to the tarry nature of the contamination observed in some areas, specifically that of the former gas production areas of the gasworks, a small volume of untreatable material may be present on site which can be managed through contingency measures such as off site disposal or stabilisation. This will be confirmed with some additional localised sampling on site.

Treated materials will be verified against remedial targets and re-used at appropriate depths dependant on their compliance with the derived depth dependant targets. A site Materials Management Plan will log the source, quantity, location, area and depth of re-use against the proposed redevelopment layout.

The overall redevelopment strategy for the site is likely to need to consider including measures typically employed in brownfield redevelopment such as certified clean cover in gardens and landscaped areas as well as certified clean service corridors.

Risks to groundwater have been proven to be minor and are not considered to be significant in the context of the site. The only exception to this is ammonia, where elevated concentrations have been seen at several locations across the site. While risks to groundwater are generally minimal, it is not deemed necessary to implement a strict groundwater treatment system at the site. The proposed bio-remediation technology will result in a reduction in ammonia present in the soil as biological processes remove the ammoniacal nitrogen, particularly when combined with pH elevation at the end of treatment. The potential risk presented by dissolved ammonia concentrations in groundwater will decrease over time on completion of the above remediation due to the removal of ongoing ammonia sources in the soils.

However, a degree of risk remains with respect to human health through generation and migration of volatile vapours from impacted groundwater into future dwellings. Therefore, removal of groundwaters and identified free product during soil remedial works will be included in the remedial strategy in order to reduce the ongoing potential source term (free product) and to further mitigate human health risks through removal of impacted groundwater in excavated areas.

Any removed perched or groundwater will be treated on site and disposed of to foul sewer under an appropriate consent, with recovered non-aqueous phase or free product disposed of off-site under relevant duty of care.

Drawing D1456/3999/A3 in Appendix A illustrates the anticipated areas requiring soil remediation, and those areas where removal of free product and groundwater will be undertaken during soil excavation. The areas requiring treatment will be refined and a detailed remedial strategy developed once proposed remedial targets have been agreed and a development plan has been provided.

6.2 Intervention and Vapour Protection Measures

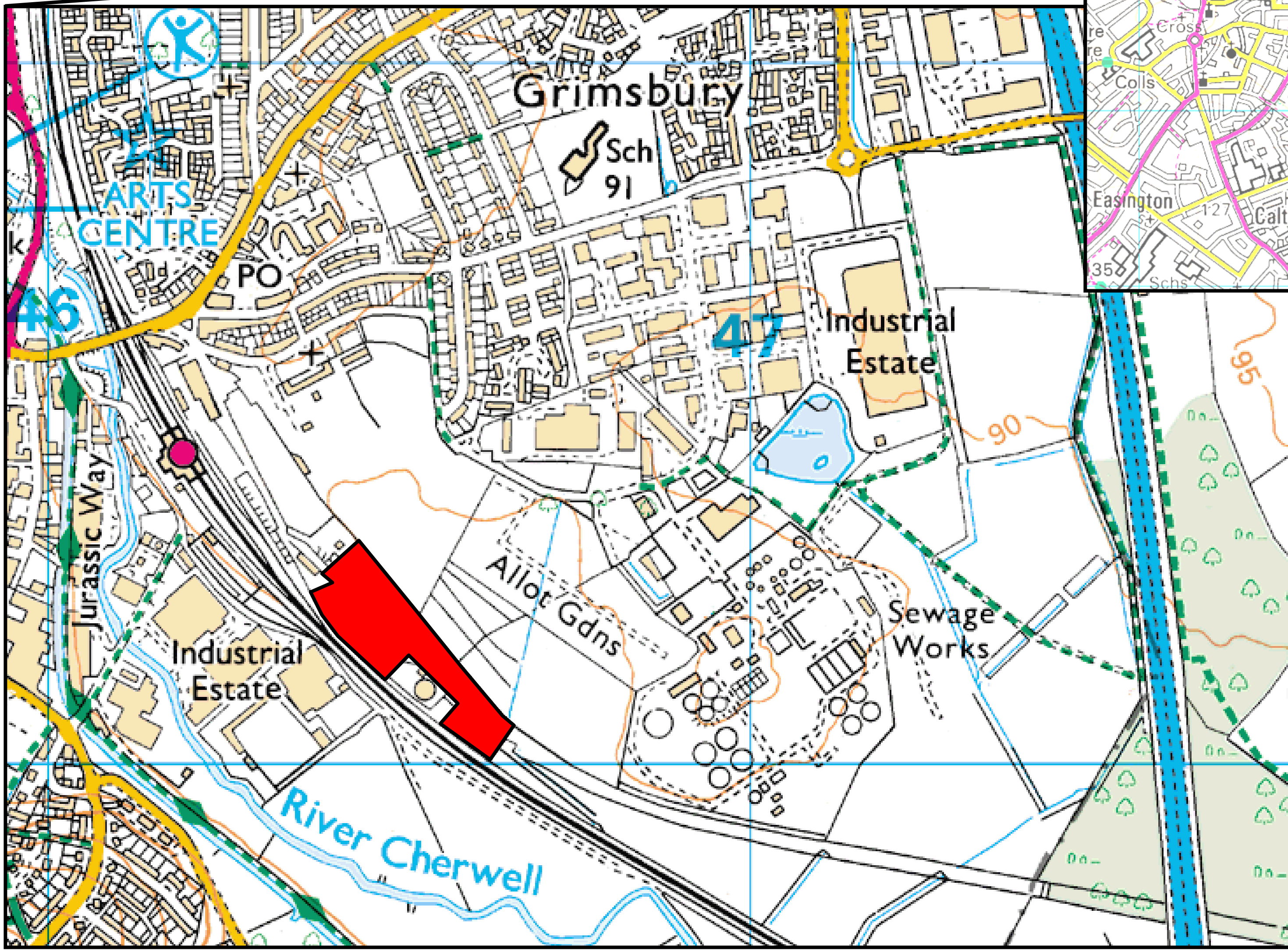
Should the additional investigation works identify areas where mitigation rather than active soil/groundwater remediation is more cost effective some of the measures below could be employed.

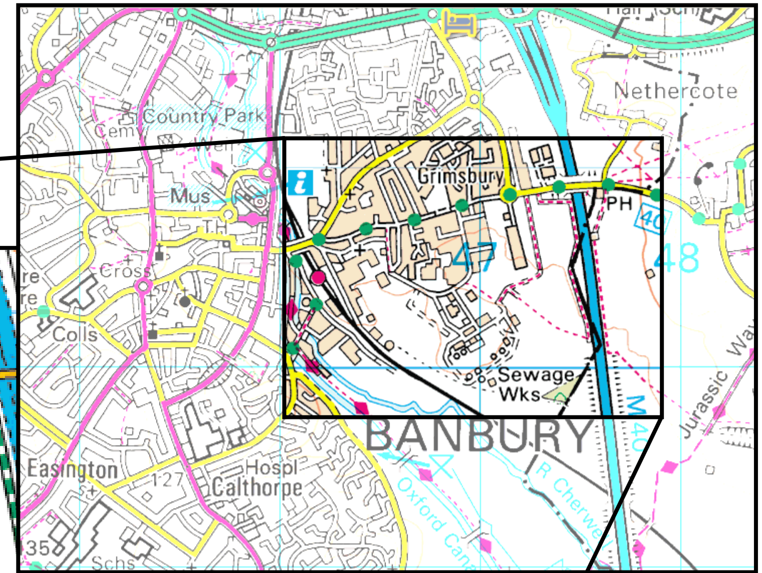
Properties at the site may need to be constructed with vapour protection measures commensurate with the level of risk posed by the substances remaining in soil and groundwater after development. The development layout and proposed remediation scheme will take this into account. There may be some areas where it is cheaper to install mitigation measures rather than undertake active soil/groundwater remediation.

To provide appropriate soil and groundwater modelling outputs to inform the final selection of the final soil & groundwater remedial targets, the human health risk assessment has considered buildings without vapour protection measures to assess the level of reliance being placed on the vapour protection.

Appendix A

Drawings



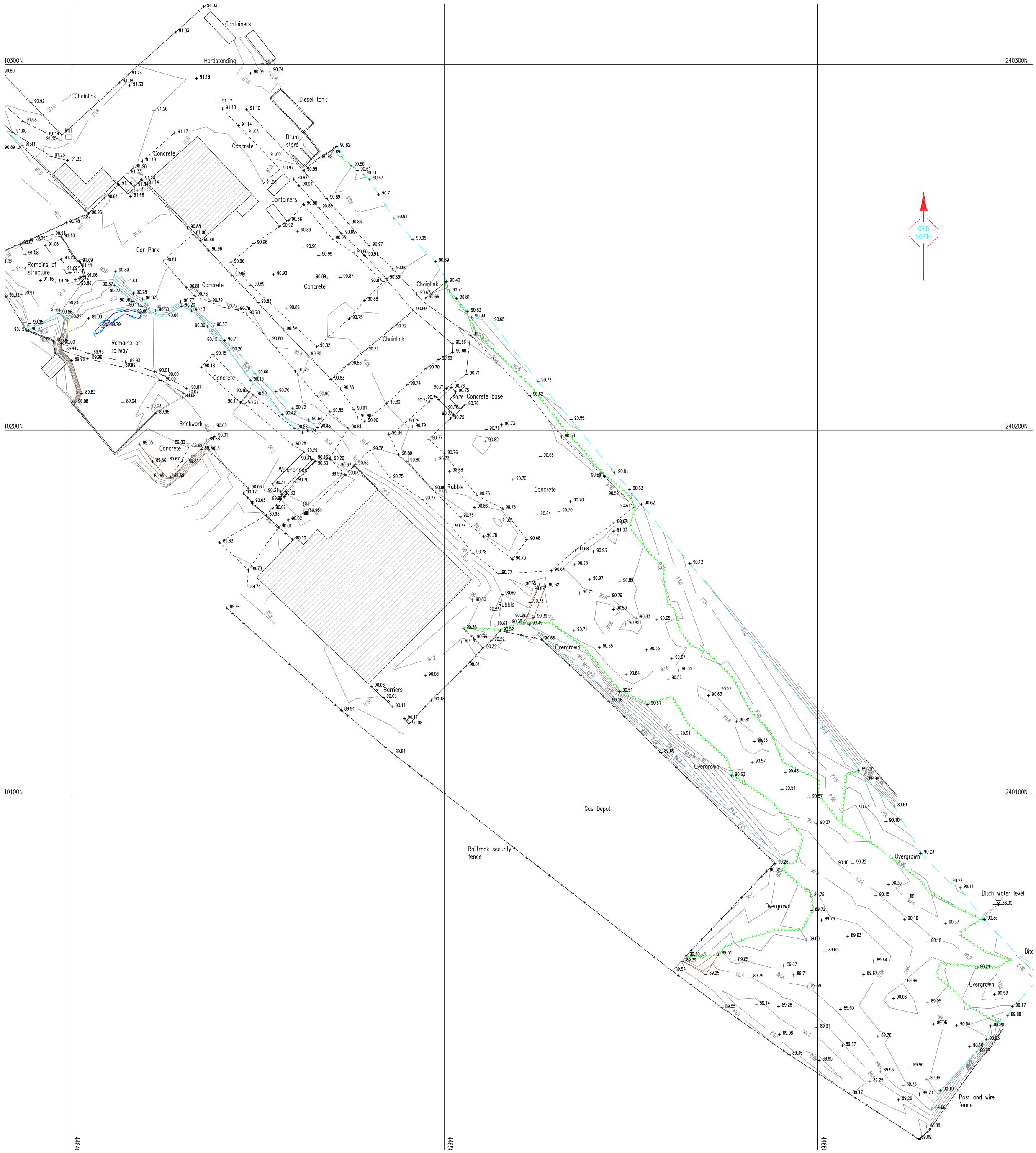


Celtic
Design and Construct Remediation

CELTIC Technologies Ltd
1210 Parkview
Arlington Business Park
Theale
Reading
RG7 4TY

Tel. 0118 916 7340
Fax. 0118 930 2371

Client: Grundon Waste Management Ltd.
Project: Merton Street Depot, Banbury
Drawing ref.: D1456/3999/A2
Title: Site Layout
Scale: NTS
Date Drawn: March 2011



KEY

- Security fence
- Fence
- Contour mAOD (90.00)
- Water level
- Manhole (MH)
- Gully (GU)
- Stop cock?
- Building
- Crest / Toe of batter
- Crest / Toe of ditch
- Crest / Toe of heap
- Haul road
- Wall
- Disused rail line
- Vegetation
- Gate

Celtic
Design and Construct Remediation

CELTIC Technologies Ltd
1210 Parkview
Arlington Business Park
Theale
Reading
RG7 4TY

Tel. 0118 916 7340
Fax. 0118 930 2371

Client: Grundon Waste Management Ltd.

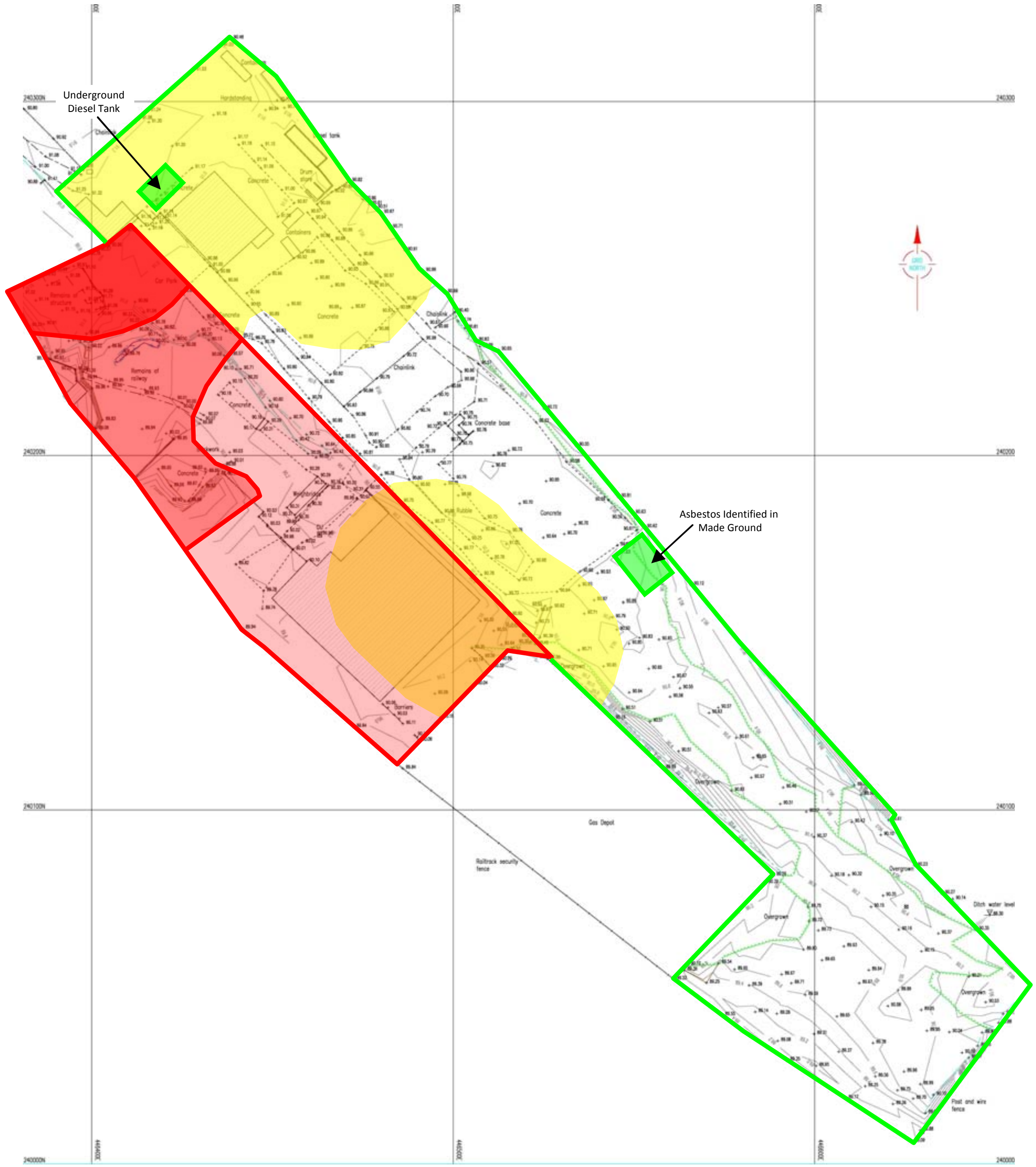
Project: Merton Street Depot, Banbury

Drawing ref.: D1456/3999/A2

Title: Site Layout

Scale: NTS

Date Drawn: March 2011



KEY

- Approximate Boundary of Remaining Land, minimal anticipated volumes for treatment
- Approximate Former Gasworks Boundary
- Proposed Remedial Area, soil treatment with free product and groundwater recovery where encountered in excavations (to depths of up to 5 m bgl)
- Proposed Remedial Area, soil treatment with free product and groundwater recovery where encountered in excavations (to depths of up to 3 m bgl)
- Area of Potential Additional Hotspots, further site investigation required (to depths of 1-2m bgl)
- Area of Potential Free Product Removal, subject to additional groundwater analysis and on-site monitoring

Celtic
Design and Construct Remediation

CELTIC Technologies Ltd
1210 Parkview
Arlington Business Park
Theale
Reading
RG7 4TY

Tel. 0118 916 7340
Fax. 0118 930 2371

Client: Grundon Waste Management Ltd.

Project: Merton Street Depot, Banbury

Drawing ref.: D1456/3999/A3

Title: Proposed Remedial Areas

Scale: NTS

Date Drawn: March 2011

Appendix B

Human Health Risk Assessment

Celtic

Design and Construct Remediation

MERTON STREET DEPOT
MERTON STREET, BANBURY
OXFORDSHIRE

R1456/11/3999

HUMAN HEALTH RISK ASSESSMENT REPORT

DRAFT REV A

MARCH 2011

Client:	**Grundon Waste Management Limited**
Report Number:	**R1456/11/3999**
Report Title:	**Merton Street Depot** **Human Health Risk Assessment Report**
Report Status:	**Draft Rev A**
Author(s): **(Signature and Date)**	**C. Helm** ______________________________
Project Manager: **(Signature and Date)**	**C. Mardle** ______________________________
QA Approved: **(Signature and Date)**	**J. Owens** ______________________________

CONTENTS

TABLES

APPENDICES

1.0 INTRODUCTION

The brief for these risk assessment works was to undertake a human health assessment to provide the technical basis for developing soils remedial/verification criteria and groundwater monitoring criteria for use in the Celtic site remediation works. A separate risk assessment has been prepared that considers risks to controlled waters.

This human health risk assessment report includes a qualitative human health risk assessment, consideration of generic assessment criteria (GACs), quantitative human health risk modelling and selection of health protective risk based soil & groundwater targets.

The risk assessment has been undertaken under the umbrella framework laid out in the CLR-11 Model Procedures for the Management of Land Contamination and R&D66:2008 (guidance for the safe development of housing on land affected by contamination). The qualitative risk assessment is equivalent to a CLR-11 preliminary risk assessment. The quantitative human health modelling is equivalent to a combination of CLR-11 generic and detailed quantitative risk assessments. The selected health protective risk based targets are to be used in conjunction with the results of a controlled waters risk assessment to provide the final remedial and verification targets for the Celtic remediation works.

The human health risk assessment work has been undertaken within the 2009 DEFRA/Agency SR3 CLEA framework and includes consideration of current UK human health generic assessment criteria (GAC). Additional human health guidance for vapour & gas risks has been drawn from CIRIA C682 (The VOCs Handbook), CIRIA C665 (Assessing risks posed by hazardous ground gases to buildings) and the CIEH Ground Gas Handbook. All references are provided in Section 4.0.

1.1 Information Sources

Information about the site, its former uses, ground conditions and ground contamination has been taken from an AEA Technology (AEAT) 1999 Site Investigation Report, a Waterman Environmental (WE) 2002 Interpretative Report and online published sources. The reports and online published sources are referenced in Section 4.0. The investigation information is briefly summarised in the following sections.

1.2 Averaging Areas

The following post development soil averaging areas have been considered by the risk assessment:

- Soils beneath buildings;
- Soils beneath hardstanding (e.g. road, pavements, parking); and
- Soils beneath soft cover areas: gardens and soft landscaping.

1.3 Depth Dependant Sources

Within the averaging areas, the risk assessment has adopted depth profiles to reflect the redeveloped site, the proposed remedial works and the remedial verification process. All depths are relative to final finished levels (FFL).

The post development depth profiles are used in the human health risk modelling to generate depth-dependant health protective targets for soils and groundwater These will be considered with the results of a controlled waters risk assessment to provide the technical basis for developing soils remedial/verification criteria and groundwater monitoring criteria for use in the Celtic site remediation works.

The following depth profiles have been considered:

- Softstanding & garden cover layer: the cover layer in these soft areas will comprise verified imported material or verified site won materials reused under the MMP and the cover layer will be at least 0.6 m thick. No treated materials will be used in the cover layer. The specification and verification of the cover layer will be undertaken separately and materials in the cover layer are not considered as a source by the risk assessment;
- Transition zone: this depth profile is expected to extend to a depth of 1.5 m below FFL. The transition zone may comprise in-situ soils, verified imported soils/materials, site-won soils reused under the MMP and treated materials reused under the MMP; and
- Deep soils: this depth profile is present below the transition zone, i.e. at depths greater than 1.5 mbgl below FFL. The deep soil zone may comprise in-situ soils, verified imported soils/materials, site-won soils reused under the MMP and treated materials reused under the MMP.

The vertical profiles are shown on Drawing Figure A.

The selected health protective targets for the transition zone will generally be highly risk protective and the transition zone has been included to act as a buffer between near surface cover (building, hardstanding and soft cover layer) and soils remaining in-situ. The health protective targets for the transition zone may also be used to determine the vertical/lateral extent of shallow excavations and for the verification of the sides/base of shallow excavations.

The selected health protective targets for the deep soils (>1.5 mbgl) may be used to determine the vertical/lateral extent of deeper excavations and for the verification of the sides/base of deeper final excavations.

1.4 Boundary Zones

The risk assessment also considers sources in site boundary zone (Drawing Figure A in Appendix A) to address the risks associated with potential lateral migration of VOC vapours onto adjacent land. Soils and groundwater in these zones are considered to represent potential sources for VOC vapours that could migrate laterally leading to vapour emission and intrusion risks to off-site receptors.

The technical basis for defining the boundary zones are discussed in Appendix B.

2.0 QUALITATIVE RISK ASSESSMENT

The qualitative source-pathways-receptor risk assessment is presented in Appendix B and considers the following substances of concern:

- TPH, BTEX & MTBE;
- 16 PAHs;
- Phenols;
- Arsenic, cadmium, chromium, copper, lead, inorganic mercury, vanadium, zinc;
- Free cyanide (as easily liberatable cyanide) and total cyanide; and
- *Residual LNAPL will be treated as part of the soil source term.*

The conceptual model drawing is presented on Drawing Figure A.

The following assumptions have been made in the qualitative risk assessment regarding the condition of the site following redevelopment:

- The site could be redeveloped for high-density apartment dwellings, low density dwellings with gardens, communal soft & hard landscaping areas and associated parking & access roads; and
- The site will have hard and soft cover and buildings;
- Localised unacceptably impacted soils will be either treated on-site and re-used or removed from the site;
- Unacceptably impacted perched water and groundwater will be treated and removed; and
- Significant LNAPL sources will be removed.

The following assumptions have been made in the qualitative risk assessment regarding the off-site uses:

- Commercial properties located to the north and west of the site are in close proximity to the site. These commercial properties are assumed not to benefit from vapour protection measures; and
- Commercial properties to the south of the site are located down groundwater gradient from the site. These commercial properties are assumed not to benefit from vapour protection measures.

The identified potentially unacceptable risks, main risk drivers and recommendations are presented in Table 1. The health protective targets are presented in Section 3.0.

Table 1 - Summary of Potentially Unacceptable Risks

Receptor Group	*Receptors*	General Source	Risk Rating	Main Risk Drivers	Recommendation
Human Health **Redeveloped site use** - *Cover layer in soft cover areas* - *Vapour protection in buildings* - *Transition zone*	- Residential site users	Contamination	Low to very Low	- Outdoor VOC vapours from soil sources - Outdoor VOC vapours from water sources	- Calculate organic health protective targets - Consider risks in the Remediation Design
	- Adjacent commercial workers	Contamination	Low	- Indoor VOC vapours from on-site soil & water in the boundary zone - Outdoor VOC vapours from on-site soil & water in the boundary zone - Indoor & outdoor VOC vapours from groundwater migration off-site	- Calculate organic health protective targets - Consider risks in the Remediation Design

Notes: Identified very low risks and low risks considered acceptable for the commercial site use following improvement works.

3.0 HEALTH PROTECTIVE TARGETS

3.1 Recommended Soil and Groundwater Targets

The recommended health protective targets for soil and groundwater, along with the CLEA human health model outputs, are summarised in Table 3 and Table 4 and have been rounded to two or three significant figure as appropriate.

The health protective targets have been selected through consideration of the site setting, the severity/scale of the contamination, risk assessment outputs, experience & expert judgment and remediation practicalities. In many cases, the targets are lower than the risk based modelling outputs to take into account wider site betterment objectives and/or to provide real world realistic/pragmatic values that are not blindly selected from the modelling outputs. This is particularly true for substances where the GACs & the modelling outputs clearly represent high concentrations compared with background/typical concentrations.

3.2 Summary of Human Health Modelling

The risk assessment modelling has been undertaken within the 2009 DEFRA/Agency SR3 CLEA framework using an Excel based CLEA-compliant spreadsheet model. The modelling includes selection of relevant UK human health GAC, a detailed pollutant linkage assessment, selection of health criteria and a conceptual exposure model (CEM) that details the required exposure and fate and transport parameters for each pathway.

The CLEA modelling considers the receptors, sources and pathways (relevant pollutant linkages) summarised in Table 2 and shown on the conceptual model, Drawing Figure A. The CLEA human health model outputs are summarised in Table 3 and Table 4, with the modelling detailed in full in Appendix C.

Table 2 - Pollutant Linkage Summary for CLEA Modelling

Receptors & Sources	On-site Residential	Off-site Commercial
Critical Receptor Modelled	SR3 Residential	SR3 Commercial
Surface soils in soft cover areas	No RPLs	No RPLs
Transition zone and deep soils beneath soft and hard cover areas (including boundary zone)	Outdoor vapour *Separate modelling for transition zone & deep soils not required as model outputs are relatively high*	Outdoor vapour *Lateral VOC Vapour indoor & outdoor*
Transition zone soils beneath buildings (including boundary zone)	Indoor vapour	
Deep soils beneath buildings (including boundary zone)	Indoor vapour	
Groundwater (Including boundary zone)	Indoor vapour Outdoor vapour	Outdoor vapour *Lateral VOC Vapour: indoor & outdoor*
Sensitive Receptor Groups Covered by Critical Receptor	*Residential site users*	*Commercial users of adjacent land*

Notes:
- *Site buildings assumed to have vapour protection*
- *Indoor air included for on-site buildings to assess the level of reliance to be placed on vapour protection*
- *Outdoor air pathway from site soils viable for on-site receptors & off-site receptors*
- *Indoor/outdoor air pathways from lateral VOC vapour migration from soils/groundwater viable for off-site commercial*
- *Lateral migration of VOC vapours only applies to sources in the boundary zone*
- *Vapour pathways only viable for sufficiently volatile/toxic organic substances*

HUMAN HEALTH MODELLING OUTPUT TABLES

Table 3 – Soil Modelling Outputs & Health Protective Targets in mg/kg

Substance	Human Health GAC			Human Health SAC						Health Protective Targets	
	Residential with Plant Uptake	Residential No Plant Uptake	Commercial	Residential Indoor air Transition Zone	Residential Indoor air Deep Soils (>1.5mbgl)	Residential Outdoor air Transition Zone	Residential Outdoor air Deep Soils (>1.5mbgl)	Commercial Indoor air Boundary Zone	Commercial Outdoor air Boundary Zone	Transition Zone	Deeper Soils (>1.5mbgl)
TPH Aliphatics C5-C6	30	30	3,400	55	124	9,170	22,900	9,210	>100,000	TBC	TBC
TPH Aliphatics C6-C8	73	73	8,300	130	300	22,400	55,900	22,500	>100,000	TBC	TBC
TPH Aliphatics C8-C10	19	19	2,100	36	79	5,870	14,700	5,840	>100,000	TBC	TBC
TPH Aliphatics C10-C12	93	93	10,000	170	390	29,100	72,700	28,900	>100,000	TBC	TBC
TPH Aliphatics C12-C16	740	740	61,000	1,480	3,280	>100,000	>100,000	>100,000	>100,000	TBC	TBC
TPH Aromatics C5-C7	65	260	28,000	310	715	54,200	>100,000	41,700	>100,000	TBC	TBC
TPH Aromatics C7-C8	120	600	59,000	720	1,700	>100,000	>100,000	94,800	>100,000	TBC	TBC
TPH Aromatics C8-C10	27	33	3,700	45	100	7,540	18,900	9,780	>100,000	TBC	TBC
TPH Aromatics C10-C12	69	180	17,000	250	555	41,100	>100,000	53,400	>100,000	TBC	TBC
TPH Aromatics C12-C16	140	1,200	36,000	2,780	6,110	>100,000	>100,000	>100,000	>100,000	TBC	TBC
TPH Aromatics C16-C21	250	1,300	28,000	53,400	>100,000	>100,000	>100,000	>100,000	>100,000	TBC	TBC
Benzene	0.08	0.27	28	0.3	0.7	55	137	40	1,400	TBC	TBC
Toluene	120	600	870	720	1,700	>100,000	>100,000	94,800	>100,000	TBC	TBC
Ethylbenzene	65	165	520	190	460	36,300	90,800	25,100	>100,000	TBC	TBC
Xylenes	42	53	475	60	146	11,400	28,600	8,650	>100,000	TBC	TBC
MTBE	49	73	7,930	85	198	>100,000	>100,000	11,100	>100,000	TBC	TBC
Phenols	180	310	3,200	990	1,060	97,000	>100,000	>100,000	>100,000	TBC	TBC
Acenaphthene	210	2,010	85,000	4,110	9,280	>100,000	>100,000	>100,000	>100,000	TBC	TBC
Acenaphthylene	170	1,950	84,000	3,950	8,650	>100,000	>100,000	>100,000	>100,000	TBC	TBC
Benzo-a-anthracene	3.1	3.7	90	12	16	5,830	14,600	2,290	>100,000	TBC	TBC
Fluorene	160	1,850	64,000	5,310	11,400	>100,000	>100,000	>100,000	>100,000	TBC	TBC
Naphthalene	1.5	1.6	200	2	4	3,520	8,800	270	>100,000	TBC	TBC

Table 4 – Groundwater Modelling Outputs & Health Protective Targets in mg/l

Substance	Human Health SAC				Health Protective Groundwater Monitoring Targets
	Residential on-site		Commercial off-site		
	Indoor air Groundwater	Outdoor air Groundwater	Indoor air Boundary Zone Groundwater	Outdoor air Boundary Zone Groundwater	
TPH Aliphatics C5-C6	4	>10,000	510	>10,000	TBC
TPH Aliphatics C6-C8	3	7,920	390	>10,000	TBC
TPH Aliphatics C8-C10	0.1	300	15	9,450	TBC
TPH Aliphatics C10-C12	0.09	190	9	6,090	TBC
TPH Aliphatics C12-C16	0.03	70	3	2,290	TBC
TPH Aromatics C5-C7	300	>10,000	>10,000	>10,000	TBC
TPH Aromatics C7-C8	330	>10,000	>10,000	>10,000	TBC
TPH Aromatics C8-C10	3	6,880	440	>10,000	TBC
TPH Aromatics C10-C12	9	>10,000	1,340	>10,000	TBC
TPH Aromatics C12-C16	30	>10,000	4,610	>10,000	TBC
TPH Aromatics C16-C21	90	>10,000	>10,000	>10,000	TBC
Benzene	0.3	650	27	>10,000	TBC
Toluene	339	>10,000	>10,000	>10,000	TBC
Ethylbenzene	40	>10,000	4,360	>10,000	TBC
Xylenes	15	>10,000	1,400	>10,000	TBC
MTBE	760	>10,000	>10,000	>10,000	TBC
Phenols	1,340	>10,000	>10,000	>10,000	TBC
Acenaphthene	480	>10,000	>10,000	>10,000	TBC
Acenaphthylene	560	>10,000	>10,000	>10,000	TBC
Benzo-a-anthracene	0.03	18	5	470	TBC
Fluorene	470	>10,000	>10,000	>10,000	TBC
Naphthalene	1	2,810	150	>10,000	TBC

4.0 REFERENCES

1. AEA Technology, January 1999, Banbury Gas Works - Site Investigation, Report Number AEAT 4496 Final
2. Waterman Environmental, March 2002, Site Investigation of the Former Banbury Gas Works, Interpretative Report for S Grundon (Waste) Limited, First Issue, R/EN2498.PN.2.1.5
3. Celtic Technologies Limited, December 2009, Outline Remediation Strategy, Merton Street Depot, Banbury, (O/Ref. 6140-154), for Grundon Waste Management Limited,
4. British Standards Institute, Code of Practice for Investigation of Contaminated Land, BS 10175:2001
5. Department of the Environment, 1988, Problems Arising from the Redevelopment of Gas Works and Similar Sites (2nd Edition), Prepared by Environmental Resources Limited, HMSO London
6. Environmental Protection Act 1990 Part IIA: Contaminated Land Consultation on Draft Statutory Guidance on Contaminated Land (2 Volumes), September 1996
7. Environment Agency web-site. www.environment-agency.gov.uk
8. British Geological Survey on-line, The BGS Lexicon of Named Rock Units, www.bgs.ac.uk/lexicon/
9. British Geological Survey on-line, Geology of Britain viewer, 1:50,000, www.bgs.ac.uk/opengeoscience/
10. British Geological Survey, 2000, The physical properties of minor aquifers in England and Wales, Hydrogeology Group, Technical Report WD/00/04, Environment Agency R&D Publication 68
11. Interdepartmental Committee for the Redevelopment of Contaminated Land, ICRCL Guidance Note 59/83, Guidance on the Assessment and Redevelopment of Contaminated Land, 2nd Edition
12. Environment Agency, 2004, Model Procedures for the Management of Land Contamination, CLR 11
13. Environment Agency, 2008, Human health toxicological assessment of contaminants in soil, Science Report – SC050021/SR2
14. Environment Agency, 2008, Updated technical background to the CLEA model, Science Report – SC050021/SR3
15. Environment Agency, CLEA Software Handbook, Science Report – SC050021/SR4
16. Environment Agency, 2008, Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values, Science Report – SC050021/SR7
17. CL:AIRE/CIEH, May 2008, Guidance on Comparing Soil Contamination Data with a Critical Concentration
18. Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency, 2002, Environment Agency R&D CLR-8, Potential Contaminants for the Assessment of Land
19. Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency, Published SGV and TOX reports
20. Land Quality Management, Nathanail, C.P., McCaffrey, C., Ashmore, M.H., Cheng, Y.Y., Gillet, A., Ogden, R. and Scott, D., 2009, The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition), Land Quality Press, Nottingham
21. WHO, March 2003, DRAFT, Guidelines for Drinking Water Quality 3, Chapter 8
22. WHO, 2000, Guidelines for Air Quality, Geneva
23. Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the Environmental Protection Act 1990
24. Dzombak, D.A., Ghosh, R.S., Wong-Chong, G.M., 2006, Cyanide in Water and Soil: Chemistry, Risk, and Management, Taylor and Francis, ISBN 1-56670-666-1
25. Environment Agency, 2006, Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans: Inorganic Cyanide, R&D Publication TOX 5
26. BRE 2004, Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land

27. Ferguson, C., Nathanail, P., McCaffrey, C., Earl, N., Foster, N., Gillet, A. and Ogden, G., April 2003, Method for Deriving Site-Specific Human Health Assessment Criteria for Contaminants in Soil, Report No LQ01, SNIFFER 2003

28. USEPA, 2004, User's Guide for Evaluating Subsurface Vapor (sic) Intrusion into Buildings, EPA Contract Number 68-W-02-33, US Environmental Protection Agency, Washington DC

29. USEPA, 2002, OSWER, Draft guidance for evaluating the vapor intrusion to indoor air pathway from groundwater and soils (subsurface vapor intrusion guidance), USEPA, Washington DC, USA

30. CIRIA, Baker, K., Hayward, H., Potter, L., Bradley, D. and MacLeod, C., 2009, The VOCs Handbook Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination, CIRIA C682, London

31. Lerner, D.N., 2002, Identifying and quantifying urban recharge: a review, Hydrogeology Journal, 10, pages 143-152, Springer-Verlag

32. Freeze, R.A. and Cherry, J.A., 1979, Groundwater, Prentice Hall

33. Fetter, C.W., 2001, Applied Hydrogeology, 4th edition, Prentice Hall

34. Bear, J., 1972, Dynamics of Fluids in Porous Media, Dover Publications, modified on www.en.wikipedia.org/wiki/Hydraulic_conductivity

35. River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010

36. Surampalli, R., Ong, S. K., Seagren, E., Nuno, J. and Banerji, S., 2004, Natural Attenuation of Hazardous Wastes, ASCE, Virginia

37. Groundwater Services Inc, Connor, J.A., Newell, C. J. and Malander, M.W., November 1996, Parameter Estimation Guidelines for Risk-Based Corrective Action (RBCA) Modeling (sic), Groundwater Services Inc., NGWA Petroleum Hydrocarbons Conference, Houston, Texas

38. Fordyce, G., Engineer, S., Price, H., Beale, L. and Mallett, H., 2008, Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D 66, Volumes 1 & 2, NHBC, Environment Agency, CIEH

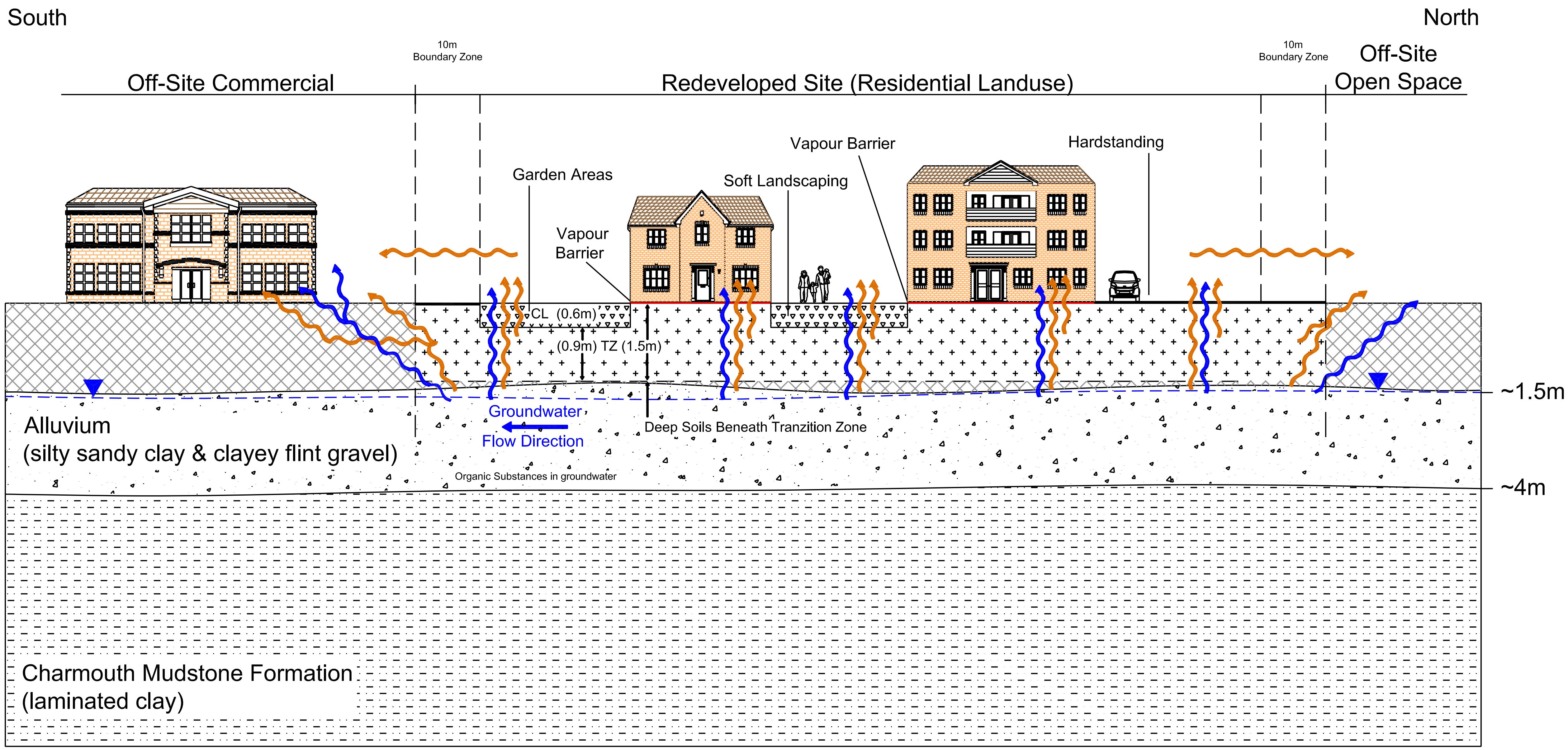
39. CIRIA, Wilson, S. et al. 2007, Assessing risks posed by hazardous ground gases to buildings, CIRIA C665

40. Wilson, S., Card, G., Haines, S., 2009, Ground Gas Handbook

APPENDICES

APPENDIX A

FIGURES



Legend

- Potential Soil Exposure Pathways
- Potential Groundwater Exposure Pathways
- Groundwater
- Cover Layer Below Gardens & Soft Landscaping
- Transition Zone
- Made Ground (Inferred)

The conceptual site model is not to scale. All depths/thicknesses shown are inferred and not taken from actual site data.

REV	COMMENT	DATE

Celtic
Design and Construct Remediation

Columbus House, Village Way, Cardiff, CF15 7NE, 029 2036 8636
Centrix House, Crow Lane East, Newton Le Willows, WA12 9UY, 01925 273222
enquiries@celtic-tech.co.uk
www.celtic-ltd.com

Client

Project
Banbury

Title
Conceptual Site Model

Drawn by	Checked	Date	Authorised	Date
CT				

Original Scale	Date	Rev	Paper
NTS	01/11	1	A3

Drawing Number
Figure A

CAD REF:-

APPENDIX B

QUALITATIVE RISK ASSESSMENT

APPENDIX B - QUALITATIVE RISK ASSESSMENT

TABLE OF CONTENTS

1.0 INTRODUCTION

The qualitative risk assessment considers the primary plausible pathways through which contaminants could impact upon human health receptors for the site following site improvement works. The conceptual model is presented as Drawing Figure A. The qualitative source-pathway-receptor risk assessment considers the following components to identify the level of potential risk:

Source The presence of potential contamination sources; these may be individual contaminants (e.g. in site soils, soil vapour, perched water or groundwater), contamination within structures or in specific areas of the site.

Pathway The presence of migration or exposure pathways linking contamination sources to receptors.

Receptor The presence of sensitive human health receptors.

The following assumptions have been made in the qualitative risk assessment regarding the condition of the site following redevelopment:

- The site could be redeveloped for high-density apartment dwellings, low density dwellings with gardens, communal soft & hard landscaping areas and associated parking & access roads; and
- The site will have hard and soft cover and buildings;
- Localised unacceptably impacted soils will be either treated on-site and re-used or removed from the site;
- Unacceptably impacted perched water and groundwater will be treated and removed; and
- Significant LNAPL sources will be removed.

The following assumptions have been made in the qualitative risk assessment regarding the off-site uses:

- Commercial properties located to the north and west of the site are in close proximity to the site. These commercial properties are assumed not to benefit from vapour protection measures; and
- Commercial properties to the south of the site are located down groundwater gradient from the site. These commercial properties are assumed not to benefit from vapour protection measures.

2.0 POST DEVELOPMENT CONTAMINATION SOURCES

2.1 Substances of Concern

The following substances of concern have been considered by the risk assessment:

- TPH, BTEX & MTBE;
- 16 PAHs;
- Phenols;
- Arsenic, cadmium, chromium, copper, lead, inorganic mercury, vanadium, zinc; and
- Free cyanide (as easily liberatable cyanide) and total cyanide.
- *Residual LNAPL will be treated as part of the soil source term.*

2.2 Post Development Sources

The following post-development on-site sources have been considered by the risk assessment:

- Transition zone and deep soils beneath soft and hard cover areas, including soils in the boundary zone;
- Transition zone soils beneath buildings, including soils in the boundary zone;
- Deep soils beneath buildings, including soils in the boundary zone;
- Groundwater, including groundwater in the boundary zone; and
- *The 'boundary zone' is a 10m wide strip around the inside of the boundary used to assess potential risk to off-site receptors via VOC vapour inhalation pathways (CIRIA C682).*

Spent oxide is a potential soil contamination source and is primarily a source of cyanide. The majority of the cyanides at former gasworks sites are complexed with iron and are relatively stable, environmentally immobile and of relatively low toxicity. Free cyanide is the considered to be the important cyanide species from a human health risk assessment perspective and free cyanide concentrations are expected to represent a very small fraction of total cyanide concentrations on a former gasworks site. As a conservative surrogate for the purposes of the risk assessment, easily liberatable cyanide concentrations will be assumed to represent concentrations of free cyanide.

2.3 Off-Site Sources

Historical plans and intrusive investigations indicate that there may be former gasworks structures remaining outside the northwestern and southwestern site boundaries. It is not known whether these areas of the former gasworks have been the subject of a programme of improvement measures.

There may be gasworks process materials outside the site boundary, which are associated with areas that may have originally been part of the site. For the risk assessment, it will be assumed that there are no significant off-site sources.

3.0 CRITICAL RECEPTORS

The plausible principal human health receptors for the redeveloped site use are:

- Residents of the redeveloped site;
- Commercial users of the adjacent sites;
- Residential users of nearby sites; and
- Nearby allotments.

The critical human health receptors to be considered by the risk assessment are:

- Residents of the redeveloped site;
- Commercial users of the adjacent sites.

Given the sensitive on-site residential receptors and the use of hard and soft cover, it is not considered necessary to separately consider the nearby residential land or allotment land (all immediately adjacent land is in commercial use).

4.0 MIGRATION AND EXPOSURE PATHWAYS

Given the residential use of the redeveloped site and the use of hard and soft cover, the primary plausible human health and exposure pathways are:

- Indoor inhalation of VOC vapours from soil and groundwater sources (including vertical & lateral migration);
- Outdoor inhalation of VOC vapours from soil and groundwater sources (including vertical & lateral migration);
- *Although buildings will have vapour protection measures, the human health risk assessment has considered buildings without vapour protection measures to assess the level of reliance being placed on the vapour protection; and*
- *CIRIA C682 recommends that the inhalation of VOC vapours (volatile organic compounds) should only consider sufficiently volatile & sufficiently toxic substances.*

Studies on unsaturated zone biodegradation in CIRIA C682 (referenced in the main report) suggest that the potential for significant lateral migration of soil vapour petroleum hydrocarbons is typically limited (providing that there are no significant preferential advective flow paths). The studies indicate that halogenated hydrocarbons may have a higher potential for lateral migration than petroleum hydrocarbons. The following distances are discussed in C682 and these provide a useful guide for assessing the likely area of concern (with regard to lateral migration and vapour intrusion into buildings) around a soil or groundwater source:

- 5 to 10 m for petroleum hydrocarbons; and
- 30 m for halogenated hydrocarbons.

As the site investigations have not identified significant chlorinated solvent primary sources or the presence of significant concentrations of solvents in groundwater, a 10 m wide ‘boundary zone’ has been adopted around the inside of the site boundary to address potential vapour risks to adjacent commercial land. Based on the studies on CIRIA C682, only soils and groundwater in the boundary zone are considered to constitute a potential VOC vapour source to immediately adjacent commercial land and buildings. Land and buildings at distances of greater than 10 m from the site boundary are unlikely

In addition, there is the potential for off-site groundwater migration beneath land down groundwater gradient to the south of the site. Potential vapour risks to this land will also be addressed via the boundary zone approach.

The site will not have a borehole that will supply potable drinking water and there are no known private or public potable water abstractions within 1 km of the site. This means that consumption of drinking water from site wells is not a plausible exposure pathway and will not be considered by the risk assessment.

5.0 QUALITATIVE RISK ASSESSMENT

The risk classification matrix, consequence ratings and probability classifications are summarised in Table 1. The adopted risk classifications are based on R&D 66 (Section 1.7 and Annexe 4).

The qualitative source-pathway-receptor assessment for each of the receptor groups is presented in Table 2 and Table 3.

Table 1 - Qualitative Risk Classification

Probability (likelihood)	**Consequence**			
	Severe	**Medium**	**Mild**	**Minor**
High likelihood	Very high risk	High risk	Moderate risk	Low risk
Likely	High risk	Moderate risk	Moderate/low risk	Low risk
Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk
No Pollutant Linkage	No potential risk			

Minor	**Mild**	**Medium**	**Severe**
- No measurable effect on humans - Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems - Repairable effects of damage to buildings, structures and services	- Exposure to human health unlikely to lead to "significant harm" - Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality; marginal effect on amenity value, agriculture or commerce - Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long term maintenance of the population - Minor damage to crops, buildings or property	- Elevated concentrations which could result in "significant harm" to humans health as defined by EPA 1990, Part 2A if exposure occurs - Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce - Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long term maintenance of the population - Significant damage to crops, buildings or property	- Highly elevated concentrations likely to result in "significant harm" to humans health as defined by EPA 1990, Part 2A if exposure occurs - Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce - Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long term maintenance of the population - Catastrophic damage to crops, buildings or property

Unlikely	**Low likelihood**	**Likely**	**High likelihood**
Improbable that exposure/event would occur even in the long term	Possible that exposure/event could occur. However, not certain that even over a long period that exposure/event would occur and is less likely in the shorter term	Probable that exposure/event would occur. However, exposure/event is not inevitable, but is possible in the short term and likely over the long term.	Exposure/event very likely in the short term and almost inevitable over the long term, or evidence at the receptor of harm or pollution

Notes: Impacts that are a breach relevant legislation are considered to be of major significance; only applies if there is a possibility of a pollutant linkage being present

Table 2 - Qualitative RA for On-site Human Health Receptors

Receptors	Sources	Pathways	Comments	Consequence	Likelihood	Risk
On-site residential users ***No perched water or NAPL sources***	i) Inorganic soil contamination in structures, made ground & natural soils	- No pathways	- Soil and groundwater source improvement measures will be undertaken. - The site will have an independently verified cover layer in areas of soft standing and gardens. - Buildings will have appropriate vapour protection measures. - Impacted perched water and significant NAPL sources will be removed/treated. - VOC vapour emissions into outdoor air following redevelopment will be very low and risks associated with outdoor vapour inhalation are likely to be negligible.	Minor	Low	Very Low
	ii) Organic soil contamination in structures, made ground & natural soils	- Outdoor inhalation of VOC vapours		Mild	Low	Low
	iii) Inorganic groundwater contamination	- No pathways		Minor	Low	Very Low
	iv) Organic & groundwater contamination	- Outdoor inhalation of VOC vapours		Mild	Low	Low

Table 3 - Qualitative RA for Off-site Human Health Receptors

Receptors	Sources	Pathways	Comments	Consequence	Likelihood	Risk
Workers and users of other adjacent land	i) Inorganic soil contamination in structures, made ground & natural soils	- No pathways	- Commercial properties are adjacent to the site. - Only vapour pathways are potentially active (see Table 2) - Lateral VOC vapour migration from on-site sources only applies to sources in the boundary zone. - VOC vapour emissions into outdoor air following redevelopment will be very low and risks associated with outdoor vapour inhalation are likely to be negligible.	Minor	Low	Very Low
	ii) Organic soil contamination in structures, made ground & natural soils	- Inhalation of VOC vapours from on-site sources - Inhalation of VOC vapours from on-site sources via lateral migration through soils		Mild	Low	Low
	iii) Organic soil contamination in the boundary zone			Mild	Low	Low
	iv) Inorganic groundwater contamination	- No pathways		Minor	Low	Very Low
	v) Organic groundwater contamination	- Inhalation of VOC vapours from on-site sources - Inhalation of VOC vapours from on-site sources via lateral migration though soils - Inhalation of VOC vapours via groundwater migration off-site		Mild	Low	Low
	vi) Organic groundwater contamination in the boundary zone			Mild	Low	Low

Intentionally Blank

APPENDIX C

HUMAN HEALTH RISK MODELLING

Appendix C - HUMAN HEALTH RISK MODELLING

TABLE OF CONTENTS

TABLES

APPENDICES

1.0 GENERAL OUTLINE OF METHODOLOGY

The following human health quantitative risk assessment has been undertaken in line with the latest (as of April 2010) Environment Agency Contaminated Land Exposure Assessment (CLEA) guidance & conceptual exposure models detailed in SC050021 SR2, SR3, SR4 & SR7 (referenced in the main report).

Additional human health guidance for vapour & gas risks has been drawn from CIRIA C682 (The VOCs Handbook), CIRIA C665 (Assessing risks posed by hazardous ground gases to buildings) and the CIEH Ground Gas Handbook.

The human health risk assessment will provide the technical basis for developing the final soils remedial/verification criteria and groundwater monitoring criteria for use in the Celtic site remediation works. A separate risk assessment has been prepared that considers risks to controlled waters.

The remediation design will consider other potentially unacceptable risks, including potential health risks to construction workers and adjacent site users during improvement works.

The stages involved in the human health risk assessment are as follows:

1. Selection of the human health substances of concern and receptor groups. This has been undertaken in the qualitative assessment in the main report;
2. Identification of available relevant UK human health generic assessment criteria (GAC) for commercial and residential use. See Section 3.0;
3. A detailed pollutant linkage assessment to identify the relevant pollutant linkages (RPLs) associated with human health. See Section 4.0;
4. Selection of health criteria for the substances of concern. See Section 5.0.
5. CLEA modelling using an Excel based spreadsheet model compliant with the CLEA-SR methodology. The modelling includes a conceptual exposure model (CEM) that details the required exposure and fate & transport parameters for each relevant exposure pathway. See Section 6.0;
6. Calculation and/or selection of site assessment criteria (SAC) and GAC. See Section 6.5; and
7. Selection of health protective targets.

The conceptual model drawing is presented on Drawing Figure A.

This report assessment should only be used by competent persons and as such, it is beyond the scope of this report to present a detailed summary of the CLEA conceptual models and their technical basis.

2.0 SUBSTANCES OF CONCERN

The human health modelling has been undertaken for the following sufficiently volatile or sufficiently toxic organic substances of concern, the majority of which are typically associated with former gasworks, metal recycling and metal manufacture sites:

Organic Substances

- TPH: aliphatic C5-C16 & aromatic fractions C5-C21;
- BTEX & MTBE;
- PAHs; and
- Total phenols.

The rationale for the choice of substances to be considered via the vapour inhalation pathways is presented in the Technical Notes in Appendix C1.

3.0 RELEVANT HUMAN HEALTH GAC

3.1 Soil GAC

The available soil GACs for human health are the Environment Agency residential and commercial soil guideline values (SGVs) for BTEX (benzene, toluene, ethylbenzene & xylenes), mercury, selenium, arsenic, nickel, cadmium, phenol and dioxins/PCBs. Additional UK-specific values can be selected from the 2009 LQM/CIEH GAC and the 2009 EIC GAC Initiative published by CL:AIRE.

The adopted soil GACs are presented in Section 6.5 and have been adjusted where necessary for a sandy loam soil with 1% soil organic matter (SOM) and reported to two significant figures. The use of 1% SOM and a sandy loam soil (soil type adopted by the EA, LQM and EIC) are considered risk protective and appropriate for the range of soils across the site.

In the absence of Agency guidance on assessing the chronic risk from lead in soils, the 'old' withdrawn SGVs, based on blood lead concentrations, have been adopted.

The nature of the proposed redeveloped site use means that the majority of the standard CLEA exposure pathways considered by the GACs will be relevant. This means that using human health GACs that include the standard CLEA pathways should be a risk protective and conservative approach for the RPLs identified in Section 4.0.

3.2 Water GAC

The available relevant human health waters quality standards that can be adopted as GACs are the UK Drinking Water Standards (DWS). Other possible GAC are provided in the Environment Agency reference, technical advice to third parties, fully referenced in the main report. The available water GACs are presented in Section 6.5.

The use of a DWS (or equivalent) as a human health GAC is considered appropriate on the simple basis that if a substance at DWS concentration is safe enough to drink and use in the household (e.g. showering, washing etc), then a DWS concentration should also be risk protective for groundwater present under commercial and residential land.

4.0 DETAILED POLLUTANT LINKAGE ASSESSMENT

4.1 Methodology

A detailed pollutant linkage assessment has been undertaken to characterise the human health Relevant Pollutant Linkages (RPLs) and includes the following elements:

Sources
↓
Critical Receptors
↓
Relevant Pollutant Linkages

A schematic human health conceptual site model for the site use is presented on Drawing Figure A.

4.2 Identified Historical Sources

The following historical primary sources have been identified and are discussed in the main report:

- Northwest area of the site: former tar & liquor well, CWG holder, CWG plant and retort house; and
- Middle southwestern corner of the site: former coal gas purifier.

The following historical secondary soil, perched water and groundwater sources have been identified and are discussed in the main report:

- Soil hotspots located in the northeastern, central and eastern parts of the site: associated with the former waste transfer station and scrap yard;
- Soil hotspots in the southern part of the site: former historical use unknown
- Perched water & groundwater located in the northwest area of the site: associated with the former tar & liquor well, CWG holder, CWG plant and retort house;
- Groundwater located in the central and eastern part of the site: associated with the former scrap yard;
- Groundwater located in the northern part of the site: associated with the former waste transfer station; and
- Groundwater in the southern part of the site: former historical use unknown.

4.3 Post Development Sources

4.3.1 Risk Assessment Assumptions

The following assumptions have been made in relation to the identification of on-site soil and groundwater sources for consideration in the risk assessment:

- The site could be redeveloped for high-density apartment dwellings, low density dwellings with gardens, communal soft & hard landscaping areas and associated parking & access roads; and
- The site will have hard and soft cover and buildings;
- Localised unacceptably impacted soils will be either treated on-site and re-used or removed from the site;
- Unacceptably impacted perched water and groundwater will be treated and removed;
- Significant LNAPL sources will be removed;
- Unacceptably impacted perched water and groundwater will be treated and removed; and
- Significant LNAPL sources will be removed.

The following assumptions have been made in relation to the identification of off-site soil and groundwater sources for consideration in the risk assessment:

- Commercial properties located to the north and west of the site are in close proximity to the site. These commercial properties are assumed not to benefit from vapour protection measures;
- Commercial properties to the south of the site are located down groundwater gradient from the site. These commercial properties are assumed not to benefit from vapour protection measures; and
- Potentially contaminated groundwater could migrate under adjacent land towards the south, towards adjacent commercial properties. However, the potential for contaminated groundwater to migrate under adjacent occupied buildings is considered minimal.

It is not expected that there will be significant residual LNAPL concentrations remaining on the site, following the expected improvement measures and on this basis, residual LNAPL will be considered as part of the soil source term in the risk assessment.

In the design for remediation works the soil quality specifications for any imported materials and engineering fill materials (including site-won materials and recovered aggregates) will be dealt with via an MMP (materials management plan). Where appropriate, the MMP will utilise the relevant findings of the risk assessment in the setting of soil quality specifications.

During remediation works, materials may be excavated and reused in other areas of the site. Excavated site-won materials and recovered aggregates may be reused at surface or at depth within the final finished soil profile in softstanding areas or beneath hardstanding. The use and soil quality/specification of these materials will be managed via the MMP.

This means that site-won and imported materials used during remediation works will not be considered as contamination sources by the risk assessment as the use of these materials will be managed by the MMP.

4.3.2 Averaging Areas

The following post development soil averaging areas have been considered by the risk assessment:

- Soils beneath buildings;
- Soils beneath hardstanding (e.g. road, pavements, parking); and
- Soils beneath soft cover areas: gardens and soft landscaping.

4.3.3 Depth Dependant Sources

Within the averaging areas, the risk assessment has adopted depth profiles to reflect the redeveloped site, the proposed remedial works and the remedial verification process. The following depth profiles have been considered and are discussed further in the main report:

- Softstanding & garden cover layer;
- Transition zone; and
- Deep soils.

4.3.4 Boundary Zones

The risk assessment also considers sources in site boundary zones (Drawing Figure A) to address the risks associated with potential lateral migration of VOC vapours onto adjacent land. Soils and groundwater in these zones are considered to represent potential sources for VOC vapours that could migrate laterally leading to vapour emission and intrusion risks to off-site receptors.

The technical basis for defining the boundary zones is discussed in Appendix B.

4.3.5 Adopted Depth Profiles

The risk assessment considers the averaging area, depth profiles and modelling depths summarised in Table 1. The averaging areas are discussed further in the main report.

Table 1 - Averaging Area Depth Profiles & Modelling Depths

Averaging Area	Depth Profile	Modelling Depth mbgl
Transition zone beneath soft cover areas (including boundary zone)	0.6 m to 1.5 m	0.6 mbgl
Transition zone beneath hard cover areas (including boundary zone)	~0.2 m to 1.5 m	0.6 mbgl *(consistent with soft cover areas)*
Transition zone soils beneath buildings (including boundary zone)	~0.2 m to 1.5 m	0.5 mbgl *(CLEA Default)*
Deep soils beneath soft & hard cover areas (including boundary zone)	> 1.5 m	0.6 mbgl *Separate modelling for transition zone & deep soils not required as model outputs are relatively high*
Deep soils beneath building (including boundary zone)	> 1.5 m	1.5 mbgl
Groundwater (including boundary zone)	1.2 m to 1.7 m	1 mbgl

4.4 Critical Receptors

The modelling considers the following residential and commercial critical receptors identified by the qualitative risk assessment:

- Residential site users; and
- Commercial users of adjacent land.

The critical human receptor for residential use will be taken as a young female child, with the duration of the exposure covering the first six years of life (age class AC1-6). The critical human receptor for commercial use will be taken as a female worker, with the duration of the exposure covering 49 years of working life from the ages of 16 to 65 (age class AC17). The standard CLEA SR3 conceptual exposure models and receptor characteristics will be adopted by the risk assessment.

As the risk assessment will consider long-term health risks to the critical receptors, it will also be protective of the long-term health of other minor potential human receptors, such as visitors and temporary workers who will have shorter-term exposures. This means that short-term exposure scenarios will not need to be considered separately.

4.5 Relevant Pollutant Linkages

The RPLs considered by risk assessment are summarised in Table 2.

Table 2 - Human Health Relevant Pollutant Linkages

Receptors & Sources	On-site Residential	Off-site Commercial
Critical Receptor Modelled	SR3 Residential	SR3 Commercial
Surface soils in soft cover areas	No RPLs	No RPLs
Transition zone and deep soils beneath soft and hard cover areas (including boundary zone)	Outdoor vapour *Separate modelling for transition zone & deep soils not required as model outputs are relatively high*	Outdoor vapour *Lateral VOC Vapour indoor & outdoor*
Transition zone soils beneath buildings (including boundary zone)	Indoor vapour	
Deep soils beneath buildings (including boundary zone)	Indoor vapour	
Groundwater (Including boundary zone)	Indoor vapour Outdoor vapour	Outdoor vapour *Lateral VOC Vapour indoor & outdoor*
Sensitive Receptor Groups Covered by Critical Receptor	*Residential site users*	*Commercial users of adjacent land*

Notes:

- *Site buildings assumed to have vapour protection*
- *Indoor air included for on-site buildings to assess the level of reliance to be placed on vapour protection*
- *Outdoor air pathway from site soils viable for on-site receptors & off-site receptors*
- *Indoor/outdoor air pathways from lateral VOC vapour migration from soils/groundwater viable for of-- site commercial*
- *Lateral migration of VOC vapours only applies to sources in the boundary zone*
- *Vapour pathways only viable for sufficiently volatile/toxic organic substances*

5.0 HEALTH CRITERIA & CHEMICAL PARAMETERS

The UK published health criteria values (HCV) used in the human health modelling are adult tolerable daily intakes (TDI) for threshold substances and index doses (ID) for non-threshold substances. The HCV have been selected in line with the recommendations in SR2.

The average adult mean daily intake (MDI) for the threshold health criteria are provided in the EA, LQM (2nd Edition) & EIC reports. For site-specific risk assessments, SR2 recommends that the MDI should be considered negligible if no data or information is available on likely background exposure (SR2 Section 3.4.1).

Table 3 summarises the toxicological data and MDI used in the CLEA modelling. TPH fraction additivity and MDIs are discussed in Appendix C2.

Table 3 - Adopted Toxicological Criteria

Substance of Concern	Toxicity Type	Source of HCV & MDI Data
TPH fractions	Threshold	TPHCWG (LQM) See Appendix C2 for MDI calculations
Benzene	Non-Threshold	Benzene CLEA SR
Toluene	Threshold	Toluene CLEA SR
Ethylbenzene	Threshold	Ethylbenzene CLEA SR
Xylene isomers	Threshold	Xylene CLEA SR
Phenol	Threshold	CLEA SR
PAHs	Threshold & Non-Threshold	LQM

Where inhalation health criteria are provided as a reference dose in mg/m^3, the criteria have been converted to a TDI (mg/kg-bw/day) using the recommended default SR3 parameters (SR3 Table 3.3) for adult body weight & daily inhalation rate, i.e. 70 kg and 20 m^3/day respectively. In line with recommendation in SR2 to SR4, the oral HCV has been used as the dermal HCV unless available guidance suggests otherwise.

The chemical-specific parameters required for the CLEA modelling are predominantly drawn from SR7, TOX & SGV reports, LQM and EIC resources and are detailed in the attachments.

6.0 CLEA MODELLING

6.1 Framework

This assessment is compliant with the current CLEA guidance & conceptual exposure models detailed in SC050021 SR2, SR3, SR4 & SR7 and associated toxicological and soil guideline documents. The modelling has been undertaken using an Excel-based spreadsheet model that compliant with the CLEA-SR methodology and provides outputs benchmarked to the current Agency CLEA Excel-based v1.06 model.

Each pollutant linkage has been assessed separately through calculation of pathways PVs. The calculated PVs represent intervention values, where the average daily exposure (ADE) is equivalent to 100% of the daily tolerable intake of the substance of concern (based on the adopted HCVs) for that CLEA pathway (i.e. ignoring other active CLEA pathways). This means that contaminant media concentrations above a PV might pose an unacceptable risk (for that pathway) to the health of the critical receptor and indicate that further consideration of the risk may be required.

If appropriate, the cumulative affect of PVs across pathways may also be considered through integration into a SAC using the method outlined in SR3. Alternatively, a single PV may be selected as the SAC for a group of active pathways. The concept of PVs is discussed in the pre-2008 SGV reports for toluene & ethylbenzene.

A conceptual exposure model (CEM) provides the parameters for the calculation of the pathway specific PVs and characterises the substances of concern, the critical receptor(s), the exposure scenario, ground conditions and the source terms. To match the input requirements of the algorithms, the CEM consists of the following elements:

- Critical receptor characteristics
- Pathway exposure models and parameters
- Source terms & soil type properties

The CEM parameters are included in the modelling outputs in the attachments.

6.2 Critical Receptor Characteristics

The exposure characteristics for the critical receptors are based on the CLEA commercial and residential exposure models and applicable age class data. The characteristics of the critical receptors that are applicable for the pathways are discussed in Section 4.4 and the receptor parameters are presented in the CLEA modelling results in the attachments.

6.3 Pathway Exposure Models

The modelled pathways are summarised in Table 2. The pathway-specific parameters are included in the CLEA modelling outputs in the attachments. The source terms are discussed in Section 6.4.

Newcastle has been adopted as the city type as none of the available cities were typically representative of Prestatyn and Newcastle is a conservative choice as it gives a relatively low model output. A site area of 0.5 hectares has been adopted for the commercial and residential receptors. A residential receptor height of 0.8 m has been adopted for the outdoor inhalation pathways.

Specific modelling considerations in relation to groundwater sources and the outdoor vapour inhalation pathway are detailed in the Technical Notes in Appendix C1.

6.4 Source Term

6.4.1 Source Depth and Soil Properties

The soil, perched water & groundwater averaging areas are discussed in Section 4.3. The adopted source term depths are detailed in Table 1.

A standard CLEA SR3 sandy loam has been adopted as the general soil type for soils in the unsaturated zone. This soil type is considered representative of the soil types on the site. A low SOM of 1% (equivalent to a fraction organic carbon [foc] of 0.0058) has been adopted as the general SOM and is considered risk protective and appropriate for the range of made ground and soils on the site. The soil properties are presented in the attachments.

6.4.2 Saturated Concentrations

Many of the CLEA algorithms depend on partitioning processes that are primarily based on linear chemical behaviour observed at low concentrations in soil and water. The CLEA methodology includes a number of checks to highlight boundary conditions when the simple linear relationships may not apply. These checks are then used to assist in the interpretation of the CLEA modelling outputs. The main checks are:

- Saturated aqueous concentrations
- Saturated vapour Concentration and associated soil concentration
- Presence of NAPL
- Saturated groundwater concentrations

The technical basis of the saturation limits are further discussed in Technical Notes in Appendix C1. The results of the saturated calculations are detailed in the attachments.

Concentrations exceeding the saturation limits may indicate the presence of non-aqueous phase liquid (NAPL) and this should be considered when assessing the CLEA model outputs. However, the saturation limits are theoretical and for contaminants that are strongly sorbed to soils (i.e. have high K_{oc}) and/or a low aqueous solubility/vapour pressure, the exceedance of a saturation limits does not necessarily imply that NAPL is present.

6.4.3 Modelling Sensitivity to Soil Parameters

The following outlines the interdependence of the vapour inhalation model outputs on the soil parameters:

- Soil Output as mg/kg: Dependent on foc & soil type
- Soil Vapour Output as mg/m^3: Independent of foc; dependant on soil type
- Groundwater Output as mg/l: Independent of foc; dependant on soil type
- Csat Vapour Output as mg/m^3: Independent of foc & soil type

6.5 CLEA Modelling Outputs

The CLEA modelling soil and groundwater outputs and relevant GACs are summarised in the summary report and are presented in full in Appendix C3. The recommended reporting protocols, detailed in the Technical Notes in Appendix C1, have been adopted to ensure that the modelling outputs are credible.

APPENDIX C1

CLEA TECHNICAL NOTES

Volatility and toxicity screening
Groundwater source modelling
Outdoor vapour inhalation algorithms
Saturation limits

Intentionally Blank

VOLATILITY AND TOXICITY SCREENING

The USEPA screening mechanism for the identification of compounds likely to have sufficient volatility or toxicity to present a risk via vapour intrusion is described in the CIRIA C682 document and taken from the USEPA draft OSWER guidance (USEPA 2002), referenced in the main report.

The screening accounts for likely volatility using Henry's law constant and likely toxicity using a modified health criteria value.

Sufficient Volatility Screening

The first stage of the screening considers Henry's law constant. Other existing guidance documents, e.g. SNIFFER and USEPA 2004 (both referenced in the main report) indicate that if a compound has a dimensionless Henry's law constant of more than 0.0004 then it is considered to be a risk via vapour intrusion and emission pathways. The USEPA screening mechanism follows the same principle and recommends the use of properties appropriate for 10^{o}C.

TPH aliphatic fractions >C16 are considered non-volatile irrespective of the CIRIA C682 methodology, due to the anomalous increasing Kaw for the aliphatic fractions.

Sufficient Volatility Screening and Phenol

The July 2009 phenol EA toxicological report indicates that phenol is more potent by inhalation than ingestion and that deriving SGVs based just on the oral TDI might be insufficiently protective of the threshold effects. The report also indicates that phenol may exhibit non-threshold mutagenicity by inhalation, although the report indicates that there are currently insufficient studies from which to derive an index dose. For these reasons, and to manage the uncertainty, phenol has been assumed to be sufficiently volatile, even though the dimensionless Henry's law constant is below the recommended value of 0.0004.

In addition to organic substances, chemical reactions involving cyanide may also form gases. However, the cyanide compounds typically found on brownfield sites are generally iron-complexed with a low potential to form gases. This means that the risk posed by cyanide gas is likely to be negligible and will not be considered by the risk assessment.

Sufficient Toxicity Screening

Screening for sufficient toxicity requires information about the toxicity of the compound via inhalation exposure. The theoretical saturated soil vapour concentration of the pure compound is calculated and compared with a modified health criteria value based on inhalation exposure.

The theoretical saturated soil vapour concentration of the pure compound is calculated using the method detailed in SR3. The modified health criteria value is calculated by modifying the TDSI or ID (in µg/kg/bw/day) to an acceptable air concentration (in µg/m^3) and compared with the calculated vapour phase concentration.

If the calculated vapour phase concentration is less than the modified HCV then it is likely that the toxicity of the compound relating to the vapour intrusion and exposure pathway will not present a significant risk to human health.

For compounds with a very low toxicological threshold for vapour inhalation or where a compound is close to failure then professional judgement and other lines of evidence may be used to inform the decision.

GROUNDWATER SOURCE MODELLING

Although the CLEA-SR methodology does not currently include groundwater as a source, the same USEPA documents used by the Environment Agency for soil sources (USEPA document *User's Guide for Evaluating Subsurface Vapour Intrusion into Buildings*, EPA Contract Number 68-W-02-33, 2004) have been be consulted to obtain the additional algorithms required for modelling a groundwater source. This means that the CLEA-SR model algorithms have been extended to enable generation of vapour inhalation modelling output for sufficiently volatile organic substances in perched water and groundwater. The modelling of water sources also takes into account the soil dependant capillary fringe about the water table.

OUTDOOR VAPOUR INHALATION ALGORITHMS

For outdoor air vapour inhalation, CLEA SR3/SR4 uses the concept of surface soils and subsurface soils. For surface soils, SR3/SR4 uses SR3 Equation 10.2; for sub-surface soils, SR4 recommends the use of SR4 equation 4.1.

This risk assessment has adopted SR3 Equation 10.2 for surface soils as recommended by SR3/SR4. The pathway actually uses an algorithm modelling source depth of 10 cm for all soils in the mixing zone as this is a necessary modelling anomaly due to the technical basis of the algorithm adopted by SR3.

The algorithm for shallow soils (SR3 Equation 10.2) also includes a time parameter that is used to estimate the average emission flux over the modelled exposure duration (with the emission flux decreasing exponentially over time). For commercial use, the default exposure duration is 49 years and the default position is to use 49 years as the time parameter in SR3 Equation 10.2. However, to provide risk protective output for this pathway, the time parameter has been reduced from 49 years to a more reasonable 6 years and this proves lower model output than using 49 years. Reducing the time parameter is acceptable in the CLEA methodology and is discussed in Section SR4 Section 4.11.

The groundwater calculations for the outdoor air pathway use SR4 equation 4.1. There is no time parameter in SR4 equation 4.1.

SATURATED AQUEOUS SOIL CONCENTRATIONS

The SR3 document provides equations to calculate the theoretical soil concentration (Csatw) where the resulting soil pore water concentration of a chemical may exceed the maximum aqueous solubility of the pure chemical in water at ambient temperature and pressure (SR3 Equation 5.11 & 5.12).

Where model output exceeds Csatw then uncertainty in the partitioning approach could affect the reliability of the model output assessment, e.g. leading to an overestimate via plant uptake and the inhalation of vapours.

SATURATED SOIL VAPOUR CONCENTRATIONS

The saturated soil vapour concentrations have been calculated for each of the sufficiently volatile substances of concern using CLEA algorithms. The Csat concentration is typically expressed as a vapour concentration (Csat-vap) in mg/m^3, but can also be expressed as a soil concentration in mg/kg (Csatv). The algorithms to calculate Csat-vap provide an upper limit vapour concentration in the soil pores; alternatively, this can be expressed as the lowest soil concentration capable of generating the upper bound vapour concentration. The Csat-vap vapour concentration (in mg/m^3) for a substance is the same irrespective of whether the source is soil, product or water (the Csat concentration is soil-type dependant).

The Csat-vap algorithms are based on the saturated vapour pressure (i.e. the source substances are assumed to be dissolved in water). Where values are not available in SR7 or LQM, the values have been corrected for ambient soil temperature by one of two methods detailed in a reference provided in SR7 (Property Estimation Methods for Chemicals, see references in main report). If the calculated vapour pressure at ambient soil temperature is above atmospheric pressure, then atmospheric pressure has been adopted as the vapour pressure at ambient soil temperature.

Vapour pressures for TPH fractions have been taken from TPHCWG documentation, with the conservative assumption that quoted values are for 10^{o}C. This approach is consistent with LQM.

SATURATED GROUNDWATER CONCENTRATIONS

Where groundwater output exceeds the theoretical solubility of a substance then uncertainty in the partitioning approach could affect the reliability of the model output assessment, e.g. leading to an overestimate via the inhalation of vapours.

REPORTING PROTOCOL FOR OUTPUTS

To ensure that the reported outputs are credible, the following reporting protocols are recommended:

- If the model output is a very large number (100,000 to 1,000,000), the output will be reported as >100,000 as the model output predicts that only very high source concentrations could give rise to unacceptable risks (i.e. average daily exposure > TDI/ID). It is not considered credible to report higher model output.
- If the output for a substance of concern is greater than the calculated Csatvap or Csatw concentrations, the model output should be ">Sat" and model outputs should be used with appropriate consideration.
- If the CLEA output for a substance of concern in groundwater is greater than its solubility in water, the model output should be ">Sol" and used with appropriate consideration.
- If the soil output is >1,000,000 mg/kg then this is an impossible concentration as this would mean there would be >1 kg of contaminant in 1 kg of soil. In this instance, the model output is "No Calculable Risk" as >1,000,000 mg/kg indicates that it is physically impossible for source area concentrations to give rise to unacceptable risk via the CLEA approach (i.e. average daily exposure > TDI/ID). Results will be reported as >100,000 mg/kg.
- If the groundwater output is >1,000,000 mg/l then this is an improbable concentration as this would mean there would be >1 kg of contaminant in 1 litre (i.e. by volume) of water. In this instance, the model output is "No Calculable Risk" and the model output is reported as >100,000 mg/l.
- If the soil vapour output in mg/m^3 >1,000,000 then the model output is "No Calculable Risk" and results will be reported as >100,000 mg/m^3 as only unfeasibly high concentrations of soil vapour could give rise to unacceptable risks via soil, soil vapour or groundwater (the mass of 1 m3 of air at sea level is ~1.25 kg).
- Outputs have been rounded to an appropriate number of significant figures (typically two or three).

Intentionally Blank

APPENDIX C2

DERIVATION OF TPH MDI
TPH FRACTION ADDITIVITY

Intentionally Blank

TPH MDI CONSIDERATIONS

The TPH fractions are threshold substances under the Agency TPH framework (P5-080/TR3). The CLEA modelling has adopted the TPH TDIs presented in the 2009 LQM 2nd Edition report and the selection of the LQM HCV is considered consistent with SR3 and the Agency TPH framework for petroleum hydrocarbons.

The adopted TDIs for TPH aliphatic and aromatic fractions are as follows:

Inhalation TDIs

- Aliphatic C5-6: 5 mg/kg-bw/day
- Aliphatic C6-8: 5 mg/kg-bw/day
- Aliphatic C8-10, C10-12, C12-16: 0.29 mg/kg-bw/day
- Aromatic C5-7, C7-8: 1.4 mg/kg-bw/day
- Aromatic C8-10, C10-12, C12-16: 0.06 mg/kg-bw/day

The LQM document adopts inhalation for the TPH fractions of 10^{99} mg/day for the calculation of the majority of the published GACs: this causes the CLEA methodology to adopt the "MDI ≤ 50% TDI" conceptual rule detailed in the SR2 for pathway calculations. The exceptions are Aromatic C5-7, C7-8, which use the Agency published MDI's for benzene and toluene respectively.

The LQM document recognises that this is a highly cautious approach for the setting of the MDIs and that its applicability should be reviewed for site-specific modelling. The CLEA SR2 document indicates that if no data on background exposure is available, then background exposure should be assumed to be negligible.

Modelling Approach to TPH MDI

The intake of TPH from background sources is considered to comprise the following components:

- Inhalation of petroleum hydrocarbons present as vapours
- Inhalation of petroleum hydrocarbons present as particulates
  Health critical particulates typically taken as the PM-10 fraction

As there is no current UK published relevant MDI available for TPH fractions, the CLEA modelling has three options for setting the oral and inhalation MDIs:

1. Assume a negligible background: MDI = 0 mg/day
2. Derive an appropriate MDI
3. Invoke the "MDI ≤ 50% TDI" conceptual rule: MDI = 50% TDI

It is considered that there will be some background TPH intake, so Option 1 is unlikely to be risk protective without further justification. However, it is likely that the inhalation MDI contribution for each of the C8-16 TPH fractions will be small relative to the TDIs. This is consistent with RIVM report 711701-025, which indicates that inhalation background exposure might be only expected from volatile TPH-based compounds.

The adoption of Option 3 is considered inappropriate without further consideration as this is could to significantly overestimate the background intake of TPH.

The CLEA modelling has adopted Option 2 and has used the following lines of evidence to derive and justify an appropriate MDI for the TPH fractions to be modelled:

1. The intake implications of using MDI = 50% MDI
2. Petroleum hydrocarbon odour thresholds
3. Diesel particulate matter air concentrations
4. Indoor air hydrocarbon contaminants as vapours/particulates
5. Available MDIs for naphthalene, BaP and the BTEX compounds detailed in the Agency TOX documents

The lines of evidence and adopted MDIs are discussed in the following sections.

DERIVING A TPH INHALATION MDI

Implications of Using 50% Inhalation TDI

Using the LQM TPH fraction MDIs (at 50% TDI except for aromatic C5-6 and C7-fractions for which LQM assign MDIs) and adult body weight of 70 kg, the implied background intakes (and implied background air concentration based on inhalation rate of 20 m^3/day) of the TPH fractions are summarised below:

- Total MDI across all fractions:530 mg/day (26 mg/m^3)
- Total MDI Aliphatic fractions: 520 mg/day (26 mg/m^3)
- Total MDI Aromatic fractions:11 mg/day (26 mg/m^3)
- Aliphatic C5-6 175 mg/day (8.75 mg/m^3)
- Aliphatic C6-8 175 mg/day (8.75 mg/m^3)
- Aliphatic C8-C10 10 mg/day (0.51 mg/m^3)
- Aliphatic C10-C12 10 mg/day (0.51 mg/m^3)
- Aliphatic C12-C16 10 mg/day (0.51 mg/m^3)
- Aromatic C5-7 0.2 mg/day (0.01 mg/m^3)
- Aromatic C7-8 0.52 mg/day (0.026 mg/m^3)
- Aromatic C8-C10 2.1 mg/day (0.11 mg/m^3)
- Aromatic C10-C12 2.1 mg/day (0.11 mg/m^3)
- Aromatic C12-C16 2.1 mg/day (0.11 mg/m^3)
- Total C8-C16 37 mg/day (1.8 mg/m^3)
  Values rounded for clarity

It is clear that the implication of using the 50% conceptual rule is a predicted significant background intake of petroleum hydrocarbons (nearly 0.2 kg per year for an adult) with the majority of the intake from light end and heavy end aliphatic hydrocarbons. The implied total background vapour concentrations represent very high levels that would easily be above recognised hydrocarbon odour thresholds. The credibility of the assumed background intake under the 50% rule is highlighted and discussed in the following sections.

Petroleum Hydrocarbon Odour Thresholds

The UN Health Criteria 171 document indicates that the odour threshold for diesel-type fuels (including kerosene) are likely to be in the range of 0.5 to 0.7 mg/m^3. Working on the basis that we do not continually smell diesel odours, then an upper bound diesel range MDI from vapour (sum C8 to C16 fractions) can be estimated using the median odour threshold concentration. Using a breathing rate of 20 m^3/day, gives an upper bound MDI for these fractions of 14 mg/day, which is ~ 3 times less than the sum of the equivalent MDI of 37 mg/day calculated using the 50% rule

In addition, the UN document indicates that at room temperatures, very low concentrations of vapours are likely to be generated from diesel range hydrocarbons because of their low volatility. Following atmospheric dispersion, dilution and degradation, this would mean that background vapour concentrations would be significantly lower than 0.6 mg/m^3. Indeed, if diesel range vapour concentrations were of this order, there would be a wealth of chemical data and papers investigating and documenting these high levels: this is clearly not the case.

Background Diesel Particulate Air Concentrations

The composition of diesel particulates and exhaust gases includes hundreds of organic compounds including soot, unburnt fuel hydrocarbons, PAHs and BTEX compounds.

The UN Health Criteria 171 document indicates that the general population is most likely to be exposed to diesel exhaust/particulates in busy streets or parking areas. The estimated annual average concentrations are 0.001 to 0.01 mg/m^3 in urban areas and 0.0006 to 0.0015 mg/m^3 in rural areas, based on German and American studies . These are lower than values quoted in LQM of 0.3 to 0.8 mg/m^3 for heavy traffic areas, which are not considered appropriate for residential land. The UN document indicates that the composition of diesel particulates is highly variable, although the data indicates that hydrocarbons derived from fuel/oil comprise 5% to 50% of the particulate mass, with a significant proportion of this being PAHs.

Using an approximate median value of 0.005 mg/m^3, a 25% TPH component to the particulates and a breathing rate of 20 m^3/day, gives an estimated TPH MDI via diesel exhaust particulates of 0.025 mg/day. If these hydrocarbons were all assumed to be C8-C16, then this MDI would be ~ 1,500 times less than the sum of the equivalent MDI of 37 mg/day for C8-C16 calculated using the 50% rule.

Indoor Air Contaminants

The online USEPA introduction to indoor air quality (www.epa.gov/iaq/rpart.html) indicates that particle levels in homes without smoking or other strong particle sources are the same as, or lower than, outdoor levels. This means that the background diesel particle levels discussed in the previous section can also be considered for indoor air exposures.

The USEPA introduction to indoor air quality indicates that studies indicate that levels of several organic substances can be present at average concentrations that are 2 to 5 times higher than outdoor concentrations (during and after certain activities, such as paint stripping, levels may be 1,000 times background outdoor levels). For the assessment of TPH MDIs, the odour threshold concentrations discussed in the previous section will also be considered for indoor air exposures.

Background exposure in buildings suffering from 'sick building syndrome' are not appropriate to consider for the setting of TPH MDIs as these buildings should be dealt with via occupational health initiatives and should not be considered as part of a normal exposure scenario.

Relevant Agency Inhalation MDIs

The following inhalation MDIs and background intake data for naphthalene, BaP and the BTEX compounds are detailed in the Agency TOX documents:

- BaP 0.000026 mg/day
- Naphthalene 0.0028 mg/day
- Benzene 0.15 mg/day
- Toluene 0.52 mg/day
- Ethylbenzene 0.13 mg/day
- Xylenes 0.14 mg/day

The MDIs show an expected general decreasing background intake relative to molecular weight. The MDI contribution for the TEX compounds represents 2% to 4% of the TDI and the MDI contribution for naphthalene represents 8% of the TDI.

LQM 2nd Edition

LQM provides information in relation to intake from air in Sections 9.4.4 and Table 9-7 and provides the following total daily intake for the C5-C16 fractions (50% TDI values provided in brackets for comparison):

- Aliphatic C5-6 0.38 mg/day (175 mg/day)
- Aliphatic C6-8 0.144 mg/day (175 mg/day)
- Aliphatic C8-C10 0.104 mg/day (10 mg/day)
- Aliphatic C10-C12 0.055 mg/day (10 mg/day)
- Aliphatic C12-C16 0.012 mg/day (10 mg/day)
- Aromatic C5-7 not given (0.2 mg/day)
- Aromatic C7-8 not given (0.52 mg/day)
- Aromatic C8-C10 0.353 mg/day (2.1 mg/day)
- Aromatic C10-C12 0.304 mg/day (2.1 mg/day)
- Aromatic C12-C16 0.096 mg/day (2.1 mg/day)

Adopted TPH Inhalation MDIs

Based on the presented lines of evidence and a need balance being risk protective with being realistic, the adopted TPH MDIs are discussed below.

The presented lines of evidence detailed in the previous sections clearly indicate the unlikelihood of the overall MDI for TPH being of the order of 530 mg/day (0.2 kg/year). The presence of diesel odours at anywhere near odour threshold is also considered very unlikely. The diesel particulate data can provide a tentative MDI for the combined C8-C16 aromatic/ aliphatic hydrocarbons of 0.025 mg/day. Additional benchmarking is provided by the MDIs for BTEX and PAHs from Agency TOX reports and the LQM fraction MDIs.

For the aliphatic hydrocarbon fractions, the adopted adult MDI is based on 5% of the inhalation TDI (as the aliphatic TDI is relatively high). For the aromatic hydrocarbon fractions, the adopted adult MDI is based on 10% of the inhalation TDI (as the aromatic TDI is relatively low). These percentages are consistent with TEX and PAHs (and still much higher than the LQM fraction MDIs) and provide a practical means to allow for a reasonable contribution to exposure from background intake.

This approach provides the following adult inhalation MDIs and implied background air concentrations:

- MDI Total C5-C16: 41 mg/day ($2\ mg/m^3$)
- MDI Aliphatic C5-6 18 mg/day ($0.9\ mg/m^3$) 5% TDI
- MDI Aliphatic C6-8 18 mg/day ($0.9\ mg/m^3$) 5% TDI
- MDI Aliphatic C8-C10: 1 mg/day ($0.05\ mg/\ m^3$) 5% TDI
- MDI Aliphatic C10-C12: 1 mg/day ($0.05\ mg/\ m^3$) 5% TDI
- MDI Aliphatic C12-C16: 1 mg/day ($0.05\ mg/\ m^3$) 5% TDI
- MDI Aromatic C5-7 0.2 mg/day ($0.01\ mg/m^3$) Benzene MDI
- MDI Aromatic C7-8 0.52 mg/day ($0.026\ mg/m^3$) Toluene MDI
- MDI Aromatic C8-C10: 0.42 mg/day ($0.021\ mg/\ m^3$) 10% TDI
- MDI Aromatic C10-C12 0.42 mg/day ($0.021\ mg/\ m^3$) 10% TDI
- MDI Aromatic C12-C16: 0.42 mg/day ($0.021\ mg/\ m^3$) 10% TDI

DERIVING A TPH ORAL MDI

Implications of Using 50% Oral TDI

Using the LQM TPH fraction MDIs (at 50% TDI except for aromatic C5-6 and C7-fractions for which LQM assign MDIs) and adult body weight of 70 kg, the implied background intakes of the TPH fractions are summarised below:

- Aliphatic C8-C10 3.5 mg/day
- Aliphatic C10-C12 3.5 mg/day
- Aliphatic C12-C16 3.5 mg/day
- Aliphatic C16-C35 131 mg/day
- Aromatic C8-C10 1.4 mg/day
- Aromatic C10-C12 1.4 mg/day
- Aromatic C12-C16 1.4 mg/day
- Aromatic C16-C21 1 mg/day
- Aromatic C21-C35 1 mg/day
- Total C8-C35 148 mg/day
  Values rounded

Mineral Oils in Food and Water

There are limited studies reporting the potential for the presence of mineral oils in food and drink. The following information has been identified:

- The Dutch Institute of Food Safety (2008) reported a UK average adult oral daily intake of mineral hydrocarbons of 0.47 mg/kg bw/day (www.library.wur.nl/way/bestanden/clc/1893136.pdf).
- A study reported in 2009 (M Biedermann et al, in Journal of Agricultural and Food Chemistry, 57, 19), indicates that aromatic hydrocarbons of mineral oil origin in foods and edible oils comprised 20-30% aromatic hydrocarbons (www.pubs.acs.org/doi/abs/10.1021/jf901375e).

Using an adult oral daily intake of 0.47 mg/kg bw/day, a 30% aromatic to 70% aliphatic split, an adult body weight of 70 kg and apportioning the total adult oral daily intake across the C8-C35 fractions, the following MDIs can be calculated:

- Aliphatic C8-C10 4.6 mg/day
- Aliphatic C10-C12 4.6 mg/day
- Aliphatic C12-C16 4.6 mg/day
- Aliphatic C16-C35 9.2 mg/day
  Treated as two fractions
- Aromatic C8-C10 2 mg/day
- Aromatic C10-C12 2 mg/day
- Aromatic C12-C16 2 mg/day
- Aromatic C16-C21 2 mg/day
- Aromatic C21-C35 2 mg/day
- Total C8-C35 33 mg/day

LQM 2nd Edition

LQM provides information in relation to intake from food in Section 9.4.2 and water in Section 9.4.3. Table 9-7 and provides the following total daily intake for the C5-C16 fractions (50% TDI values provided in brackets for comparison):

- Aliphatic C5-6 0.38 mg/day (175 mg/day)
- Aliphatic C6-8 0.144 mg/day (175 mg/day)
- Aliphatic C8-C10 0.104 mg/day (10 mg/day)
- Aliphatic C10-C12 0.055 mg/day (10 mg/day)
- Aliphatic C12-C16 0.012 mg/day (10 mg/day)
- Aromatic C5-7 not given (0.2 mg/day)
- Aromatic C7-8 not given (0.52 mg/day)
- Aromatic C8-C10 0.353 mg/day (2.1 mg/day)
- Aromatic C10-C12 0.304 mg/day (2.1 mg/day)
- Aromatic C12-C16 0.096 mg/day (2.1 mg/day)

Adopted TPH Oral MDIs

The calculated MDIs detailed in the previous sections have been adopted for the TPH fractions. For adults, this means that 50 % rule will be invoked for all fractions except aliphatic C16-C35.

TPH FRACTION ADDITIVITY

The current Agency guidance on Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils (Science Report P5-080/TR3) recommends that additivity of the toxicological effects across TPH fractions are considered where appropriate by human health risk assessments.

Where appropriate, CLEA model output can be calculated for the sum of the TPH fractions (∑TPH) from the individual CLEA pathway outputs for each modelled TPH fraction. This is undertaken using a representative composition of TPH (i.e. percentage breakdown of fraction) in soil and groundwater.

However, because of the mixed TPH sources identified at the site it is not considered appropriate to generate ∑TPH as part of the CLEA modelling. The CLEA TPH fraction outputs will be considered in the Remediation Design and will take into account the issue of TPH fraction additivity where appropriate.

APPENDIX C3

CLEA MODELLING OUTPUT

REDEVELOPED SITE USE

Intentionally Blank

CLEA MODELLING OUTPUT

REDEVELOPED SITE USE
RESIDENTIAL - SOIL & GROUNDWATER

Intentionally Blank

ACTIVE CHILD RECEPTOR

Child Scenario	Receptor	AgeClass	AgeClass	AgeClass	AgeClass	AgeClass	AgeClass
SR3 Residential	**Female Child AC1-6**	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**
Gardener	Average						
Direct soil & dust ingestion	days/year	180	365	365	365	365	365
Consumption of homegrown produce	days/year	180	365	365	365	365	365
Skin contact - indoors	days/year	180	365	365	365	365	365
Skin contact - outdoors	days/year	180	365	365	365	365	365
Inhalation of dusts & vapours - indoors	days/year	365	365	365	365	365	365
Inhalation of dusts & vapours - outdoors	days/year	365	365	365	365	365	365
Occupany period - indoor	hours/day	23	23	23	23	19	19
Occupany period - outdoor	hours/day	1	1	1	1	1	1
Averaging Time	Days	365	365	365	365	365	365
Exposure Duration	years	1	1	1	1	1	1
Soil skin adherence factor - indoor	mg/cm2/day	0.06	0.06	0.06	0.06	0.06	0.06
Soil skin adherence factor - outdoor	mg/cm2/day	1	1	1	1	1	1
Direct soil & dust ingestion rate	g/day	0.1	0.1	0.1	0.1	0.1	0.1
Body weight	kg	5.6	9.8	12.7	15.1	16.9	19.7
Body height	m	0.7	0.8	0.9	0.9	1	1.1
Inhalation rate	m3/day	8.5	13.3	12.7	12.2	12.2	12.2
Max exp skin factor - indoor	m2/m2	0.32	0.33	0.32	0.35	0.35	0.33
Max exp skin factor - outdoor	m2/m2	0.26	0.26	0.25	0.28	0.28	0.26
Max exposed skin area - indoor	m2	0.0366	0.0533	0.0620	0.0742	0.0822	0.0873
Max exposed area - outdoor	m2	0.0297	0.0420	0.0485	0.0593	0.0657	0.0688
Total skin area	m2	0.34	0.48	0.58	0.64	0.70	0.79
HG Fraction - Green Veg	Average	0.05	0.05	0.05	0.05	0.05	0.05
HG Fraction - Root Veg	Average	0.06	0.06	0.06	0.06	0.06	0.06
HG Fraction - Tuber Veg	Average	0.02	0.02	0.02	0.02	0.02	0.02
HG Fraction - Herb Fruit	Average	0.06	0.06	0.06	0.06	0.06	0.06
HG Fraction - Shrub Fruit	Average	0.09	0.09	0.09	0.09	0.09	0.09
HG Fraction - Tree Fruit	Average	0.04	0.04	0.04	0.04	0.04	0.04
Green vegetables	g-FW/kg-bw/day	7.12	6.85	6.85	6.85	3.74	3.74
Root vegetables	g-FW/kg-bw/day	10.69	3.3	3.3	3.3	1.77	1.77
Tuber vegetables	g-FW/kg-bw/day	16.03	5.46	5.46	5.46	3.38	3.38
Herbaceous fruit	g-FW/kg-bw/day	1.83	3.96	3.96	3.96	1.85	1.85
Shrub fruit	g-FW/kg-bw/day	2.23	0.54	0.54	0.54	0.16	0.16
Tree fruit	g-FW/kg-bw/day	3.82	11.96	11.96	11.96	4.26	4.26
Oral MDI Correction Factor	Unitless	0.53	0.66	0.65	0.65	0.74	0.74
Inhalation MDI Correction Factor	Unitless	0.51	0.8	0.77	0.74	0.74	0.74
Typical Body Weight for MDI Calcs	kg	5.6	9.8	12.7	15.1	16.9	19.7

	CHEMICAL DATABASE		COC-1	COC-2	COC-3	COC-4	COC-5	COC-6	COC-7	COC-8	COC-9	COC-10	COC-11	COC-12	COC-13	COC-14	COC-15	COC-16
1	Chemical	Comments/Notes/Units	Aliphatic TPH C5-6	Aliphatic TPH C6-8	Aliphatic TPH C8-10	Aliphatic TPH C10-12	Aliphatic TPH C12-16	Aromatic TPH C5-7	Aromatic TPH C7-8	Aromatic TPH C8-10	Aromatic TPH C10-12	Aromatic TPH C12-16	Aromatic TPH C16-21	Benzene	Toluene	Ethylbenzene	Xylene-m	Xylene-o
2	CAS/REF		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	71432	108883	100414	108383	95476
3	Type	O=Organic, I=Inorganic	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
4	Oral HCV	HCV Type	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	ID	TDI	TDI	TDI	TDI
5	Adopted TDI	mg/kg-BW/day	5.00000	5.00000	0.10000	0.10000	0.10000	0.22300	0.22300	0.04000	0.04000	0.04000	0.03000	0.00029	0.22300	0.10000	0.18000	0.18000
6	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Benzene CLEA SR	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
7	Inhalation HCV	HCV Type	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	NR	ID	TDI	TDI	TDI	TDI
8	Vapour Assessment	Y/N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	Adopted TDI	mg/kg-BW/day	5.00000	5.00000	0.29000	0.29000	0.29000	1.40000	1.40000	0.06000	0.06000	0.06000	0.03000	0.00140	1.40000	0.22000	0.06000	0.06000
10	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Oral HCV	Benzene CLEA SR	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
11	Dermal HCV	HCV Type	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV
12	Adopted TDI	mg/kg-BW/day	5.0000	5.0000	0.1000	0.1000	0.1000	0.2230	0.2230	0.0400	0.0400	0.0400	0.0300	0.0003	0.2230	0.1000	0.1800	0.1800
13	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Benzene CLEA SR	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
14	Combine AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Oral adult MDI	mg/day	18	18	4.6	4.6	4.6	0.003	0.01	2	2	2	2	0	0.01	0.005	0.011	0.02
16		Notes	Based on 5% of TDI	Based on 5% of TDI	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Index Dose	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
17	Inhalation adult MDI	mg/day	18	18	1	1	1	0.2	0.52	0.42	0.42	0.42	0.210	0	0.52	0.13	0.14	0.14
18		Notes	Based on 5% of TDI	Based on 5% of TDI	Based on 5% of TDI	Based on 5% of TDI	Based on 5% of TDI	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Based on 10% of TDI	Based on 10% of TDI	Based on 10% of TDI	Based on 10% of TDI	Index Dose	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
19	Kaw (H')		2.10E+01	2.73E+01	4.15E+01	6.44E+01	1.71E+02	1.16E-01	1.15E-01	2.53E-01	7.22E-02	1.26E-02	6.95E-04	1.16E-01	1.15E-01	1.39E-01	1.12E-01	9.20E-02
20		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
21	Dair	m2/s	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	8.77E-06	7.78E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	8.77E-06	7.78E-06	7.04E-06	7.03E-06	7.01E-06
22		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
23	Dwat	m2/s	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	6.64E-10	5.88E-10	1.00E-09	1.00E-09	1.00E-09	1.00E-09	6.64E-10	5.88E-10	5.31E-10	5.31E-10	5.31E-10
24		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
25	RAM	g/mol	81	100	130	160	200	78	92	120	130	150	190	78	92	106	106	106
26		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
27	VP	Pa	21,922	3,451	320	32	2	6,240	1,730	320	32	1	0	6,240	1,730	553	495	386
28		At 283 K & Stand Pressure unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
29	Solubility	mg/l	3.59E+01	5.37E+00	4.27E-01	3.39E-02	7.59E-04	1.78E+03	5.90E+02	6.46E+01	2.45E+01	5.75E+00	6.53E-01	1.78E+03	5.90E+02	1.80E+02	2.00E+02	1.73E+02
30		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	At 25oC. CLEA SR7
31	Koc - log	Log (cm3/g)	2.91E+00	3.58E+00	4.48E+00	5.38E+00	6.73E+00	1.83E+00	2.31E+00	3.20E+00	3.40E+00	3.70E+00	4.15E+00	1.83E+00	2.31E+00	2.65E+00	2.69E+00	2.63E+00
32	Koc	cm3/g)	812.831	3,801.894	30,199.517	239,883.292	5,370,317.964	67.608	204.174	1,584.893	2,511.886	5,011.872	14,125.375	67.608	204.174	446.684	489.779	426.580
33		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
34	Kow - log	Log (dimensionless)	3.31E+00	4.13E+00	5.22E+00	6.30E+00	7.94E+00	2.13E+00	2.73E+00	3.69E+00	3.93E+00	4.29E+00	4.82E+00	2.13E+00	2.73E+00	3.15E+00	3.20E+00	3.12E+00
35	Kow	dimensionless	2,042	13,490	165,959	1,995,262	87,096,359	135	537	4,898	8,511	19,498	66,069	135	537	1,413	1,585	1,318
36		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
37	Kd - Metals Only	cm3/g	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	n/a	n/a	n/a	n/a	NR
38		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	Dermal AF	unitless	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01
40		Notes	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	CLEA default SR3	CLEA default SR3	CLEA default SR3	CLEA default SR3	CLEA default SR3
41	Soil-plant availability correction (d)	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
42	Fint-rs: Root-Shoot	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
43	Fint-rst: Root-RootStore	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
44	Fint-rt: Root-Tuber	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
45	Fint-rf: Root-Fruit	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
46	Soil plant CF - green veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
47	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Soil plant CF - root veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
50	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	Soil plant CF - tuber veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
53	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	Soil plant CF - H fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
56	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	Soil plant CF - S fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
59	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	Soil plant CF - T fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
62	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	Soil-to-dust TF	g/g-DW	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
65	BA Fraction	Soil	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
66	BA Fraction	Airborne dust	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
67	Indoor Air CF for Soil & Groundwater	unitless	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1
68	Molar Gas Constant Pa/m3/mol/K	8.314472																
69	Ambient Temperature Tamb K	283																
70	Soil Water Partition Coefficent Kd	SR3 Eq 5.2	4.71	22.05	175.16	1391.32	31147.84	0.39	1.18	9.19	14.57	29.07	81.93	0.39	1.18	2.59	2.84	2.47
71	Total Soil Water Partition Coefficent Ksw	SR3 Eq 5.4	8.46	26.84	182.29	1402.24	31176.38	0.68	1.48	9.51	14.85	29.34	82.20	0.68	1.48	2.89	3.13	2.76
72	Saturated Aqaues Contration for InOrganics Csatw	SR3 Eq 5.11 (mg/kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
73	Saturated Aqaues Contration for Organics Csatw	SR3 Eq 5.12 (mg/kg)	303.7	144.1	77.8	47.5	23.7	1217.6	870.8	614.1	363.9	168.7	53.7	1217.6	870.8	519.6	626.4	477.8
74	Saturated Vapour Concentration Csatvap	SR3 Eq 5.13 (mg/m3)	754,647	146,664	17,680	2,183	130	207,143	67,744	16,320	1,773	73	0	207,143	67,744	24,952	22,335	17,417
75	Saturated Vapour Concentration Csatv	SR3 Eq 5.13 (mg/kg)	304	144	78	48	24	1,221	869	613	365	169	54	1,221	869	518	625	523
76																		
77	Inorganics - Calculated Veg Uptake Parameters																	
78	CR Soil to Root System correction factor	SR3 Eq 7.3 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
79	Inorganic CF for Gveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
80	Inorganic CF for Rveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
81	Inorganic CF for Tveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
82	Inorganic CF for Friut	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
83																		
84	Oganics - Calculated Veg Uptake Parameters																	
85	Organic CFgv Green Veg	SR3 Eq 7.5	0.7986	0.2764	0.0285	0.0011	0.0000	1.9747	1.6046	0.5459	0.3903	0.2163	0.0734	1.9747	1.6046	1.2160	1.1679	1.2344
86	Organic CFrv Root Veg	SR3 Eq 7.7	1.1427	0.3740	0.0554	0.0072	0.0003	4.6358	2.7188	0.7485	0.5278	0.2964	0.1148	4.6358	2.7188	1.8299	1.7394	1.8680
87	Organic CFtv Tuber Veg	SR3 Eq 7.9	0.180	0.105	0.047	0.012	0.001	1.432	0.716	0.197	0.151	0.112	0.069	1.432	0.716	0.468	0.439	0.484
88	Organic CFtf Tree Fruit	SR3 Eq 7.15	0.221500514	0.032049131	0.000738482	5.80217E-06	3.81981E-10	3.353121216	1.604905763	0.146641519	0.073485373	0.023681795	0.003610906	3.353121216	1.604905763	0.710769458	0.638091339	0.753858233
89																		
90	Krw root & water partition coeffecient	SR3 Eq 7.6	11.7	47.1	319.8	2165.1	39637.8	2.2	4.7	22.1	33.3	62.2	157.8	2.2	4.7	9.0	9.8	8.6
91	Kch for Root Tubers	SR3 Table 7.5	2	3	3	3	3	1	1	2	2	3	3	1	1	2	2	2
92	Kpw potato & water partition coeffecient	SR3 Eq 7.8	1.64	3.26	14.17	87.99	1586.89	1.05	1.15	2.05	2.50	3.87	7.69	1.05	1.15	1.53	1.56	1.52
93	k1 chemical flux into potoato	SR3 Eq 7.11	0.003530	0.001113	0.000164	0.000021	0.000001	0.028982	0.011895	0.003141	0.002010	0.001017	0.000363	0.028982	0.011895	0.005492	0.005062	0.005740
94	k2 chemical out of potoato	SR3 Eq 7.10	0.018210	0.009147	0.002106	0.000339	0.000019	0.018840	0.015222	0.014532	0.011926	0.007715	0.003880	0.018840	0.015222	0.010342	0.010143	0.010457
95	Kwood wood & water partition coeffecient	SR3 Eq 7.12	66	219	1,069	5,148	55,986	12	29	115	164	276	597	12	29	53	57	50
96	Cxy Chem Conc in Xylem	SR3 Eq 7.13	0.0693107808	0.0100591920	0.0002357104	0.0000019998	0.0000000003	1.0481001205	0.5018192642	0.0459312092	0.0230393138	0.0074414470	0.0011418894	1.0481001205	0.5018192642	0.2223490211	0.1996290519	0.2358178405
97	Nomimal Cs: cancels out	Required for Calcs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
98	Cstem Chem Conc in woody stem	SR3 Eq 7.14	4.594	2.192	0.247	0.009	0.000	12.487	14.311	5.287	3.757	2.044	0.674	12.487	14.311	11.678	11.275	11.857
99																		

COC-17	COC-18	COC-19
Xylene-p	**MTBE EIC**	**Phenol SR Tox**
106423	1634044	108952
O	O	O
TDI	TDI	TDI
0.18000	0.30000	0.70000
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
TDI	TDI	TDI
Y	Y	Y
0.06000	0.72200	0.01000
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
Oral HCV	Oral HCV	Inhal HCV
0.1800	0.3000	0.0100
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
Yes	Yes	Yes
0.02	0.001	0.35
CLEA Tox 19	EIC Jan 2010	Phenol CLEA SR
0.14	0.2	0.04
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
1.07E-01	1.60E-02	8.35E-06
CLEA SR7	EIC Jan 2010	CLEA SR7
7.04E-06	7.82E-06	7.90E-06
CLEA SR7	EIC Jan 2010	CLEA SR7
5.31E-10	5.62E-10	6.36E-10
CLEA SR7	EIC Jan 2010	CLEA SR7
106	88	94
CLEA SR7	EIC Jan 2010	CLEA SR7
475	18,425	12
CLEA SR7	EIC Jan 2010	CLEA SR7
2.00E+02	4.80E+04	8.41E+04
CLEA SR7	EIC Jan 2010	At 25oC. CLEA SR7
2.65E+00	1.53E+00	1.92E+00
446.684	33.884	83.176
CLEA SR7	EIC Jan 2010	CLEA SR7
3.15E+00	9.40E-01	1.48E+00
1,413	9	30
CLEA SR7	EIC Jan 2010	CLEA SR7
NR	NR	NR
0	EIC Jan 2010	0
1.00E-01	1.00E-01	3.00E-01
CLEA default SR3	EIC Jan 2010	Phenol CLEA SR
NR	NR	NR
NR	NR	NR
NR	NR	NR
NR	NR	NR
NR	NR	NR
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
0.5	0.5	0.5
1	1	1
1	1	1
10 & 1	1 & 1	1 & 1
2.59	0.20	0.48
2.88	0.47	0.76
n/a	n/a	n/a
576.2	22651.3	63508.3
21,433	690,240	460
577	20,358	41,597
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
1.2160	1.1133	1.0476
1.8299	4.8412	2.4020
0.469	1.660	1.131
0.712074286	1.995957512	2.140255569
9.0	1.1	1.3
2	0.2	0.5
1.53	0.84	0.91
0.005503	0.035557	0.025146
0.010342	0.020017	0.020836
53	2	5
0.2227572087	0.6237630319	0.6688917673
1	1	1
11.700	1.315	3.095

	CHEMICAL DATABASE		COC-1	COC-2	COC-3	COC-4	COC-5
1	Chemical	Comments/Notes/Units	Acenaphthene	Acenaphthylene	Benzo-a-anthracene	Fluorene	Naphthalene
2	CAS/REF		83329	208968	56553	86737	91203
3	Type	O=Organic, I=Inorganic	O	O	O	O	O
4	Oral HCV	HCV Type	TDI	TDI	ID	TDI	TDI
5	Adopted TDI	mg/kg-BW/day	0.06000	0.06000	0.00014	0.04000	0.02000
6	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009
7	Inhalation HCV	HCV Type	TDI	TDI	ID	TDI	TDI
8	Vapour Assessment	Y/N	Y	Y	Y	Y	Y
9	Adopted TDI	mg/kg-BW/day	0.06000	0.06000	0.00000	0.04000	0.00086
10	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009
11	Dermal HCV	HCV Type	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV
12	Adopted TDI	mg/kg-BW/day	0.0600	0.0600	0.0001	0.0400	0.0200
13	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009
14	Combine AC		Yes	Yes	Yes	Yes	Yes
15	Oral adult MDI	mg/day	0.00098	0.00014	0	0.00059	0.007
16		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Index Dose	LQM 2nd Ed 2009	LQM 2nd Ed 2009
17	Inhalation adult MDI	mg/day	0.000025	0.000011	0	0.00096	0.0028
18		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Index Dose	LQM 2nd Ed 2009	LQM 2nd Ed 2009
19	Kaw (H')		7.59E-04	5.68E-04	3.16E-05	4.12E-04	6.62E-03
20		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
21	Dair	m2/s	5.85E-06	5.97E-06	4.60E-06	5.58E-06	6.52E-06
22		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
23	Dwat	m2/s	4.70E-10	4.82E-10	3.80E-10	4.47E-10	5.16E-10
24		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
25	RAM	g/mol	154	152	228	166	128
26		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
27	VP	Pa	0	0	0	0	2
28		At 283 K & Stand Pressure unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
29	Solubility	mg/l	4.11E+00	7.95E+00	3.80E-03	1.86E+00	1.90E+01
30		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
31	Koc - log	Log (cm3/g)	3.37E+00	3.26E+00	4.89E+00	3.45E+00	2.81E+00
32	Koc	cm3/g)	2,344.229	1,819.701	77,624.712	2,818.383	645.654
33		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
34	Kow - log	Log (dimensionless)	4.03E+00	3.91E+00	5.91E+00	4.13E+00	3.34E+00
35	Kow	dimensionless	10,715	8,128	812,831	13,490	2,188
36		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
37	Kd - Metals Only	cm3/g	NR	NR	NR	NR	NR
38		Notes	0	0	0	0	0
39	Dermal AF	unitless	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01
40		Notes	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II
41	Soil-plant availability correction (d)	unitless	NR	NR	NR	NR	NR
42	Fint-rs: Root-Shoot	unitless	NR	NR	NR	NR	NR
43	Fint-rst: Root-RootStore	unitless	NR	NR	NR	NR	NR
44	Fint-rt: Root-Tuber	unitless	NR	NR	NR	NR	NR
45	Fint-rf: Root-Fruit	unitless	NR	NR	NR	NR	NR
46	Soil plant CF - green veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
47	Fresh weight to dry soil	Type	0	0	0	0	0
48		Notes	0	0	0	0	0
49	Soil plant CF - root veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
50	Fresh weight to dry soil	Type	0	0	0	0	0
51		Notes	0	0	0	0	0
52	Soil plant CF - tuber veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
53	Fresh weight to dry soil	Type	0	0	0	0	0
54		Notes	0	0	0	0	0
55	Soil plant CF - H fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
56	Fresh weight to dry soil	Type	0	0	0	0	0
57		Notes	0	0	0	0	0
58	Soil plant CF - S fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
59	Fresh weight to dry soil	Type	0	0	0	0	0
60		Notes	0	0	0	0	0
61	Soil plant CF - T fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
62	Fresh weight to dry soil	Type	0	0	0	0	0
63		Notes	0	0	0	0	0
64	Soil-to-dust TF	g/g-DW	0.5	0.5	0.5	0.5	0.5
65	BA Fraction	Soil	1	1	1	1	1
66	BA Fraction	Airborne dust	1	1	1	1	1
67	Indoor Air CF for Soil & Groundwater	unitless	1 & 1	1 & 1	1 & 1	1 & 1	1 & 1
68	Molar Gas Constant Pa/m3/mol/K	8.314472					
69	Ambient Temperature Tamb K	283					
70	Soil Water Partition Coefficent Kd	SR3 Eq 5.2	13.60	10.55	450.22	16.35	3.74
71	Total Soil Water Partition Coefficent Ksw	SR3 Eq 5.4	13.87	10.83	450.50	16.62	4.02
72	Saturated Aqaues Contration for InOrganics Csatw	SR3 Eq 5.11 (mg/kg)	n/a	n/a	n/a	n/a	n/a
73	Saturated Aqaues Contration for Organics Csatw	SR3 Eq 5.12 (mg/kg)	57.0	86.1	1.7	30.9	76.4
74	Saturated Vapour Concentration Csatvap	SR3 Eq 5.13 (mg/m3)	5	5	0	1	126
75	Saturated Vapour Concentration Csatv	SR3 Eq 5.13 (mg/kg)	88	87	2	44	76
76							
77	**Inorganics - Calculated Veg Uptake Parameters**						
78	CR Soil to Root System correction factor	SR3 Eq 7.3 or Database	n/a	n/a	n/a	n/a	n/a
79	Inorganic CF for Gveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
80	Inorganic CF for Rveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
81	Inorganic CF for Tveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
82	Inorganic CF for Friut	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
83							
84	**Oganics - Calculated Veg Uptake Parameters**						
85	Organic CFgv Green Veg	SR3 Eq 7.5	0.4327	0.5309	0.0059	0.3712	1.0151
86	Organic CFrv Root Veg	SR3 Eq 7.7	0.5871	0.7227	0.0220	0.5045	1.4712
87	Organic CFtv Tuber Veg	SR3 Eq 7.9	0.165	0.183	0.015	0.146	0.360
88	Organic CFtf Tree Fruit	SR3 Eq 7.15	0.070133873	0.103067786	5.59723E-05	0.051751154	0.457318798
89							
90	Krw root & water partition coeffecient	SR3 Eq 7.6	39.6	32.2	1084.8	47.1	12.3
91	Kch for Root Tubers	SR3 Table 7.5	3	2	3	3	2
92	Kpw potato & water partition coeffecient	SR3 Eq 7.8	2.96	2.46	44.77	3.26	1.66
93	k1 chemical flux into potoato	SR3 Eq 7.11	0.001012	0.001329	0.000025	0.000803	0.003834
94	k2 chemical out of potoato	SR3 Eq 7.10	0.004735	0.005854	0.000253	0.004089	0.009263
95	Kwood wood & water partition coeffecient	SR3 Eq 7.12	189	159	2,918	219	69
96	Cxy Chem Conc in Xylem	SR3 Eq 7.13	0.0219997760	0.0323110414	0.0000185122	0.0162430236	0.1431102676
97	Nomimal Cs: cancels out	Required for Calcs	1	1	1	1	1
98	Cstem Chem Conc in woody stem	SR3 Eq 7.14	4.147	5.118	0.051	3.539	9.907
99							

Merton Street, Banbury, on-site residential trans zone | **Project Ref** **41403** | **14 Oct 10** | **Revision** **100** | **SR3 V701**

Child Scenario SR3 Residential

Female Child AC1-6: Site Assessment Criteria

Calculate GACs

Calculate SSAC

Key Parameter Check

Oral Pathways: Ingestion; Veg Attached (n/a); Veg Direct (n/a); Dermal

Inhalation Pathways: Dust Inhalation; Vapour Inhalation

No	Type	COC	SOIL-D (Ingestion)	SOIL-ID (Veg Attached)	Veg-D (Veg Direct)	DERM-I (Dermal)	DERM-O	Dust-I (Dust Inhalation)	Dust-O	Vap In (Vapour Inhalation)	Out Surf	Out Sub	Oral MDI 50% Rule	Inhal MDI 50% Rule	Comb AC	Derm Via	Vol Ass	Use Vol	Calculated SSAC	Adopted SSAC
COC-1	TPH	Aliphatic TPH C5-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	56	n/a	9,169.800	FALSE	FALSE	Yes	Oral HCV	Y	Yes	55.49	
COC-2	TPH	Aliphatic TPH C6-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	136	n/a	22,380	FALSE	FALSE	Yes	Oral HCV	Y	Yes	135.47	
COC-3	TPH	Aliphatic TPH C8-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	36	n/a	5,868	TRUE	FALSE	Yes	Oral HCV	Y	Yes	36	
COC-4	TPH	Aliphatic TPH C10-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	177	n/a	29,090	TRUE	FALSE	Yes	Oral HCV	Y	Yes	176.0	
COC-5	TPH	Aliphatic TPH C12-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,483	n/a	243,600	TRUE	FALSE	Yes	Oral HCV	Y	Yes	1,474	
COC-6	TPH	Aromatic TPH C5-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	314	n/a	54,170	FALSE	FALSE	Yes	Oral HCV	Y	Yes	312	
COC-7	TPH	Aromatic TPH C7-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	729	n/a	131,000	FALSE	FALSE	Yes	Oral HCV	Y	Yes	725	
COC-8	TPH	Aromatic TPH C8-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	46	n/a	7,544	TRUE	FALSE	Yes	Oral HCV	Y	Yes	46	
COC-9	TPH	Aromatic TPH C10-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	251	n/a	41,090	TRUE	FALSE	Yes	Oral HCV	Y	Yes	249	
COC-10	TPH	Aromatic TPH C12-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,783	n/a	449,600	TRUE	FALSE	Yes	Oral HCV	Y	Yes	2,766	
COC-11	TPH	Aromatic TPH C16-21	n/a	n/a	n/a	n/a	n/a	n/a	n/a	53,410	n/a	6,750,000	TRUE	FALSE	Yes	Oral HCV	Y	Yes	52,991	
COC-12	BTEX	Benzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.317	n/a	55	FALSE	FALSE	Yes	Oral HCV	Y	Yes	0	
COC-13	BTEX	Toluene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	729	n/a	131,000	FALSE	FALSE	Yes	Oral HCV	Y	Yes	725	
COC-14	BTEX	Ethylbenzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	196	n/a	36,340	FALSE	FALSE	Yes	Oral HCV	Y	Yes	195	
COC-15	BTEX	Xylene-m	n/a	n/a	n/a	n/a	n/a	n/a	n/a	64	n/a	11,890	FALSE	FALSE	Yes	Oral HCV	Y	Yes	64	
COC-16	BTEX	Xylene-o	n/a	n/a	n/a	n/a	n/a	n/a	n/a	69	n/a	12,790	FALSE	FALSE	Yes	Oral HCV	Y	Yes	68	
COC-17	BTEX	Xylene-p	n/a	n/a	n/a	n/a	n/a	n/a	n/a	62	n/a	11,430	FALSE	FALSE	Yes	Oral HCV	Y	Yes	61	
COC-18	BTEX	MTBE EIC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	85	n/a	152,300	FALSE	FALSE	Yes	Oral HCV	Y	Yes	85	
COC-19	OTHER	Phenol SR Tox	n/a	n/a	n/a	n/a	n/a	n/a	n/a	990	n/a	96,960	FALSE	FALSE	Yes	Inhal HCV	Y	Yes	980	
COC-20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a	

Uses Highest ADE

No	Csatv	Csatw	Total ORAL	Total INHAL	SOIL-D	SOIL-I	VEG	DERM-I	DERM-O	DUST-I	DUST-O	VAP-I	VAP-Osurf	VAP-Osub	ADE COC	ADE BG	Oral Active	Dermal
COC-1	304	304	-	55.5	-	-	-	n/a	n/a	-	-	78%	-	0%	78.2%	21.8%	N	O
COC-2	144	144	-	135.5	-	-	-	n/a	n/a	-	-	78%	-	0%	78.2%	21.8%	N	O
COC-3	78	78	-	35.5	-	-	-	n/a	n/a	-	-	79%	-	0%	79.1%	20.9%	N	O
COC-4	48	48	-	176.0	-	-	-	n/a	n/a	-	-	79%	-	0%	79.1%	20.9%	N	O
COC-5	24	24	-	1,474.0	-	-	-	n/a	n/a	-	-	79%	-	0%	79.1%	20.9%	N	O
COC-6	1,221	1,218	-	312.39	-	-	-	n/a	n/a	-	-	99%	-	1%	99.1%	0.9%	N	O
COC-7	869	871	-	725.0	-	-	-	n/a	n/a	-	-	97%	-	1%	97.7%	2.3%	N	O
COC-8	613	614	-	45.7	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-9	365	364	-	249.4	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-10	169	169	-	2,765.9	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-11	54	54	-	52,990.7	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-12	1,221	1,218	-	0.315	-	-	-	n/a	n/a	-	-	99%	-	1%	100.0%	0.0%	N	O
COC-13	869	871	-	725.0	-	-	-	n/a	n/a	-	-	97%	-	1%	97.7%	2.3%	N	O
COC-14	518	520	-	194.7	-	-	-	n/a	n/a	-	-	96%	-	1%	96.4%	3.6%	N	O
COC-15	625	626	-	63.7	-	-	-	n/a	n/a	-	-	85%	-	0%	85.9%	14.1%	N	O
COC-16	523	478	-	68.5	-	-	-	n/a	n/a	-	-	85%	-	0%	85.9%	14.1%	N	O
COC-17	577	576	-	61.3	-	-	-	n/a	n/a	-	-	85%	-	0%	85.9%	14.1%	N	O
COC-18	20,358	22,651	-	85.4	-	-	-	n/a	n/a	-	-	98%	-	0%	98.3%	1.7%	N	O
COC-19	41,597	63,508	-	980.1	-	-	-	n/a	n/a	-	-	75%	-	1%	75.8%	24.2%	N	I
COC-20	n/a	n/a	-	-	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a

Child Receptor

Adult Receptor

Soil Only

GW Only

Soil & GW

Global SOM	1.00%	0.0058	Foc Equiv
Soil Type	Sandy Loam	Default Sandy Loam	
City	Newcastle	Default Newcastle	
Site Area Res	2	Hectares	Default 0.01
Site Area Com	2	Hectares	Default 2
Wind Type	Urban		

Indoor Air	Residential	Commercial	
Building	SR3 Small Terrace	SR3 Pre-1970 3 Storey Office	
Building Qs	Site Specific	Site Specific	
Foundation Void	No Void	n/a	
Use CF of >1	Y	Y	
Indoor Soil Source	50	50	DF = 50 cm
Indoor GW Source	100	100	cm

TPH Select

Solvents

TPH >C8 Select

ODDs

TPH All

Metals

PAH 16

Merton Street, Banbury, on-site residential trans zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 9 Indoor Air Inhalation - Subsurface Soil

SR3 V701

Parameter	Symbol	Value	Units	Notes
Soil Source Properties				
Depth to Contamination from Floor Level	Ls	65	cm	Default 65cm ignore void height
Depth to Contamination from Base of Foundation	Lt (Ls-Zc)	50	cm	SR4 Eq 4.3

Soil Properties		Soil Diffusion Zone	Adopted Fnd Crack	Void Fnd Crack	
Soil Types		Sandy Loam	Sandy Loam	Dry Sand	
Air-filled porosity	Oa	0.2	0.2	0.47	cm3/cm3
Water-filled porosity	Ow	0.33	0.33	0.07	cm3/cm3
Total Porosity/Satuated Porosity	Ot	0.53	0.53	0.54	cm3/cm3
Residual soil water content	Or	0.12	0.12	0.07	cm3/cm3
Saturated hydraulic conductivity	Ks	0.00356			
van Genuchten shape parameter (m)	M	0.3201			
Bulk density	p	1.21	g/cm3		
Mean Particle Diameter (D)	D	0.03			

Parameter	Symbol	Value	Units	Notes
Groundwater Specific Properties & Calculations				
Depth to Water Table from Floor Level	Lw	115	cm	
Depth to Water Table from Base Slab	Ltw (Lw-Zc)	100	cm	
van Genuchten shape parameter (n)	n	1.47	unitless	
Air-filled porosity in the capillary zone	Oacz	0.08	unitless	
Water-filled porosity in the capillary zone	Owcz	0.45	unitless	
Thickness of capillary Zone	Lcz	25.00	cm	
Building Ventilation & Ingress Calculations		Y	Use Indoor Air CF of >1	
Building Ventilation rate	Qb or (Qb +Qs)	18,667	cm3/s	SR3 Eq 10.5 (+ Qs) ☐ Use Qb=Qb+Qs
Flow Rate of Soil Gas (Default 25 (17-150))	Qs	14.5	cm3/s	Site Specific; SR3 Eq A9 Defualt = 25
Natural Ventilation with opening one walls	Qv1	477	cm3/s	○ One Wall; BS5925 Table 12a
Natural Ventilation with opening on two walls	Qv2	7,802	cm3/s	● Two Walls; BS5925 Table 11a
Adopted Void Ventilation Rate	Qv	0	cm3/s	
Effective Crack radius	rcrack	0.200	cm	SR3 Eq A3
Effective Total Fluid Saturation	ste	0.512	unitless	SR3 Eq A4
Relative Soil Permeability	krg	0.642	unitless	SR3 Eq A5
Soil Intrinsic Permeability	ki	4.75E-08	cm2	SR3 Eq A6
Effective Air Permeability	kv	3.05E-08	cm2	SR3 Eq A7
Effective Air Viscosity	ua	1.75E-04	g/cm/s	SR3 Eq A8
Soil Temperature	Tamb	283.15	K	SR3 Default
BS5925:1991 Void Ventilation Parameters				
Discharge Coefficient (sharp edged orifice)	Cd	0.61	unitless	BS5925 Pg16
Effective Fraction of void openings	Veff	0.5	unitless	Default 50% Efficiency
Effective equivalent area of openings for one wa	Aw	0.0194	m2	BS5925 Table 12a
Effective equivalent area of openings for two wa	Aw	0.0137	m2	BS5925 Table 11a
Wind Speed at building height Uz	ur	0.98	m/s	BS5925 Eq 5
Differential Mean Pressure Coefficient	Cp	0.9	unitless	BS5925 Table 13
CLEA Standard wind Speed at 10m	Um	5	m/s	SR3
Height of void openings above ground	Uz	0.10	m	
BS5921 Terrain Type		Urban	Drop Down Menu on CONTOL PANEL	
Terrain Factor 1	K	0.35	unitless	BS5925 Terrain Factors
Terrain Factor 2	Alp	0.25	unitless	BS5925 Terrain Factors
Building Parameters		SR3 Small Terrace	SR3 Default = Small Terrace	Drop Down Menu on CONTOL PANEL
Length of building	Lb	529	cm	
Width of building	Wb	529	cm	
Height of building	Hb	480	cm	
Height of living space above ground	Hliving	480	cm	
Height of living space below ground	Hcellar	0	cm	
Foundation or slab thickness	Lc	15	cm	
Floor-wall seam crack width	Wcr	0.2	cm	
Living space air exchange rate	ER	0.5	hr-1	Plastic: 77.5; Brick: 14.0
External air density		1.2	kg/m3	SR3 Default = 1.2
Accel due to gravity	g	9.80655	m/s2	SR3
Annual Temp diff indoor/outdoors	DeltaT	6	K	SR3 Default = 6
Indoor Temperature	Ti	298	K	SR3 Default = 298
Pressure difference due to temperature	PD Temp	1.1	Pa	SR3 Eq 4.6
Pressure difference due to wind	PD Wind	2.0	Pa	SR3 Default = 2
Total Pressure diff soil/outdoors & building	PD in Pa	3.1	Pa	
Total Pressure diff soil/outdoors & building	PD	31	g/cm/s2	
Area of enclosed space below ground	Ab	280,000	cm2	SR3 Eq A1
Floor-wall seam perimeter	Xc	2,117	cm	SR3 Eq A2
Area of total cracks between floor and wall	Ac	423	cm2	Wcr * Xc
Crack depth below ground	Zc (Hcell+Lc)	15	cm	SR4 Eq 4.3

Building Void Parameters (☐ Consider Void)	Symbol	Value	Units
Sub Floor Void Height	Hv	15	cm
Height void openings above ground	Uz	10	cm
Open area of a single air brick		77.5	cm2
No air bricks along open building side		5	c 1.5m centres
Area void openings on building side	Av	387.5	cm2

	Value	Units
Building ventialtion rate	1,613	m3/day
Building volume	134	m3
Air chages per day	12	changes/day
Sourec area	28	m2
Source Thickness	4	m
Source Volume	112	m3
Soil Mass	135,520	kg

Results Summary		mg/kg	mg/m3	mg/l	mg/m3	mg/day	kg	Years
No	COC	PV-Soil	PV-Vap	PV-GW	PV-GWV	Src Dep Rate	Src Mass	Depl Time
COC-1	Aliphatic TPH C5-6	56	139,000	4.8	101,000	13,225	7.57	1.6
COC-2	Aliphatic TPH C6-8	136	139,000	3.7	101,000	13,225	18.47	3.8
COC-3	Aliphatic TPH C8-10	36	8,130	0.143	5,950	774	4.84	17.1
COC-4	Aliphatic TPH C10-12	>Sat (177)	>Sat (8,130)	>Sol (0.092)	>Sat (5,950)	774	24.00	84.9
COC-5	Aliphatic TPH C12-16	>Sat (1,480)	>Sat (8,130)	>Sol (0.035)	>Sat (5,950)	774	200.97	711.2
COC-6	Aromatic TPH C5-7	314	53,300	305	35,400	4,484	42.58	26.0
COC-7	Aromatic TPH C7-8	729	56,800	339	39,000	4,432	98.79	61.1
COC-8	Aromatic TPH C8-10	46	1,220	3.2	820	126	6.23	135.7
COC-9	Aromatic TPH C10-12	251	1,220	9.5	683	126	34.00	740.4
COC-10	Aromatic TPH C12-16	>Sat (2,780)	>Sat (1,190)	>Sol (30)	>Sat (377)	126	377.10	8,212.8
COC-11	Aromatic TPH C16-21	(53,400)	>Sat (452)	>Sol (93)	>Sat (64)	63	7238.63	315,295.9
COC-12	Benzene	0.317	54	0.308	36	4.5	0.04	26.1
COC-13	Toluene	729	56,800	339	39,000	4,432	98.79	61.1
COC-14	Ethylbenzene	196	9,420	49	6,810	689	26.52	105.5
COC-15	Xylene-m	64	2,290	14	1,610	171	8.68	139.0
COC-16	Xylene-o	69	2,290	17	1,570	171	9.33	149.5
COC-17	Xylene-p	62	2,290	15	1,600	171	8.35	133.7
COC-18	MTBE EIC	86	2,900	764	12,200	2,297	11.58	13.8
COC-19	Phenol SR Tox	990	11	1,340	11	26	134.18	14,246.3
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Checks Against Sat Limits		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	COC	Csatv Soil	>Csatv Soil	Csatw Soil	>CsatwSoil	Csatvap Soil	>Csatvap Soil	Solubility	>Sol	Csatvap Soil	>Csatvap Soil
COC-1	Aliphatic TPH C5-6	304	N	304	N	754647	N	35.9	N	754647	N
COC-2	Aliphatic TPH C6-8	144	N	144	N	146664	N	5	N	146664	N
COC-3	Aliphatic TPH C8-10	78	N	78	N	17680	N	0	N	17680	N
COC-4	Aliphatic TPH C10-12	48	Y	48	Y	2183	Y	0.034	Y	2183	Y
COC-5	Aliphatic TPH C12-16	24	Y	24	Y	130	Y	0.000759	Y	130	Y
COC-6	Aromatic TPH C5-7	1221	N	1218	N	207143	N	1780	N	207143	N
COC-7	Aromatic TPH C7-8	869	N	871	N	67744	N	590	N	67744	N
COC-8	Aromatic TPH C8-10	613	N	614	N	16320	N	65	N	16320	N
COC-9	Aromatic TPH C10-12	365	N	364	N	1773	N	25	N	1773	N
COC-10	Aromatic TPH C12-16	169	Y	169	Y	73	Y	6	Y	73	Y
COC-11	Aromatic TPH C16-21	54	Y	54	Y	0	Y	1	Y	0	Y
COC-12	Benzene	1221	N	1218	N	207143	N	1780	N	207143	N
COC-13	Toluene	869	N	871	N	67744	N	590	N	67744	N
COC-14	Ethylbenzene	518	N	520	N	24952	N	180	N	24952	N
COC-15	Xylene-m	625	N	626	N	22335	N	200	N	22335	N
COC-16	Xylene-o	523	N	478	N	17417	N	173	N	17417	N
COC-17	Xylene-p	577	N	576	N	21433	N	200	N	21433	N
COC-18	MTBE EIC	20358	N	22651	N	690240	N	48000	N	690240	N
COC-19	Phenol SR Tox	41597	N	63508	N	460	N	84100	N	460	N
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

ADE Contribution

No	ADE %	AC1	AC2	AC3	AC4	AC5	AC6	COC ADE	BG ADE
COC-1	Aliphatic TPH C5-6	123%	110%	81%	65%	48%	41%	**78.2%**	**21.8%**
COC-2	Aliphatic TPH C6-8	123%	110%	81%	65%	48%	41%	**78.2%**	**21.8%**
COC-3	Aliphatic TPH C8-10	124%	111%	82%	66%	49%	42%	**79.1%**	**20.9%**
COC-4	Aliphatic TPH C10-12	124%	111%	82%	66%	49%	42%	**79.1%**	**20.9%**
COC-5	Aliphatic TPH C12-16	124%	111%	82%	66%	49%	42%	**79.1%**	**20.9%**
COC-6	Aromatic TPH C5-7	156%	139%	103%	83%	61%	53%	**99.1%**	**0.9%**
COC-7	Aromatic TPH C7-8	154%	137%	101%	82%	60%	52%	**97.7%**	**2.3%**
COC-8	Aromatic TPH C8-10	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-9	Aromatic TPH C10-12	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-10	Aromatic TPH C12-16	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-11	Aromatic TPH C16-21	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-12	Benzene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-13	Toluene	154%	137%	101%	82%	60%	52%	**97.7%**	**2.3%**
COC-14	Ethylbenzene	152%	136%	100%	81%	60%	51%	**96.4%**	**3.6%**
COC-15	Xylene-m	135%	121%	89%	72%	53%	46%	**85.9%**	**14.1%**
COC-16	Xylene-o	135%	121%	89%	72%	53%	46%	**85.9%**	**14.1%**
COC-17	Xylene-p	135%	121%	89%	72%	53%	46%	**85.9%**	**14.1%**
COC-18	MTBE EIC	155%	138%	102%	82%	61%	52%	**98.3%**	**1.7%**
COC-19	Phenol SR Tox	119%	107%	78%	63%	47%	40%	**75.8%**	**24.2%**
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

				Adult	Calcs use Child MDI		CLEA 10m3/day 20kg					
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deff Soil
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	8.2000	1.0E-05	1.0E-09	21.000000	8.458219	0.001675
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	8.2000	1.0E-05	1.0E-09	27.300000	26.836109	0.001675
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	0.4800	1.0E-05	1.0E-09	41.500000	182.289431	0.001674
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	0.4800	1.0E-05	1.0E-09	64.400000	1,402.240448	0.001674
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	0.4800	1.0E-05	1.0E-09	171.000000	31,176.381380	0.001674
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	2.7800	8.8E-06	6.6E-10	0.11600000	0.68402895	0.001474
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	2.7480	7.8E-06	5.9E-10	0.11500000	1.475944	0.001307
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	TRUE	Y	0.0780	1.0E-05	1.0E-09	0.25300000	9.506926	0.001678
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	TRUE	Y	0.0780	1.0E-05	1.0E-09	0.07220000	14.853602	0.001687
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	TRUE	Y	0.0780	1.0E-05	1.0E-09	0.01260000	29.343669	0.001745
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	TRUE	Y	0.0390	1.0E-05	1.0E-09	0.00069500	82.200020	0.002951
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	0.0028	8.8E-06	6.6E-10	0.11600000	0.68402895	0.001474
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	2.7480	7.8E-06	5.9E-10	0.11500000	1.475944	0.001307
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	0.4270	7.0E-06	5.3E-10	0.13900000	2.886467	0.001182
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	0.1060	7.0E-06	5.3E-10	0.11200000	3.131957	0.001181
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	0.1060	7.0E-06	5.3E-10	0.09200000	2.762095	0.001179
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	0.1060	7.0E-06	5.3E-10	0.10700000	2.881178	0.001183
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	1.4240	7.8E-06	5.6E-10	0.01600000	0.47190151	0.001341
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	0.0160	7.9E-06	6.4E-10	0.00000835	0.75515164	0.068911
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a

						All MG/KG						Soil	Vapour
No	Deff Soil	-	Deff Crack	Peclet Number	Alpha	Indoor CF Soil	Corrected Alpha	AC1	AC2	AC3	AC4	AC5	AC6	PV-Soil	PV-Vap
COC-1	0.001675	-	0.001675	1.18E+133	3.05E-04	10	3.05E-05	31	36	54	70	97	117	**56**	**138,608**
COC-2	0.001675	-	0.001675	1.18E+133	3.05E-04	10	3.05E-05	74	88	131	171	238	284	**136**	**138,609**
COC-3	0.001674	-	0.001674	1.19E+133	3.05E-04	10	3.05E-05	20	23	34	45	62	74	**36**	**8,134**
COC-4	0.001674	-	0.001674	1.19E+133	3.05E-04	10	3.05E-05	98	114	171	222	308	368	**177**	**8,134**
COC-5	0.001674	-	0.001674	1.19E+133	3.05E-04	10	3.05E-05	818	958	1,431	1,861	2,576	3,079	**1,483**	**8,134**
COC-6	0.001474	-	0.001474	1.65E+151	2.82E-04	10	2.82E-05	199	223	303	376	510	595	**314**	**53,286**
COC-7	0.001307	-	0.001307	2.85E+170	2.60E-04	10	2.60E-05	458	514	704	875	1,187	1,387	**729**	**56,799**
COC-8	0.001678	-	0.001678	6.27E+132	3.05E-04	10	3.05E-05	18	24	44	63	90	111	**46**	**1,223**
COC-9	0.001687	-	0.001687	1.28E+132	3.06E-04	10	3.06E-05	100	133	242	342	489	606	**251**	**1,219**
COC-10	0.001745	-	0.001745	5.07E+127	3.13E-04	10	3.13E-05	1,114	1,473	2,685	3,793	5,425	6,721	**2,783**	**1,195**
COC-11	0.002951	-	0.002951	3.19E+75	4.13E-04	10	4.13E-05	21,386	28,278	51,543	72,813	104,135	129,014	**53,414**	**452**
COC-12	0.001474	-	0.001474	1.65E+151	2.82E-04	10	2.82E-05	0.202	0.225	0.306	0.379	0.513	0.598	**0.317**	**54**
COC-13	0.001307	-	0.001307	2.85E+170	2.60E-04	10	2.60E-05	458	514	704	875	1,187	1,387	**729**	**56,799**
COC-14	0.001182	-	0.001182	3.06E+188	2.43E-04	10	2.43E-05	122	137	189	235	320	374	**196**	**9,423**
COC-15	0.001181	-	0.001181	4.20E+188	2.43E-04	10	2.43E-05	37	43	62	79	108	128	**64**	**2,289**
COC-16	0.001179	-	0.001179	1.03E+189	2.43E-04	10	2.43E-05	40	46	66	85	116	138	**69**	**2,293**
COC-17	0.001183	-	0.001183	2.11E+188	2.44E-04	10	2.44E-05	36	41	59	76	104	123	**62**	**2,287**
COC-18	0.001341	-	0.001341	1.65E+166	2.65E-04	1	2.65E-04	54	60	82	102	139	162	**85**	**2,898**
COC-19	0.068911	-	0.068911	1.71E+03	7.48E-04	1	7.48E-04	528	626	956	1,255	1,745	2,095	**990**	**11**
COC-20	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

				Adult	Calcs use Child MDI		CLEA 10m3/day 20kg					
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deffcz
COC-1	TPH	Aliphatic TPH C5-6	5	18	FALSE	Y	8.2	0.00001	0.000000001	21	8.458218647	0.00008
COC-2	TPH	Aliphatic TPH C6-8	5	18	FALSE	Y	8.2	0.00001	0.000000001	27.3	26.83610895	0.00008
COC-3	TPH	Aliphatic TPH C8-10	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	41.5	182.2894312	0.00008
COC-4	TPH	Aliphatic TPH C10-12	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	64.4	1402.240448	0.00008
COC-5	TPH	Aliphatic TPH C12-16	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	171	31176.38138	0.00008
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2	FALSE	Y	2.78	0.00000877	6.64E-10	0.116	0.684028952	0.00009
COC-7	TPH	Aromatic TPH C7-8	1.4	0.52	FALSE	Y	2.748	0.00000778	5.88E-10	0.115	1.475943545	0.00008
COC-8	TPH	Aromatic TPH C8-10	0.06	0.42	TRUE	Y	0.078	0.00001	0.000000001	0.253	9.506925971	0.00009
COC-9	TPH	Aromatic TPH C10-12	0.06	0.42	TRUE	Y	0.078	0.00001	0.000000001	0.0722	14.85360246	0.00012
COC-10	TPH	Aromatic TPH C12-16	0.06	0.42	TRUE	Y	0.078	0.00001	0.000000001	0.0126	29.34366947	0.00028
COC-11	TPH	Aromatic TPH C16-21	0.03	0.21	TRUE	Y	0.039	0.00001	0.000000001	0.000695	82.20001974	0.00363
COC-12	BTEX	Benzene	0.0014	0	FALSE	Y	0.0028	0.00000877	6.64E-10	0.116	0.684028952	0.00009
COC-13	BTEX	Toluene	1.4	0.52	FALSE	Y	2.748	0.00000778	5.88E-10	0.115	1.475943545	0.00008
COC-14	BTEX	Ethylbenzene	0.22	0.13	FALSE	Y	0.427	0.00000704	5.31E-10	0.139	2.886467314	0.00007
COC-15	BTEX	Xylene-m	0.06	0.14	FALSE	Y	0.106	0.00000703	5.31E-10	0.112	3.131956822	0.00007
COC-16	BTEX	Xylene-o	0.06	0.14	FALSE	Y	0.106	0.00000701	5.31E-10	0.092	2.762095093	0.00007
COC-17	BTEX	Xylene-p	0.06	0.14	FALSE	Y	0.106	0.00000704	5.31E-10	0.107	2.881178058	0.00007
COC-18	BTEX	MTBE EIC	0.722	0.2	FALSE	Y	1.424	0.00000782	5.62E-10	0.016	0.471901511	0.00015
COC-19	OTHER	Phenol SR Tox	0.01	0.04	FALSE	Y	0.016	0.0000079	6.36E-10	0.00000835	0.75515164	0.18770
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a

												Groundwater	Vapour
No	Deffcz	Deffwt	Deff Crack	Peclet Number	Alpha	Indoor CF GW	Corrected Alpha	AC1	AC2	AC3	AC4	AC5	AC6	PV-GW	PV-GWV
COC-1	0.00008	0.00029	0.001675	1.18E+133	4.17E-05	1	4.17E-05	2.6	3.1	4.7	6.1	8.4	10	**4.8**	**101,263**
COC-2	0.00008	0.00029	0.001675	1.18E+133	4.17E-05	1	4.17E-05	2.0	2.4	3.6	4.7	6.5	7.7	**3.7**	**101,289**
COC-3	0.00008	0.00029	0.001674	1.19E+133	4.17E-05	1	4.17E-05	0.079	0.093	0.138	0.180	0.249	0.297	**0.143**	**5,946**
COC-4	0.00008	0.00029	0.001674	1.19E+133	4.17E-05	1	4.17E-05	0.051	0.060	0.089	0.116	0.160	0.192	**0.092**	**5,947**
COC-5	0.00008	0.00029	0.001674	1.19E+133	4.17E-05	1	4.17E-05	0.019	0.022	0.034	0.044	0.060	0.072	**0.035**	**5,948**
COC-6	0.00009	0.00030	0.001474	1.65E+151	4.24E-05	1	4.24E-05	193	216	294	365	495	577	**305**	**35,365**
COC-7	0.00008	0.00027	0.001307	2.85E+170	3.79E-05	1	3.79E-05	213	239	328	407	553	646	**339**	**39,030**
COC-8	0.00009	0.00032	0.001678	6.27E+132	4.56E-05	1	4.56E-05	1.3	1.7	3.1	4.4	6.3	7.8	**3.2**	**820**
COC-9	0.00012	0.00039	0.001687	1.28E+132	5.46E-05	1	5.46E-05	3.8	5.0	9.1	13	18	23	**9.5**	**683**
COC-10	0.00028	0.00076	0.001745	5.07E+127	9.90E-05	1	9.90E-05	12	16	29	41	58	72	**30**	**377**
COC-11	0.00363	0.00310	0.002951	3.19E+75	2.90E-04	1	2.90E-04	37	49	89	126	180	223	**92**	**64**
COC-12	0.00009	0.00030	0.001474	1.65E+151	4.24E-05	1	4.24E-05	0.196	0.219	0.297	0.367	0.498	0.580	**0.308**	**36**
COC-13	0.00008	0.00027	0.001307	2.85E+170	3.79E-05	1	3.79E-05	213	239	328	407	553	646	**339**	**39,030**
COC-14	0.00007	0.00023	0.001182	3.06E+188	3.37E-05	1	3.37E-05	31	34	47	59	80	94	**49**	**6,811**
COC-15	0.00007	0.00024	0.001181	4.20E+188	3.45E-05	1	3.45E-05	8.4	9.7	14	18	24	29	**14**	**1,613**
COC-16	0.00007	0.00025	0.001179	1.03E+189	3.54E-05	1	3.54E-05	10.0	11	16	21	29	34	**17**	**1,571**
COC-17	0.00007	0.00024	0.001183	2.11E+188	3.48E-05	1	3.48E-05	8.7	10	14	18	25	30	**15**	**1,601**
COC-18	0.00015	0.00046	0.001341	1.65E+166	6.27E-05	1	6.27E-05	482	540	738	916	1,243	1,452	**764**	**12,232**
COC-19	0.18770	0.08186	0.068911	1.71E+03	7.30E-04	1	7.30E-04	717	849	1,297	1,703	2,368	2,843	**1,344**	**11**
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

Merton Street, Banbury, on-site residential trans zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 11 Outdoor Air Inhalation - Subsurface Soil

SR3 V701

Outdoor Air Source Properties				
Depth to subsurface contamination	Ls	60	cm	SR3 Default = 100cm
Generic SR3 Receptor Height	H	0.8	m	SR3 Default = 0.8m
Source Area	Asource	2.00	Hectare	SR3 Default = 0.01
SR3 City Surrogate	Location	Newcastle 0.8m	City	SR3 Default = Newcastle
Air Dispersion factor	Q/Cwind	68	g/m2/s per kg/m3	
Groundwater Specific Calculations				
Depth to Water Table	Lgw	100	cm	
van Genuchten shape parameter (n)	n	1.47	unitless	
Air-filled porosity in the capillary zone	Oacz	0.08	unitless	
Water-filled porosity in the capillary zone	Owcz	0.45	unitless	
Thickness of capillary Zone	Lcz	25.00	cm	
Soil Properties		Sandy Loam		
Air-filled porosity	Oa	0.2	cm3/cm3	
Water-filled porosity	Ow	0.33	cm3/cm3	
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3	
Residual soil water content	Or	0.12	cm3/cm3	
Saturated hydraulic conductivity		0.00356	cm/s	
van Genuchten shape parameter (m)	M	0.3201	unitless	
Bulk density	p	1.21	g/cm3	
Mean Particle Diameter (D)	D	0.03	m/s	

Results Summary		mg/kg	mg/m3	mg/l	mg/m3
No	COC	PV-Soil	PV-Vap	PV-GW	PV-GWV
COC-1	Aliphatic TPH C5-6	>Sat (9,170)	No Risk	>Sol (10,300)	No Risk
COC-2	Aliphatic TPH C6-8	>Sat (22,400)	No Risk	>Sol (7,920)	No Risk
COC-3	Aliphatic TPH C8-10	>Sat (5,870)	No Risk	>Sol (306)	No Risk
COC-4	Aliphatic TPH C10-12	>Sat (29,100)	No Risk	>Sol (197)	No Risk
COC-5	Aliphatic TPH C12-16	>Sat (244,000)	No Risk	>Sol (74)	No Risk
COC-6	Aromatic TPH C5-7	>Sat (54,200)	No Risk	>Sol (650,000)	No Risk
COC-7	Aromatic TPH C7-8	>Sat (131,000)	No Risk	>Sol (728,000)	No Risk
COC-8	Aromatic TPH C8-10	>Sat (7,540)	>Sat (201,000)	>Sol (6,880)	No Risk
COC-9	Aromatic TPH C10-12	>Sat (41,100)	>Sat (200,000)	>Sol (19,800)	No Risk
COC-10	Aromatic TPH C12-16	>Sat (450,000)	>Sat (193,000)	>Sol (58,900)	>Sat (743,000)
COC-11	Aromatic TPH C16-21	No Risk	>Sat (57,100)	>Sol (130,000)	>Sat (90,700)
COC-12	Benzene	55	9,270	656	76,000
COC-13	Toluene	>Sat (131,000)	No Risk	>Sol (728,000)	No Risk
COC-14	Ethylbenzene	>Sat (36,300)	No Risk	>Sol (106,000)	No Risk
COC-15	Xylene-m	>Sat (11,900)	>Sat (425,000)	>Sol (31,000)	No Risk
COC-16	Xylene-o	>Sat (12,800)	>Sat (426,000)	>Sol (36,800)	No Risk
COC-17	Xylene-p	>Sat (11,400)	>Sat (425,000)	>Sol (32,200)	No Risk
COC-18	MTBE EIC	>Sat (152,000)	No Risk	No Risk	No Risk
COC-19	Phenol SR Tox	>Sat (97,000)	>Sat (1,070)	>Sol (180,000)	>Sat (1,500)
COC-20	n/a	No Risk	No Risk	No Risk	No Risk

Checks Against Saturation Limits		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	COC	Csatv Soil	>Csatv Soil	Csatw Soil	>CsatwSoil	Csatvap Soil	>Csatvap Soil	Solubility	>Sol	Csatvap Soil	>Csatvap Soil
COC-1	Aliphatic TPH C5-6	304	Y	304	Y	754647	Y	36	Y	754647	Y
COC-2	Aliphatic TPH C6-8	144	Y	144	Y	146664	Y	5	Y	146664	Y
COC-3	Aliphatic TPH C8-10	78	Y	78	Y	17680	Y	0	Y	17680	Y
COC-4	Aliphatic TPH C10-12	48	Y	48	Y	2183	Y	0.034	Y	2183	Y
COC-5	Aliphatic TPH C12-16	24	Y	24	Y	130	Y	0.000759	Y	130	Y
COC-6	Aromatic TPH C5-7	1221	Y	1218	Y	207143	Y	1780	Y	207143	Y
COC-7	Aromatic TPH C7-8	869	Y	871	Y	67744	Y	590	Y	67744	Y
COC-8	Aromatic TPH C8-10	613	Y	614	Y	16320	Y	65	Y	16320	Y
COC-9	Aromatic TPH C10-12	365	Y	364	Y	1773	Y	25	Y	1773	Y
COC-10	Aromatic TPH C12-16	169	Y	169	Y	73	Y	6	Y	73	Y
COC-11	Aromatic TPH C16-21	54	Y	54	Y	0	Y	1	Y	0	Y
COC-12	Benzene	1221	N	1218	N	207143	N	1780	N	207143	N
COC-13	Toluene	869	Y	871	Y	67744	Y	590	Y	67744	Y
COC-14	Ethylbenzene	518	Y	520	Y	24952	Y	180	Y	24952	Y
COC-15	Xylene-m	625	Y	626	Y	22335	Y	200	Y	22335	Y
COC-16	Xylene-o	523	Y	478	Y	17417	Y	173	Y	17417	Y
COC-17	Xylene-p	577	Y	576	Y	21433	Y	200	Y	21433	Y
COC-18	MTBE EIC	20358	Y	22651	Y	690240	Y	48000	Y	690240	Y
COC-19	Phenol SR Tox	41597	Y	63508	Y	460	Y	84100	Y	460	Y
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

No	5214.912559	6127.32329	9206.072469	12004.31062	13741.82743	16444.63136	COC ADE	BG ADE
COC-1	123%	110%	81%	65%	48%	41%	78.2%	21.8%
COC-2	123%	110%	81%	65%	48%	41%	78.2%	21.8%
COC-3	124%	111%	82%	66%	49%	42%	79.1%	20.9%
COC-4	124%	111%	82%	66%	49%	42%	79.1%	20.9%
COC-5	124%	111%	82%	66%	49%	42%	79.1%	20.9%
COC-6	156%	139%	103%	83%	61%	53%	99.1%	0.9%
COC-7	154%	137%	101%	82%	60%	52%	97.7%	2.3%
COC-8	91%	81%	60%	48%	36%	31%	57.6%	42.4%
COC-9	91%	81%	60%	48%	36%	31%	57.6%	42.4%
COC-10	91%	81%	60%	48%	36%	31%	57.6%	42.4%
COC-11	91%	81%	60%	48%	36%	31%	57.6%	42.4%
COC-12	157%	141%	104%	84%	62%	53%	100.0%	0.0%
COC-13	154%	137%	101%	82%	60%	52%	97.7%	2.3%
COC-14	152%	136%	100%	81%	60%	51%	96.4%	3.6%
COC-15	135%	121%	89%	72%	53%	46%	85.9%	14.1%
COC-16	135%	121%	89%	72%	53%	46%	85.9%	14.1%
COC-17	135%	121%	89%	72%	53%	46%	85.9%	14.1%
COC-18	155%	138%	102%	82%	61%	52%	98.3%	1.7%
COC-19	119%	107%	78%	63%	47%	40%	75.8%	24.2%
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

					Calcs use Child MDI		CLEA 10m3/day 20kg																Soil	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Outdoor mg/m3	Dair	Dwater	Kaw	Ksw	-	Deff	VF	AC1	AC2	AC3	AC4	AC5	AC6	PV-Soil	PV-Vap
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	21.0	8.4582	-	0.001675	1.02E-05	5,215	6,127	9,206	12,004	13,742	16,445	9,170	22,766,758
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	27.3	26.8361	-	0.001675	4.18E-06	12,728	14,954	22,468	29,298	33,538	40,135	22,380	22,766,754
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	41.5	182.2894	-	0.001674	9.34E-07	3,366	3,944	5,892	7,662	8,761	10,470	5,868	1,336,010
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	64.4	1,402.2404	-	0.001674	1.88E-07	16,688	19,549	29,205	37,979	43,427	51,902	29,090	1,336,015
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	171.0	31,176.3814	-	0.001674	2.25E-08	139,729	163,691	244,545	318,012	363,630	434,590	243,581	1,336,022
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	2.78	8.8E-06	6.6E-10	0.1	0.6840	-	0.001474	6.12E-07	35,671	39,950	54,383	67,422	75,516	88,107	54,165	9,185,488
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	-	0.001307	2.50E-07	85,670	96,163	131,556	163,547	183,404	214,293	131,030	10,209,378
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.3	9.5069	-	0.001678	1.09E-07	3,142	4,155	7,573	10,698	12,639	15,659	7,544	200,763
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0722	14.8536	-	0.001687	2.01E-08	17,114	22,629	41,246	58,266	68,838	85,284	41,088	199,718
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0126	29.3437	-	0.001745	1.84E-09	187,272	247,625	451,346	637,600	753,293	933,261	449,619	193,064
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	TRUE	Y	0.04	1.0E-05	1.0E-09	0.0006950	82.2000	-	0.002951	6.12E-11	2,811,583	3,717,676	6,776,220	9,572,507	11,309,454	14,011,371	6,750,288	57,074
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	0.00	8.8E-06	6.6E-10	0.1	0.6840	-	0.001474	6.12E-07	36	40	55	68	76	89	55	9,266
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	-	0.001307	2.50E-07	85,670	96,163	131,556	163,547	183,404	214,293	131,030	10,209,378
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	0.43	7.0E-06	5.3E-10	0.1	2.8865	-	0.001182	1.40E-07	23,588	26,537	36,484	45,478	51,061	59,746	36,338	1,749,896
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	3.1320	-	0.001181	1.04E-07	7,215	8,295	11,940	15,245	17,297	20,488	11,892	425,275
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.0920	2.7621	-	0.001179	9.62E-08	7,763	8,925	12,845	16,401	18,608	22,042	12,794	426,153
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	2.8812	-	0.001183	1.08E-07	6,937	7,975	11,479	14,656	16,629	19,697	11,433	424,602
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	1.42	7.8E-06	5.6E-10	0.0160	0.4719	-	0.001341	1.11E-07	99,887	112,016	152,927	189,898	212,846	248,544	152,315	5,164,285
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	0.02	7.9E-06	6.4E-10	0.0000084	0.7552	-	0.068911	1.87E-09	53,822	63,771	97,342	127,876	146,836	176,330	96,960	1,072
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

					Calcs use Child MDI		CLEA 10m3/day 20kg																Groundwater	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Outdoor mg/m3	Dair	Dwater	Kaw	Ksw	Deffcz	Deff	VF	AC1	AC2	AC3	AC4	AC5	AC6	PV-GW	PV-GWV
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	21.0	8.4582	0.00008	0.0002941	1.07E-06	5,852	6,875	10,330	13,470	15,420	18,452	10,289	216,077,699
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	27.3	26.8361	0.00008	0.0002940	4.40E-07	4,503	5,290	7,948	10,364	11,865	14,198	7,917	216,137,738
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	41.5	182.2894	0.00008	0.0002939	9.84E-08	175	205	307	399	456	545	306	12,687,486
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	64.4	1,402.2404	0.00008	0.0002938	1.98E-08	113	132	198	257	294	352	197	12,690,242
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	171.0	31,176.3814	0.00008	0.0002937	2.37E-09	43	50	75	97	111	132	74	12,693,358
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	2.78	8.8E-06	6.6E-10	0.1	0.6840	0.00009	0.0002992	7.46E-08	428,018	479,358	652,533	808,996	906,112	1,057,182	649,920	75,390,770
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	0.00008	0.0002657	3.04E-08	475,967	534,263	730,905	908,640	1,018,963	1,190,576	727,981	83,717,844
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.3	9.5069	0.00008	0.0003227	1.26E-08	2,864	3,787	6,903	9,751	11,521	14,273	6,876	1,739,714
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0722	14.8536	0.00012	0.0003919	2.80E-09	8,264	10,927	19,917	28,136	33,241	41,183	19,841	1,432,505
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0126	29.3437	0.00028	0.0007561	4.77E-10	24,545	32,456	59,157	83,569	98,733	122,321	58,931	742,529
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	TRUE	Y	0.04	1.0E-05	1.0E-09	0.0006950	82.2000	0.00363	0.0030958	3.85E-11	54,345	71,859	130,977	185,027	218,600	270,825	130,476	90,681
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	0.00	8.8E-06	6.6E-10	0.1	0.6840	0.00009	0.0002992	7.46E-08	434	485	658	815	912	1,063	656	76,049
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	0.00008	0.0002657	3.04E-08	475,967	534,263	730,905	908,640	1,018,963	1,190,576	727,981	83,717,844
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	0.43	7.0E-06	5.3E-10	0.1	2.8865	0.00007	0.0002347	1.66E-08	68,613	77,190	106,124	132,286	148,526	173,787	105,700	14,692,307
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	3.1320	0.00007	0.0002409	1.27E-08	18,826	21,644	31,152	39,775	45,128	53,456	31,028	3,475,180
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.0920	2.7621	0.00007	0.0002476	1.21E-08	22,299	25,638	36,900	47,114	53,456	63,320	36,754	3,381,346
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	2.8812	0.00007	0.0002428	1.33E-08	19,554	22,481	32,357	41,314	46,874	55,524	32,229	3,448,479
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	1.42	7.8E-06	5.6E-10	0.0160	0.4719	0.00015	0.0004551	2.27E-08	1,039,172	1,165,350	1,590,960	1,975,588	2,214,329	2,585,705	1,584,594	25,353,509
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	0.02	7.9E-06	6.4E-10	0.0000084	0.7552	0.18770	0.0818632	1.33E-09	99,995	118,478	180,849	237,577	272,802	327,598	180,139	1,504
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

Output Checked against CLEA UK 1.06

Merton Street, Banbury, on-site residential trans zone | **Project Ref** 41403 | **14 Oct 10** | **Revision** 100 | **SR3 V701**

Child Scenario SR3 Residential

Female Child AC1-6: Site Assessment Criteria

☐ Calculate GACs

☒ Calculate SSAC

Key Parameter Check

Oral Pathways — Ingestion; Veg Attached (n/a); Veg Direct (n/a); Dermal

Inhalation Pathways — Dust Inhalation; Vapour Inhalation

No	Type	COC	Ingestion SOIL-D	Veg Attached SOIL-ID	Veg Direct Veg-D	Dermal DERM-I	DERM-O	Dust Inhalation Dust-I	Dust-O	Vapour Inhalation Vap In	Out Surf	Out Sub
COC-1	PAH	**Acenaphthene**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4,112	n/a	6,993,000.000
COC-2	PAH	**Acenaphthylene**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,946	n/a	6,364,000
COC-3	PAH	**Benzo-a-anthracene**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12	n/a	5,833
COC-4	PAH	**Fluorene**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,306	n/a	8,283,000
COC-5	PAH	**Naphthalene**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.9	n/a	3,520
COC-6	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	NONE	**n/a**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

No	Oral MDI 50% Rule	Inhal MDI 50% Rule	Comb AC	Derm Via	Vol Ass	Use Vol	Calculated SSAC	Adopted SSAC	Csatv	Csatw	Total ORAL	Total INHAL
COC-1	FALSE	FALSE	*Yes*	*Oral HCV*	*Y*	Yes	**4,109.68**		88	57	-	4,109.7
COC-2	FALSE	FALSE	*Yes*	*Oral HCV*	*Y*	Yes	**3,943.55**		87	86	-	3,943.6
COC-3	FALSE	FALSE	*Yes*	*Oral HCV*	*Y*	Yes	**12**		1.7	1.7	-	11.7
COC-4	FALSE	FALSE	*Yes*	*Oral HCV*	*Y*	Yes	**5,302.6**		44	31	-	5,302.6
COC-5	FALSE	FALSE	*Yes*	*Oral HCV*	*Y*	Yes	**2**		76	76	-	1.9
COC-6	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-7	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-8	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-9	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-10	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-11	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-12	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-13	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-14	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-15	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-16	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-17	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-18	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-19	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-
COC-20	n/a	n/a	*n/a*	*n/a*	*n/a*	Yes	**n/a**		n/a	n/a	-	-

Uses Highest ADE

No	SOIL-D	SOIL-I	VEG	DERM-I	DERM-O	DUST-I	DUST-O	VAP-I	VAP-Osurf	VAP-Osub	ADE COC	ADE BG	Oral Active	Dermal
COC-1	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-2	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-3	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-4	-	-	-	n/a	n/a	-	-	100%	-	0%	99.9%	0.1%	N	O
COC-5	-	-	-	n/a	n/a	-	-	80%	-	0%	80.3%	19.7%	N	O
COC-6	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-7	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-8	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-9	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-10	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-11	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-12	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-13	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-14	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-15	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-16	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-17	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-18	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-19	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-20	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a

☒ Child Receptor

☐ Adult Receptor

☐ Soil Only

☐ GW Only

☒ Soil & GW

Global SOM	1.00%	0.0058	Foc Equiv
Soil Type	Sandy Loam	Default Sandy Loam	
City	Newcastle	Default Newcastle	
Site Area Res	2	Hectares	Default 0.01
Site Area Com	2	Hectares	Default 2
Wind Type	Urban		

Indoor Air	**Residential**	**Commercial**	
Building	SR3 Small Terrace	SR3 Pre-1970 3 Storey Office	
Building Qs	Site Specific	Site Specific	
Foundation Void	No Void	n/a	
Use CF of >1	Y	Y	
Indoor Soil Source	50	50	DF = 50 cm
Indoor GW Source	100	100	cm

TPH Select | Solvents

TPH >C8 Select | ODDs

TPH All | Metals

PAH 16

Merton Street, Banbury, on-site residential trans zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 9 Indoor Air Inhalation - Subsurface Soil

SR3 V701

Soil Source Properties

Depth to Contamination from Floor Level	Ls	65	cm	Default 65cm ignore void height
Depth to Contamination from Base of Foundation	Lt (Ls-Zc)	50	cm	SR4 Eq 4.3

Soil Properties

		Soil Diffusion Zone	Adopted Fnd Crack	Void Fnd Crack	
Soil Types		Sandy Loam	Sandy Loam	Dry Sand	
Air-filled porosity	Oa	0.2	0.2	0.47	cm3/cm3
Water-filled porosity	Ow	0.33	0.33	0.07	cm3/cm3
Total Porosity/Satuated Porosity	Ot	0.53	0.53	0.54	cm3/cm3
Residual soil water content	Or	0.12	0.12	0.07	cm3/cm3
Saturated hydraulic conductivity	Ks	0.00356			
van Genuchten shape parameter (m)	M	0.3201			
Bulk density	p	1.21	g/cm3		
Mean Particle Diameter (D)	D	0.03			

Groundwater Specific Properties & Calculations

Depth to Water Table from Floor Level	Lw	115	cm
Depth to Water Table from Base Slab	Ltw (Lw-Zc)	100	cm
van Genuchten shape parameter (n)	n	1.47	unitless
Air-filled porosity in the capillary zone	Oacz	0.08	unitless
Water-filled porosity in the capillary zone	Owcz	0.45	unitless
Thickness of capillary Zone	Lcz	25.00	cm

Building Ventilation & Ingress Calculations

		Y	Use Indoor Air CF of >1		
Building Ventilation rate	Qb or (Qb +Qs)	18,667	cm3/s	SR3 Eq 10.5 (+ Qs)	☐ Use Qb=Qb+Qs
Flow Rate of Soil Gas (Default 25 (17-150))	Qs	14.5	cm3/s	Site Specific	SR3 Eq A9 Defualt = 25
Natural Ventilation with opening one walls	Qv1	477	cm3/s	○ One Wall	BS5925 Table 12a
Natural Ventilation with opening on two walls	Qv2	7,802	cm3/s	● Two Walls	BS5925 Table 11a
Adopted Void Ventilation Rate	Qv	0	cm3/s		
Effective Crack radius	rcrack	0.200	cm	SR3 Eq A3	
Effective Total Fluid Saturation	ste	0.512	unitless	SR3 Eq A4	
Relative Soil Permeability	krg	0.642	unitless	SR3 Eq A5	
Soil Intrinsic Permeability	ki	4.75E-08	cm2	SR3 Eq A6	
Effective Air Permeability	kv	3.05E-08	cm2	SR3 Eq A7	
Effective Air Viscosity	ua	1.75E-04	g/cm/s	SR3 Eq A8	
Soil Temperature	Tamb	283.15	K	SR3 Default	

BS5925:1991 Void Ventilation Parameters

Discharge Coefficient (sharp edged orifice)	Cd	0.61	unitless	BS5925 Pg16
Effective Fraction of void openings	Veff	0.5	unitless	Default 50% Efficiency
Effective equivalent area of openings for one wall	Aw	0.0194	m2	BS5925 Table 12a
Effective equivalent area of openings for two walls	Aw	0.0137	m2	BS5925 Table 11a
Wind Speed at building height Uz	ur	0.98	m/s	BS5925 Eq 5
Differential Mean Pressure Coefficient	Cp	0.9	unitless	BS5925 Table 13
CLEA Standard wind Speed at 10m	Um	5	m/s	SR3
Height of void openings above ground	Uz	0.10	m	
BS5921 Terrain Type		Urban	Drop Down Menu on CONTOL PANEL	
Terrain Factor 1	K	0.35	unitless	BS5925 Terrain Factors
Terrain Factor 2	Alp	0.25	unitless	BS5925 Terrain Factors

Building Parameters

SR3 Small Terrace | SR3 Default = Small Terrace | Drop Down Menu on CONTOL PANEL

Length of building	Lb	529	cm
Width of building	Wb	529	cm
Height of building	Hb	480	cm
Height of living space above ground	Hliving	480	cm
Height of living space below ground	Hcellar	0	cm
Foundation or slab thickness	Lc	15	cm
Floor-wall seam crack width	Wcr	0.2	cm
Living space air exchange rate	ER	0.5	hr-1

Building Void Parameters ☐ Consider Void

Sub Floor Void Height Hv	15	cm
Height void openings above ground Uz	10	cm
Open area of a single air brick	77.5	cm2
No air bricks along open building side	5	c 1.5m centres
Area void openings on building side Av	387.5	cm2

Plastic: 77.5; Brick: 14.0

External air density		1.2	kg/m3	SR3 Default = 1.2
Accel due to gravity	g	9.80665	m/s2	SR3
Annual Temp diff indoor/outdoors	DeltaT	6	K	SR3 Default = 6
Indoor Temperature	Ti	298	K	SR3 Default = 298
Pressure difference due to temperature	PD Temp	1.1	Pa	SR3 Eq 4.6
Pressure difference due to wind	PD Wind	2.0	Pa	SR3 Default = 2
Total Pressure diff soil/outdoors & building	PD in Pa	3.1	Pa	
Total Pressure diff soil/outdoors & building	PD	31	g/cm/s2	
Area of enclosed space below ground	Ab	280,000	cm2	SR3 Eq A1
Floor-wall seam perimeter	Xc	2,117	cm	SR3 Eq A2
Area of total cracks between floor and wall	Ac	423	cm2	Wcr * Xc
Crack depth below ground	Zc (Hcell+Lc)	15	cm	SR4 Eq 4.3

Results Summary

No	COC	mg/kg PV-Soil	mg/m3 PV-Vap	mg/l PV-GW	mg/m3 PV-GWV
COC-1	Acenaphthene	>Sat (4,110)	>Sat (225)	>Sol (480)	>Sat (364)
COC-2	Acenaphthylene	>Sat (3,950)	>Sat (207)	>Sol (562)	>Sat (319)
COC-3	Benzo-a-anthracene	>Sat (12)	>Sat (0.001)	>Sol (0.029)	>Sat (0.001)
COC-4	Fluorene	>Sat (5,310)	>Sat (132)	>Sol (476)	>Sat (196)
COC-5	Naphthalene	1.9	3.1	1.4	9.2
COC-6	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a

Src Dep Rate mg/day	Src Mass kg	Depl Time Years
194	557.27	7,889.0
194	534.72	7,569.7
0.002	1.58	2,804,028.3
129	719.11	15,288.2
2.3	0.26	301.3
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a

Building ventialtion rate	1,613	m3/day
Building volume	134	m3
Air chages per day	12	changes/day
Sourec area	28	m2
Source Thickness	4	m
Source Volume	112	m3
Soil Mass	135,520	kg

Checks Against Sat Limits

No	COC	mg/kg Csatv Soil	>Csatv Soil	mg/kg Csatw Soil	>CsatwSoil	mg/m3 Csatvap Soil	>Csatvap Soil	mg/l Solubility	>Sol	mg/m3 Csatvap Soil	>Csatvap Soil
COC-1	Acenaphthene	88	Y	57	Y	5	Y	4.1	Y	5	Y
COC-2	Acenaphthylene	87	Y	86	Y	5	Y	8	Y	5	Y
COC-3	Benzo-a-anthracene	2	Y	2	Y	0.000120	Y	0.004	Y	0.000120	Y
COC-4	Fluorene	44	Y	31	Y	1	Y	2	Y	1	Y
COC-5	Naphthalene	76	N	76	N	126	N	19	N	126	N
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

ADE Contribution

No	ADE %	AC1	AC2	AC3	AC4	AC5	AC6	COC ADE	BG ADE
COC-1	Acenaphthene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-2	Acenaphthylene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-3	Benzo-a-anthracene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-4	Fluorene	157%	140%	103%	84%	62%	53%	**99.9%**	**0.1%**
COC-5	Naphthalene	126%	113%	83%	67%	50%	43%	**80.3%**	**19.7%**
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

No	Type	COC	HCV	Adult MDI/day	Calcs use Child MDI MDI 51% Rule	Suff Vol	CLEA 10m3/day 20kg Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deff Soil	-	Deff Crack	Peclet Number	Alpha	Indoor CF Soil	Corrected Alpha	AC1	AC2	AC3	AC4	AC5	AC6	Soil PV-Soil	Vapour PV-Vap
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	0.1200	5.9E-06	4.7E-10	0.00075900	13.869380	0.001529	-	0.001529	5.39E+145	2.88E-04	1	2.88E-04	2,615	2,924	3,969	4,912	6,655	7,758	**4,112**	**225**
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	0.1200	6.0E-06	4.8E-10	0.00056800	10.827086	0.001753	-	0.001753	1.38E+127	3.13E-04	1	3.13E-04	2,509	2,806	3,808	4,713	6,386	7,444	**3,946**	**207**
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	0.0000	4.6E-06	3.8E-10	0.00003160	450.496060	0.011441	-	0.011441	3.00E+19	6.33E-04	1	6.33E-04	7.4	8.3	11	14	19	22	**12**	**0.001**
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	0.0799	5.6E-06	4.5E-10	0.00041200	16.619416	0.001897	-	0.001897	2.88E+117	3.28E-04	1	3.28E-04	3,372	3,772	5,121	6,341	8,591	10,016	**5,306**	**132**
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	0.0014	6.5E-06	5.2E-10	0.00662000	4.018616	0.001161	-	0.001161	8.78E+191	2.40E-04	1	2.40E-04	1.1	1.2	1.8	2.4	3.3	3.9	**1.9**	**3.1**
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

All MG/KG

No	Type	COC	HCV	Adult MDI/day	Calcs use Child MDI MDI 51% Rule	Suff Vol	CLEA 10m3/day 20kg Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deffcz	Deffwt	Deff Crack	Peclet Number	Alpha	Indoor CF GW	Corrected Alpha	AC1	AC2	AC3	AC4	AC5	AC6	Groundwater PV-GW	Vapour PV-GWV
COC-1	PAH	Acenaphthene	0.06	0.000025	FALSE	Y	0.1199975	0.00000585	4.7E-10	0.000759	13.86937986	0.00157	0.00154	0.001529	5.39E+145	1.78E-04	1	1.78E-04	305	341	463	574	777	906	**480**	**364**
COC-2	PAH	Acenaphthylene	0.06	0.000011	FALSE	Y	0.1199989	0.00000597	4.82E-10	0.000568	10.82708614	0.00214	0.00184	0.001753	1.38E+127	2.03E-04	1	2.03E-04	357	400	542	671	909	1,060	**562**	**319**
COC-3	PAH	Benzo-a-anthracene	0.00000048	0	FALSE	Y	0.00000096	0.0000046	3.8E-10	0.0000316	450.4960601	0.02966	0.01352	0.011441	3.00E+19	5.61E-04	1	5.61E-04	0.019	0.021	0.028	0.035	0.047	0.055	**0.029**	**0.001**
COC-4	PAH	Fluorene	0.04	0.00096	FALSE	Y	0.079904	0.00000558	4.47E-10	0.000412	16.61941637	0.00272	0.00205	0.001897	2.88E+117	2.20E-04	1	2.20E-04	302	338	459	568	770	898	**476**	**196**
COC-5	PAH	Naphthalene	0.00086	0.0028	FALSE	Y	0.00144	0.00000652	5.16E-10	0.00662	4.018616016	0.00025	0.00060	0.001161	8.78E+191	8.10E-05	1	8.10E-05	0.775	0.905	1.3	1.7	2.4	2.9	**1.4**	**9.2**
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

Merton Street, Banbury, on-site residential trans zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 11 Outdoor Air Inhalation - Subsurface Soil

SR3 V701

Outdoor Air Source Properties

Parameter	Symbol	Value	Unit	Default
Depth to subsurface contamination	Ls	**60**	cm	SR3 Default = 100cm
Generic SR3 Receptor Height	H	0.8	m	SR3 Default = 0.8m
Source Area	Asource	**2.00**	Hectare	SR3 Default = 0.01
SR3 City Surrogate	Location	**Newcastle 0.8m**	City	SR3 Default = Newcastle
Air Dispersion factor	Q/Cwind	68	g/m2/s per kg/m3	

Groundwater Specific Calculations

Parameter	Symbol	Value	Unit
Depth to Water Table	Lgw	**100**	cm
van Genuchten shape parameter (n)	n	1.47	unitless
Air-filled porosity in the capillary zone	Oacz	0.08	unitless
Water-filled porosity in the capillary zone	Owcz	0.45	unitless
Thickness of capillary Zone	Lcz	25.00	cm

Soil Properties

Parameter	Symbol	**Sandy Loam**	Unit
Air-filled porosity	Oa	0.2	cm3/cm3
Water-filled porosity	Ow	0.33	cm3/cm3
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3
Residual soil water content	Or	0.12	cm3/cm3
Saturated hydraulic conductivity		0.00356	cm/s
van Genuchten shape parameter (m)	M	0.3201	unitless
Bulk density	p	1.21	g/cm3
Mean Particle Diameter (D)	D	0.03	m/s

Results Summary		mg/kg	mg/m3	mg/l	mg/m3
No	**COC**	**PV-Soil**	**PV-Vap**	**PV-GW**	**PV-GWV**
COC-1	Acenaphthene	No Risk	>Sat (383,000)	>Sol (834,000)	>Sat (633,000)
COC-2	Acenaphthylene	No Risk	>Sat (334,000)	>Sol (935,000)	>Sat (531,000)
COC-3	Benzo-a-anthracene	>Sat (5,830)	>Sat (0.409)	>Sol (18)	>Sat (0.577)
COC-4	Fluorene	No Risk	>Sat (205,000)	>Sol (768,000)	>Sat (316,000)
COC-5	Naphthalene	>Sat (3,520)	>Sat (5,800)	>Sol (2,810)	>Sat (18,600)
COC-6	n/a	No Risk	No Risk	No Risk	No Risk
COC-7	n/a	No Risk	No Risk	No Risk	No Risk
COC-8	n/a	No Risk	No Risk	No Risk	No Risk
COC-9	n/a	No Risk	No Risk	No Risk	No Risk
COC-10	n/a	No Risk	No Risk	No Risk	No Risk
COC-11	n/a	No Risk	No Risk	No Risk	No Risk
COC-12	n/a	No Risk	No Risk	No Risk	No Risk
COC-13	n/a	No Risk	No Risk	No Risk	No Risk
COC-14	n/a	No Risk	No Risk	No Risk	No Risk
COC-15	n/a	No Risk	No Risk	No Risk	No Risk
COC-16	n/a	No Risk	No Risk	No Risk	No Risk
COC-17	n/a	No Risk	No Risk	No Risk	No Risk
COC-18	n/a	No Risk	No Risk	No Risk	No Risk
COC-19	n/a	No Risk	No Risk	No Risk	No Risk
COC-20	n/a	No Risk	No Risk	No Risk	No Risk

Checks Against Saturation Limits		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	**COC**	**Csatv Soil**	**>Csatv Soil**	**Csatw Soil**	**>CsatwSoil**	**Csatvap Soil**	**>Csatvap Soil**	**Solubility**	**>Sol**	**Csatvap Soil**	**>Csatvap Soil**
COC-1	Acenaphthene	88	Y	57	Y	5	Y	4	Y	5	Y
COC-2	Acenaphthylene	87	Y	86	Y	5	Y	8	Y	5	Y
COC-3	Benzo-a-anthracene	2	Y	2	Y	0.000120	Y	0.004	Y	0.000120	Y
COC-4	Fluorene	44	Y	31	Y	1	Y	2	Y	1	Y
COC-5	Naphthalene	76	Y	76	Y	126	Y	19	Y	126	Y
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

4625603.49	5173392.671	7021094.355	8690085.1	9726010.438	11337449.85	COC ADE	BG ADE
157%	141%	104%	84%	62%	53%	100.0%	0.0%
157%	141%	104%	84%	62%	53%	100.0%	0.0%
157%	141%	104%	84%	62%	53%	100.0%	0.0%
157%	140%	103%	84%	62%	53%	99.9%	0.1%
126%	113%	83%	67%	50%	43%	80.3%	19.7%
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

					Calcs use Child MDI		CLEA 10m3/day 20kg														Soil	Vapour
No	**Type**	**COC**	**HCV**	**MDI/day**	MDI 51% Rule	**Suff Vol**	Allowable Outdoor mg/m3	**Dair**	**Dwater**	**Kaw**	**Ksw**	**-**	Deff	VF	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**	**PV-Soil**	**PV-Vap**
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	0.12	5.9E-06	4.7E-10	0.0007590	13.8694	-	0.001529	2.05E-10	4,625,603	5,173,393	7,021,094	8,690,085	9,726,010	11,337,450	**6,992,971**	**382,689**
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	0.12	6.0E-06	4.8E-10	0.0005680	10.8271	-	0.001753	2.25E-10	4,209,675	4,708,197	6,389,720	7,908,605	8,851,361	10,317,871	**6,364,126**	**333,869**
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	0.00	4.6E-06	3.8E-10	0.0000316	450.4961	-	0.011441	1.97E-12	3,859	4,315	5,857	7,249	8,113	9,457	**5,833**	**0.409**
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	0.08	5.6E-06	4.5E-10	0.0004120	16.6194	-	0.001897	1.15E-10	5,474,935	6,124,673	8,316,254	10,295,944	11,524,721	13,436,150	**8,282,946**	**205,337**
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	0.00	6.5E-06	5.2E-10	0.0066	4.0186	-	0.001161	4.69E-09	2,041	2,382	3,534	4,580	5,230	6,241	**3,520**	**5,799**
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

					Calcs use Child MDI		CLEA 10m3/day 20kg														Groundwater	Vapour
No	**Type**	**COC**	**HCV**	**MDI/day**	MDI 51% Rule	**Suff Vol**	Allowable Outdoor mg/m3	**Dair**	**Dwater**	**Kaw**	**Ksw**	Deffcz	Deff	VF	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**	**PV-GW**	**PV-GWV**
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	0.12	5.9E-06	4.7E-10	0.0007590	13.8694	0.00157	0.0015403	1.24E-10	551,806	617,153	837,573	1,036,673	1,160,252	1,352,487	**834,218**	**633,171**
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	0.12	6.0E-06	4.8E-10	0.0005680	10.8271	0.00214	0.0018359	1.42E-10	618,635	691,896	939,005	1,162,213	1,300,756	1,516,268	**935,244**	**531,218**
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	0.00	4.6E-06	3.8E-10	0.0000316	450.4961	0.02966	0.0135169	1.39E-12	12	14	18	23	25	30	**18**	**0.577**
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	0.08	5.6E-06	4.5E-10	0.0004120	16.6194	0.00272	0.0020523	7.48E-11	507,526	567,757	770,916	954,433	1,068,341	1,245,530	**767,828**	**316,345**
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	0.00	6.5E-06	5.2E-10	0.0066	4.0186	0.00025	0.0006033	1.46E-09	1,629	1,901	2,821	3,656	4,174	4,981	**2,809**	**18,599**
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

Notes:

Output Checked against CLEA UK 1.06

Merton Street, Banbury, on-site residential deep zone | **Project Ref** 41403 | **14 Oct 10** | **SR3 V701**

Child Scenario SR3 Residential | **Revision** 100

Female Child AC1-6: Site Assessment Criteria

Calculate GACs

Calculate SSAC

Key Parameter Check

No	Type	COC	Oral Pathways: Ingestion SOIL-D	Veg Attached (n/a) SOIL-ID	Veg Direct (n/a) Veg-D	Dermal DERM-I	DERM-O	Inhalation Pathways: Dust Inhalation Dust-I	Dust-O	Vapour Inhalation Vap In	Out Surf	Out Sub	Oral MDI 50% Rule	Inhal MDI 50% Rule	Comb AC	Derm Via	Vol Ass	Use Vol	Calculated SSAC	Adopted SSAC
COC-1	TPH	Aliphatic TPH C5-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	124	n/a	22,924.000	FALSE	FALSE	Yes	Oral HCV	Y	Yes	122.94	
COC-2	TPH	Aliphatic TPH C6-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	302	n/a	55,950	FALSE	FALSE	Yes	Oral HCV	Y	Yes	300.08	
COC-3	TPH	Aliphatic TPH C8-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	79	n/a	14,670	TRUE	FALSE	Yes	Oral HCV	Y	Yes	79	
COC-4	TPH	Aliphatic TPH C10-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	392	n/a	72,730	TRUE	FALSE	Yes	Oral HCV	Y	Yes	390.0	
COC-5	TPH	Aliphatic TPH C12-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,283	n/a	609,000	TRUE	FALSE	Yes	Oral HCV	Y	Yes	3,265	
COC-6	TPH	Aromatic TPH C5-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	715	n/a	135,400	FALSE	FALSE	Yes	Oral HCV	Y	Yes	711	
COC-7	TPH	Aromatic TPH C7-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,697	n/a	327,600	FALSE	FALSE	Yes	Oral HCV	Y	Yes	1,688	
COC-8	TPH	Aromatic TPH C8-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	102	n/a	18,860	TRUE	FALSE	Yes	Oral HCV	Y	Yes	101	
COC-9	TPH	Aromatic TPH C10-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	555	n/a	102,700	TRUE	FALSE	Yes	Oral HCV	Y	Yes	552	
COC-10	TPH	Aromatic TPH C12-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	6,106	n/a	1,124,000	TRUE	FALSE	Yes	Oral HCV	Y	Yes	6,073	
COC-11	TPH	Aromatic TPH C16-21	n/a	n/a	n/a	n/a	n/a	n/a	n/a	103,300	n/a	16,880,000	TRUE	FALSE	Yes	Oral HCV	Y	Yes	102,672	
COC-12	BTEX	Benzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.721	n/a	137	FALSE	FALSE	Yes	Oral HCV	Y	Yes	1	
COC-13	BTEX	Toluene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,697	n/a	327,600	FALSE	FALSE	Yes	Oral HCV	Y	Yes	1,688	
COC-14	BTEX	Ethylbenzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	464	n/a	90,850	FALSE	FALSE	Yes	Oral HCV	Y	Yes	462	
COC-15	BTEX	Xylene-m	n/a	n/a	n/a	n/a	n/a	n/a	n/a	152	n/a	29,730	FALSE	FALSE	Yes	Oral HCV	Y	Yes	151	
COC-16	BTEX	Xylene-o	n/a	n/a	n/a	n/a	n/a	n/a	n/a	163	n/a	31,990	FALSE	FALSE	Yes	Oral HCV	Y	Yes	163	
COC-17	BTEX	Xylene-p	n/a	n/a	n/a	n/a	n/a	n/a	n/a	146	n/a	28,580	FALSE	FALSE	Yes	Oral HCV	Y	Yes	145	
COC-18	BTEX	MTBE EIC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	198	n/a	380,800	FALSE	FALSE	Yes	Oral HCV	Y	Yes	198	
COC-19	OTHER	Phenol SR Tox	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,062	n/a	242,400	FALSE	FALSE	Yes	Inhal HCV	Y	Yes	1,057	
COC-20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a	

No	Csatv	Csatw	Total ORAL	Total INHAL	SOIL-D	SOIL-I	VEG	DERM-I	DERM-O	DUST-I	DUST-O	VAP-I	VAP-Osurf	VAP-Osub	ADE COC (Uses Highest ADE)	ADE BG	Oral Active	Dermal
COC-1	304	304	-	122.9	-	-	-	n/a	n/a	-	-	78%	-	0%	78.2%	21.8%	N	O
COC-2	144	144	-	300.1	-	-	-	n/a	n/a	-	-	78%	-	0%	78.2%	21.8%	N	O
COC-3	78	78	-	78.7	-	-	-	n/a	n/a	-	-	79%	-	0%	79.1%	20.9%	N	O
COC-4	48	48	-	390.0	-	-	-	n/a	n/a	-	-	79%	-	0%	79.1%	20.9%	N	O
COC-5	24	24	-	3,265.4	-	-	-	n/a	n/a	-	-	79%	-	0%	79.1%	20.9%	N	O
COC-6	1,221	1,218	-	710.75	-	-	-	n/a	n/a	-	-	99%	-	1%	99.1%	0.9%	N	O
COC-7	869	871	-	1,688.3	-	-	-	n/a	n/a	-	-	97%	-	1%	97.7%	2.3%	N	O
COC-8	613	614	-	101.2	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-9	365	364	-	551.5	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-10	169	169	-	6,073.0	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-11	54	54	-	102,671.7	-	-	-	n/a	n/a	-	-	57%	-	0%	57.6%	42.4%	N	O
COC-12	1,221	1,218	-	0.717	-	-	-	n/a	n/a	-	-	99%	-	1%	100.0%	0.0%	N	O
COC-13	869	871	-	1,688.3	-	-	-	n/a	n/a	-	-	97%	-	1%	97.7%	2.3%	N	O
COC-14	518	520	-	461.8	-	-	-	n/a	n/a	-	-	96%	-	0%	96.4%	3.6%	N	O
COC-15	625	626	-	151.1	-	-	-	n/a	n/a	-	-	85%	-	0%	85.9%	14.1%	N	O
COC-16	523	478	-	162.6	-	-	-	n/a	n/a	-	-	85%	-	0%	85.9%	14.1%	N	O
COC-17	577	576	-	145.4	-	-	-	n/a	n/a	-	-	85%	-	0%	85.9%	14.1%	N	O
COC-18	20,358	22,651	-	197.9	-	-	-	n/a	n/a	-	-	98%	-	0%	98.3%	1.7%	N	O
COC-19	41,597	63,508	-	1,057.4	-	-	-	n/a	n/a	-	-	75%	-	0%	75.8%	24.2%	N	I
COC-20	n/a	n/a	-	-	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a

Child Receptor

Adult Receptor

Soil Only

GW Only

Soil & GW

Global SOM	1.00%	0.0058	Foc Equiv
Soil Type	Sandy Loam	Default Sandy Loam	
City	Newcastle	Default Newcastle	
Site Area Res	2	Hectares	Default 0.01
Site Area Com	2	Hectares	Default 2
Wind Type	Urban		

Indoor Air	Residential	Commercial	
Building	SR3 Small Terrace	SR3 Pre-1970 3 Storey Office	
Building Qs	Site Specific	Site Specific	
Foundation Void	No Void	n/a	
Use CF of >1	Y	Y	
Indoor Soil Source	150	50	DF = 50 cm
Indoor GW Source	100	100	cm

TPH Select | Solvents

TPH >C8 Select | ODDs

TPH All | Metals

PAH 16

Merton Street, Banbury, on-site residential deep zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 9 Indoor Air Inhalation - Subsurface Soil

SR3 V701

Soil Source Properties

Depth to Contamination from Floor Level	Ls	165	cm	Default 65cm ignore void height
Depth to Contamination from Base of Foundation	Lt (Ls-Zc)	150	cm	SR4 Eq 4.3

Soil Properties

		Soil Diffusion Zone	Adopted Fnd Crack	Void Fnd Crack	
Soil Types		Sandy Loam	Sandy Loam	Dry Sand	
Air-filled porosity	Oa	0.2	0.2	0.47	cm3/cm3
Water-filled porosity	Ow	0.33	0.33	0.07	cm3/cm3
Total Porosity/Satuated Porosity	Ot	0.53	0.53	0.54	cm3/cm3
Residual soil water content	Or	0.12	0.12	0.07	cm3/cm3
Saturated hydraulic conductivity	Ks	0.00356			
van Genuchten shape parameter (m)	M	0.3201			
Bulk density	p	1.21	g/cm3		
Mean Particle Diameter (D)	D	0.03			

Groundwater Specific Properties & Calculations

Depth to Water Table from Floor Level	Lw	115	cm
Depth to Water Table from Base Slab	Ltw (Lw-Zc)	100	cm
van Genuchten shape parameter (n)	n	1.47	unitless
Air-filled porosity in the capillary zone	Oacz	0.08	unitless
Water-filled porosity in the capillary zone	Owcz	0.45	unitless
Thickness of capillary Zone	Lcz	25.00	cm

Building Ventilation & Ingress Calculations

		Y	Use Indoor Air CF of >1			
Building Ventilation rate	Qb or (Qb +Qs)	18,667	cm3/s	SR3 Eq 10.5 (+ Qs)	☐ Use Qb=Qb+Qs	
Flow Rate of Soil Gas (Default 25 (17-150))	Qs	14.5	cm3/s	Site Specific	SR3 Eq A9	Defualt = 25
Natural Ventilation with opening one walls	Qv1	477	cm3/s	○ One Wall	BS5925 Table 12a	
Natural Ventilation with opening on two walls	Qv2	7,802	cm3/s	● Two Walls	BS5925 Table 11a	
Adopted Void Ventilation Rate	Qv	0	cm3/s			
Effective Crack radius	rcrack	0.200	cm	SR3 Eq A3		
Effective Total Fluid Saturation	ste	0.512	unitless	SR3 Eq A4		
Relative Soil Permeability	krg	0.642	unitless	SR3 Eq A5		
Soil Intrinsic Permeability	ki	4.75E-08	cm2	SR3 Eq A6		
Effective Air Permeability	kv	3.05E-08	cm2	SR3 Eq A7		
Effective Air Viscosity	ua	1.75E-04	g/cm/s	SR3 Eq A8		
Soil Temperature	Tamb	283.15	K	SR3 Default		

BS5925:1991 Void Ventilation Parameters

Discharge Coefficient (sharp edged orifice)	Cd	0.61	unitless	BS5925 Pg16
Effective Fraction of void openings	Veff	0.5	unitless	Default 50% Efficiency
Effective equivalent area of openings for one wall	Aw	0.0194	m2	BS5925 Table 12a
Effective equivalent area of openings for two walls	Aw	0.0137	m2	BS5925 Table 11a
Wind Speed at building height Uz	ur	0.98	m/s	BS5925 Eq 5
Differential Mean Pressure Coefficient	Cp	0.9	unitless	BS5925 Table 13
CLEA Standard wind Speed at 10m	Um	5	m/s	SR3
Height of void openings above ground	Uz	0.10	m	
BS5921 Terrain Type		Urban	Drop Down Menu on CONTOL PANEL	
Terrain Factor 1	K	0.35	unitless	BS5925 Terrain Factors
Terrain Factor 2	Alp	0.25	unitless	BS5925 Terrain Factors

Building Parameters

		SR3 Small Terrace	SR3 Default = Small Terrace	Drop Down Menu on CONTOL PANEL			
				Building Void Parameters	☐ Consider Void		
Length of building	Lb	529	cm				
Width of building	Wb	529	cm	Sub Floor Void Height	Hv	15	cm
Height of building	Hb	480	cm	Height void openings above ground	Uz	10	cm
Height of living space above ground	Hliving	480	cm	Open area of a single air brick		77.5	cm2
Height of living space below ground	Hcellar	0	cm	No air bricks along open building side		5	c 1.5m centres
Foundation or slab thickness	Lc	15	cm	Area void openings on building side	Av	387.5	cm2
Floor-wall seam crack width	Wcr	0.2	cm				
Living space air exchange rate	ER	0.5	hr-1	Plastic: 77.5; Brick: 14.0			

External air density		1.2	kg/m3	SR3 Default = 1.2
Accel due to gravity	g	9.80655	m/s2	SR3
Annual Temp diff indoor/outdoors	DeltaT	6	K	SR3 Default = 6
Indoor Temperature	Ti	298	K	SR3 Default = 298
Pressure difference due to temperature	PD Temp	1.1	Pa	SR3 Eq 4.6
Pressure difference due to wind	PD Wind	2.0	Pa	SR3 Default = 2
Total Pressure diff soil/outdoors & building	PD in Pa	3.1	Pa	
Total Pressure diff soil/outdoors & building	PD	31	g/cm/s2	
Area of enclosed space below ground	Ab	280,000	cm2	SR3 Eq A1
Floor-wall seam perimeter	Xc	2,117	cm	SR3 Eq A2
Area of total cracks between floor and wall	Ac	423	cm2	Wcr * Xc
Crack depth below ground	Zc (Hcell+Lc)	15	cm	SR4 Eq 4.3

Results Summary

No	COC	PV-Soil (mg/kg)	PV-Vap (mg/m3)	PV-GW (mg/l)	PV-GWV (mg/m3)	Src Dep Rate (mg/day)	Src Mass (kg)	Depl Time (Years)
COC-1	Aliphatic TPH C5-6	124	307,000	n/a	n/a	13,225	16.75	3.5
COC-2	Aliphatic TPH C6-8	>Sat (302)	>Sat (307,000)	n/a	n/a	13,225	40.88	8.5
COC-3	Aliphatic TPH C8-10	>Sat (79)	>Sat (18,000)	n/a	n/a	774	10.72	37.9
COC-4	Aliphatic TPH C10-12	>Sat (392)	>Sat (18,000)	n/a	n/a	774	53.14	188.1
COC-5	Aliphatic TPH C12-16	>Sat (3,280)	>Sat (18,000)	n/a	n/a	774	444.93	1,574.6
COC-6	Aromatic TPH C5-7	715	121,000	n/a	n/a	4,484	96.83	59.2
COC-7	Aromatic TPH C7-8	>Sat (1,700)	>Sat (132,000)	n/a	n/a	4,432	230.02	142.2
COC-8	Aromatic TPH C8-10	102	2,710	n/a	n/a	126	13.79	300.2
COC-9	Aromatic TPH C10-12	>Sat (555)	>Sat (2,700)	n/a	n/a	126	75.15	1,636.7
COC-10	Aromatic TPH C12-16	>Sat (6,110)	>Sat (2,620)	n/a	n/a	126	827.42	18,020.1
COC-11	Aromatic TPH C16-21	(103,000)	>Sat (873)	n/a	n/a	63	13999.40	609,777.5
COC-12	Benzene	0.721	122	n/a	n/a	4.5	0.10	59.3
COC-13	Toluene	>Sat (1,700)	>Sat (132,000)	n/a	n/a	4,432	230.02	142.2
COC-14	Ethylbenzene	464	22,400	n/a	n/a	689	62.91	250.3
COC-15	Xylene-m	152	5,430	n/a	n/a	171	20.59	329.9
COC-16	Xylene-o	163	5,440	n/a	n/a	171	22.14	354.9
COC-17	Xylene-p	146	5,420	n/a	n/a	171	19.80	317.3
COC-18	MTBE EIC	198	6,710	n/a	n/a	2,297	26.84	32.0
COC-19	Phenol SR Tox	1,060	12	n/a	n/a	26	143.89	15,277.4
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Building ventilation rate	1,613	m3/day
Building volume	134	m3
Air chages per day	12	changes/day
Sourec area	28	m2
Source Thickness	4	m
Source Volume	112	m3
Soil Mass	135,520	kg

Checks Against Sat Limits

No	COC	Csatv Soil (mg/kg)	>Csatv Soil	Csatw Soil (mg/kg)	>CsatwSoil	Csatvap Soil (mg/m3)	>Csatvap Soil	Solubility (mg/l)	>Sol	Csatvap Soil (mg/m3)	>Csatvap Soil
COC-1	Aliphatic TPH C5-6	304	N	304	N	754647	N	35.9	n/a	754647	n/a
COC-2	Aliphatic TPH C6-8	144	Y	144	Y	146664	Y	5	n/a	146664	n/a
COC-3	Aliphatic TPH C8-10	78	Y	78	Y	17680	Y	0	n/a	17680	n/a
COC-4	Aliphatic TPH C10-12	48	Y	48	Y	2183	Y	0.034	n/a	2183	n/a
COC-5	Aliphatic TPH C12-16	24	Y	24	Y	130	Y	0.000759	n/a	130	n/a
COC-6	Aromatic TPH C5-7	1221	N	1218	N	207143	N	1780	n/a	207143	n/a
COC-7	Aromatic TPH C7-8	869	Y	871	Y	67744	Y	590	n/a	67744	n/a
COC-8	Aromatic TPH C8-10	613	N	614	N	16320	N	65	n/a	16320	n/a
COC-9	Aromatic TPH C10-12	365	Y	364	Y	1773	Y	25	n/a	1773	n/a
COC-10	Aromatic TPH C12-16	169	Y	169	Y	73	Y	6	n/a	73	n/a
COC-11	Aromatic TPH C16-21	54	Y	54	Y	0	Y	1	n/a	0	n/a
COC-12	Benzene	1221	N	1218	N	207143	N	1780	n/a	207143	n/a
COC-13	Toluene	869	Y	871	Y	67744	Y	590	n/a	67744	n/a
COC-14	Ethylbenzene	518	N	520	N	24952	N	180	n/a	24952	n/a
COC-15	Xylene-m	625	N	626	N	22335	N	200	n/a	22335	n/a
COC-16	Xylene-o	523	N	478	N	17417	N	173	n/a	17417	n/a
COC-17	Xylene-p	577	N	576	N	21433	N	200	n/a	21433	n/a
COC-18	MTBE EIC	20358	N	22651	N	690240	N	48000	n/a	690240	n/a
COC-19	Phenol SR Tox	41597	N	63508	N	460	N	84100	n/a	460	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

ADE Contribution

No	ADE %	AC1	AC2	AC3	AC4	AC5	AC6	COC ADE	BG ADE
COC-1	Aliphatic TPH C5-6	123%	110%	81%	65%	48%	41%	**78.2%**	**21.8%**
COC-2	Aliphatic TPH C6-8	123%	110%	81%	65%	48%	41%	**78.2%**	**21.8%**
COC-3	Aliphatic TPH C8-10	124%	111%	82%	66%	49%	42%	**79.1%**	**20.9%**
COC-4	Aliphatic TPH C10-12	124%	111%	82%	66%	49%	42%	**79.1%**	**20.9%**
COC-5	Aliphatic TPH C12-16	124%	111%	82%	66%	49%	42%	**79.1%**	**20.9%**
COC-6	Aromatic TPH C5-7	156%	139%	103%	83%	61%	53%	**99.1%**	**0.9%**
COC-7	Aromatic TPH C7-8	154%	137%	101%	82%	60%	52%	**97.7%**	**2.3%**
COC-8	Aromatic TPH C8-10	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-9	Aromatic TPH C10-12	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-10	Aromatic TPH C12-16	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-11	Aromatic TPH C16-21	91%	81%	60%	48%	36%	31%	**57.6%**	**42.4%**
COC-12	Benzene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-13	Toluene	154%	137%	101%	82%	60%	52%	**97.7%**	**2.3%**
COC-14	Ethylbenzene	152%	136%	100%	81%	60%	51%	**96.4%**	**3.6%**
COC-15	Xylene-m	135%	121%	89%	72%	53%	46%	**85.9%**	**14.1%**
COC-16	Xylene-o	135%	121%	89%	72%	53%	46%	**85.9%**	**14.1%**
COC-17	Xylene-p	135%	121%	89%	72%	53%	46%	**85.9%**	**14.1%**
COC-18	MTBE EIC	155%	138%	102%	82%	61%	52%	**98.3%**	**1.7%**
COC-19	Phenol SR Tox	119%	107%	78%	63%	47%	40%	**75.8%**	**24.2%**
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

				Adult	Calcs use Child MDI		CLEA 10m3/day 20kg															All MG/KG				Soil	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deff Soil	-	Deff Crack	Peclet Number	Alpha	Indoor CF Soil	Corrected Alpha	AC1	AC2	AC3	AC4	AC5	AC6	PV-Soil	PV-Vap
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	8.2000	1.0E-05	1.0E-09	21.000000	8.458219	0.001675	-	0.001675	1.18E+133	1.38E-04	10	1.38E-05	68	79	119	156	216	258	**124**	**306,863**
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	8.2000	1.0E-05	1.0E-09	27.300000	26.836109	0.001675	-	0.001675	1.18E+133	1.38E-04	10	1.38E-05	165	194	291	380	526	629	**302**	**306,864**
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	0.4800	1.0E-05	1.0E-09	41.500000	182.289431	0.001674	-	0.001674	1.19E+133	1.38E-04	10	1.38E-05	44	51	76	99	137	164	**79**	**18,008**
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	0.4800	1.0E-05	1.0E-09	64.400000	1,402.240448	0.001674	-	0.001674	1.19E+133	1.38E-04	10	1.38E-05	216	253	378	492	681	814	**392**	**18,008**
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	0.4800	1.0E-05	1.0E-09	171.000000	31,176.381380	0.001674	-	0.001674	1.19E+133	1.38E-04	10	1.38E-05	1,810	2,121	3,169	4,120	5,703	6,816	**3,283**	**18,008**
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	2.7800	8.8E-06	6.6E-10	0.11600000	0.68402895	0.001474	-	0.001474	1.65E+151	1.24E-04	10	1.24E-05	452	507	690	855	1,159	1,352	**715**	**121,171**
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	2.7480	7.8E-06	5.9E-10	0.11500000	1.475944	0.001307	-	0.001307	2.85E+170	1.12E-04	10	1.12E-05	1,067	1,197	1,638	2,037	2,765	3,230	**1,697**	**132,251**
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	TRUE	Y	0.0780	1.0E-05	1.0E-09	0.25300000	9.506926	0.001678	-	0.001678	6.27E+132	1.38E-04	10	1.38E-05	41	54	98	139	198	246	**102**	**2,707**
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	TRUE	Y	0.0780	1.0E-05	1.0E-09	0.07220000	14.853602	0.001687	-	0.001687	1.28E+132	1.39E-04	10	1.39E-05	222	294	535	756	1,081	1,339	**555**	**2,695**
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	TRUE	Y	0.0780	1.0E-05	1.0E-09	0.01260000	29.343669	0.001745	-	0.001745	5.07E+127	1.42E-04	10	1.42E-05	2,445	3,232	5,892	8,323	11,903	14,747	**6,106**	**2,622**
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	TRUE	Y	0.0390	1.0E-05	1.0E-09	0.00069500	82.200020	0.002951	-	0.002951	3.19E+75	2.14E-04	10	2.14E-05	41,360	54,690	99,683	140,818	201,396	249,511	**103,301**	**873**
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	0.0028	8.8E-06	6.6E-10	0.11600000	0.68402895	0.001474	-	0.001474	1.65E+151	1.24E-04	10	1.24E-05	0.458	0.513	0.696	0.861	1.2	1.4	**0.721**	**122**
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	2.7480	7.8E-06	5.9E-10	0.11500000	1.475944	0.001307	-	0.001307	2.85E+170	1.12E-04	10	1.12E-05	1,067	1,197	1,638	2,037	2,765	3,230	**1,697**	**132,251**
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	0.4270	7.0E-06	5.3E-10	0.13900000	2.886467	0.001182	-	0.001182	3.06E+188	1.03E-04	10	1.03E-05	290	326	448	558	759	888	**464**	**22,355**
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	0.1060	7.0E-06	5.3E-10	0.11200000	3.131957	0.001181	-	0.001181	4.20E+188	1.03E-04	10	1.03E-05	89	102	147	187	257	305	**152**	**5,432**
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	0.1060	7.0E-06	5.3E-10	0.09200000	2.762095	0.001179	-	0.001179	1.03E+189	1.02E-04	10	1.02E-05	95	110	158	201	277	328	**163**	**5,442**
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	0.1060	7.0E-06	5.3E-10	0.10700000	2.881178	0.001183	-	0.001183	2.11E+188	1.03E-04	10	1.03E-05	85	98	141	180	247	293	**146**	**5,425**
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	1.4240	7.8E-06	5.6E-10	0.01600000	0.47190151	0.001341	-	0.001341	1.65E+166	1.14E-04	1	1.14E-04	125	140	191	237	322	376	**198**	**6,714**
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	0.0160	7.9E-06	6.4E-10	0.00000835	0.75515164	0.068911	-	0.068911	1.71E+03	6.98E-04	1	6.98E-04	567	671	1,025	1,346	1,871	2,247	**1,062**	**12**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

				Adult	Calcs use Child MDI		CLEA 10m3/day 20kg																		Groundwater	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deffcz	Deffwt	Deff Crack	Peclet Number	Alpha	Indoor CF GW	Corrected Alpha	AC1	AC2	AC3	AC4	AC5	AC6	PV-GW	PV-GWV
COC-1	TPH	Aliphatic TPH C5-6	5	18	FALSE	Y	8.2	0.00001	0.000000001	21	8.458218647	0.00008	0.00029	0.001675	1.18E+133	4.17E-05	1	4.17E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-2	TPH	Aliphatic TPH C6-8	5	18	FALSE	Y	8.2	0.00001	0.000000001	27.3	26.83610895	0.00008	0.00029	0.001675	1.18E+133	4.17E-05	1	4.17E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-3	TPH	Aliphatic TPH C8-10	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	41.5	182.2894312	0.00008	0.00029	0.001674	1.19E+133	4.17E-05	1	4.17E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-4	TPH	Aliphatic TPH C10-12	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	64.4	1402.240448	0.00008	0.00029	0.001674	1.19E+133	4.17E-05	1	4.17E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-5	TPH	Aliphatic TPH C12-16	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	171	31176.38138	0.00008	0.00029	0.001674	1.19E+133	4.17E-05	1	4.17E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2	FALSE	Y	2.78	0.00000877	6.64E-10	0.116	0.684028952	0.00009	0.00030	0.001474	1.65E+151	4.24E-05	1	4.24E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	TPH	Aromatic TPH C7-8	1.4	0.52	FALSE	Y	2.748	0.00000778	5.88E-10	0.115	1.475943545	0.00008	0.00027	0.001307	2.85E+170	3.79E-05	1	3.79E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	TPH	Aromatic TPH C8-10	0.06	0.42	TRUE	Y	0.078	0.00001	0.000000001	0.253	9.506925971	0.00009	0.00032	0.001678	6.27E+132	4.56E-05	1	4.56E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	TPH	Aromatic TPH C10-12	0.06	0.42	TRUE	Y	0.078	0.00001	0.000000001	0.0722	14.85360246	0.00012	0.00039	0.001687	1.28E+132	5.46E-05	1	5.46E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	TPH	Aromatic TPH C12-16	0.06	0.42	TRUE	Y	0.078	0.00001	0.000000001	0.0126	29.34366947	0.00028	0.00076	0.001745	5.07E+127	9.90E-05	1	9.90E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	TPH	Aromatic TPH C16-21	0.03	0.21	TRUE	Y	0.039	0.00001	0.000000001	0.000695	82.20001974	0.00363	0.00310	0.002951	3.19E+75	2.90E-04	1	2.90E-04	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	BTEX	Benzene	0.0014	0	FALSE	Y	0.0028	0.00000877	6.64E-10	0.116	0.684028952	0.00009	0.00030	0.001474	1.65E+151	4.24E-05	1	4.24E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	BTEX	Toluene	1.4	0.52	FALSE	Y	2.748	0.00000778	5.88E-10	0.115	1.475943545	0.00008	0.00027	0.001307	2.85E+170	3.79E-05	1	3.79E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	BTEX	Ethylbenzene	0.22	0.13	FALSE	Y	0.427	0.00000704	5.31E-10	0.139	2.886467314	0.00007	0.00023	0.001182	3.06E+188	3.37E-05	1	3.37E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	BTEX	Xylene-m	0.06	0.14	FALSE	Y	0.106	0.00000703	5.31E-10	0.112	3.131956822	0.00007	0.00024	0.001181	4.20E+188	3.45E-05	1	3.45E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	BTEX	Xylene-o	0.06	0.14	FALSE	Y	0.106	0.00000701	5.31E-10	0.092	2.762095093	0.00007	0.00025	0.001179	1.03E+189	3.54E-05	1	3.54E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	BTEX	Xylene-p	0.06	0.14	FALSE	Y	0.106	0.00000704	5.31E-10	0.107	2.881178058	0.00007	0.00024	0.001183	2.11E+188	3.48E-05	1	3.48E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	BTEX	MTBE EIC	0.722	0.2	FALSE	Y	1.424	0.00000782	5.62E-10	0.016	0.471901511	0.00015	0.00046	0.001341	1.65E+166	6.27E-05	1	6.27E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	OTHER	Phenol SR Tox	0.01	0.04	FALSE	Y	0.016	0.0000079	6.36E-10	0.00000835	0.75515164	0.18770	0.08186	0.068911	1.71E+03	7.30E-04	1	7.30E-04	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

Merton Street, Banbury, on-site residential deep zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 11 Outdoor Air Inhalation - Subsurface Soil SR3 V701

Outdoor Air Source Properties

Depth to subsurface contamination	Ls	150	cm	SR3 Default = 100cm
Generic SR3 Receptor Height	H	0.8	m	SR3 Default = 0.8m
Source Area	Asource	2.00	Hectare	SR3 Default = 0.01
SR3 City Surrogate	Location	Newcastle 0.8m	City	SR3 Default = Newcastle
Air Dispersion factor	Q/Cwind	68	g/m2/s per kg/m3	

Groundwater Specific Calculations

Depth to Water Table	Lgw	100	cm
van Genuchten shape parameter (n)	n	1.47	unitless
Air-filled porosity in the capillary zone	Oacz	0.08	unitless
Water-filled porosity in the capillary zone	Owcz	0.45	unitless
Thickness of capillary Zone	Lcz	25.00	cm

Soil Properties

		Sandy Loam	
Air-filled porosity	Oa	0.2	cm3/cm3
Water-filled porosity	Ow	0.33	cm3/cm3
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3
Residual soil water content	Or	0.12	cm3/cm3
Saturated hydraulic conductivity		0.00356	cm/s
van Genuchten shape parameter (m)	M	0.3201	unitless
Bulk density	p	1.21	g/cm3
Mean Particle Diameter (D)	D	0.03	m/s

Results Summary		mg/kg	mg/m3	mg/l	mg/m3
No	COC	PV-Soil	PV-Vap	PV-GW	PV-GWV
COC-1	Aliphatic TPH C5-6	>Sat (22,900)	No Risk	No Risk	No Risk
COC-2	Aliphatic TPH C6-8	>Sat (55,900)	No Risk	No Risk	No Risk
COC-3	Aliphatic TPH C8-10	>Sat (14,700)	No Risk	No Risk	No Risk
COC-4	Aliphatic TPH C10-12	>Sat (72,700)	No Risk	No Risk	No Risk
COC-5	Aliphatic TPH C12-16	>Sat (609,000)	No Risk	No Risk	No Risk
COC-6	Aromatic TPH C5-7	>Sat (135,000)	No Risk	No Risk	No Risk
COC-7	Aromatic TPH C7-8	>Sat (328,000)	No Risk	No Risk	No Risk
COC-8	Aromatic TPH C8-10	>Sat (18,900)	>Sat (502,000)	No Risk	No Risk
COC-9	Aromatic TPH C10-12	>Sat (103,000)	>Sat (499,000)	No Risk	No Risk
COC-10	Aromatic TPH C12-16	No Risk	>Sat (483,000)	No Risk	No Risk
COC-11	Aromatic TPH C16-21	No Risk	>Sat (143,000)	No Risk	No Risk
COC-12	Benzene	137	23,200	No Risk	No Risk
COC-13	Toluene	>Sat (328,000)	No Risk	No Risk	No Risk
COC-14	Ethylbenzene	>Sat (90,800)	No Risk	No Risk	No Risk
COC-15	Xylene-m	>Sat (29,700)	No Risk	No Risk	No Risk
COC-16	Xylene-o	>Sat (32,000)	No Risk	No Risk	No Risk
COC-17	Xylene-p	>Sat (28,600)	No Risk	No Risk	No Risk
COC-18	MTBE EIC	>Sat (381,000)	No Risk	No Risk	No Risk
COC-19	Phenol SR Tox	>Sat (242,000)	>Sat (2,680)	No Risk	No Risk
COC-20	n/a	No Risk	No Risk	No Risk	No Risk

Checks Against Saturation Limits		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	COC	Csatv Soil	>Csatv Soil	Csatw Soil	>CsatwSoil	Csatvap Soil	>Csatvap Soil	Solubility	>Sol	Csatvap Soil	>Csatvap Soil
COC-1	Aliphatic TPH C5-6	304	Y	304	Y	754647	Y	36	n/a	754647	n/a
COC-2	Aliphatic TPH C6-8	144	Y	144	Y	146664	Y	5	n/a	146664	n/a
COC-3	Aliphatic TPH C8-10	78	Y	78	Y	17680	Y	0	n/a	17680	n/a
COC-4	Aliphatic TPH C10-12	48	Y	48	Y	2183	Y	0.034	n/a	2183	n/a
COC-5	Aliphatic TPH C12-16	24	Y	24	Y	130	Y	0.000759	n/a	130	n/a
COC-6	Aromatic TPH C5-7	1221	Y	1218	Y	207143	Y	1780	n/a	207143	n/a
COC-7	Aromatic TPH C7-8	869	Y	871	Y	67744	Y	590	n/a	67744	n/a
COC-8	Aromatic TPH C8-10	613	Y	614	Y	16320	Y	65	n/a	16320	n/a
COC-9	Aromatic TPH C10-12	365	Y	364	Y	1773	Y	25	n/a	1773	n/a
COC-10	Aromatic TPH C12-16	169	Y	169	Y	73	Y	6	n/a	73	n/a
COC-11	Aromatic TPH C16-21	54	Y	54	Y	0	Y	1	n/a	0	n/a
COC-12	Benzene	1221	N	1218	N	207143	N	1780	n/a	207143	n/a
COC-13	Toluene	869	Y	871	Y	67744	Y	590	n/a	67744	n/a
COC-14	Ethylbenzene	518	Y	520	Y	24952	Y	180	n/a	24952	n/a
COC-15	Xylene-m	625	Y	626	Y	22335	Y	200	n/a	22335	n/a
COC-16	Xylene-o	523	Y	478	Y	17417	Y	173	n/a	17417	n/a
COC-17	Xylene-p	577	Y	576	Y	21433	Y	200	n/a	21433	n/a
COC-18	MTBE EIC	20358	Y	22651	Y	690240	Y	48000	n/a	690240	n/a
COC-19	Phenol SR Tox	41597	Y	63508	Y	460	Y	84100	n/a	460	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

13037.20169	15318.21457	23015.04046	30010.59306	34354.35854	41111.32706	COC ADE	BG ADE
123%	110%	81%	65%	48%	41%	78.2%	21.8%
123%	110%	81%	65%	48%	41%	78.2%	21.8%
124%	111%	82%	66%	49%	42%	79.1%	20.9%
124%	111%	82%	66%	49%	42%	79.1%	20.9%
124%	111%	82%	66%	49%	42%	79.1%	20.9%
156%	139%	103%	83%	61%	53%	99.1%	0.9%
154%	137%	101%	82%	60%	52%	97.7%	2.3%
91%	81%	60%	48%	36%	31%	57.6%	42.4%
91%	81%	60%	48%	36%	31%	57.6%	42.4%
91%	81%	60%	48%	36%	31%	57.6%	42.4%
91%	81%	60%	48%	36%	31%	57.6%	42.4%
157%	141%	104%	84%	62%	53%	100.0%	0.0%
154%	137%	101%	82%	60%	52%	97.7%	2.3%
152%	136%	100%	81%	60%	51%	96.4%	3.6%
135%	121%	89%	72%	53%	46%	85.9%	14.1%
135%	121%	89%	72%	53%	46%	85.9%	14.1%
135%	121%	89%	72%	53%	46%	85.9%	14.1%
155%	138%	102%	82%	61%	52%	98.3%	1.7%
119%	107%	78%	63%	47%	40%	75.8%	24.2%
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

					Calcs use Child MDI		CLEA 10m3/day 20kg															Soil	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Outdoor mg/m3	Dair	Dwater	Kaw	Ksw	-	Deff	VF	AC1	AC2	AC3	AC4	AC5	AC6	PV-Soil	PV-Vap
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	21.0	8.4582	-	0.001675	4.08E-06	13,037	15,318	23,015	30,011	34,354	41,111	**22,924**	**56,916,547**
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	27.3	26.8361	-	0.001675	1.67E-06	31,819	37,386	56,171	73,244	83,846	100,337	**55,950**	**56,916,741**
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	41.5	182.2894	-	0.001674	3.74E-07	8,416	9,859	14,729	19,154	21,902	26,176	**14,671**	**3,340,023**
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	64.4	1,402.2404	-	0.001674	7.54E-08	41,719	48,873	73,013	94,949	108,569	129,755	**72,726**	**3,340,037**
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	171.0	31,176.3814	-	0.001674	9.00E-09	349,323	409,228	611,362	795,030	909,074	1,086,476	**608,952**	**3,340,054**
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	2.78	8.8E-06	6.6E-10	0.1	0.6840	-	0.001474	2.45E-07	89,179	99,875	135,957	168,556	188,791	220,266	**135,412**	**22,963,713**
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	-	0.001307	9.99E-08	214,175	240,407	328,891	408,868	458,511	535,733	**327,575**	**25,523,441**
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.3	9.5069	-	0.001678	4.38E-08	7,855	10,387	18,933	26,745	31,598	39,147	**18,860**	**501,908**
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0722	14.8536	-	0.001687	8.04E-09	42,784	56,572	103,114	145,665	172,096	213,211	**102,719**	**499,295**
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0126	29.3437	-	0.001745	7.35E-10	468,181	619,062	1,128,366	1,594,000	1,883,234	2,333,153	**1,124,048**	**482,660**
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	TRUE	Y	0.04	1.0E-05	1.0E-09	0.0006950	82.2000	-	0.002951	2.45E-11	7,028,958	9,294,189	16,940,550	23,931,268	28,273,635	35,028,428	**16,875,720**	**142,684**
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	0.00	8.8E-06	6.6E-10	0.1	0.6840	-	0.001474	2.45E-07	90	101	137	170	190	221	**137**	**23,164**
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	-	0.001307	9.99E-08	214,175	240,407	328,891	408,868	458,511	535,733	**327,575**	**25,523,441**
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	0.43	7.0E-06	5.3E-10	0.1	2.8865	-	0.001182	5.58E-08	58,970	66,342	91,210	113,695	127,653	149,364	**90,846**	**4,374,739**
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	3.1320	-	0.001181	4.14E-08	18,038	20,739	29,849	38,112	43,241	51,221	**29,731**	**1,063,187**
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.0920	2.7621	-	0.001179	3.85E-08	19,406	22,312	32,113	41,002	46,521	55,106	**31,986**	**1,065,383**
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	2.8812	-	0.001183	4.31E-08	17,342	19,938	28,697	36,640	41,572	49,243	**28,583**	**1,061,506**
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	1.42	7.8E-06	5.6E-10	0.0160	0.4719	-	0.001341	4.46E-08	249,719	280,040	382,316	474,744	532,115	621,359	**380,787**	**12,910,711**
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	0.02	7.9E-06	6.4E-10	0.0000084	0.7552	-	0.068911	7.47E-10	134,556	159,427	243,356	319,691	367,091	440,825	**242,400**	**2,680**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

					Calcs use Child MDI		CLEA 10m3/day 20kg															Groundwater	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Allowable Outdoor mg/m3	Dair	Dwater	Kaw	Ksw	Deffcz	Deff	VF	AC1	AC2	AC3	AC4	AC5	AC6	PV-GW	PV-GWV
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	21.0	8.4582	0.00008	0.0002941	1.07E-06	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	8.20	1.0E-05	1.0E-09	27.3	26.8361	0.00008	0.0002940	4.40E-07	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	41.5	182.2894	0.00008	0.0002939	9.84E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	64.4	1,402.2404	0.00008	0.0002938	1.98E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	0.48	1.0E-05	1.0E-09	171.0	31,176.3814	0.00008	0.0002937	2.37E-09	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	2.78	8.8E-06	6.6E-10	0.1	0.6840	0.00009	0.0002992	7.46E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	0.00008	0.0002657	3.04E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.3	9.5069	0.00009	0.0003227	1.26E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0722	14.8536	0.00012	0.0003919	2.80E-09	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	TRUE	Y	0.08	1.0E-05	1.0E-09	0.0126	29.3437	0.00028	0.0007561	4.77E-10	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	TRUE	Y	0.04	1.0E-05	1.0E-09	0.0006950	82.2000	0.00363	0.0030958	3.85E-11	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	0.00	8.8E-06	6.6E-10	0.1	0.6840	0.00009	0.0002992	7.46E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	2.75	7.8E-06	5.9E-10	0.1	1.4759	0.00008	0.0002657	3.04E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	0.43	7.0E-06	5.3E-10	0.1	2.8865	0.00007	0.0002347	1.66E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	3.1320	0.00007	0.0002409	1.27E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.0920	2.7621	0.00007	0.0002476	1.21E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	0.11	7.0E-06	5.3E-10	0.1	2.8812	0.00007	0.0002428	1.33E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	1.42	7.8E-06	5.6E-10	0.0160	0.4719	0.00015	0.0004551	2.27E-08	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	0.02	7.9E-06	6.4E-10	0.0000084	0.7552	0.18770	0.0818632	1.33E-09	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

Notes:
Output Checked against CLEA UK 1.06

Merton Street, Banbury, on-site residential deep zone | **Project Ref** | **14 Oct 10** | **SR3 V701**

Child Scenario SR3 Residential | **41403** | **Revision**

Female Child AC1-6: Site Assessment Criteria | **100**

Calculate GACs

Calculate SSAC

Key Parameter Check

Oral Pathways

Inhalation Pathways

No	Type	COC	Ingestion SOIL-D	Veg Attached (n/a) SOIL-ID	Veg Direct (n/a) Veg-D	Dermal DERM-I	DERM-O	Dust Inhalation Dust-I	Dust-O	Vapour Inhalation Vap In	Out Surf	Out Sub	Oral MDI 50% Rule	Inhal MDI 50% Rule	Comb AC	Derm Via	Vol Ass	Use Vol	Calculated SSAC	Adopted SSAC	Csatv	Csatw	Total ORAL	Total INHAL
COC-1	PAH	Acenaphthene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	9,280	n/a	17,482,000.000	FALSE	FALSE	Yes	Oral HCV	Y	Yes	9,275.28		88	57	-	9,275.3
COC-2	PAH	Acenaphthylene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	8,649	n/a	15,910,000	FALSE	FALSE	Yes	Oral HCV	Y	Yes	8,644.30		87	86	-	8,644.3
COC-3	PAH	Benzo-a-anthracene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	16	n/a	14,580	FALSE	FALSE	Yes	Oral HCV	Y	Yes	16		1.7	1.7	-	16.0
COC-4	PAH	Fluorene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	11,430	n/a	20,710,000	FALSE	FALSE	Yes	Oral HCV	Y	Yes	11,423.7		44	31	-	11,423.7
COC-5	PAH	Naphthalene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4.5	n/a	8,801	FALSE	FALSE	Yes	Oral HCV	Y	Yes	4		76	76	-	4.5
COC-6	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-7	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-8	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-9	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-10	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-11	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-12	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-13	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-14	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-15	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-16	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-17	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-18	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-19	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-

No	SOIL-D	SOIL-I	VEG	DERM-I	DERM-O	DUST-I	DUST-O	VAP-I	VAP-Osurf	VAP-Osub	ADE COC	ADE BG	Oral Active	Dermal
								Uses Highest ADE						
COC-1	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-2	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-3	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-4	-	-	-	n/a	n/a	-	-	100%	-	0%	99.9%	0.1%	N	O
COC-5	-	-	-	n/a	n/a	-	-	80%	-	0%	80.3%	19.7%	N	O
COC-6	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-7	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-8	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-9	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-10	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-11	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-12	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-13	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-14	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-15	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-16	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-17	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-18	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-19	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-20	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a

Child Receptor

Adult Receptor

Soil Only

GW Only

Soil & GW

Global SOM	1.00%	0.0058	Foc Equiv
Soil Type	Sandy Loam	Default Sandy Loam	
City	Newcastle	Default Newcastle	
Site Area Res	2	Hectares	Default 0.01
Site Area Com	2	Hectares	Default 2
Wind Type	Urban		

Indoor Air	Residential	Commercial	
Building	SR3 Small Terrace	SR3 Pre-1970 3 Storey Office	
Building Qs	Site Specific	Site Specific	
Foundation Void	No Void	n/a	
Use CF of >1	Y	Y	
Indoor Soil Source	150	50	DF = 50 cm
Indoor GW Source	100	100	cm

TPH Select

Solvents

TPH >C8 Select

ODDs

TPH All

Metals

PAH 16

Merton Street, Banbury, on-site residential deep zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 9 Indoor Air Inhalation - Subsurface Soil

SR3 V701

Soil Source Properties						
Depth to Contamination from Floor Level	Ls	165			cm	Default 65cm ignore void height
Depth to Contamination from Base of Foundation	Lt (Ls-Zc)	150			cm	SR4 Eq 4.3
Soil Properties		**Soil Diffusion Zone**	**Adopted Fnd Crack**	**Void Fnd Crack**		
Soil Types		Sandy Loam	Sandy Loam	Dry Sand		
Air-filled porosity	Oa	0.2	0.2	0.47	cm3/cm3	
Water-filled porosity	Ow	0.33	0.33	0.07	cm3/cm3	
Total Porosity/Satuated Porosity	Ot	0.53	0.53	0.54	cm3/cm3	
Residual soil water content	Or	0.12	0.12	0.07	cm3/cm3	
Saturated hydraulic conductivity	Ks	0.00356				
van Genuchten shape parameter (m)	M	0.3201				
Bulk density	p	1.21	g/cm3			
Mean Particle Diameter (D)	D	0.03				
Groundwater Specific Properties & Calculations						
Depth to Water Table from Floor Level	Lw	115			cm	
Depth to Water Table from Base Slab	Ltw (Lw-Zc)	100			cm	
van Genuchten shape parameter (n)	n	1.47			unitless	
Air-filled porosity in the capillary zone	Oacz	0.08			unitless	
Water-filled porosity in the capillary zone	Owcz	0.45			unitless	
Thickness of capillary Zone	Lcz	25.00			cm	

Building Ventilation & Ingress Calculations		Y	Use Indoor Air CF of >1		
Building Ventilation rate	Qb or (Qb +Qs)	18,667	cm3/s	SR3 Eq 10.5 (+ Qs)	☐ Use Qb=Qb+Qs
Flow Rate of Soil Gas (Default 25 (17-150))	Qs	14.5	cm3/s	Site Specific	SR3 Eq A9 Defualt = 25
Natural Ventilation with opening one walls	Qv1	477	cm3/s	○ One Wall	BS5925 Table 12a
Natural Ventilation with opening on two walls	Qv2	7,802	cm3/s	● Two Walls	BS5925 Table 11a
Adopted Void Ventilation Rate	Qv	0	cm3/s		
Effective Crack radius	rcrack	0.200	cm	SR3 Eq A3	
Effective Total Fluid Saturation	ste	0.512	unitless	SR3 Eq A4	
Relative Soil Permeability	krg	0.642	unitless	SR3 Eq A5	
Soil Intrinsic Permeability	ki	4.75E-08	cm2	SR3 Eq A6	
Effective Air Permeability	kv	3.05E-08	cm2	SR3 Eq A7	
Effective Air Viscosity	ua	1.75E-04	g/cm/s	SR3 Eq A8	
Soil Temperature	Tamb	283.15	K	SR3 Default	
BS5925:1991 Void Ventilation Parameters					
Discharge Coefficient (sharp edged orifice)	Cd	0.61	unitless	BS5925 Pg16	
Effective Fraction of void openings	Veff	0.5	unitless	Default 50% Efficiency	
Effective equivalent area of openings for one wall	Aw	0.0194	m2	BS5925 Table 12a	
Effective equivalent area of openings for two walls	Aw	0.0137	m2	BS5925 Table 11a	
Wind Speed at building height Uz	ur	0.98	m/s	BS5925 Eq 5	
Differential Mean Pressure Coefficient	Cp	0.9	unitless	BS5925 Table 13	
CLEA Standard wind Speed at 10m	Um	5	m/s	SR3	
Height of void openings above ground	Uz	0.10	m		
BS5921 Terrain Type		Urban	Drop Down Menu on CONTOL PANEL		
Terrain Factor 1	K	0.35	unitless	BS5925 Terrain Factors	
Terrain Factor 2	Alp	0.25	unitless	BS5925 Terrain Factors	

Building Parameters		SR3 Small Terrace	SR3 Default = Small Terrace	Drop Down Menu on CONTOL PANEL			
				Building Void Parameters	☐ Consider Void		
Length of building	Lb	529	cm				
Width of building	Wb	529	cm	Sub Floor Void Height	Hv	15	cm
Height of building	Hb	480	cm	Height void openings above ground	Uz	10	cm
Height of living space above ground	Hliving	480	cm	Open area of a single air brick		77.5	cm2
Height of living space below ground	Hcellar	0	cm	No air bricks along open building side		5	c 1.5m centres
Foundation or slab thickness	Lc	15	cm	Area void openings on building side	Av	387.5	cm2
Floor-wall seam crack width	Wcr	0.2	cm				
Living space air exchange rate	ER	0.5	hr-1	Plastic: 77.5; Brick: 14.0			

External air density		1.2	kg/m3	SR3 Default = 1.2
Accel due to gravity	g	9.80665	m/s2	SR3
Annual Temp diff indoor/outdoors	DeltaT	6	K	SR3 Default = 6
Indoor Temperature	Ti	298	K	SR3 Default = 298
Pressure difference due to temperature	PD Temp	1.1	Pa	SR3 Eq 4.6
Pressure difference due to wind	PD Wind	2.0	Pa	SR3 Default = 2
Total Pressure diff soil/outdoors & building	PD in Pa	3.1	Pa	
Total Pressure diff soil/outdoors & building	PD	31	g/cm/s2	
Area of enclosed space below ground	Ab	280,000	cm2	SR3 Eq A1
Floor-wall seam perimeter	Xc	2,117	cm	SR3 Eq A2
Area of total cracks between floor and wall	Ac	423	cm2	Wcr * Xc
Crack depth below ground	Zc (Hcell+Lc)	15	cm	SR4 Eq 4.3

Results Summary		mg/kg	mg/m3	mg/l	mg/m3	mg/day	kg	Years
No	**COC**	**PV-Soil**	**PV-Vap**	**PV-GW**	**PV-GWV**	**Src Dep Rate**	**Src Mass**	**Depl Time**
COC-1	Acenaphthene	>Sat (9,280)	>Sat (508)	n/a	n/a	194	1257.66	17,804.0
COC-2	Acenaphthylene	>Sat (8,650)	>Sat (454)	n/a	n/a	194	1172.12	16,592.9
COC-3	Benzo-a-anthracene	>Sat (16)	>Sat (0.001)	n/a	n/a	0.002	2.17	3,837,830.1
COC-4	Fluorene	(11,400)	>Sat (283)	n/a	n/a	129	1548.70	32,924.9
COC-5	Naphthalene	4.5	7.4	n/a	n/a	2.3	0.61	717.2
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Building ventilation rate	1,613	m3/day
Building volume	134	m3
Air chages per day	12	changes/day
Sourec area	28	m2
Source Thickness	4	m
Source Volume	112	m3
Soil Mass	135,520	kg

Checks Against Sat Limits		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	**COC**	**Csatv Soil**	**>Csatv Soil**	**Csatw Soil**	**>CsatwSoil**	**Csatvap Soil**	**>Csatvap Soil**	**Solubility**	**>Sol**	**Csatvap Soil**	**>Csatvap Soil**
COC-1	Acenaphthene	88	Y	57	Y	5	Y	4.1	n/a	5	n/a
COC-2	Acenaphthylene	87	Y	86	Y	5	Y	8	n/a	5	n/a
COC-3	Benzo-a-anthracene	2	Y	2	Y	0.000120	Y	0.004	n/a	0.000120	n/a
COC-4	Fluorene	44	Y	31	Y	1	Y	2	n/a	1	n/a
COC-5	Naphthalene	76	N	76	N	126	N	19	n/a	126	n/a
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

ADE Contribution									
No	**ADE %**	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**	**COC ADE**	**BG ADE**
COC-1	Acenaphthene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-2	Acenaphthylene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-3	Benzo-a-anthracene	157%	141%	104%	84%	62%	53%	**100.0%**	**0.0%**
COC-4	Fluorene	157%	140%	103%	84%	62%	53%	**99.9%**	**0.1%**
COC-5	Naphthalene	126%	113%	83%	67%	50%	43%	**80.3%**	**19.7%**
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

				Adult	Calcs use Child MDI		CLEA 10m3/day 20kg												All MG/KG							Soil	Vapour
No	**Type**	**COC**	**HCV**	**MDI/day**	**MDI 51% Rule**	**Suff Vol**	**Allowable Indoor mg/m3**	**Dair**	**Dwater**	**Kaw**	**Ksw**	**Deff Soil**	**-**	**Deff Crack**	**Peclet Number**	**Alpha**	**Indoor CF Soil**	**Corrected Alpha**	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**	**PV-Soil**	**PV-Vap**
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	0.1200	5.9E-06	4.7E-10	0.00075900	13.869380	0.001529	-	0.001529	5.39E+145	1.28E-04	1	1.28E-04	5,901	6,600	8,957	11,086	15,020	17,508	**9,280**	**508**
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	0.1200	6.0E-06	4.8E-10	0.00056800	10.827086	0.001753	-	0.001753	1.38E+127	1.43E-04	1	1.43E-04	5,500	6,151	8,348	10,332	13,998	16,317	**8,649**	**454**
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	0.0000	4.6E-06	3.8E-10	0.00003160	450.496060	0.011441	-	0.011441	3.00E+19	4.62E-04	1	4.62E-04	10	11	15	19	26	30	**16**	**0.001**
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	0.0799	5.6E-06	4.5E-10	0.00041200	16.619416	0.001897	-	0.001897	2.88E+117	1.52E-04	1	1.52E-04	7,261	8,123	11,029	13,655	18,503	21,571	**11,428**	**283**
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	0.0014	6.5E-06	5.2E-10	0.00662000	4.018616	0.001161	-	0.001161	8.78E+191	1.01E-04	1	1.01E-04	2.5	2.9	4.3	5.6	7.8	9.3	**4.5**	**7.4**
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

				Adult	Calcs use Child MDI		CLEA 10m3/day 20kg																			Groundwater	Vapour
No	**Type**	**COC**	**HCV**	**MDI/day**	**MDI 51% Rule**	**Suff Vol**	**Allowable Indoor mg/m3**	**Dair**	**Dwater**	**Kaw**	**Ksw**	**Deffcz**	**Deffwt**	**Deff Crack**	**Peclet Number**	**Alpha**	**Indoor CF GW**	**Corrected Alpha**	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**	**PV-GW**	**PV-GWV**
COC-1	PAH	Acenaphthene	0.06	0.000025	FALSE	Y	0.1199975	0.00000585	4.7E-10	0.000759	13.86937986	0.00157	0.00154	0.001529	5.39E+145	1.78E-04	1	1.78E-04	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-2	PAH	Acenaphthylene	0.06	0.000011	FALSE	Y	0.1199989	0.00000597	4.82E-10	0.000568	10.82708614	0.00214	0.00184	0.001753	1.38E+127	2.03E-04	1	2.03E-04	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-3	PAH	Benzo-a-anthracene	0.00000048	0	FALSE	Y	0.00000096	0.0000046	3.8E-10	0.0000316	450.4960601	0.02966	0.01352	0.011441	3.00E+19	5.61E-04	1	5.61E-04	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-4	PAH	Fluorene	0.04	0.00096	FALSE	Y	0.079904	0.00000558	4.47E-10	0.000412	16.61941637	0.00272	0.00205	0.001897	2.88E+117	2.20E-04	1	2.20E-04	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-5	PAH	Naphthalene	0.00086	0.0028	FALSE	Y	0.00144	0.00000652	5.16E-10	0.00662	4.018616016	0.00025	0.00060	0.001161	8.78E+191	8.10E-05	1	8.10E-05	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

Merton Street, Banbury, on-site residential deep zone
SR3 Residential - Child Scenario - Female Child AC1-6
RPL 11 Outdoor Air Inhalation - Subsurface Soil

SR3 V701

Outdoor Air Source Properties

Depth to subsurface contamination	Ls	**150**	cm	SR3 Default = 100cm
Generic SR3 Receptor Height	H	0.8	m	SR3 Default = 0.8m
Source Area	Asource	**2.00**	Hectare	SR3 Default = 0.01
SR3 City Surrogate	Location	**Newcastle 0.8m**	City	SR3 Default = Newcastle
Air Dispersion factor	Q/Cwind	68	g/m2/s per kg/m3	

Groundwater Specific Calculations

Depth to Water Table	Lgw	**100**	cm
van Genuchten shape parameter (n)	n	1.47	unitless
Air-filled porosity in the capillary zone	Oacz	0.08	unitless
Water-filled porosity in the capillary zone	Owcz	0.45	unitless
Thickness of capillary Zone	Lcz	25.00	cm

Soil Properties

		Sandy Loam	
Air-filled porosity	Oa	0.2	cm3/cm3
Water-filled porosity	Ow	0.33	cm3/cm3
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3
Residual soil water content	Or	0.12	cm3/cm3
Saturated hydraulic conductivity		0.00356	cm/s
van Genuchten shape parameter (m)	M	0.3201	unitless
Bulk density	p	1.21	g/cm3
Mean Particle Diameter (D)	D	0.03	m/s

Results Summary

		mg/kg	mg/m3	mg/l	mg/m3
No	**COC**	**PV-Soil**	**PV-Vap**	**PV-GW**	**PV-GWV**
COC-1	Acenaphthene	No Risk	>Sat (957,000)	No Risk	No Risk
COC-2	Acenaphthylene	No Risk	>Sat (835,000)	No Risk	No Risk
COC-3	Benzo-a-anthracene	>Sat (14,600)	>Sat (1.0)	No Risk	No Risk
COC-4	Fluorene	No Risk	>Sat (513,000)	No Risk	No Risk
COC-5	Naphthalene	>Sat (8,800)	>Sat (14,500)	No Risk	No Risk
COC-6	n/a	No Risk	No Risk	No Risk	No Risk
COC-7	n/a	No Risk	No Risk	No Risk	No Risk
COC-8	n/a	No Risk	No Risk	No Risk	No Risk
COC-9	n/a	No Risk	No Risk	No Risk	No Risk
COC-10	n/a	No Risk	No Risk	No Risk	No Risk
COC-11	n/a	No Risk	No Risk	No Risk	No Risk
COC-12	n/a	No Risk	No Risk	No Risk	No Risk
COC-13	n/a	No Risk	No Risk	No Risk	No Risk
COC-14	n/a	No Risk	No Risk	No Risk	No Risk
COC-15	n/a	No Risk	No Risk	No Risk	No Risk
COC-16	n/a	No Risk	No Risk	No Risk	No Risk
COC-17	n/a	No Risk	No Risk	No Risk	No Risk
COC-18	n/a	No Risk	No Risk	No Risk	No Risk
COC-19	n/a	No Risk	No Risk	No Risk	No Risk
COC-20	n/a	No Risk	No Risk	No Risk	No Risk

Checks Against Saturation Limits

		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	**COC**	**Csatv Soil**	**>Csatv Soil**	**Csatw Soil**	**>CsatwSoil**	**Csatvap Soil**	**>Csatvap Soil**	**Solubility**	**>Sol**	**Csatvap Soil**	**>Csatvap Soil**
COC-1	Acenaphthene	88	Y	57	Y	5	Y	4	n/a	5	n/a
COC-2	Acenaphthylene	87	Y	86	Y	5	Y	8	n/a	5	n/a
COC-3	Benzo-a-anthracene	2	Y	2	Y	0.000120	Y	0.004	n/a	0.000120	n/a
COC-4	Fluorene	44	Y	31	Y	1	Y	2	n/a	1	n/a
COC-5	Naphthalene	76	Y	76	Y	126	Y	19	n/a	126	n/a
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

11564008.72	**12933481.68**	**17552735.89**	**21725212.75**	**24315026.09**	**28343624.62**	**COC ADE**	**BG ADE**
157%	141%	104%	84%	62%	53%	100.0%	0.0%
157%	141%	104%	84%	62%	53%	100.0%	0.0%
157%	141%	104%	84%	62%	53%	100.0%	0.0%
157%	140%	103%	84%	62%	53%	99.9%	0.1%
126%	113%	83%	67%	50%	43%	80.3%	19.7%
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

					Calcs use Child MDI		CLEA 10m3/day 20kg			
No	**Type**	**COC**	**HCV**	**MDI/day**	MDI 51% Rule	**Suff Vol**	Allowable Outdoor mg/m3	**Dair**	**Dwater**	**Kaw**
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	0.12	5.9E-06	4.7E-10	0.0007590
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	0.12	6.0E-06	4.8E-10	0.0005680
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	0.00	4.6E-06	3.8E-10	0.0000316
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	0.08	5.6E-06	4.5E-10	0.0004120
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	0.00	6.5E-06	5.2E-10	0.0066
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a

											Soil	Vapour
No	**Ksw**	**-**	Deff	VF	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**	**PV-Soil**	**PV-Vap**
COC-1	13.8694	-	0.001529	8.20E-11	11,564,009	12,933,482	17,552,736	21,725,213	24,315,026	28,343,625	**17,482,428**	**956,724**
COC-2	10.8271	-	0.001753	9.01E-11	10,524,187	11,770,492	15,974,301	19,771,513	22,128,403	25,794,677	**15,910,315**	**834,671**
COC-3	450.4961	-	0.011441	7.87E-13	9,646	10,789	14,642	18,122	20,282	23,643	**14,583**	**1.0**
COC-4	16.6194	-	0.001897	4.61E-11	13,687,338	15,311,682	20,790,635	25,739,861	28,811,801	33,590,376	**20,707,365**	**513,341**
COC-5	4.0186	-	0.001161	1.87E-09	5,102	5,956	8,835	11,451	13,075	15,602	**8,801**	**14,497**
COC-6	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

					Calcs use Child MDI		CLEA 10m3/day 20kg			
No	**Type**	**COC**	**HCV**	**MDI/day**	MDI 51% Rule	**Suff Vol**	Allowable Outdoor mg/m3	**Dair**	**Dwater**	**Kaw**
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	0.12	5.9E-06	4.7E-10	0.0007590
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	0.12	6.0E-06	4.8E-10	0.0005680
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	0.00	4.6E-06	3.8E-10	0.0000316
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	0.08	5.6E-06	4.5E-10	0.0004120
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	0.00	6.5E-06	5.2E-10	0.0066
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	n/a	n/a	n/a

											Groundwater	Vapour
No	**Ksw**	Deffcz	Deff	VF	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**	**AC6**	**PV-GW**	**PV-GWV**
COC-1	13.8694	0.00157	0.0015403	1.24E-10	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-2	10.8271	0.00214	0.0018359	1.42E-10	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-3	450.4961	0.02966	0.0135169	1.39E-12	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-4	16.6194	0.00272	0.0020523	7.48E-11	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-5	4.0186	0.00025	0.0006033	1.46E-09	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	**n/a**

Notes:

Output Checked against CLEA UK 1.06

CLEA MODELLING OUTPUT

REDEVELOPED SITE USE
OFF-SITE COMMERCIAL - SOIL & GROUNDWATER

Intentionally Blank

ACTIVE ADULT RECEPTOR

Adult Scenario	Receptor	AgeClass
SR3 Commercial	**Female Worker AC17**	**AC17**
Gardener	n/a	
Direct soil & dust ingestion	days/year	230
Consumption of homegrown produce	days/year	n/a
Skin contact - indoors	days/year	230
Skin contact - outdoors	days/year	170
Inhalation of dusts & vapours - indoors	days/year	230
Inhalation of dusts & vapours - outdoors	days/year	170
Occupany period - indoor	hours/day	8.3
Occupany period - outdoor	hours/day	0.7
Averaging Time	Days	17885
Exposure Duration	years	49
Soil skin adherence factor - indoor	mg/cm2/day	0.14
Soil skin adherence factor - outdoor	mg/cm2/day	0.14
Direct soil & dust ingestion rate	g/day	0.05
Body weight	kg	70
Body height	m	1.6
Inhalation rate	m3/day	14.8
Max exp skin factor - indoor	m2/m2	0.08
Max exp skin factor - outdoor	m2/m2	0.08
Max exposed skin area - indoor	m2	0.0476
Max exposed area - outdoor	m2	0.0476
Total skin area	m2	1.7850
HG Fraction - Green Veg	n/a	n/a
HG Fraction - Root Veg	n/a	n/a
HG Fraction - Tuber Veg	n/a	n/a
HG Fraction - Herb Fruit	n/a	n/a
HG Fraction - Shrub Fruit	n/a	n/a
HG Fraction - Tree Fruit	n/a	n/a
Green vegetables	g-FW/kg-bw/day	n/a
Root vegetables	g-FW/kg-bw/day	n/a
Tuber vegetables	g-FW/kg-bw/day	n/a
Herbaceous fruit	g-FW/kg-bw/day	n/a
Shrub fruit	g-FW/kg-bw/day	n/a
Tree fruit	g-FW/kg-bw/day	n/a
Oral MDI Correction Factor	Unitless	1
Inhalation MDI Correction Factor	Unitless	1

	CHEMICAL DATABASE		COC-1	COC-2	COC-3	COC-4	COC-5	COC-6	COC-7	COC-8	COC-9	COC-10	COC-11	COC-12	COC-13	COC-14	COC-15	COC-16
1	Chemical	Comments/Notes/Units	Aliphatic TPH C5-6	Aliphatic TPH C6-8	Aliphatic TPH C8-10	Aliphatic TPH C10-12	Aliphatic TPH C12-16	Aromatic TPH C5-7	Aromatic TPH C7-8	Aromatic TPH C8-10	Aromatic TPH C10-12	Aromatic TPH C12-16	Aromatic TPH C16-21	Benzene	Toluene	Ethylbenzene	Xylene-m	Xylene-o
2	CAS/REF		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	71432	108883	100414	108383	95476
3	Type	O=Organic, I=Inorganic	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
4	Oral HCV	HCV Type	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	ID	TDI	TDI	TDI	TDI
5	Adopted TDI	mg/kg-BW/day	5.00000	5.00000	0.10000	0.10000	0.10000	0.22300	0.22300	0.04000	0.04000	0.04000	0.03000	0.00029	0.22300	0.10000	0.18000	0.18000
6	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Benzene CLEA SR	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
7	Inhalation HCV	HCV Type	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	TDI	NR	ID	TDI	TDI	TDI	TDI
8	Vapour Assessment	Y/N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	Adopted TDI	mg/kg-BW/day	5.00000	5.00000	0.29000	0.29000	0.29000	1.40000	1.40000	0.06000	0.06000	0.06000	0.03000	0.00140	1.40000	0.22000	0.06000	0.06000
10	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Oral HCV	Benzene CLEA SR	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
11	Dermal HCV	HCV Type	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV
12	Adopted TDI	mg/kg-BW/day	5.0000	5.0000	0.1000	0.1000	0.1000	0.2230	0.2230	0.0400	0.0400	0.0400	0.0300	0.0003	0.2230	0.1000	0.1800	0.1800
13	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Benzene CLEA SR	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
14	Combine AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Oral adult MDI	mg/day	18	18	4.6	4.6	4.6	0.003	0.01	2	2	2	2	0	0.01	0.005	0.011	0.02
16		Notes	Based on 5% of TDI	Based on 5% of TDI	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Dutch Institute Food Safety 2008	Index Dose	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
17	Inhalation adult MDI	mg/day	18	18	1	1	1	0.2	0.52	0.42	0.42	0.42	0.210	0	0.52	0.13	0.14	0.14
18		Notes	Based on 5% of TDI	Based on 5% of TDI	Based on 5% of TDI	Based on 5% of TDI	Based on 5% of TDI	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Based on 10% of TDI	Based on 10% of TDI	Based on 10% of TDI	Based on 10% of TDI	Index Dose	Toluene CLEA SR	Ethylbenzene CLEA SR	Xylene CLEA SR	Xylene CLEA SR
19	Kaw (H')		2.10E+01	2.73E+01	4.15E+01	6.44E+01	1.71E+02	1.16E-01	1.15E-01	2.53E-01	7.22E-02	1.26E-02	6.95E-04	1.16E-01	1.15E-01	1.39E-01	1.12E-01	9.20E-02
20		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
21	Dair	m2/s	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	8.77E-06	7.78E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	8.77E-06	7.78E-06	7.04E-06	7.03E-06	7.01E-06
22		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
23	Dwat	m2/s	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	6.64E-10	5.88E-10	1.00E-09	1.00E-09	1.00E-09	1.00E-09	6.64E-10	5.88E-10	5.31E-10	5.31E-10	5.31E-10
24		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
25	RAM	g/mol	81	100	130	160	200	78	92	120	130	150	190	78	92	106	106	106
26		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
27	VP	Pa	21,922	3,451	320	32	2	6,240	1,730	320	32	1	0	6,240	1,730	553	495	386
28		At 283 K & Stand Pressure unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
29	Solubility	mg/l	3.59E+01	5.37E+00	4.27E-01	3.39E-02	7.59E-04	1.78E+03	5.90E+02	6.46E+01	2.45E+01	5.75E+00	6.53E-01	1.78E+03	5.90E+02	1.80E+02	2.00E+02	1.73E+02
30		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	At 25oC. CLEA SR7
31	Koc - log	Log (cm3/g)	2.91E+00	3.58E+00	4.48E+00	5.38E+00	6.73E+00	1.83E+00	2.31E+00	3.20E+00	3.40E+00	3.70E+00	4.15E+00	1.83E+00	2.31E+00	2.65E+00	2.69E+00	2.63E+00
32	Koc	cm3/g)	812.831	3,801.894	30,199.517	239,883.292	5,370,317.964	67.608	204.174	1,584.893	2,511.886	5,011.872	14,125.375	67.608	204.174	446.684	489.779	426.580
33		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
34	Kow - log	Log (dimensionless)	3.31E+00	4.13E+00	5.22E+00	6.30E+00	7.94E+00	2.13E+00	2.73E+00	3.69E+00	3.93E+00	4.29E+00	4.82E+00	2.13E+00	2.73E+00	3.15E+00	3.20E+00	3.12E+00
35	Kow	dimensionless	2,042	13,490	165,959	1,995,262	87,096,359	135	537	4,898	8,511	19,498	66,069	135	537	1,413	1,585	1,318
36		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7	CLEA SR7
37	Kd - Metals Only	cm3/g	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	n/a	n/a	n/a	n/a	NR
38		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	Dermal AF	unitless	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01
40		Notes	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	SR3 & LQM 2nd Ed 2009	CLEA default SR3	CLEA default SR3	CLEA default SR3	CLEA default SR3	CLEA default SR3
41	Soil-plant availability correction (d)	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
42	Fint-rs: Root-Shoot	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
43	Fint-rst: Root-RootStore	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
44	Fint-rt: Root-Tuber	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
45	Fint-rf: Root-Fruit	unitless	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
46	Soil plant CF - green veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
47	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Soil plant CF - root veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
50	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	Soil plant CF - tuber veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
53	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	Soil plant CF - H fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
56	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	Soil plant CF - S fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
59	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	Soil plant CF - T fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
62	Fresh weight to dry soil	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63		Notes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	Soil-to-dust TF	g/g-DW	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
65	BA Fraction	Soil	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
66	BA Fraction	Airborne dust	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
67	Indoor Air CF for Soil & Groundwater	unitless	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1	10 & 1
68	Molar Gas Constant Pa/m3/mol/K	8.314472																
69	Ambient Temperature Tamb K	283																
70	Soil Water Partition Coefficent Kd	SR3 Eq 5.2	4.71	22.05	175.16	1391.32	31147.84	0.39	1.18	9.19	14.57	29.07	81.93	0.39	1.18	2.59	2.84	2.47
71	Total Soil Water Partition Coefficent Ksw	SR3 Eq 5.4	8.46	26.84	182.29	1402.24	31176.38	0.68	1.48	9.51	14.85	29.34	82.20	0.68	1.48	2.89	3.13	2.76
72	Saturated Aqaues Contration for InOrganics Csatw	SR3 Eq 5.11 (mg/kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
73	Saturated Aqaues Contration for Organics Csatw	SR3 Eq 5.12 (mg/kg)	303.7	144.1	77.8	47.5	23.7	1217.6	870.8	614.1	363.9	168.7	53.7	1217.6	870.8	519.6	626.4	477.8
74	Saturated Vapour Concentration Csatvap	SR3 Eq 5.13 (mg/m3)	754,647	146,664	17,680	2,183	130	207,143	67,744	16,320	1,773	73	0	207,143	67,744	24,952	22,335	17,417
75	Saturated Vapour Concentration Csatv	SR3 Eq 5.13 (mg/kg)	304	144	78	48	24	1,221	869	613	365	169	54	1,221	869	518	625	523
76																		
77	**Inorganics - Calculated Veg Uptake Parameters**																	
78	CR Soil to Root System correction factor	SR3 Eq 7.3 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
79	Inorganic CF for Gveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
80	Inorganic CF for Rveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
81	Inorganic CF for Tveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
82	Inorganic CF for Friut	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
83																		
84	**Oganics - Calculated Veg Uptake Parameters**																	
85	Organic CFgv Green Veg	SR3 Eq 7.5	0.7986	0.2764	0.0285	0.0011	0.0000	1.9747	1.6046	0.5459	0.3903	0.2163	0.0734	1.9747	1.6046	1.2160	1.1679	1.2344
86	Organic CFrv Root Veg	SR3 Eq 7.7	1.1427	0.3740	0.0554	0.0072	0.0003	4.6358	2.7188	0.7485	0.5278	0.2964	0.1148	4.6358	2.7188	1.8299	1.7394	1.8680
87	Organic CFtv Tuber Veg	SR3 Eq 7.9	0.180	0.105	0.047	0.012	0.001	1.432	0.716	0.197	0.151	0.112	0.069	1.432	0.716	0.468	0.439	0.484
88	Organic CFtf Tree Fruit	SR3 Eq 7.15	0.221500514	0.032049131	0.000738482	5.80217E-06	3.81981E-10	3.353121216	1.604905763	0.146641519	0.073485373	0.023681795	0.003610906	3.353121216	1.604905763	0.710769458	0.638091339	0.753858233
89																		
90	Krw root & water partition coeffecient	SR3 Eq 7.6	11.7	47.1	319.8	2165.1	39637.8	2.2	4.7	22.1	33.3	62.2	157.8	2.2	4.7	9.0	9.8	8.6
91	Kch for Root Tubers	SR3 Table 7.5	2	3	3	3	3	1	1	2	2	3	3	1	1	2	2	2
92	Kpw potato & water partition coeffecient	SR3 Eq 7.8	1.64	3.26	14.17	87.99	1586.89	1.05	1.15	2.05	2.50	3.87	7.69	1.05	1.15	1.53	1.56	1.52
93	k1 chemical flux into potoato	SR3 Eq 7.11	0.003530	0.001113	0.000164	0.000021	0.000001	0.028982	0.011895	0.003141	0.002010	0.001017	0.000363	0.028982	0.011895	0.005492	0.005062	0.005740
94	k2 chemical out of potoato	SR3 Eq 7.10	0.018210	0.009147	0.002106	0.000339	0.000019	0.018840	0.015222	0.014532	0.011926	0.007715	0.003880	0.018840	0.015222	0.010342	0.010143	0.010457
95	Kwood wood & water partition coeffecient	SR3 Eq 7.12	66	219	1,069	5,148	55,986	12	29	115	164	276	597	12	29	53	57	50
96	Cxy Chem Conc in Xylem	SR3 Eq 7.13	0.0693107808	0.0100591920	0.0002357104	0.0000019998	0.0000000003	1.0481001205	0.5018192642	0.0459312092	0.0230393138	0.0074414470	0.0011418894	1.0481001205	0.5018192642	0.2223490211	0.1996290519	0.2358178405
97	Nomimal Cs: cancels out	Required for Calcs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
98	Cstem Chem Conc in woody stem	SR3 Eq 7.14	4.594	2.192	0.247	0.009	0.000	12.487	14.311	5.287	3.757	2.044	0.674	12.487	14.311	11.678	11.275	11.857
99																		

COC-17	COC-18	COC-19
Xylene-p	**MTBE EIC**	**Phenol SR Tox**
106423	1634044	108952
O	O	O
TDI	TDI	TDI
0.18000	0.30000	0.70000
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
TDI	TDI	TDI
Y	Y	Y
0.06000	0.72200	0.01000
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
Oral HCV	Oral HCV	Inhal HCV
0.1800	0.3000	0.0100
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
Yes	Yes	Yes
0.02	0.001	0.35
CLEA Tox 19	EIC Jan 2010	Phenol CLEA SR
0.14	0.2	0.04
Xylene CLEA SR	EIC Jan 2010	Phenol CLEA SR
1.07E-01	1.60E-02	8.35E-06
CLEA SR7	EIC Jan 2010	CLEA SR7
7.04E-06	7.82E-06	7.90E-06
CLEA SR7	EIC Jan 2010	CLEA SR7
5.31E-10	5.62E-10	6.36E-10
CLEA SR7	EIC Jan 2010	CLEA SR7
106	88	94
CLEA SR7	EIC Jan 2010	CLEA SR7
475	18,425	12
CLEA SR7	EIC Jan 2010	CLEA SR7
2.00E+02	4.80E+04	8.41E+04
CLEA SR7	EIC Jan 2010	At 25oC. CLEA SR7
2.65E+00	1.53E+00	1.92E+00
446.684	33.884	83.176
CLEA SR7	EIC Jan 2010	CLEA SR7
3.15E+00	9.40E-01	1.48E+00
1,413	9	30
CLEA SR7	EIC Jan 2010	CLEA SR7
NR	NR	NR
0	EIC Jan 2010	0
1.00E-01	1.00E-01	3.00E-01
CLEA default SR3	EIC Jan 2010	Phenol CLEA SR
NR	NR	NR
NR	NR	NR
NR	NR	NR
NR	NR	NR
NR	NR	NR
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
NR	NR	NR
0	0	0
0	0	0
0.5	0.5	0.5
1	1	1
1	1	1
10 & 1	1 & 1	1 & 1
2.59	0.20	0.48
2.88	0.47	0.76
n/a	n/a	n/a
576.2	22651.3	63508.3
21,433	690,240	460
577	20,358	41,597
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
1.2160	1.1133	1.0476
1.8299	4.8412	2.4020
0.469	1.660	1.131
0.712074286	1.995957512	2.140255569
9.0	1.1	1.3
2	0.2	0.5
1.53	0.84	0.91
0.005503	0.035557	0.025146
0.010342	0.020017	0.020836
53	2	5
0.2227572087	0.6237630319	0.6688917673
1	1	1
11.700	1.315	3.095

	CHEMICAL DATABASE		COC-1	COC-2	COC-3	COC-4	COC-5
1	Chemical	Comments/Notes/Units	Acenaphthene	Acenaphthylene	Benzo-a-anthracene	Fluorene	Naphthalene
2	CAS/REF		83329	208968	56553	86737	91203
3	Type	O=Organic, I=Inorganic	O	O	O	O	O
4	Oral HCV	HCV Type	TDI	TDI	ID	TDI	TDI
5	Adopted TDI	mg/kg-BW/day	0.06000	0.06000	0.00014	0.04000	0.02000
6	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009
7	Inhalation HCV	HCV Type	TDI	TDI	ID	TDI	TDI
8	Vapour Assessment	Y/N	Y	Y	Y	Y	Y
9	Adopted TDI	mg/kg-BW/day	0.06000	0.06000	0.00000	0.04000	0.00086
10	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009
11	Dermal HCV	HCV Type	Oral HCV	Oral HCV	Oral HCV	Oral HCV	Oral HCV
12	Adopted TDI	mg/kg-BW/day	0.0600	0.0600	0.0001	0.0400	0.0200
13	Notes	Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009	LQM 2nd Ed 2009
14	Combine AC		Yes	Yes	Yes	Yes	Yes
15	Oral adult MDI	mg/day	0.00098	0.00014	0	0.00059	0.007
16		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Index Dose	LQM 2nd Ed 2009	LQM 2nd Ed 2009
17	Inhalation adult MDI	mg/day	0.000025	0.000011	0	0.00096	0.0028
18		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	Index Dose	LQM 2nd Ed 2009	LQM 2nd Ed 2009
19	Kaw (H')		7.59E-04	5.68E-04	3.16E-05	4.12E-04	6.62E-03
20		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
21	Dair	m2/s	5.85E-06	5.97E-06	4.60E-06	5.58E-06	6.52E-06
22		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
23	Dwat	m2/s	4.70E-10	4.82E-10	3.80E-10	4.47E-10	5.16E-10
24		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
25	RAM	g/mol	154	152	228	166	128
26		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
27	VP	Pa	0	0	0	0	2
28		At 283 K & Stand Pressure unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
29	Solubility	mg/l	4.11E+00	7.95E+00	3.80E-03	1.86E+00	1.90E+01
30		At 283 K unless stated	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
31	Koc - log	Log (cm3/g)	3.37E+00	3.26E+00	4.89E+00	3.45E+00	2.81E+00
32	Koc	cm3/g)	2,344.229	1,819.701	77,624.712	2,818.383	645.654
33		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
34	Kow - log	Log (dimensionless)	4.03E+00	3.91E+00	5.91E+00	4.13E+00	3.34E+00
35	Kow	dimensionless	10,715	8,128	812,831	13,490	2,188
36		Notes	LQM 2nd Ed 2009	LQM 2nd Ed 2009	CLEA SR7	LQM 2nd Ed 2009	CLEA SR7
37	Kd - Metals Only	cm3/g	NR	NR	NR	NR	NR
38		Notes	0	0	0	0	0
39	Dermal AF	unitless	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01
40		Notes	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II	SR3 Table 8.2 & LQM-II
41	Soil-plant availability correction (d)	unitless	NR	NR	NR	NR	NR
42	Fint-rs: Root-Shoot	unitless	NR	NR	NR	NR	NR
43	Fint-rst: Root-RootStore	unitless	NR	NR	NR	NR	NR
44	Fint-rt: Root-Tuber	unitless	NR	NR	NR	NR	NR
45	Fint-rf: Root-Fruit	unitless	NR	NR	NR	NR	NR
46	Soil plant CF - green veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
47	Fresh weight to dry soil	Type	0	0	0	0	0
48		Notes	0	0	0	0	0
49	Soil plant CF - root veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
50	Fresh weight to dry soil	Type	0	0	0	0	0
51		Notes	0	0	0	0	0
52	Soil plant CF - tuber veg	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
53	Fresh weight to dry soil	Type	0	0	0	0	0
54		Notes	0	0	0	0	0
55	Soil plant CF - H fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
56	Fresh weight to dry soil	Type	0	0	0	0	0
57		Notes	0	0	0	0	0
58	Soil plant CF - S fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
59	Fresh weight to dry soil	Type	0	0	0	0	0
60		Notes	0	0	0	0	0
61	Soil plant CF - T fruit	mg/g-DW-FW/mg/g-DW-soil	NR	NR	NR	NR	NR
62	Fresh weight to dry soil	Type	0	0	0	0	0
63		Notes	0	0	0	0	0
64	Soil-to-dust TF	g/g-DW	0.5	0.5	0.5	0.5	0.5
65	BA Fraction	Soil	1	1	1	1	1
66	BA Fraction	Airborne dust	1	1	1	1	1
67	Indoor Air CF for Soil & Groundwater	unitless	1 & 1	1 & 1	1 & 1	1 & 1	1 & 1
68	Molar Gas Constant Pa/m3/mol/K	8.314472					
69	Ambient Temperature Tamb K	283					
70	Soil Water Partition Coefficent Kd	SR3 Eq 5.2	13.60	10.55	450.22	16.35	3.74
71	Total Soil Water Partition Coefficent Ksw	SR3 Eq 5.4	13.87	10.83	450.50	16.62	4.02
72	Saturated Aqaues Contration for InOrganics Csatw	SR3 Eq 5.11 (mg/kg)	n/a	n/a	n/a	n/a	n/a
73	Saturated Aqaues Contration for Organics Csatw	SR3 Eq 5.12 (mg/kg)	57.0	86.1	1.7	30.9	76.4
74	Saturated Vapour Concentration Csatvap	SR3 Eq 5.13 (mg/m3)	5	5	0	1	126
75	Saturated Vapour Concentration Csatv	SR3 Eq 5.13 (mg/kg)	88	87	2	44	76
76							
77	**Inorganics - Calculated Veg Uptake Parameters**						
78	CR Soil to Root System correction factor	SR3 Eq 7.3 or Database	n/a	n/a	n/a	n/a	n/a
79	Inorganic CF for Gveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
80	Inorganic CF for Rveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
81	Inorganic CF for Tveg	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
82	Inorganic CF for Friut	SR3 Eq 7.4 or Database	n/a	n/a	n/a	n/a	n/a
83							
84	**Oganics - Calculated Veg Uptake Parameters**						
85	Organic CFgv Green Veg	SR3 Eq 7.5	0.4327	0.5309	0.0059	0.3712	1.0151
86	Organic CFrv Root Veg	SR3 Eq 7.7	0.5871	0.7227	0.0220	0.5045	1.4712
87	Organic CFtv Tuber Veg	SR3 Eq 7.9	0.165	0.183	0.015	0.146	0.360
88	Organic CFtf Tree Fruit	SR3 Eq 7.15	0.070133873	0.103067786	5.59723E-05	0.051751154	0.457318798
89							
90	Krw root & water partition coeffecient	SR3 Eq 7.6	39.6	32.2	1084.8	47.1	12.3
91	Kch for Root Tubers	SR3 Table 7.5	3	2	3	3	2
92	Kpw potato & water partition coeffecient	SR3 Eq 7.8	2.96	2.46	44.77	3.26	1.66
93	k1 chemical flux into potoato	SR3 Eq 7.11	0.001012	0.001329	0.000025	0.000803	0.003834
94	k2 chemical out of potoato	SR3 Eq 7.10	0.004735	0.005854	0.000253	0.004089	0.009263
95	Kwood wood & water partition coeffecient	SR3 Eq 7.12	189	159	2,918	219	69
96	Cxy Chem Conc in Xylem	SR3 Eq 7.13	0.0219997760	0.0323110414	0.0000185122	0.0162430236	0.1431102676
97	Nomimal Cs: cancels out	Required for Calcs	1	1	1	1	1
98	Cstem Chem Conc in woody stem	SR3 Eq 7.14	4.147	5.118	0.051	3.539	9.907
99							

Merton Street, Banbury, off-site commercial trans zone | **Project Ref** 41403 | **14 Oct 10** | **SR3 V701**

Adult Scenario SR3 Commercial | **Revision** 100

Female Worker AC17: Site Assessment Criteria

◯ Calculate GACs

◉ Calculate SSAC

Key Parameter Check

Oral Pathways | **Inhalation Pathways**

No	Type	COC	Ingestion SOIL-D	Veg Attached (n/a) SOIL-ID	Veg Direct (n/a) Veg-D	Dermal DERM-I	DERM-O	Dust Inhalation Dust-I	Dust-O	Vapour Inhalation Vap In	Out Surf	Out Sub
COC-1	TPH	Aliphatic TPH C5-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	9,210	n/a	285,980.000
COC-2	TPH	Aliphatic TPH C6-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	22,480	n/a	698,000
COC-3	TPH	Aliphatic TPH C8-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,839	n/a	181,300
COC-4	TPH	Aliphatic TPH C10-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	28,950	n/a	898,800
COC-5	TPH	Aliphatic TPH C12-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	242,400	n/a	7,525,000
COC-6	TPH	Aromatic TPH C5-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	41,660	n/a	1,402,000
COC-7	TPH	Aromatic TPH C7-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	94,850	n/a	3,427,000
COC-8	TPH	Aromatic TPH C8-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	9,776	n/a	303,100
COC-9	TPH	Aromatic TPH C10-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	53,420	n/a	1,651,000
COC-10	TPH	Aromatic TPH C12-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	597,600	n/a	18,070,000
COC-11	TPH	Aromatic TPH C16-21	n/a	n/a	n/a	n/a	n/a	n/a	n/a	13,010,000	n/a	271,300,000
COC-12	BTEX	Benzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	42	n/a	1,404
COC-13	BTEX	Toluene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	94,850	n/a	3,427,000
COC-14	BTEX	Ethylbenzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	25,100	n/a	960,600
COC-15	BTEX	Xylene-m	n/a	n/a	n/a	n/a	n/a	n/a	n/a	8,990	n/a	344,200
COC-16	BTEX	Xylene-o	n/a	n/a	n/a	n/a	n/a	n/a	n/a	9,661	n/a	370,300
COC-17	BTEX	Xylene-p	n/a	n/a	n/a	n/a	n/a	n/a	n/a	8,651	n/a	330,900
COC-18	BTEX	MTBE EIC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	11,140	n/a	3,966,000
COC-19	OTHER	Phenol SR Tox	n/a	n/a	n/a	n/a	n/a	n/a	n/a	267,300	n/a	3,102,000
COC-20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

No	Oral MDI 50% Rule	Inhal MDI 50% Rule	Comb AC	Derm Via	Vol Ass	Use Vol	Calculated SSAC	Adopted SSAC	Csatv	Csatw	Total ORAL	Total INHAL
COC-1	FALSE	FALSE	Yes	Oral HCV	Y	Yes	8,923.02		304	304	-	8,923.0
COC-2	FALSE	FALSE	Yes	Oral HCV	Y	Yes	21,778.59		144	144	-	21,778.6
COC-3	TRUE	FALSE	Yes	Oral HCV	Y	Yes	5,657		78	78	-	5,656.8
COC-4	TRUE	FALSE	Yes	Oral HCV	Y	Yes	28,046.6		48	48	-	28,046.6
COC-5	TRUE	FALSE	Yes	Oral HCV	Y	Yes	234,835		24	24	-	234,835.3
COC-6	FALSE	FALSE	Yes	Oral HCV	Y	Yes	40,458		1,221	1,218	-	40,457.81
COC-7	FALSE	FALSE	Yes	Oral HCV	Y	Yes	92,296		869	871	-	92,295.5
COC-8	TRUE	FALSE	Yes	Oral HCV	Y	Yes	9,471		613	614	-	9,470.5
COC-9	TRUE	FALSE	Yes	Oral HCV	Y	Yes	51,746		365	364	-	51,745.7
COC-10	TRUE	FALSE	Yes	Oral HCV	Y	Yes	578,469		169	169	-	578,469.2
COC-11	TRUE	FALSE	Yes	Oral HCV	Y	Yes	12,414,664		54	54	-	12,414,663.6
COC-12	FALSE	FALSE	Yes	Oral HCV	Y	Yes	41		1,221	1,218	-	40.5
COC-13	FALSE	FALSE	Yes	Oral HCV	Y	Yes	92,296		869	871	-	92,295.5
COC-14	FALSE	FALSE	Yes	Oral HCV	Y	Yes	24,461		518	520	-	24,460.9
COC-15	FALSE	FALSE	Yes	Oral HCV	Y	Yes	8,761		625	626	-	8,761.2
COC-16	FALSE	FALSE	Yes	Oral HCV	Y	Yes	9,415		523	478	-	9,415.4
COC-17	FALSE	FALSE	Yes	Oral HCV	Y	Yes	8,431		577	576	-	8,430.6
COC-18	FALSE	FALSE	Yes	Oral HCV	Y	Yes	11,109		20,358	22,651	-	11,108.8
COC-19	FALSE	FALSE	Yes	Inhal HCV	Y	Yes	246,094		41,597	63,508	-	246,094.0
COC-20	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-

Uses Highest ADE

No	SOIL-D	SOIL-I	VEG	DERM-I	DERM-O	DUST-I	DUST-O	VAP-I	VAP-Osurf	VAP-Osub	ADE COC	ADE BG	Oral Active	Dermal
COC-1	-	-	-	n/a	n/a	-	-	92%	-	3%	94.9%	5.1%	N	O
COC-2	-	-	-	n/a	n/a	-	-	92%	-	3%	94.9%	5.1%	N	O
COC-3	-	-	-	n/a	n/a	-	-	92%	-	3%	95.1%	4.9%	N	O
COC-4	-	-	-	n/a	n/a	-	-	92%	-	3%	95.1%	4.9%	N	O
COC-5	-	-	-	n/a	n/a	-	-	92%	-	3%	95.1%	4.9%	N	O
COC-6	-	-	-	n/a	n/a	-	-	97%	-	3%	99.8%	0.2%	N	O
COC-7	-	-	-	n/a	n/a	-	-	97%	-	3%	99.5%	0.5%	N	O
COC-8	-	-	-	n/a	n/a	-	-	87%	-	3%	90.0%	10.0%	N	O
COC-9	-	-	-	n/a	n/a	-	-	87%	-	3%	90.0%	10.0%	N	O
COC-10	-	-	-	n/a	n/a	-	-	87%	-	3%	90.0%	10.0%	N	O
COC-11	-	-	-	n/a	n/a	-	-	86%	-	4%	90.0%	10.0%	N	O
COC-12	-	-	-	n/a	n/a	-	-	97%	-	3%	100.0%	0.0%	N	O
COC-13	-	-	-	n/a	n/a	-	-	97%	-	3%	99.5%	0.5%	N	O
COC-14	-	-	-	n/a	n/a	-	-	97%	-	3%	99.2%	0.8%	N	O
COC-15	-	-	-	n/a	n/a	-	-	94%	-	2%	96.7%	3.3%	N	O
COC-16	-	-	-	n/a	n/a	-	-	94%	-	2%	96.7%	3.3%	N	O
COC-17	-	-	-	n/a	n/a	-	-	94%	-	2%	96.7%	3.3%	N	O
COC-18	-	-	-	n/a	n/a	-	-	99%	-	0%	99.6%	0.4%	N	O
COC-19	-	-	-	n/a	n/a	-	-	87%	-	7%	94.3%	5.7%	N	I
COC-20	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a

◯ Child Receptor

◉ Adult Receptor

◯ Soil Only

◯ GW Only

◉ Soil & GW

Global SOM	1.00%	0.0058	Foc Equiv
Soil Type	Sandy Loam	Default Sandy Loam	
City	Newcastle	Default Newcastle	
Site Area Res	2	Hectares	Default 0.01
Site Area Com	2	Hectares	Default 2
Wind Type	Urban		

Indoor Air	Residential	Commercial	
Building	SR3 Small Terrace	SR3 Pre-1970 3 Storey Office	
Building Qs	Site Specific	Site Specific	
Foundation Void	No Void	n/a	
Use CF of >1	Y	Y	
Indoor Soil Source	50	50	DF = 50 cm
Indoor GW Source	100	100	cm

TPH Select | Solvents

TPH >C8 Select | ODDs

TPH All | Metals

PAH 16

Merton Street, Banbury, off-site commercial trans zone
SR3 Commercial - Adult Scenario - Female Worker AC17
RPL 9 Indoor Air Inhalation - Subsurface Soil

SR3 V701

Parameter	Symbol	Value	Unit	Reference
Indoor Air Specific Properties Calculations		Y	Use Indoor Air CF of >1	
Depth to Contamination from Floor Level	L	**65**	cm (default 65cm)	
Depth to Contamination from Base of Slab	Lt (L-Lc)	**50**	cm	
Generic SR3 Receptor Height	H	1.6	m	
Building Ventilation rate	Qb	1,130,528	cm3/s	SR3
Volumetric Flow Rate of Soil Gas (default 150)	Qsoil	79.3	cm3/s SR3 Eq A9	Site Specific
Peclet Number	Exp function			SR3 EqA10
Effective Crack radius	rcrack	0.200	cm	SR3 Eq A3
Effective Total Fluid Saturation	ste	0.512	unitless	SR3 Eq A4
Relative Soil Permeability	krg	0.642	unitless	SR3 Eq A5
Soil Intrinsic Permeability	ki	4.75E-08	cm2	SR3 Eq A6
Effective Air Permeability	kv	3.05E-08	cm2	SR3 Eq A7
Effective Air Viscosity	ua	1.75E-04	g/cm/s	SR3 Eq A8
Soil Temperature	Tamb	283.15	K	SR3
Groundwater Specific Calculations				
Depth to Water Table from Floor Level	Lw	**115**	cm	
Depth to Water Table from Base Slab	Ltw (Lw-Lc)	**100**	cm	
van Genuchten shape parameter (n)	n	1.47	unitless	
Air-filled porosity in the capillary zone	Oacz	0.08	unitless	
Water-filled porosity in the capillary zone	Owcz	0.45	unitless	
Thickness of capillary Zone	Lcz	25.00	cm	
Soil Properties		**Sandy Loam**		
Air-filled porosity	Oa	0.2	cm3/cm3	
Water-filled porosity	Ow	0.33	cm3/cm3	
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3	
Residual soil water content	Or	0.12	cm3/cm3	
Saturated hydraulic conductivity		0.00356	cm/s	
van Genuchten shape parameter (m)	M	0.3201	unitless	
Bulk density	p	1.21	g/cm3	
Mean Particle Diameter (D)	D	0.03	m/s	
Building Parameters		**SR3 Pre-1970 3 Storey Office**	**SR3 Default = Pre 1970s Office**	
Length of building	Lb	2,059	cm	
Width of building	Wb	2,059	cm	
Height of building	Hb	1,020	cm	
Height of living space above ground	Hliving	960	cm	
Height of living space below ground	Hcellar	0	cm	
Foundation or slab thickness	Lc	15	cm	
Floor-wall seam crack width	Wcr	0.2	cm	
Living space air exchange rate	ER	1.0	hr-1	
External air density		1.2	kg/m3	SR3 Default = 1.2
Accel due to gravity	g	9.80655	m/s2	SR3
Annual Temp diff indoor/outdoors	DeltaT	6	K	SR3 Default = 297
Indoor Temperature	Ti	298	K	SR3 Default = 298
Pressure difference due to temperature	PD Temp	2.4	Pa	SR3 Eq 4.6
Pressure difference due to wind	PD Wind	2.0	Pa	SR3 Default = 2
Total Pressure diff soil/outdoors & building	PD in Pa	4.4	Pa	
Total Pressure diff soil/outdoors & building	PD	44	g/cm/s2	
Area of enclosed space below ground	Ab	4,239,481	cm2	SR3 Eq A1
Floor-wall seam perimeter	Xc	8,236	cm	SR3 Eq A2
Area of total cracks between floor and wall	Ac	1,647	cm2	Wcr * Xc
Crack depth below ground	Zc (Hcell+Lc)	15	cm	SR4 Eq 4.3

Results Summary		mg/kg	mg/m3	mg/l	mg/m3	ADE Contribution	
No	COC	PV-Soil	PV-Vap	PV-GW	PV-GWV	COC ADE	BG ADE
COC-1	Aliphatic TPH C5-6	>Sat (9,210)	No Risk	>Sol (514)	No Risk	94.86%	5.14%
COC-2	Aliphatic TPH C6-8	>Sat (22,500)	No Risk	>Sol (396)	No Risk	94.86%	5.14%
COC-3	Aliphatic TPH C8-10	>Sat (5,840)	No Risk	>Sol (15)	>Sat (628,000)	95.07%	4.93%
COC-4	Aliphatic TPH C10-12	>Sat (28,900)	No Risk	>Sol (9.8)	>Sat (628,000)	95.07%	4.93%
COC-5	Aliphatic TPH C12-16	>Sat (242,000)	No Risk	>Sol (3.7)	>Sat (629,000)	95.07%	4.93%
COC-6	Aromatic TPH C5-7	>Sat (41,700)	No Risk	>Sol (27,000)	No Risk	99.80%	0.20%
COC-7	Aromatic TPH C7-8	>Sat (94,800)	No Risk	>Sol (30,100)	No Risk	99.47%	0.53%
COC-8	Aromatic TPH C8-10	>Sat (9,780)	>Sat (260,000)	>Sol (449)	>Sat (114,000)	90.00%	10.00%
COC-9	Aromatic TPH C10-12	>Sat (53,400)	>Sat (260,000)	>Sol (1,340)	>Sat (96,400)	90.00%	10.00%
COC-10	Aromatic TPH C12-16	>Sat (598,000)	>Sat (257,000)	>Sol (4,610)	>Sat (58,000)	90.00%	10.00%
COC-11	Aromatic TPH C16-21	No Risk	>Sat (110,000)	>Sol (19,300)	>Sat (13,400)	90.00%	10.00%
COC-12	Benzene	42	7,080	27	3,140	100.00%	0.00%
COC-13	Toluene	>Sat (94,800)	No Risk	>Sol (30,100)	No Risk	99.47%	0.53%
COC-14	Ethylbenzene	>Sat (25,100)	No Risk	>Sol (4,360)	>Sat (605,000)	99.16%	0.84%
COC-15	Xylene-m	>Sat (8,990)	>Sat (321,000)	>Sol (1,400)	>Sat (157,000)	96.67%	3.33%
COC-16	Xylene-o	>Sat (9,660)	>Sat (322,000)	>Sol (1,670)	>Sat (153,000)	96.67%	3.33%
COC-17	Xylene-p	>Sat (8,650)	>Sat (321,000)	>Sol (1,460)	>Sat (156,000)	96.67%	3.33%
COC-18	MTBE EIC	11,100	378,000	>Sol (71,100)	No Risk	99.60%	0.40%
COC-19	Phenol SR Tox	>Sat (267,000)	>Sat (2,960)	>Sol (357,000)	>Sat (2,980)	94.29%	5.71%
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Checks Against Saturation Limits		mg/kg		mg/kg		mg/m3			mg/l		mg/m3	
No	COC	Csatv Soil	>Csatv Soil	Csatw Soil	>CsatwSoil	Csatvap Soil	>Csatvap Soil		Solubility	>Sol	Csatvap Soil	>Csatvap Soil
COC-1	Aliphatic TPH C5-6	304	Y	304	Y	754647	Y		36	Y	754647	Y
COC-2	Aliphatic TPH C6-8	144	Y	144	Y	146664	Y		5	Y	146664	Y
COC-3	Aliphatic TPH C8-10	78	Y	78	Y	17680	Y		0	Y	17680	Y
COC-4	Aliphatic TPH C10-12	48	Y	48	Y	2183	Y		0.034	Y	2183	Y
COC-5	Aliphatic TPH C12-16	24	Y	24	Y	130	Y		0.000759	Y	130	Y
COC-6	Aromatic TPH C5-7	1221	Y	1218	Y	207143	Y		1780	Y	207143	Y
COC-7	Aromatic TPH C7-8	869	Y	871	Y	67744	Y		590	Y	67744	Y
COC-8	Aromatic TPH C8-10	613	Y	614	Y	16320	Y		65	Y	16320	Y
COC-9	Aromatic TPH C10-12	365	Y	364	Y	1773	Y		25	Y	1773	Y
COC-10	Aromatic TPH C12-16	169	Y	169	Y	73	Y		6	Y	73	Y
COC-11	Aromatic TPH C16-21	54	Y	54	Y	0	Y		1	Y	0	Y
COC-12	Benzene	1221	N	1218	N	207143	N		1780	N	207143	N
COC-13	Toluene	869	Y	871	Y	67744	Y		590	Y	67744	Y
COC-14	Ethylbenzene	518	Y	520	Y	24952	Y		180	Y	24952	Y
COC-15	Xylene-m	625	Y	626	Y	22335	Y		200	Y	22335	Y
COC-16	Xylene-o	523	Y	478	Y	17417	Y		173	Y	17417	Y
COC-17	Xylene-p	577	Y	576	Y	21433	Y		200	Y	21433	Y
COC-18	MTBE EIC	20358	N	22651	N	690240	N		48000	Y	690240	Y
COC-19	Phenol SR Tox	41597	Y	63508	Y	460	Y		84100	Y	460	Y
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a

No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	CLEA 10m3/day 20kg Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deff	-	Peclet Number	Alpha	Indoor CF Soil	Corrected Alpha	Soil AC17
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	8.2000	0.00001	0.000000001	21	8.458218647	0.001675	-	1.00E+95	4.50E-05	10	4.50E-06	9,210
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	8.2000	0.00001	0.000000001	27.3	26.83610895	0.001675	-	1.00E+95	4.50E-05	10	4.50E-06	22,479
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	0.4800	0.00001	0.000000001	41.5	182.2894312	0.001674	-	1.00E+95	4.50E-05	10	4.50E-06	5,839
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	0.4800	0.00001	0.000000001	64.4	1402.240448	0.001674	-	1.00E+95	4.50E-05	10	4.50E-06	28,945
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	0.4800	0.00001	0.000000001	171	31176.38138	0.001674	-	1.00E+95	4.50E-05	10	4.50E-06	242,365
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	2.7800	0.00000877	6.64E-10	0.116	0.684028952	0.001474	-	1.00E+95	4.29E-05	10	4.29E-06	41,664
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	2.7480	0.00000778	5.88E-10	0.115	1.475943545	0.001307	-	1.00E+95	4.09E-05	10	4.09E-06	94,849
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	FALSE	Y	0.0780	0.00001	0.000000001	0.253	9.506925971	0.001678	-	1.00E+95	4.50E-05	10	4.50E-06	9,776
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	FALSE	Y	0.0780	0.00001	0.000000001	0.0722	14.85360246	0.001687	-	1.00E+95	4.51E-05	10	4.51E-06	53,424
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	FALSE	Y	0.0780	0.00001	0.000000001	0.0126	29.34366947	0.001745	-	1.00E+95	4.57E-05	10	4.57E-06	597,572
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	FALSE	Y	0.0390	0.00001	0.000000001	0.000695	82.20001974	0.002951	-	1.00E+95	5.33E-05	10	5.33E-06	13,009,306
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	0.0028	0.00000877	6.64E-10	0.116	0.684028952	0.001474	-	1.00E+95	4.29E-05	10	4.29E-06	42
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	2.7480	0.00000778	5.88E-10	0.115	1.475943545	0.001307	-	1.00E+95	4.09E-05	10	4.09E-06	94,849
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	0.4270	0.00000704	5.31E-10	0.139	2.886467314	0.001182	-	1.00E+95	3.92E-05	10	3.92E-06	25,101
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	0.1060	0.00000703	5.31E-10	0.112	3.131956822	0.001181	-	1.00E+95	3.92E-05	10	3.92E-06	8,990
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	0.1060	0.00000701	5.31E-10	0.092	2.762095093	0.001179	-	1.00E+95	3.91E-05	10	3.91E-06	9,661
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	0.1060	0.00000704	5.31E-10	0.107	2.881178058	0.001183	-	1.00E+95	3.92E-05	10	3.92E-06	8,651
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	1.4240	0.00000782	5.62E-10	0.016	0.471901511	0.001341	-	1.00E+95	4.13E-05	1	4.13E-05	11,139
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	0.0160	0.0000079	6.36E-10	0.00000835	0.75515164	0.068911	-	3.57E+04	6.92E-05	1	6.92E-05	267,336
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a

No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	CLEA 10m3/day 20kg Allowable Indoor mg/m3	Dair	Dwater	Kaw	Ksw	Deffcz	Deffwt	Peclet Number	Alpha	Indoor CF GW	Corrected Alpha	Groundwater AC17
COC-1	TPH	Aliphatic TPH C5-6	5	18	FALSE	Y	8.2	0.00001	0.000000001	21	8.458218647	0.00008	0.00029	1.00E+95	9.53E-06	1	9.53E-06	514
COC-2	TPH	Aliphatic TPH C6-8	5	18	FALSE	Y	8.2	0.00001	0.000000001	27.3	26.83610895	0.00008	0.00029	1.00E+95	9.53E-06	1	9.53E-06	396
COC-3	TPH	Aliphatic TPH C8-10	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	41.5	182.2894312	0.00008	0.00029	1.00E+95	9.52E-06	1	9.52E-06	15
COC-4	TPH	Aliphatic TPH C10-12	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	64.4	1402.240448	0.00008	0.00029	1.00E+95	9.52E-06	1	9.52E-06	9.8
COC-5	TPH	Aliphatic TPH C12-16	0.29	1	FALSE	Y	0.48	0.00001	0.000000001	171	31176.38138	0.00008	0.00029	1.00E+95	9.52E-06	1	9.52E-06	3.7
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2	FALSE	Y	2.78	0.00000877	6.64E-10	0.116	0.684028952	0.00009	0.00030	1.00E+95	9.67E-06	1	9.67E-06	27,021
COC-7	TPH	Aromatic TPH C7-8	1.4	0.52	FALSE	Y	2.748	0.00000778	5.88E-10	0.115	1.475943545	0.00008	0.00027	1.00E+95	8.72E-06	1	8.72E-06	30,123
COC-8	TPH	Aromatic TPH C8-10	0.06	0.42	FALSE	Y	0.078	0.00001	0.000000001	0.253	9.506925971	0.00009	0.00032	1.00E+95	1.03E-05	1	1.03E-05	449
COC-9	TPH	Aromatic TPH C10-12	0.06	0.42	FALSE	Y	0.078	0.00001	0.000000001	0.0722	14.85360246	0.00012	0.00039	1.00E+95	1.22E-05	1	1.22E-05	1,336
COC-10	TPH	Aromatic TPH C12-16	0.06	0.42	FALSE	Y	0.078	0.00001	0.000000001	0.0126	29.34366947	0.00028	0.00076	1.00E+95	2.02E-05	1	2.02E-05	4,606
COC-11	TPH	Aromatic TPH C16-21	0.03	0.21	FALSE	Y	0.039	0.00001	0.000000001	0.000695	82.20001974	0.00363	0.00310	1.00E+95	4.37E-05	1	4.37E-05	19,280
COC-12	BTEX	Benzene	0.0014	0	FALSE	Y	0.0028	0.00000877	6.64E-10	0.116	0.684028952	0.00009	0.00030	1.00E+95	9.67E-06	1	9.67E-06	27
COC-13	BTEX	Toluene	1.4	0.52	FALSE	Y	2.748	0.00000778	5.88E-10	0.115	1.475943545	0.00008	0.00027	1.00E+95	8.72E-06	1	8.72E-06	30,123
COC-14	BTEX	Ethylbenzene	0.22	0.13	FALSE	Y	0.427	0.00000704	5.31E-10	0.139	2.886467314	0.00007	0.00023	1.00E+95	7.82E-06	1	7.82E-06	4,356
COC-15	BTEX	Xylene-m	0.06	0.14	FALSE	Y	0.106	0.00000703	5.31E-10	0.112	3.131956822	0.00007	0.00024	1.00E+95	8.00E-06	1	8.00E-06	1,404
COC-16	BTEX	Xylene-o	0.06	0.14	FALSE	Y	0.106	0.00000701	5.31E-10	0.092	2.762095093	0.00007	0.00025	1.00E+95	8.20E-06	1	8.20E-06	1,668
COC-17	BTEX	Xylene-p	0.06	0.14	FALSE	Y	0.106	0.00000704	5.31E-10	0.107	2.881178058	0.00007	0.00024	1.00E+95	8.06E-06	1	8.06E-06	1,460
COC-18	BTEX	MTBE EIC	0.722	0.2	FALSE	Y	1.424	0.00000782	5.62E-10	0.016	0.471901511	0.00015	0.00046	1.00E+95	1.37E-05	1	1.37E-05	71,061
COC-19	OTHER	Phenol SR Tox	0.01	0.04	FALSE	Y	0.016	0.0000079	6.36E-10	0.00000835	0.75515164	0.18770	0.08186	3.57E+04	6.86E-05	1	6.86E-05	357,258
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Notes:
Output Checked against CLEA UK 1.06

Merton Street, Banbury, off-site commercial trans zone
SR3 Commercial - Adult Scenario - Female Worker AC17
RPL 11 Outdoor Air Inhalation - Subsurface Soil

SR3 V701

Outdoor Air Source Properties

Depth to subsurface contamination	Ls	60	cm	SR3 Default = 100cm
Generic SR3 Receptor Height	H	1.6	m	SR3 Default = 1.6m
Source Area	Asource	2.00	Hectare	SR3 Default = 2
SR3 City Surrogate	Location	Newcastle 1.6m	City	SR3 Default = Newcastle
Air Dispersion factor	Q/Cwind	120	g/m2/s per kg/m3	

Groundwater Specific Calculations

Depth to Water Table	Lgw	100	cm
van Genuchten shape parameter (n)	n	1.47	unitless
Air-filled porosity in the capillary zone	Oacz	0.08	unitless
Water-filled porosity in the capillary zone	Owcz	0.45	unitless
Thickness of capillary Zone	Lcz	25.00	cm

Soil Properties

		Sandy Loam		SR3 Default = Sandy Loam
Air-filled porosity	Oa	0.2	cm3/cm3	
Water-filled porosity	Ow	0.33	cm3/cm3	
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3	
Residual soil water content	Or	0.12	cm3/cm3	
Saturated hydraulic conductivity		0.00356	cm/s	
van Genuchten shape parameter (m)	M	0.3201	unitless	
Bulk density	p	1.21	g/cm3	
Mean Particle Diameter (D)	D	0.03	m/s	

Results Summary		mg/kg	mg/m3	mg/l	mg/m3	ADE Contribution	
No	COC	PV-Soil	PV-Vap	PV-GW	PV-GWV	COC ADE	BG ADE
COC-1	Aliphatic TPH C5-6	>Sat (286,000)	No Risk	>Sol (321,000)	No Risk	94.86%	5.14%
COC-2	Aliphatic TPH C6-8	>Sat (698,000)	No Risk	>Sol (247,000)	No Risk	94.86%	5.14%
COC-3	Aliphatic TPH C8-10	>Sat (181,000)	No Risk	>Sol (9,450)	No Risk	95.07%	4.93%
COC-4	Aliphatic TPH C10-12	>Sat (899,000)	No Risk	>Sol (6,090)	No Risk	95.07%	4.93%
COC-5	Aliphatic TPH C12-16	No Risk	No Risk	>Sol (2,290)	No Risk	95.07%	4.93%
COC-6	Aromatic TPH C5-7	No Risk	No Risk	No Risk	No Risk	99.80%	0.20%
COC-7	Aromatic TPH C7-8	No Risk	No Risk	No Risk	No Risk	99.47%	0.53%
COC-8	Aromatic TPH C8-10	>Sat (303,000)	No Risk	>Sol (276,000)	No Risk	90.00%	10.00%
COC-9	Aromatic TPH C10-12	No Risk	No Risk	>Sol (797,000)	No Risk	90.00%	10.00%
COC-10	Aromatic TPH C12-16	No Risk	No Risk	No Risk	No Risk	90.00%	10.00%
COC-11	Aromatic TPH C16-21	No Risk	No Risk	No Risk	No Risk	90.00%	10.00%
COC-12	Benzene	>Sat (1,400)	>Sat (238,000)	>Sol (16,900)	No Risk	100.00%	0.00%
COC-13	Toluene	No Risk	No Risk	No Risk	No Risk	99.47%	0.53%
COC-14	Ethylbenzene	>Sat (961,000)	No Risk	No Risk	No Risk	99.16%	0.84%
COC-15	Xylene-m	>Sat (344,000)	No Risk	>Sol (898,000)	No Risk	96.67%	3.33%
COC-16	Xylene-o	>Sat (370,000)	No Risk	No Risk	No Risk	96.67%	3.33%
COC-17	Xylene-p	>Sat (331,000)	No Risk	>Sol (933,000)	No Risk	96.67%	3.33%
COC-18	MTBE EIC	No Risk	No Risk	No Risk	No Risk	99.60%	0.40%
COC-19	Phenol SR Tox	No Risk	>Sat (34,300)	No Risk	>Sat (48,100)	94.29%	5.71%
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Checks Against Saturation Limits		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	COC	Csatv Soil	>Csatv Soil	Csatw Soil	>CsatwSoil	Csatvap Soil	>Csatvap Soil	Solubility	>Sol	Csatvap Soil	>Csatvap Soil
COC-1	Aliphatic TPH C5-6	304	Y	304	Y	754647	Y	36	Y	754647	Y
COC-2	Aliphatic TPH C6-8	144	Y	144	Y	146664	Y	5	Y	146664	Y
COC-3	Aliphatic TPH C8-10	78	Y	78	Y	17680	Y	0	Y	17680	Y
COC-4	Aliphatic TPH C10-12	48	Y	48	Y	2183	Y	0.034	Y	2183	Y
COC-5	Aliphatic TPH C12-16	24	Y	24	Y	130	Y	0.000759	Y	130	Y
COC-6	Aromatic TPH C5-7	1221	Y	1218	Y	207143	Y	1780	Y	207143	Y
COC-7	Aromatic TPH C7-8	869	Y	871	Y	67744	Y	590	Y	67744	Y
COC-8	Aromatic TPH C8-10	613	Y	614	Y	16320	Y	65	Y	16320	Y
COC-9	Aromatic TPH C10-12	365	Y	364	Y	1773	Y	25	Y	1773	Y
COC-10	Aromatic TPH C12-16	169	Y	169	Y	73	Y	6	Y	73	Y
COC-11	Aromatic TPH C16-21	54	Y	54	Y	0	Y	1	Y	0	Y
COC-12	Benzene	1221	Y	1218	Y	207143	Y	1780	Y	207143	Y
COC-13	Toluene	869	Y	871	Y	67744	Y	590	Y	67744	Y
COC-14	Ethylbenzene	518	Y	520	Y	24952	Y	180	Y	24952	Y
COC-15	Xylene-m	625	Y	626	Y	22335	Y	200	Y	22335	Y
COC-16	Xylene-o	523	Y	478	Y	17417	Y	173	Y	17417	Y
COC-17	Xylene-p	577	Y	576	Y	21433	Y	200	Y	21433	Y
COC-18	MTBE EIC	20358	Y	22651	Y	690240	Y	48000	Y	690240	Y
COC-19	Phenol SR Tox	41597	Y	63508	Y	460	Y	84100	Y	460	Y
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

														Soil	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Dair	Dwater	Kaw	Ksw	-	Deff	VF	AC17	AC17
COC-1	TPH	Aliphatic TPH C5-6	5.0	18.0000	FALSE	Y	1.0E-05	1.0E-09	21.000000	8.458219	-	0.001675	5.77E-06	285,982	710,034,435
COC-2	TPH	Aliphatic TPH C6-8	5.0	18.0000	FALSE	Y	1.0E-05	1.0E-09	27.300000	26.836109	-	0.001675	2.37E-06	697,971	710,036,150
COC-3	TPH	Aliphatic TPH C8-10	0.3	1.0000	FALSE	Y	1.0E-05	1.0E-09	41.500000	182.289431	-	0.001674	5.29E-07	181,307	41,276,396
COC-4	TPH	Aliphatic TPH C10-12	0.3	1.0000	FALSE	Y	1.0E-05	1.0E-09	64.400000	1,402.240448	-	0.001674	1.07E-07	898,753	41,276,566
COC-5	TPH	Aliphatic TPH C12-16	0.3	1.0000	FALSE	Y	1.0E-05	1.0E-09	171.000000	31,176.381380	-	0.001674	1.28E-08	7,525,500	41,276,774
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2000	FALSE	Y	8.8E-06	6.6E-10	0.11600000	0.68402895	-	0.001474	3.47E-07	1,401,542	237,678,350
COC-7	TPH	Aromatic TPH C7-8	1.4	0.5200	FALSE	Y	7.8E-06	5.9E-10	0.11500000	1.475944	-	0.001307	1.41E-07	3,427,266	267,039,715
COC-8	TPH	Aromatic TPH C8-10	0.0600	0.4200	FALSE	Y	1.0E-05	1.0E-09	0.25300000	9.506926	-	0.001678	6.20E-08	303,146	8,067,387
COC-9	TPH	Aromatic TPH C10-12	0.0600	0.4200	FALSE	Y	1.0E-05	1.0E-09	0.07220000	14.853602	-	0.001687	1.14E-08	1,651,050	8,025,380
COC-10	TPH	Aromatic TPH C12-16	0.0600	0.4200	FALSE	Y	1.0E-05	1.0E-09	0.01260000	29.343669	-	0.001745	1.04E-09	18,067,309	7,757,997
COC-11	TPH	Aromatic TPH C16-21	0.0300	0.2100	FALSE	Y	1.0E-05	1.0E-09	0.00069500	82.200020	-	0.002951	3.47E-11	271,250,735	2,293,421
COC-12	BTEX	Benzene	0.0014	0.0000	FALSE	Y	8.8E-06	6.6E-10	0.11600000	0.68402895	-	0.001474	3.47E-07	1,404	238,164
COC-13	BTEX	Toluene	1.4	0.5200	FALSE	Y	7.8E-06	5.9E-10	0.11500000	1.475944	-	0.001307	1.41E-07	3,427,266	267,039,715
COC-14	BTEX	Ethylbenzene	0.2	0.1300	FALSE	Y	7.0E-06	5.3E-10	0.13900000	2.886467	-	0.001182	7.91E-08	960,552	46,256,112
COC-15	BTEX	Xylene-m	0.0600	0.1400	FALSE	Y	7.0E-06	5.3E-10	0.11200000	3.131957	-	0.001181	5.87E-08	344,167	12,307,537
COC-16	BTEX	Xylene-o	0.0600	0.1400	FALSE	Y	7.0E-06	5.3E-10	0.09200000	2.762095	-	0.001179	5.45E-08	370,269	12,332,951
COC-17	BTEX	Xylene-p	0.0600	0.1400	FALSE	Y	7.0E-06	5.3E-10	0.10700000	2.881178	-	0.001183	6.10E-08	330,880	12,288,075
COC-18	BTEX	MTBE EIC	0.7	0.2000	FALSE	Y	7.8E-06	5.6E-10	0.01600000	0.47190151	-	0.001341	6.31E-08	3,966,169	134,474,482
COC-19	OTHER	Phenol SR Tox	0.0100	0.0400	FALSE	Y	7.9E-06	6.4E-10	0.00000835	0.75515164	-	0.068911	1.06E-09	3,101,925	34,299
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a

														Groundwater	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Dair	Dwater	Kaw	Ksw	Deffcz	Deff	VF	AC17	AC17
COC-1	TPH	Aliphatic TPH C5-6	5	18	FALSE	Y	0.00001	0.000000001	21	8.458218647	0.00008	0.0002941	6.08E-07	320,901	6,738,913,513
COC-2	TPH	Aliphatic TPH C6-8	5	18	FALSE	Y	0.00001	0.000000001	27.3	26.83610895	0.00008	0.0002940	2.49E-07	246,915	6,740,787,822
COC-3	TPH	Aliphatic TPH C8-10	0.29	1	FALSE	Y	0.00001	0.000000001	41.5	182.2894312	0.00008	0.0002939	5.58E-08	9,445	391,983,495
COC-4	TPH	Aliphatic TPH C10-12	0.29	1	FALSE	Y	0.00001	0.000000001	64.4	1402.240448	0.00008	0.0002938	1.12E-08	6,088	392,068,655
COC-5	TPH	Aliphatic TPH C12-16	0.29	1	FALSE	Y	0.00001	0.000000001	171	31176.38138	0.00008	0.0002937	1.34E-09	2,293	392,164,930
COC-6	TPH	Aromatic TPH C5-7	1.4	0.2	FALSE	Y	0.00000877	6.64E-10	0.116	0.684028952	0.00009	0.0002992	4.23E-08	16,816,966	1,950,768,103
COC-7	TPH	Aromatic TPH C7-8	1.4	0.52	FALSE	Y	0.00000778	5.88E-10	0.115	1.475943545	0.00008	0.0002657	1.73E-08	19,041,310	2,189,750,612
COC-8	TPH	Aromatic TPH C8-10	0.06	0.42	FALSE	Y	0.00001	0.000000001	0.253	9.506925971	0.00009	0.0003227	7.16E-09	276,316	69,907,950
COC-9	TPH	Aromatic TPH C10-12	0.06	0.42	FALSE	Y	0.00001	0.000000001	0.0722	14.85360246	0.00012	0.0003919	1.59E-09	797,274	57,563,160
COC-10	TPH	Aromatic TPH C12-16	0.06	0.42	FALSE	Y	0.00001	0.000000001	0.0126	29.34366947	0.00028	0.0007561	2.71E-10	2,368,052	29,837,453
COC-11	TPH	Aromatic TPH C16-21	0.03	0.21	FALSE	Y	0.00001	0.000000001	0.000695	82.20001974	0.00363	0.0030958	2.18E-11	5,242,995	3,643,882
COC-12	BTEX	Benzene	0.0014	0	FALSE	Y	0.00000877	6.64E-10	0.116	0.684028952	0.00009	0.0002992	4.23E-08	16,851	1,954,757
COC-13	BTEX	Toluene	1.4	0.52	FALSE	Y	0.00000778	5.88E-10	0.115	1.475943545	0.00008	0.0002657	1.73E-08	19,041,310	2,189,750,612
COC-14	BTEX	Ethylbenzene	0.22	0.13	FALSE	Y	0.00000704	5.31E-10	0.139	2.886467314	0.00007	0.0002347	9.42E-09	2,794,037	388,371,150
COC-15	BTEX	Xylene-m	0.06	0.14	FALSE	Y	0.00000703	5.31E-10	0.112	3.131956822	0.00007	0.0002409	7.18E-09	897,968	100,572,373
COC-16	BTEX	Xylene-o	0.06	0.14	FALSE	Y	0.00000701	5.31E-10	0.092	2.762095093	0.00007	0.0002476	6.87E-09	1,063,661	97,856,814
COC-17	BTEX	Xylene-p	0.06	0.14	FALSE	Y	0.00000704	5.31E-10	0.107	2.881178058	0.00007	0.0002428	7.51E-09	932,707	99,799,636
COC-18	BTEX	MTBE EIC	0.722	0.2	FALSE	Y	0.00000782	5.62E-10	0.016	0.471901511	0.00015	0.0004551	1.29E-08	41,261,766	660,188,253
COC-19	OTHER	Phenol SR Tox	0.01	0.04	FALSE	Y	0.0000079	6.36E-10	0.00000835	0.75515164	0.18770	0.0818632	7.54E-10	5,762,959	48,121
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

Output Checked against CLEA UK 1.06

Merton Street, Banbury, off-site commercial trans zone | **Project Ref** 41403 | **14 Oct 10** | **SR3 V701**

Adult Scenario SR3 Commercial | **Revision** 100

Female Worker AC17: Site Assessment Criteria

Calculate GACs

Calculate SSAC

Key Parameter Check

No	Type	COC	Oral Pathways: Ingestion SOIL-D	Veg Attached SOIL-ID (n/a)	Veg Direct Veg-D (n/a)	Dermal DERM-I	DERM-O	Inhalation Pathways: Dust Inhalation Dust-I	Dust-O	Vapour Inhalation Vap In	Out Surf	Out Sub
COC-1	PAH	Acenaphthene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	546,640	n/a	##############
COC-2	PAH	Acenaphthylene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	542,600	n/a	163,600,000
COC-3	PAH	Benzo-a-anthracene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,290	n/a	149,900
COC-4	PAH	Fluorene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	745,000	n/a	213,100,000
COC-5	PAH	Naphthalene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	278	n/a	107,500
COC-6	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

No	Oral MDI 50% Rule	Inhal MDI 50% Rule	Comb AC	Derm Via	Vol Ass	Use Vol	Calculated SSAC	Adopted SSAC	Csatv	Csatw	Total ORAL	Total INHAL
COC-1	FALSE	FALSE	Yes	Oral HCV	Y	Yes	544,982.65		88	57	-	544,982.6
COC-2	FALSE	FALSE	Yes	Oral HCV	Y	Yes	540,806.35		87	86	-	540,806.3
COC-3	FALSE	FALSE	Yes	Oral HCV	Y	Yes	2,256		1.7	1.7	-	2,255.5
COC-4	FALSE	FALSE	Yes	Oral HCV	Y	Yes	742,404.5		44	31	-	742,404.5
COC-5	FALSE	FALSE	Yes	Oral HCV	Y	Yes	277		76	76	-	277.4
COC-6	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-7	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-8	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-9	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-10	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-11	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-12	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-13	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-14	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-15	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-16	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-17	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-18	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-19	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-
COC-20	n/a	n/a	n/a	n/a	n/a	Yes	n/a		n/a	n/a	-	-

Uses Highest ADE

No	SOIL-D	SOIL-I	VEG	DERM-I	DERM-O	DUST-I	DUST-O	VAP-I	VAP-Osurf	VAP-Osub	ADE COC	ADE BG	Oral Active	Dermal
COC-1	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-2	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-3	-	-	-	n/a	n/a	-	-	98%	-	2%	100.0%	0.0%	N	O
COC-4	-	-	-	n/a	n/a	-	-	100%	-	0%	100.0%	0.0%	N	O
COC-5	-	-	-	n/a	n/a	-	-	95%	-	0%	95.3%	4.7%	N	O
COC-6	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-7	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-8	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-9	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-10	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-11	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-12	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-13	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-14	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-15	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-16	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-17	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-18	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-19	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a
COC-20	-	-	-	n/a	n/a	-	-	-	-	-	-	-	n/a	n/a

Child Receptor

Adult Receptor

Soil Only

GW Only

Soil & GW

Global SOM	1.00%	0.0058	Foc Equiv
Soil Type	Sandy Loam	Default Sandy Loam	
City	Newcastle	Default Newcastle	
Site Area Res	2	Hectares	Default 0.01
Site Area Com	2	Hectares	Default 2
Wind Type	Urban		

Indoor Air	Residential	Commercial	
Building	SR3 Small Terrace	SR3 Pre-1970 3 Storey Office	
Building Qs	Site Specific	Site Specific	
Foundation Void	No Void	n/a	
Use CF of >1	Y	Y	
Indoor Soil Source	50	50	DF = 50 cm
Indoor GW Source	100	100	cm

TPH Select | Solvents

TPH >C8 Select | ODDs

TPH All | Metals

PAH 16

Merton Street, Banbury, off-site commercial trans zone
SR3 Commercial - Adult Scenario - Female Worker AC17
RPL 9 Indoor Air Inhalation - Subsurface Soil SR3 V701

Indoor Air Specific Properties Calculations		Y	**Use Indoor Air CF of >1**	
Depth to Contamination from Floor Level	L	**65**	cm (default 65cm)	
Depth to Contamination from Base of Slab	Lt (L-Lc)	**50**	cm	
Generic SR3 Receptor Height	H	1.6	m	
Building Ventilation rate	Qb	1,130,528	cm3/s	SR3
Volumetric Flow Rate of Soil Gas (default 150)	Qsoil	79.3	cm3/s SR3 Eq A9	Site Specific
Peclet Number	Exp function			SR3 EqA10
Effective Crack radius	rcrack	0.200	cm	SR3 Eq A3
Effective Total Fluid Saturation	ste	0.512	unitless	SR3 Eq A4
Relative Soil Permeability	krg	0.642	unitless	SR3 Eq A5
Soil Intrinsic Permeability	ki	4.75E-08	cm2	SR3 Eq A6
Effective Air Permeability	kv	3.05E-08	cm2	SR3 Eq A7
Effective Air Viscosity	ua	1.75E-04	g/cm/s	SR3 Eq A8
Soil Temperature	Tamb	283.15	K	SR3
Groundwater Specific Calculations				
Depth to Water Table from Floor Level	Lw	**115**	cm	
Depth to Water Table from Base Slab	Ltw (Lw-Lc)	**100**	cm	
van Genuchten shape parameter (n)	n	1.47	unitless	
Air-filled porosity in the capillary zone	Oacz	0.08	unitless	
Water-filled porosity in the capillary zone	Owcz	0.45	unitless	
Thickness of capillary Zone	Lcz	25.00	cm	
Soil Properties		**Sandy Loam**		
Air-filled porosity	Oa	0.2	cm3/cm3	
Water-filled porosity	Ow	0.33	cm3/cm3	
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3	
Residual soil water content	Or	0.12	cm3/cm3	
Saturated hydraulic conductivity		0.00356	cm/s	
van Genuchten shape parameter (m)	M	0.3201	unitless	
Bulk density	p	1.21	g/cm3	
Mean Particle Diameter (D)	D	0.03	m/s	
Building Parameters		**SR3 Pre-1970 3 Storey Office**	**SR3 Default = Pre 1970s Office**	
Length of building	Lb	2,059	cm	
Width of building	Wb	2,059	cm	
Height of building	Hb	1,020	cm	
Height of living space above ground	Hliving	960	cm	
Height of living space below ground	Hcellar	0	cm	
Foundation or slab thickness	Lc	15	cm	
Floor-wall seam crack width	Wcr	0.2	cm	
Living space air exchange rate	ER	1.0	hr^{-1}	
External air density		1.2	kg/m3	SR3 Default = 1.2
Accel due to gravity	g	9.80655	m/s2	SR3
Annual Temp diff indoor/outdoors	DeltaT	6	K	SR3 Default = 297
Indoor Temperature	Ti	298	K	SR3 Default = 298
Pressure difference due to temperature	PD Temp	2.4	Pa	SR3 Eq 4.6
Pressure difference due to wind	PD Wind	2.0	Pa	SR3 Default = 2
Total Pressure diff soil/outdoors & building	PD in Pa	4.4	Pa	
Total Pressure diff soil/outdoors & building	PD	44	g/cm/s^2	
Area of enclosed space below ground	Ab	4,239,481	cm^2	SR3 Eq A1
Floor-wall seam perimeter	Xc	8,236	cm	SR3 Eq A2
Area of total cracks between floor and wall	Ac	1,647	cm^2	Wcr * Xc
Crack depth below ground	Zc (Hcell+Lc)	15	cm	SR4 Eq 4.3

Results Summary		mg/kg	mg/m3	mg/l	mg/m3	ADE Contribution	
No	**COC**	**PV-Soil**	**PV-Vap**	**PV-GW**	**PV-GWV**	**COC ADE**	**BG ADE**
COC-1	Acenaphthene	>Sat (547,000)	>Sat (29,900)	>Sol (54,200)	>Sat (41,100)	100.00%	0.00%
COC-2	Acenaphthylene	>Sat (543,000)	>Sat (28,500)	>Sol (66,000)	>Sat (37,500)	100.00%	0.00%
COC-3	Benzo-a-anthracene	>Sat (2,290)	>Sat (0.161)	>Sol (5.4)	>Sat (0.169)	100.00%	0.00%
COC-4	Fluorene	>Sat (745,000)	>Sat (18,500)	>Sol (57,400)	>Sat (23,600)	99.97%	0.03%
COC-5	Naphthalene	>Sat (278)	>Sat (458)	>Sol (157)	>Sat (1,040)	95.35%	4.65%
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Checks Against Saturation Limits		mg/kg		mg/kg		mg/m3			mg/l		mg/m3	
No	**COC**	**Csatv Soil**	**>Csatv Soil**	**Csatw Soil**	**>CsatwSoil**	**Csatvap Soil**	**>Csatvap Soil**		**Solubility**	**>Sol**	**Csatvap Soil**	**>Csatvap Soil**
COC-1	Acenaphthene	88	Y	57	Y	5	Y		4	Y	5	Y
COC-2	Acenaphthylene	87	Y	86	Y	5	Y		8	Y	5	Y
COC-3	Benzo-a-anthracene	2	Y	2	Y	0.000120	Y		0.004	Y	0.000120	Y
COC-4	Fluorene	44	Y	31	Y	1	Y		2	Y	1	Y
COC-5	Naphthalene	76	Y	76	Y	126	Y		19	Y	126	Y
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a

							CLEA 10m3/day 20kg											Soil
No	**Type**	**COC**	**HCV**	**MDI/day**	**MDI 51% Rule**	**Suff Vol**	**Allowable Indoor mg/m3**	**Dair**	**Dwater**	**Kaw**	**Ksw**	**Deff**	**-**	**Peclet Number**	**Alpha**	**Indoor CF Soil**	**Corrected Alpha**	**AC17**
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	0.1200	0.00000585	4.7E-10	0.000759	13.86937986	0.001529	-	1.00E+95	4.35E-05	1	4.35E-05	546,643
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	0.1200	0.00000597	4.82E-10	0.000568	10.82708614	0.001753	-	1.00E+95	4.57E-05	1	4.57E-05	542,618
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	0.0000	0.0000046	3.8E-10	0.0000316	450.4960601	0.011441	-	2.63E+27	6.49E-05	1	6.49E-05	2,290
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	0.0799	0.00000558	4.47E-10	0.000412	16.61941637	0.001897	-	1.00E+95	4.70E-05	1	4.70E-05	744,986
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	0.0014	0.00000652	5.16E-10	0.00662	4.018616016	0.001161	-	1.00E+95	3.89E-05	1	3.89E-05	278
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a

							CLEA 10m3/day 20kg											Groundwater
No	**Type**	**COC**	**HCV**	**MDI/day**	**MDI 51% Rule**	**Suff Vol**	**Allowable Indoor mg/m3**	**Dair**	**Dwater**	**Kaw**	**Ksw**	**Deffcz**	**Deffwt**	**Peclet Number**	**Alpha**	**Indoor CF GW**	**Corrected Alpha**	**AC17**
COC-1	PAH	Acenaphthene	0.06	0.000025	FALSE	Y	0.1199975	0.00000585	4.7E-10	0.000759	13.86937986	0.00157	0.00154	1.00E+95	3.17E-05	1	3.17E-05	54,157
COC-2	PAH	Acenaphthylene	0.06	0.000011	FALSE	Y	0.1199989	0.00000597	4.82E-10	0.000568	10.82708614	0.00214	0.00184	1.00E+95	3.47E-05	1	3.47E-05	65,976
COC-3	PAH	Benzo-a-anthracene	0.00000048	0	FALSE	Y	0.00000096	0.0000046	3.8E-10	0.0000316	450.4960601	0.02966	0.01352	2.63E+27	6.16E-05	1	6.16E-05	5.3
COC-4	PAH	Fluorene	0.04	0.00096	FALSE	Y	0.079904	0.00000558	4.47E-10	0.000412	16.61941637	0.00272	0.00205	1.00E+95	3.67E-05	1	3.67E-05	57,392
COC-5	PAH	Naphthalene	0.00086	0.0028	FALSE	Y	0.00144	0.00000652	5.16E-10	0.00662	4.018616016	0.00025	0.00060	1.00E+95	1.71E-05	1	1.71E-05	157
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Notes:
Output Checked against CLEA UK 1.06

Merton Street, Banbury, off-site commercial trans zone
SR3 Commercial - Adult Scenario - Female Worker AC17
RPL 11 Outdoor Air Inhalation - Subsurface Soil

SR3 V701

Outdoor Air Source Properties				
Depth to subsurface contamination	Ls	**60**	cm	SR3 Default = 100cm
Generic SR3 Receptor Height	H	1.6	m	SR3 Default = 1.6m
Source Area	Asource	**2.00**	Hectare	SR3 Default = 2
SR3 City Surrogate	Location	**Newcastle 1.6m**	City	SR3 Default = Newcastle
Air Dispersion factor	Q/Cwind	120	g/m2/s per kg/m3	
Groundwater Specific Calculations				
Depth to Water Table	Lgw	**100**	cm	
van Genuchten shape parameter (n)	n	1.47	unitless	
Air-filled porosity in the capillary zone	Oacz	0.08	unitless	
Water-filled porosity in the capillary zone	Owcz	0.45	unitless	
Thickness of capillary Zone	Lcz	25.00	cm	
Soil Properties		**Sandy Loam**		SR3 Default = Sandy Loam
Air-filled porosity	Oa	0.2	cm3/cm3	
Water-filled porosity	Ow	0.33	cm3/cm3	
Total Porosity/Satuated Porosity	Ot	0.53	cm3/cm3	
Residual soil water content	Or	0.12	cm3/cm3	
Saturated hydraulic conductivity		0.00356	cm/s	
van Genuchten shape parameter (m)	M	0.3201	unitless	
Bulk density	p	1.21	g/cm3	
Mean Particle Diameter (D)	D	0.03	m/s	

Results Summary		mg/kg	mg/m3	mg/l	mg/m3	ADE Contribution	
No	COC	PV-Soil	PV-Vap	PV-GW	PV-GWV	COC ADE	BG ADE
COC-1	Acenaphthene	No Risk	No Risk	No Risk	No Risk	100.00%	0.00%
COC-2	Acenaphthylene	No Risk	No Risk	No Risk	No Risk	100.00%	0.00%
COC-3	Benzo-a-anthracene	>Sat (150,000)	>Sat (11)	>Sol (470)	>Sat (15)	100.00%	0.00%
COC-4	Fluorene	No Risk	No Risk	No Risk	No Risk	99.97%	0.03%
COC-5	Naphthalene	>Sat (107,000)	>Sat (177,000)	>Sol (85,800)	>Sat (568,000)	95.35%	4.65%
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Checks Against Saturation Limits		mg/kg		mg/kg		mg/m3		mg/l		mg/m3	
No	COC	Csatv Soil	>Csatv Soil	Csatw Soil	>CsatwSoil	Csatvap Soil	>Csatvap Soil	Solubility	>Sol	Csatvap Soil	>Csatvap Soil
COC-1	Acenaphthene	88	Y	57	Y	5	Y	4	Y	5	Y
COC-2	Acenaphthylene	87	Y	86	Y	5	Y	8	Y	5	Y
COC-3	Benzo-a-anthracene	2	Y	2	Y	0.000120	Y	0.004	Y	0.000120	Y
COC-4	Fluorene	44	Y	31	Y	1	Y	2	Y	1	Y
COC-5	Naphthalene	76	Y	76	Y	126	Y	19	Y	126	Y
COC-6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

														Soil	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Dair	Dwater	Kaw	Ksw	-	Deff	VF	AC17	AC17
COC-1	PAH	Acenaphthene	0.0600	0.0000	FALSE	Y	5.9E-06	4.7E-10	0.00075900	13.869380	-	0.001529	1.16E-10	179,749,527	9,836,769
COC-2	PAH	Acenaphthylene	0.0600	0.0000	FALSE	Y	6.0E-06	4.8E-10	0.00056800	10.827086	-	0.001753	1.28E-10	163,583,729	8,581,770
COC-3	PAH	Benzo-a-anthracene	0.0000005	0.0000	FALSE	Y	4.6E-06	3.8E-10	0.00003160	450.496060	-	0.011441	1.11E-12	149,936	11
COC-4	PAH	Fluorene	0.0400	0.0010	FALSE	Y	5.6E-06	4.5E-10	0.00041200	16.619416	-	0.001897	6.53E-11	213,140,411	5,283,811
COC-5	PAH	Naphthalene	0.0008600	0.0028	FALSE	Y	6.5E-06	5.2E-10	0.00662000	4.018616	-	0.001161	2.66E-09	107,487	177,067
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	0.0E+00	0.0E+00	0.00000000	n/a	-	n/a	n/a	n/a	n/a

														Groundwater	Vapour
No	Type	COC	HCV	MDI/day	MDI 51% Rule	Suff Vol	Dair	Dwater	Kaw	Ksw	Deffcz	Deff	VF	AC17	AC17
COC-1	PAH	Acenaphthene	0.06	0.000025	FALSE	Y	0.00000585	4.7E-10	0.000759	13.86937986	0.00157	0.0015403	7.02E-11	21,442,998	16,275,236
COC-2	PAH	Acenaphthylene	0.06	0.000011	FALSE	Y	0.00000597	4.82E-10	0.000568	10.82708614	0.00214	0.0018359	8.03E-11	24,039,534	13,654,455
COC-3	PAH	Benzo-a-anthracene	0.00000048	0	FALSE	Y	0.0000046	3.8E-10	0.0000316	450.4960601	0.02966	0.0135169	7.90E-13	470	15
COC-4	PAH	Fluorene	0.04	0.00096	FALSE	Y	0.00000558	4.47E-10	0.000412	16.61941637	0.00272	0.0020523	4.24E-11	19,758,099	8,140,337
COC-5	PAH	Naphthalene	0.00086	0.0028	FALSE	Y	0.00000652	5.16E-10	0.00662	4.018616016	0.00025	0.0006033	8.28E-10	85,785	567,898
COC-6	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-7	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-8	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-9	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-10	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-11	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-12	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-13	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-14	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-15	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-16	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-17	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-18	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-19	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a
COC-20	NONE	n/a	n/a	n/a	TRUE	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

Output Checked against CLEA UK 1.06

Appendix C

Groundwater Risk Assessment

Celtic

Design and Construct Remediation

MERTON STREET DEPOT
MERTON STREET, BANBURY
OXFORDSHIRE

R1456/11/3999

GROUNDWATER RISK ASSESSMENT
DRAFT

MARCH 2011

Client:	**Grundon Waste Management Limited**
Report Number:	**R1456/11/3999**
Report Title:	**Merton Street Depot Groundwater Risk Assessment**
Report Status:	**Draft**
Author(s): (Signature and Date)	**Jim Sladen** ______________________________________
Project Manager: (Signature and Date)	**Christine Mardle** ______________________________________
QA Approved: (Signature and Date)	**Jon Owens** ______________________________________

CONTENTS

APPENDICES

FIGURES

1.0 INTRODUCTION

This appendix describes modelling of the groundwater system in the vicinity of the site. This modelling was undertaken to assist in development of the conceptual model with respect to the groundwater pathway in order to allow predictions to be made as to the likely degree of dilution and attenuation of potential contaminants and their likely fate in the groundwater system. As such it assists in the quantification of the risks to controlled waters that may be associated with migration of any potential contaminants remaining on site.

Final re-development details are not available at the time of preparation of the present report but it is understood that consideration is being given to re-development for residential use.

2.0 INITIAL CONCEPTUAL MODEL OF GROUNDWATER FLOW

2.1 Ground Conditions

A summary of ground conditions present on site and a description of the various phases of ground investigation are detailed in previous reports, including AEA Technology (AEAT) 1999 Site Investigation Report, and Waterman Environmental (WE) 2002 Interpretative Report. The present appendix is concerned with the potential migration and fate of dissolved contaminants within the groundwater system.

The natural geology at the site comprises Recent Alluvial deposits overlying early Post Glacial River Terrace deposits, which in turn overlie mudstones of the Lower Lias Clay. Made Ground is present over the natural soils in most of the site area.

Made Ground extends locally to depths in excess of 3 m but is generally less than 2 m and is generally granular in nature. The Recent Alluvial soils are not always identified on the available logs of boreholes and trial pits but where present generally comprise clays and silts, extending to variable depths but typically about 1 to 3 m. The underlying River Terrace Gravels, which are also of alluvial origin but relate to an earlier more active stage of the river, are present throughout the site area and typically extends to a depth of about 5 m.

2.2 Topographic Setting and Surface Water Features

The site lies close to the edge of the historical floodplain of the River Cherwell, which flows in a generally south easterly direction at this point, passing some 200 to 300 m to the south west of the site.

Figure 1 shows the site's topographic setting. Surface water features as well as selected surface level contours have been highlighted for clarity. Ground levels rise to the east, gently at first and then more steeply up to the high ground of Overthorpe, some 2 km to the east north-east of the site. There are a number of tributaries of the Cherwell that flow from the higher ground, some of which have clearly been modified in the past and some are now partly in culvert. One of these streams, which has been straightened, passes close to the south eastern corner of the site.

There is a dry ditch running along the north eastern site boundary that leads into the stream to the south east and which presumably takes surface run-off during periods of extreme rainfall.

The Oxford Canal follows the Cherwell valley but lies to the west of the river from the site and as such would not be expected to influence groundwater conditions to the east of the river.

Surface water features in the vicinity of the site are illustrated in Figure 2, selected topographic contours have been highlighted for clarity.

2.3 Anticipated Pattern of Near Surface Groundwater Flow

The natural direction of near surface groundwater flow below the site would be expected to be to the south west in the northern site area, with discharge to the River Cherwell. Conditions within the southern site area could be affected by the presence of the small stream to the southeast and a more southerly component of groundwater flow may be expected. However, it seems probable the eventual discharge would still be to the Cherwell, except possibly in the easterly most corner of the site.

Groundwater originating as infiltration within the site area would be expected to migrate vertically until the saturated zone of the Terrace Gravel stratum and then flow sub-horizontally within that unit to discharge. Where recent alluvial clays overlie the Terrace Gravel, the net direction of flow through the clays would be expected to be vertical due to their relatively lower hydraulic conductivity. However, some perching of groundwater on the alluvial soils may occur, particularly following long periods of above normal rainfall.

2.4 Potential Controlled Waters Receptors

The bedrock below the site is considered to be Unproductive Strata and the site area is not classified as an aquifer by the Environment Agency. However, this is considered due to the fact that available geological mapping does not show the Terrace Gravel stratum to extend below the site, refer Figure 4. The Terrace Gravel would be considered to potentially represent a Secondary A aquifer. As this unit is known to extend below the site from site investigation information, the groundwater below the site should be considered to be a potential receptor.

The site does not lie within any groundwater source protection zones and there are no licensed groundwater abstractions within influencing distance. The potentially critical receptor with respect to controlled waters is therefore considered to be the surface water system, in particular the River Cherwell but also a small stream to the south of the site, and the shallow sand and gravel secondary aquifer.

2.5 Potential Contaminants of Concern

The distribution of potential contaminants on site has been discussed in other reports. With regard to the groundwater pathway, the main contaminants of concern are considered to be elevated concentrations of some organic compounds, in particular PAHs, associated with the former gas works usage. However, for the present study a wider range has been considered for completeness as follows:

- Metals
- BTEX Compounds
- Other TPH Fractions
- PAH Compounds
- Phenols
- Cyanide and Ammonia

3.0 MEASURED GROUNDWATER CONDITIONS ON SITE

3.1 Groundwater Levels

Data concerning groundwater conditions are available from two main phases of previous ground investigation, the first undertaken by AEA Technology in 1998 and the second by Waterman Environmental in 2002. In addition, accessible standpipes have recently been monitored by Celtic (2011). It should be noted that the AEA study involved monitoring of significantly more standpipe locations than any of the subsequent monitoring although the Waterman study reports results from three monitoring visits. Figures 3a to 3e show inferred contours of groundwater level on site for each of the available monitoring dates. The mean groundwater level on site varies. Using the location of well MW08 near the site centre as a guide the following illustrates the general trend:

Date	Approximate Water Level at Site Centre (mAOD)
16 November 1998	88.9
25 January 2002	88.5
01 February 2002	88.7
08 February 2002	88.7
17 February 2011	88.3

Note that when MW08 was not monitored, the level has been interpolated from contouring.

When groundwater levels on site are relatively low, the inferred direction of groundwater flow is to the south west in the northern and central site areas and to the south in the southern site area. This is entirely consistent with the site's topographic setting, as discussed earlier in the report. At times of relatively higher average water level, there is an indication of some potential local mounding within the central site area although the general inferred directions of groundwater flow remains unchanged. It is possible that the apparent mounding reflects some temporary perched conditions developing on the near surface alluvial clays following relatively high rainfall.

The data suggest that under normal conditions groundwater leaving the site would be expected to discharge eventually to the River Cherwell. Only under times of relatively high water table is potential discharge to the small stream to the south suggested by the data and then only from a small area in the extreme south east of the site.

The measured data infer an overall drop in groundwater level across the site of about 0.5 m to 0.8 m.

3.2 Distribution of Potential Contaminants within the Groundwater

As with groundwater levels, data concerning chemical characteristics of the groundwater are available from the two main phases of ground investigation. However, while the AEA data included some 14 wells distributed across the site, the Waterman study only presented data from five wells and for some determinands only one well. Furthermore, none of the wells sampled by Waterman were 'downstream' with respect to inferred direction of groundwater flow. As such the AEA data are considered to give a better picture of overall site conditions. Contours of concentration of the main potential contaminants of concern are included in Appendix C.

Generally, highest concentrations of organic compounds are present in groundwater in the northern and central site areas. It may be observed that the following PAH compounds have been reported at concentrations that are significantly higher than their respective solubilities:

Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)flouranthene
Benzo(k)flouranthene
Benzo(ghi)perylene
Chrysene
Dibenzo(ah-ac)anthracene
Indeno(123-cd)pyrene

That these compounds have apparently been measured at concentrations significantly higher than their solubility suggests that the test samples have included some non-aqueous phase and as such the measured concentrations do not reflect true dissolved phase. This phenomenon is frequently observed when soils contain significant concentrations of non-aqueous phase organic compounds, particularly if sampling is undertaken shortly after installation of the monitoring wells and may reflect disturbance during drilling. By implication, measured concentrations of other PAH compounds, even if not exceeding solubility, may be higher than the true dissolved phase concentration.

It is noteworthy that most of the monitoring wells along the downstream (south-western) site boundary show very low levels of PAH compounds in the groundwater. Generally concentrations of potential contaminants in the south-eastern site area are relatively very low.

4.0 DEVELOPMENT OF EXTENDED CONCEPTUAL MODEL

4.1 General

The patterns of groundwater flow beneath the site and between the site and the discharge points are important to the assessment of risks associated with the groundwater pathway. Although estimates may be made based on hydraulic gradient and estimated hydraulic conductivity of the site subsoils, the latter parameter in particular can not be measured directly, is difficult to estimate and may be expected to vary quite significantly on a local level.

By modelling of the catchment area, however, estimated flow volumes become less sensitive to exact assumed conductivity and more dependant on the net infiltration over the catchment and other boundary conditions, which, although uncertain, compared to hydraulic conductivity, may be estimated with a relatively higher degree of confidence. Based on such modelling, a combination of average hydraulic conductivity and hydraulic gradient may be chosen that is consistent with the overall anticipated volume of groundwater flow and boundary conditions. This 'water balance' approach has the advantage that modelled flow volumes are consistent with the conceptual model of the local hydrogeology. The risk of adopting values of hydraulic conductivity, gradient and aquifer thickness for RTM analysis that together imply an impossible volume of groundwater flow is avoided.

In order further to develop the conceptual model of general groundwater flow conditions, a plan view numerical model of flow within the local catchment area has been developed. Consideration of the surface water levels suggests that they are reasonably consistent with groundwater levels within site area. It is considered therefore that local groundwater flow conditions may be adequately modelled by a consideration of conditions within the local surface water catchment area. Figure 5 shows the modelled area, which may be considered generally to represent the surface water catchment area, defined by the Cherwell to the west and tributaries to the south and north. The small discontinuous stream immediately to the south of the site was modelled within the wider catchment. High ground to the east is considered to be a natural groundwater divide and lines from the local high to surface water features were assumed likely to approximate to groundwater divide/flow lines.

4.2 Modelling Software

Numerical modelling undertaken as part of the present study has made use of the SEEP/W program developed by Geo-Slope International Ltd. This was chosen as it allows rapid parametric studies to be undertaken and the implications of various assumptions to be graphically displayed. The program is based on the well-established finite element method for continuum analysis. Although similar analysis may be undertaken using finite difference based methods, the finite element approach offers some advantages, in particular the method is less sensitive to such factors as node spacing as conditions are not assumed to be linear within elements. In this process the study area is divided into a number of elements. If required, potential patterns of contaminant transport may be mapped on the results of the SEEP/W analysis with the use of a companion program CTRAN/W.

4.3 Rainfall and Potential Infiltration

The average long-term annual rainfall for the area is approximately 665 mm and for agricultural areas an actual evapotranspiration of about 450 mm could be anticipated, giving an estimated net annual infiltration of about 215 mm. However, the catchment is predominantly urban apart from some agricultural usage in the eastern higher ground. Infiltration in urban areas is variable and is influenced by such factors as the proportion of storm run-off directed to sewers rather than soakaways.

Hard cover areas would be expected to have relatively lower infiltration as a result of storm run-off to sewer. Indeed, infiltration beneath some hard cover areas such as buildings may be negligible. Connor et al 1996 have suggested a likely range of 0.1 to 1 % of precipitation for hard cover usage. Fetter (2001) suggests typical average infiltration rates for urban areas in the range 10 to 20 % of precipitation.

4.4 Finite Element Representation and Boundary Conditions

Previous experience has shown that, where practical, it is preferable to model the entire catchment area within which the study site lies as this reduces the uncertainties concerning model boundary conditions. The finite element mesh used for the plan view analysis is shown in Figure 5.

For modelling a local grid co-ordinate system was adopted, as follows:

Zero Easting = 446000 Easting National Grid
Zero Northing = 239000 Northing National Grid

As may be seen, the boundaries of the mesh follow the features that form the boundary of the catchment, principally the streams to the north and south, river to the west and topographic high ground to the east. For the surface water boundaries, the boundary condition was set to a head equal to the water level at that point. Actual levels used were estimated from the topographic mapping together with specific levels determined by surveying as part of the present study. Flow lines were modelled as a no flow boundary. The small stream to the south of the site was modelled as internal specified head conditions, based on surveyed water levels in that feature.

4.5 Model Calibration

4.5.1 General

The model must be calibrated such that, as far as practicable without introducing speculative complexity, conditions both assumed and predicted by the model, match known conditions. The important model parameters are:

- Boundary Conditions

- Surface infiltration
- Aquifer transmissivity and its spatial variation

In the present case, boundary conditions are reasonably straightforward and have been discussed above. Although actual infiltration is not known with certainty, there is an approximately linear relationship between adopted infiltration and transmissivity inferred from inverse modelling to known groundwater levels so that if necessary the effect of varying average infiltration on inferred transmissivity may be readily estimated. At head boundaries, constant levels were assumed and seasonal variations in stream levels were ignored. This is considered reasonable for a simulation of average flow conditions as surface water levels are largely constrained by topographic features.

As discussed above, the available geological mapping suggests that the catchment may be divided into two main areas. The eastern higher ground where bedrock is not shown to be overlain by drift deposits, and the river flood plain area where River Terrace deposits likely dominate the local hydrogeology. Although not shown on the available geological mapping, the River Terrace deposits extend past the site area. The higher ground to the east is underlain predominantly by mudstones of likely relatively low hydraulic conductivity. However, although assumed transmissivity in that area would affect absolute predicted groundwater levels in the higher ground, it would have a lesser impact on potential volume of groundwater flow from the higher ground into the site area, which would be more controlled by assumed infiltration. Initially therefore, a single value of transmissivity was adopted for the catchment area.

4.5.2 Transmissvity

It follows from the above that the main phase of calibration with respect to modelling average flow conditions comprises the variation of catchment transmissivity until a reasonable match with measured conditions is achieved. This process, in which estimates of transmissivity are essentially derived from known groundwater level conditions, is termed inverse modelling (Anderson and Woessner 1992). As groundwater levels are only known in the site area, it is likely that the model would not accurately predict groundwater levels in the eastern catchment area, but these are not of major importance to the present study, which is concerned with potential flow from the site to discharge.

In reality, spatial variation in transmissivity may be complex and there may be additional internal drainage features such as storm sewers that affect the overall water balance. Although these complexities are inevitable, it is not considered appropriate simply to introduce speculative variations in say transmissivity within the catchment area simply to achieve an apparently better fit to measured conditions unless there is some other reason to justify the suspected heterogeneity. Indeed it is arguable that it is better to keep the numerical model as simple as possible with a view to providing a useful extension to the conceptual model of the general pattern of groundwater movement rather than exactly matching the minutiae of measured data.

The transmissivity was varied until a good match with measured site conditions was achieved.

Figure 6 shows a plot of predicted groundwater level at the site centre (MW08 location) vs assumed average transmissivity for two assumed levels of infiltration, 10% and 20% of precipitation. This suggests that an effective average transmissivity of the order of 2 e-4 m2/s (about 17.3 m2/d) is required to explain the measured site water levels within the context of the assumed boundary conditions. Assuming a saturated thickness of aquifer of about 3.0 m, this suggests an average horizontal hydraulic conductivity of 6.7 e-5 m/s (5.76 m/d), which is considered reasonable for sand and gravel (eg Freeze and Cherry 1979). Given mainly urban but partly agricultural nature of the catchment, an average infiltration of about 20 % of infiltration is considered reasonable.

Figure 7a shows the calibrated pattern of groundwater flow for the catchment area based on the adopted boundary conditions and 7b shows predicted conditions for the site area. As can be seen the predicted conditions are consistent with the preliminary conceptual model, which anticipated a south-westerly direction of groundwater flow in the northern and central site areas and southerly flow within the southern site area. Predicted groundwater levels on site are also a reasonably good match with those inferred from the site monitoring (Figures 3a to 3e). As such, it is not considered that introduction of any more complex pattern of transmissivity distribution is warranted.

4.6 Potential Patterns of Contaminant Migration

Predicted flow paths from various areas of the site associated with pure advective transport are shown on Figure 8. These are based on a simple ‘particle tracking’ analysis and suggest that in terms of surface water receptor, eventual discharge of groundwater emanating from the site areas would be expected to the River Cherwell. In view of these factors and as the south easterly corner of the site shows relatively low levels of potential contaminants in the groundwater the small stream to the east of the site is unlikely to receive potentially contaminated groundwater from the site area.

4.7 Critical Receptors

Of the potential controlled waters receptors identified in Section 2.4 above, it may be concluded that, should any significant source of contamination be present on site, potentially viable pollution linkages exist with regard to the following:

- Shallow alluvial Secondary Aquifer
- River Cherwell

Land usages between the site and the Cherwell are such that in practice, given the proximity to the river, they would effectively preclude the development of any groundwater abstraction downstream of the site, certainly for potable purposes. Accordingly, it is considered that in terms of risk based derivation of remedial targets, the critical controlled water receptor should strictly be considered to be the River Cherwell, which is more than 200 m from the site. Nevertheless a compliance point 50 m downstream from the site within the Secondary Aquifer will also be considered.

This would also be protective to the Cherwell and reasonably protective to the shallow Secondary Aquifer.

5.0 DEVELOPMENT OF REMEDIAL TARGETS FOR POTENTIAL CONTAMINANTS

5.1 General

For the present study, the main potential contaminants of concern with regard to controlled waters are PAH compounds but remedial targets for a range of other potential organic compounds and metals have also been derived.

The Environment Agency's Remedial Targets Methodology, Hydrogeological risk assessment for land contamination, was used to simulate conditions in the site area. The associated Remedial Targets Worksheet, Release 3.1 is rather awkward for use with multiple potential contaminants and an in-house spreadsheet was used for parametric studies. This has been validated against the Remedial Targets Worksheet, Release 3.1 and all input data are included in the output sheets to allow check analysis.

5.2 Compliance Criteria

As the critical receptor is considered to be the River Cherwell, the relevant compliance criteria with respect to the surface water are considered to be Environmental Quality Standards (EQS) levels where these have been published. Dilution within the surface water system will initially be ignored, which is conservative.

Where no EQS values are available, compliance criteria will be based on EQS levels published for similar compounds/ions. Where these are not available, relevant UK Drinking Water Standards (DWS) will be adopted. Where new EQS values have been proposed in the recent document 'The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010, these have been adopted. Otherwise former EQS values for surface water have been adopted. Based on this approach, the following compliance criteria have been adopted (all in mg/l).

Substance	EQS	DWS	Adopted Compliance Criterion	Comment
Benzene	0.01	0.001	0.01	EQS
Toluene	0.05	-	0.05	EQS
Ethylbenzene	0.02	-	0.05	EQS
m-Xylene	0.03	-	0.03	EQS
o-Xylene	0.03	-	0.03	EQS
p-Xylene	0.03	-	0.03	EQS
Benzo[a]anthracene	-	-	0.0024	EQS Naphthalene
Benzo[b]flouranthene	0.00003	0.0001	0.00003	EQS
Benzo[k]flouranthene	0.00003	0.0001	0.00003	EQS
Benzo[ghi]perylene	0.000002	0.0001	0.000002	EQS
Benzo[a]pyrene	0.000002	0.00001	0.00005	EQS
Chrysene	-	-	0.0024	EQS Naphthalene
Dibenzo[ah]anthracene	-	-	0.0024	EQS Naphthalene
Flouranthene	-	-	0.0001	EQS
Indeno[123-cd]pyrene	0.000002	0.0001	0.000002	EQS
Naphthalene	0.0024	-	0.0024	EQS
Pyrene	0.0024	-	0.0024	EQS
Acenaphthalene	-	-	0.0024	EQS Naphthalene

Substance	EQS	DWS	Adopted Compliance Criterion	Comment
Acenaphthene	-	-	0.0024	EQS Naphthalene
Flourene	-	-	0.0024	EQS Naphthalene
Phenanthrene	-	-	0.0024	EQS Naphthalene
Anthracene	-	-	0.0001	EQS
Phenol	0.03	0.0005	0.0077	EQS
TPH Aliphatic C8-C10	-	0.01	0.01	Former DWS (Sum of Fractions)
TPH Aliphatic C10-C12	-	0.01	0.01	
TPH Aliphatic C12-C16	-	0.01	0.01	
TPH Aliphatic C16-C21	-	0.01	0.01	
TPH Aliphatic C21-C35	-	0.01	0.01	
TPH Aliphatic C35-C44	-	0.01	0.01	
TPH Aromatic C8-C10	-	0.01	0.01	
TPH Aromatic C10-C12	-	0.01	0.01	
TPH Aromatic C12-C16	-	0.01	0.01	
TPH Aromatic C16-C21	-	0.01	0.01	
TPH Aromatic C21-C35	-	0.01	0.01	
TPH Aromatic C35-C44	-	0.01	0.01	
Arsenic	0.05	0.01	0.05	EQS
Cadmium	0.005	0.005	0.00025	EQS
Copper	0.012	2	0.028	EQS
Chromium	0.02	0.05	0.02	FEQS
Lead	0.02	0.025	0.0072	EQS
Inorganic Mercury	0.001	0.001	0.00005	EQS
Nickel	0.04	0.02	0.02	EQS
Selenium	-	0.01	0.01	DWS
Zinc	0.05	5	0.125	EQS
Easily Lib. Cyanide	0.001	-	0.001	EQS
Total Cyanide	-	0.05	0.05	DWS
Ammonia	0.5	0.6	0.6	EQS

EQS - Environmental Quality Standard
FEQS - Former Environmental Quality Standard
DWS - Drinking Water Standard

Note that for some inorganics, the EQS is dependant on the carbonate content of the receiving stream. For these, the upper limit EQS values were adopted. This is considered reasonable as dilution within the receiving stream has been ignored.

Some PAH compounds and higher level TPH fractions have very low aqueous solubility. Where the aqueous solubility is less than the adopted compliance criterion, more detailed analysis of potential fate and transport is not strictly warranted but these compounds have been included in the RTM analysis for completeness.

Within the RTM methodology, unless background concentrations are high, remedial targets are directly proportional to the adopted compliance criterion so that it is not necessary to repeat analysis if the effect of varying compliance criterion is to be studied.

5.3 Level 1 Parameters

5.3.1 General

The Level 1 analysis compares estimated pore water concentration to the compliance criteria. The additional parameters required for this assessment are as follows:

Physiochemical Parameters	Source of Parameter Adopted
Organics:	
Henry's Constant	EA 2008 (SR7 Report)/LQM 2009
Organic Carbon Partition Coefficient	EA 2008 (SR7 Report)/LQM 2009
Inorganics:	
Soil Water Partition Coefficient	See Text Discussion
Soil Properties:	
Air and Water Filled Porosity	Typical Values for Soil Types-CLEA Sandy Loam
Bulk Density	Typical Values for Soil Types-CLEA Sandy Loam
Fraction of Organic Carbon	0.01 (1%) – Reasonable Lower Bound

Values of Koc for the various compounds and fractions have been based on EA Report SR7 (2008) and, for TPH fractions, LQM (2009). The latter are based primarily on TPHWG recommendations (Gustafson et al 1997).

5.3.2 Soil Water Partition Coefficient For Inorganics and Non-Volatile Organics

Within the RTM methodology, the estimated pore water concentration is related to total concentration as follows:

$$RTs = Cs = Ct \,.\, [\, Kd + ((\theta w + \theta a \,.\, H) / \rho)]$$

Where:
RTs = Soil remedial target (mg/kg)
Kd = Soil water partition coefficient (l/kg)
θw = Water-filled soil porosity
θa = Air-filled soil porosity
H = Henry's Law constant (dimensionless)
ρ = Bulk Density (g/cm^3)
Ct = Target Concentration for pore water (mg/l)
Cs = Total soil concentration (mg/kg)

For most inorganics, the ratio $(\theta w + \theta a \,.\, H) / \rho$ is small compared to Kd and may therefore be ignored such that:

$$RTs = Cs = Ct \,.\, Kd$$

This assumption is always conservative with respect to RTM analysis. As the target concentration is compared to results of leaching tests, it may be inferred that an estimate of Kd may be obtained as the ratio of total to leachable measured concentrations.

Site specific leaching test data are available. However, for many samples tested some of the leachable concentrations were below the limit of detection so that only a lower bound of the Kd value may be determined from those samples. Where the total concentration was below the limit of detection, no sensible estimate of Kd is possible and these are not included in the analysis. The available data are summarised in the following table:

Constituent	No. of Deter-minations	Inferred Lower Bound Kd (l/kg)			RIVM 2001
		Average	Maximum	Minimum	
Arsenic	8	4,186	7,400	290	1,800
Cadmium	5	545	875	25	2,560
Copper	7	7,177	9,900	140	4,800
Chromium	8	4,463	21,000	850	2000
Lead	7	53	131	7	-
Inorganic Mercury	8	9,150	22,000	2,900	36,000
Nickel	6	429	1,000	6	7500
Selenium	8	5,635	9,900	180	2,000
Zinc	0				-
Total Cyanide	8	11,681	22,400	4,350	2,600
Free Cyanide	5	151	480	9	-
Complex Cyanide	2	20	20	20	-
Ammonia as NH4	3	233	460	39	-
					Based on Koc
Benzo[a]anthracene	3	2,066	5,000	109	776
Benzo[b]flouranthene	1		3,000		1050
Benzo[k]flouranthene	1		3,000		1480
Benzo[ghi]perylene	1		1,000		4170
Benzo[a]pyrene	3	1,715	4,000	104	1290
Chrysene	1		4,000		550
Dibenzo[ah]anthracene	1		1,000		1860
Flouranthene	3	2,459	4,000	307	182
Indeno[123-cd]pyrene	1		2,000		871
Naphthalene	3	5,778	13,000	333	6.5
Pyrene	3	2,402	4,500	246	162
Acenaphthalene	3	1,139	2,500	250	25
Acenaphthene	1		333		79
Flourene	3	854	1,420	142	126
Phenanthrene	3	3,771	6,000	483	251
Anthracene	3	1,190	1,730	173	316

Generally, where the leachable concentration was below the detection limit, the leachable level was assumed equal to the detection limit. This is conservative with regard to RTM modelling and very conservative where total concentrations are low, which was often the case. In such cases the maximum measured Kd may be a better reflection of actual conditions.

More generic values of Kd have been suggested by Lijzen et al 2001 (RIVM Report 711701 023) and where available, these have been included in the above table.

For RTM analysis, the site specific lower bound Kd values were used for metals, where available.

As discussed above, values of Kd for organics have been based on Koc and soil organic content. However, leachate data for PAHs have also been included in the above table and are compared to the computed values based on Koc. As may be seen, the site values are generally much higher than the computed values. This suggests that for PAHs leachate concentrations are likely to be a more realistic indicator of potential mobility and derived soil targets from the RTM analysis are likely to be unduly low.

Kd values for ammonia have been based on Buss et al 2004.

5.4 Level 2 Parameters

The Level 2 analysis considers attenuation in the vadose zone below the source and subsequent dilution that would occur within the aquifer below the site. The attenuation is characterised by an attenuation factor (AFU2) and the dilution by a dilution factor (DF2). The overall reduction factor in concentration at Level 2 would be computed as AFU2 x DF2. If the depth to groundwater is not great, as is the present case, it is conservative to ignore Level 2 attenuation, i.e. to assume AFU2 = 1.0.

If attenuation in the unsaturated zone is ignored, no additional physiochemical parameters are needed for Level 2 assessment. Site parameters required are the infiltration rate, geometry of 'source' and the volume of flow within the aquifer mixing zone. The latter is usually computed from the hydraulic gradient, the hydraulic conductivity and the thickness of the mixing zone. In the present case the average hydraulic conductivity has been calculated based on inverse modelling and may therefore be assumed to be known with a relatively high level of confidence.

For the RTM analysis, the aquifer thickness has been assumed to be 3 m, which is consistent with the average saturated zone of the Terrace Gravel from site investigation data. A mixing zone of 3 m has also been assumed as the site is wide in relation to the aquifer thickness. The assumed aquifer thickness in relation to the transmissivity inferred from the modelling suggests an hydraulic conductivity of about 5.8 m/d. The hydraulic gradient was taken as the site average from the calibrated model (0.0044).

With regard to Level 2 analysis, only the length of the source in the direction parallel to the groundwater flow is required with regard to source geometry. This has been based on the approximate site dimensions, as discussed in Section 5.5.3, below.

Infiltration within the site area was assumed to be the average estimated value, 20% of precipitation, as discussed above. This is considered reasonable for a residential type re-development but would likely be very conservative for a hard covered commercial development.

5.5 Level 3 Parameters

5.5.1 General

The Level 3 analysis considers dispersion and degradation within the aquifer as the plume moves away form the source area.

The additional parameters necessary for this analysis are the longitudinal and lateral dispersivities, the half life degradation rate and the partition coefficient (Kd) of the substances in the aquifer. For organics the fraction of organic carbon is needed to compute Kd. This would be expected to be relatively high for a shallow recent made ground/alluvial aquifer and a sensible lower bound of 0.1 % (0.001) was adopted. This is lower than the mean value expected for shallow sand and gravel aquifers based on EA P2 228 (2002).

Longitudinal and lateral dispersivities were set 10 and 1 % respectively of the path length to discharge.

The total porosity of unconsolidated deposits is likely to be of the order of 0.3 to 0.5 (Freeze and Cherry 1979). In such strata, the effective porosity is likely to equate to close to the total porosity and a value of 0.35 was adopted.

5.5.2 Degradation Parameters

For metals, degradation has been ignored.

It is conservative in RTM analysis to ignore degradation of organic compounds. However, it is generally found that some degradation of organic compounds invariably occurs in the groundwater system and to ignore this effect can in many cases be extremely conservative.

Adopted degradation rates are based primarily on EA P2 228 (2002). The data presented in EA P2 228 for shallow sand and gravel aquifers are considered relevant to the present case in so far as it is considered to be shallow groundwater flow that is of interest and the aquifer is unconfined at this point. Generally, where a range of typical field values has been given, the upper limit has been adopted. These data are relevant to field conditions, i.e. not the 'dissolved phase only' option in the EA RTM Spreadsheet. As pointed out by Alvarez and Illman (2006), Wiedemeier et al (1999) and ASTM (1998), if it is assumed that degradation occurs only in the dissolved phase, then the degradation rate derived from field conditions should be multiplied by the retardation factor. If this is done, derived remedial targets are in fact the same for either option.

It is generally found that for TPH compounds, rates of degradation in the field reduce with increasing molecule size. For TPH fractions where no guidance is given in EA P2 228, approximate half lives have been estimated based on the guidance given in EA P2 228 for BTEX and scaling half lives based on the general relationship between half life and molecule size proposed in New Zealand Guidance.

For cyanide it is known that some degradation will occur in the groundwater in both aerobic and anaerobic conditions (Young et al 1992, Alvarez and Illman 2006). Meehan (2000) reports degradation rates of greater than 0.017 days-1 for gas works sites in Australia. For the present study, it was found that even a relatively low potential degradation rate had a significant impact on derived remedial targets and accordingly a detailed analysis of potential site specific rate of decay is not considered warranted. An arbitrary but very low rate of degradation was adopted.

With the exception of naphthalene, EA P2 228 (2002) does not report degradation rates for PAH compounds. Other PAH compounds are not generally critical with respect to the water environment. This is because of low solubility and generally high partition coefficients. Data presented by Surampalli et al (2004), based on field studies, suggest typical half lives in unconfined shallow aquifers for PAH compounds of less than 2 years. For the present study arbitrary but relatively high half life of 10 years has been adopted for PAH compounds other than naphthalene. More detailed assessment is not considered warranted as these compounds are not highly mobile in the groundwater environment and rarely are critical. The adopted values are summarised in the table below:

Substance	**Half life (days)**	**Source**
Benzene	350	Upper Limit EA Report P2-228/TR
Toluene	200	
Ethylbenzene	200	
m-Xylene	200	
o-Xylene	200	
p-Xylene	200	
Benzo[a]anthracene	3650	High value based on literature, eg Surampalli et al 2004
Benzo[b]flouranthene	3650	
Benzo[k]flouranthene	3650	
Benzo[ghi]perylene	3650	
Benzo[a]pyrene	3650	
Chrysene	3650	
Dibenzo[ah]anthracene	3650	
Flouranthene	3650	
Indeno[123-cd]pyrene	3650	
Naphthalene	300	Upper Limit EA Report P2-228/TR
Pyrene	3650	High value based on literature, eg Surampalli et al 2004
Acenaphthalene	3650	
Acenaphthene	3650	
Flourene	3650	
Phenanthrene	3650	
Anthracene	3650	
Phenol	100	Upper Limit EA Report P2-228/TR
TPH Aliphatic C8-C10	700	Upper Limit for BTEX EA Report P2-228/TR scaled according to NZ Practice
TPH Aliphatic C10-C12	1750	
TPH Aromatic C8-C10	700	
TPH Aromatic C10-C12	1750	
TPH Aromatic C12-C16	2450	
TPH Aromatic C16-C21	3500	
Cyanide	3500	Very High Value
Ammonia	1280	Upper Limit from Buss et al 2004

5.5.3 Source Zone

Based on the above discussions, the critical receptors are considered to comprise the River Cherwell and the shallow sand and gravel secondary aquifer. Initially no dilution within the river will be assumed, this is a very conservative assumption with regard to assessment of real risks to a surface water receptor. However, a compliance point at 50 m downstream from the site boundary has been adopted, as discussed above (Case 1). This is considered reasonable as some impaction of the shallow aquifer on site has occurred.

In addition, a condition more representative of the actual surface water receptor (200 m to compliance) has also been considered (Case 2). For the purposes of the present study, initially analyses were conducted considering the whole north western site area as a potential source and dimensions of 200 m by 200m were adopted for the assumed length and width of the source area. Derived remedial targets should, strictly, be compared to average conditions within the source zones and for analysis the average distance from the source zone to the compliance point has been considered with respect to Level 3 attenuation.

5.6 Derived Remedial Targets

RTM spreadsheets are included in Appendix B.

Derived remedial targets for soils, pore water (leachate) and groundwater are summarised in the following tables. These should be used within the overall assessment in conjunction with pragmatic considerations and human health issues to develop appropriate overall remedial targets, and the values presented below are not proposed remedial targets in themselves. Note that some of the derived targets exceed the likely solubility of some compounds and some derived soil targets exceed residual saturation levels. These factors should be considered in the overall assessment.

Case 1: 50m to Compliance			
Substance	**RTM Remedial Target Concentrations**		
	Level 3 Soil (mg/kg)	**Level 3 Pore Water (mg/l)**	**Level 3 Groundwater (mg/l)**
Benzene	5.28E-01	6.05E-01	2.96E-01
Toluene	1.10E+02	4.93E+01	2.41E+01
Ethylbenzene	ES	ES	ES
m-Xylene	ES	ES	1.76E+02
o-Xylene	ES	ES	1.06E+02
p-Xylene	ES	ES	1.25E+02
Benzo[a]anthracene	ES	ES	ES
Benzo[b]flouranthene	ES	ES	ES
Benzo[k]flouranthene	ES	ES	ES
Benzo[ghi]perylene	ES	ES	ES
Benzo[a]pyrene	ES	ES	ES
Chrysene	ES	ES	ES
Dibenzo[ah]anthracene	ES	ES	ES
Flouranthene	ES	ES	ES
Indeno[123-cd]pyrene	ES	ES	ES

Case 1: 50m to Compliance			
Substance	RTM Remedial Target Concentrations		
	Level 3 Soil (mg/kg)	Level 3 Pore Water (mg/l)	Level 3 Groundwater (mg/l)
Naphthalene	7.09E+01	1.07E+01	5.24E+00
Pyrene	ES	ES	ES
Acenaphthalene	3.87E+00	1.53E-01	7.48E-02
Acenaphthene	ES	ES	2.00E+00
Flourene	ES	ES	ES
Phenanthrene	ES	ES	ES
Anthracene	ES	ES	ES
Phenol	4.96E+00	1.09E+01	5.35E+00
TPH Aliphatic C5-C6	ES	ES	2.29E+01
TPH Aliphatic C6-C7	ES	ES	ES
TPH Aliphatic C8-C10	ES	ES	ES
TPH Aliphatic C10-C12	ES	ES	ES
TPH Aliphatic C12-C16	ES	ES	ES
TPH Aliphatic C16-C21	ES	ES	ES
TPH Aliphatic C21-C35	ES	ES	ES
TPH Aromatic C8-C10	4.73E+02	2.94E+01	1.44E+01
TPH Aromatic C10-C12	1.09E+02	4.33E+00	2.12E+00
TPH Aromatic C12-C16	ES	ES	ES
TPH Aromatic C16-C21	ES	ES	ES
TPH Aromatic C21-C35	ES	ES	ES
Arsenic	1.24E+03	2.97E-01	1.45E-01
Cadmium	8.07E-01	1.48E-03	7.24E-04
Copper	7.41E+02	1.66E-01	8.13E-02
Chromium	8.53E+02	1.19E-01	5.81E-02
Lead	3.92E+02	4.28E-02	2.09E-02
Inorganic Mercury	1.27E-01	2.96E-04	1.45E-04
Nickel	6.70E+02	1.19E-01	5.81E-02
Selenium	2.97E+00	5.92E-02	2.90E-02
Zinc	8.70E+03	7.44E-01	3.64E-01
Water Soluble Boron	1.20E+02	1.18E+01	5.79E+00
Easily Lib. Cyanide	6.84E+03	3.39E+02	1.66E+02
Total Cyanide	3.61E+17	2.40E+15	1.18E+15
Ammonia	2.46E+01	3.01E+01	1.47E+01

ES - Target exceeds solubility

Case 2: 200m to Compliance			
Substance	RTM Remedial Target Concentrations		
	Level 3 Soil (mg/kg)	Level 3 Pore Water (mg/l)	Level 3 Groundwater (mg/l)
Benzene	6.02E+00	6.90E+00	3.38E+00
Toluene	ES	ES	ES
Ethylbenzene	ES	ES	ES
m-Xylene	ES	ES	ES
o-Xylene	ES	ES	ES
p-Xylene	ES	ES	ES
Benzo[a]anthracene	ES	ES	ES
Benzo[b]flouranthene	ES	ES	ES
Benzo[k]flouranthene	ES	ES	ES
Benzo[ghi]perylene	ES	ES	ES

Case 2: 200m to Compliance			
Substance	**RTM Remedial Target Concentrations**		
	Level 3 Soil (mg/kg)	**Level 3 Pore Water (mg/l)**	**Level 3 Groundwater (mg/l)**
Benzo[a]pyrene	ES	ES	ES
Chrysene	ES	ES	ES
Dibenzo[ah]anthracene	ES	ES	ES
Flouranthene	ES	ES	ES
Indeno[123-cd]pyrene	ES	ES	ES
Naphthalene	ES	ES	ES
Pyrene	ES	ES	ES
Acenaphthalene	4.55E+01	1.80E+00	8.81E-01
Acenaphthene	ES	ES	ES
Flourene	ES	ES	ES
Phenanthrene	ES	ES	ES
Anthracene	ES	ES	ES
Phenol	3.17E+02	6.99E+02	3.42E+02
TPH Aliphatic C5-C6	ES	ES	ES
TPH Aliphatic C6-C7	ES	ES	ES
TPH Aliphatic C8-C10	ES	ES	ES
TPH Aliphatic C10-C12	ES	ES	ES
TPH Aliphatic C12-C16	ES	ES	ES
TPH Aliphatic C16-C21	ES	ES	ES
TPH Aliphatic C21-C35	ES	ES	ES
TPH Aromatic C8-C10	ES	ES	ES
TPH Aromatic C10-C12	ES	ES	ES
TPH Aromatic C12-C16	ES	ES	ES
TPH Aromatic C16-C21	ES	ES	ES
TPH Aromatic C21-C35	ES	ES	ES
Arsenic	2.48E+03	5.91E-01	2.89E-01
Cadmium	1.61E+00	2.94E-03	1.44E-03
Copper	1.48E+03	3.31E-01	1.62E-01
Chromium	1.70E+03	2.37E-01	1.16E-01
Lead	7.82E+02	8.54E-02	4.18E-02
Inorganic Mercury	2.53E-01	5.89E-04	2.88E-04
Nickel	1.33E+03	2.37E-01	1.16E-01
Selenium	5.91E+00	1.18E-01	5.76E-02
Zinc	1.74E+04	1.49E+00	7.27E-01
Water Soluble Boron	2.39E+02	2.35E+01	1.15E+01
Easily Lib. Cyanide	5.76E+06	2.85E+05	1.40E+05
Total Cyanide	1.53E+21	1.02E+19	5.00E+18
Ammonia	2.49E+02	3.06E+02	1.50E+02

5.7 Comparison with Measured Conditions

In the contour plots included in Appendix C, a contour level equal to the adopted compliance value (EQS) is included, where exceeded, and is highlighted as a red line. Where all measured concentrations are below EQS, this is indicated on the plots. With regard to comparison with Case 2 derived targets (protective to surface water) all measured concentrations are lower than derived targets with the exception of a single relatively high nickel value. With regard to Case 1 targets and leaving aside ammonia, which is generally elevated throughout the site, the following table lists all substances measured in any groundwater samples above EQS levels in January 1999:

Benzene	Exceeds EQS in Central and Northeastern Site Area. Locally above derived target in site centre but meets remedial target prior to downstream site boundary
Toluene	Somewhat above EQS in central site area but meets EQS prior to site boundary. Below Target throughout site
Ethylbenzene	Somewhat above EQS in central site area but meets EQS prior to site boundary. Meets target throughout site. Target value exceeds solubility
Xylenes	Somewhat above EQS in central site area but meets target throughout site
Benzo[a]anthracene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Benzo[b]flouranthene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Benzo[k]flouranthene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Benzo[ghi]perylene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Benzo[a]pyrene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Chrysene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Dibenzo[ah]anthracene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Flouranthene	Exceeds EQS in Northern and Central Site Areas but Target Value exceeds solubility
Indeno[123-cd]pyrene	Exceeds EQS in Northern and Central Site Areas but Target Value exceeds solubility
Naphthalene	Exceeds EQS in Northern Site Area but meets target throughout site.
Pyrene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Acenaphthalene	Generally Exceeds EQS and locally exceeds Target in Northern and Central Site Area
Acenaphthene	Exceeds EQS in Northern Site Area but meets target throughout site
Flourene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Phenanthrene	Exceeds EQS in Northern Site Area but Target Value exceeds solubility
Anthracene	Exceeds EQS in Northern and Central Site Area but Target Value exceeds solubility
Phenol	Somewhat above EQS in central site area but meets EQS prior to site boundary and meets Target throughout site
Nickel	Locally Elevated above EQS and target in Southernmost and Northern Areas of Site
Selenium	Locally Elevated above EQS in Southernmost and Northernmost Areas of Site – Locally above target in northern site area but meets EQS Prior to Downstream Boundary
Total Cyanide	Generally Elevated above EQS in Central Site Area but does not exceed Target

Substances ***in bold italics*** were measured in concentrations that exceed solubility

Where the derived leachate remedial target exceeds solubility, it is not considered that the substance could potentially pose a significant risk to controlled waters. In Appendix D, plots are included showing the site zoned into three areas, where measured concentrations are below EQS (white), where concentrations exceed EQS but are below derived remedial targets (yellow) and where remedial targets are exceeded (pink). These are provided for all substances that show some EQS exceedences and for which the derived remedial target does not exceed solubility and the results are also summarised in the above table. Only the following substances show any exceedences with respect to derived remedial targets:

Nickel
Selenium
Benzene
Acenaphthalene

In each case the area of exceedence is very small in relation to the assumed source area (200 m by 200 m). As remedial targets apply to average conditions within the source area, it is not considered that these local exceedences would merit groundwater remediation per se provided any residual soil sources that are present above the water table are removed.

In Appendix E, plots show the locations of substances that are present in measured concentrations above their solubility compared to EQS values, and this can be used as an indication of the location and potential extent of potential free product (plots have not been generated for chrysene and dibenzo[ah]anthracene as although concentrations were recorded above the solubility, no specific EQS exists for these determinands). Although target concentrations for these contaminants are above the solubility and therefore the theoretical risk to controlled waters posed by these contaminants is not considered significant, these areas are highlighted as a potential ongoing source of contamination due to the presence, or inferred presence, or free product. As such, it would be prudent to include a degree of recovery of free product from these areas in any remedial strategy that is developed for the site.

6.0 SENSITIVITY ANALYSIS

The RTM analysis requires estimates to be made of a large number of parameters the exact values of which are generally unknown. In many cases sensible 'worst-case' values have been adopted as discussed above. The in-house implementation of the EA RTM approach allows automatic sensitivity analysis to be undertaken that is useful in highlighting the potentially most critical parameters. The procedure adopted was to vary each parameter by +10% and compute the resultant change to the derived remedial targets. This work is summarised below for benzene in Case 1.

Parameter	Effect of +10% change on Benzene Target, expressed as +/- percentage change		Comment on Selected Parameter
	Level 3 Soil Target	Level 3 Groundwater Target	
Soil Bulk Density	-2.1	-	Reasonable value adopted
Soil Porosity	+0.58	-	Not Critical
Soil Water Porosity	+1.7	-	Reasonable value adopted
Soil Fraction of Organic Carbon	+7.7	-	Sensible lower bound adopted
Site Infiltration	-13	-8.7	Reasonable values for usage considered
Saturated Aquifer Thickness	0	0	Not Critical
Mixing Zone Thickness	+5.3	+0.19	Constrained by total aquifer thickness
Site Hydraulic Gradient	-4.5	-9.1	Based on site measurement.
Site Aquifer Hydraulic Conductivity	-4.5	-9.1	Based on inverse modelling.
Length of Source Parallel to Flow	+4.0	+9.1	Site Dimension
Saturated Aquifer Bulk Density	+5.4	+5.4	Parameter not likely to change significantly
Saturated Aquifer Porosity	+15.2	+15.2	Reasonable Average Value
Source Width Orthogonal to Flow	VS	VS	Not Critical
Aquifer Fraction of Organic Carbon	+5.4	+5.4	Reasonable low value adopted
Aquifer Longitudinal DIspersivity	-3.5	-3.5	Reasonable literature value adopted
Aquifer Transverse DIspersivity	VS	VS	Not Critical
Aquifer Vertical DIspersivity	+4.6	+4.6	Not Critical
Henry's Law Coefficient	+0.36	-	Not Critical
Level 1 Partition Coefficient	+7.74	-	EA Recommended Parameters for organics. Site specific data used for inorganics.
Level 3 Partition Coefficient	+5.4	+5.4	
Half Life Saturated Zone	-16.5	-16.5	Sensible Upper Limit Adopted

7.0 SUMMARY CONCLUSIONS

Near surface groundwater on site would be expected to flow generally south-westwards or southwards from the site area with eventual discharge to the River Cherwell. The majority of flow of groundwater originating as infiltration within the site area would be expected to flow within the saturated zone of the Terrace Gravel strata. Inverse modelling has allowed a site-specific estimate to be made of the potential transmissivity of the aquifer that is consistent with the overall water balance in the catchment area and measured mean groundwater levels on site.

The River Cherwell is considered to be the critical receptor with respect to the groundwater pathway as land usage between the site and the river would preclude development of any potable abstraction within the shallow sand and gravel secondary aquifer. However, remedial targets have been derived that are protective to both the surface water receptor and the shallow sand and gravel aquifer.

Derived remedial targets for groundwater are only exceeded locally within the site and for a small number of substances. As remedial targets apply to average conditions within the source area, it is not considered that these local exceedences would merit groundwater remediation per se provided any significant residual soil sources that are present above the water table are removed.

8.0 REFERENCES

Alvarez, A.A and Illman W.A. 2006. Bioremediation and Natural Attenuation. Wiley.

Anderson, M P and Woessner, W W. Applied Groundwater Modelling. Academic Press Inc. 1992.

ASTM (1998). 1998 Annual Book of ASTM Standards. Standard Guide for Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites. E 1943-98, pp875-917.

Ataie-Ashtiani, B., Volker, R.E. and Lockington, D.A. 2002. Contaminant transport in aquifers influenced by tide. Australian Civil Engineering Transactions, CE43. 1-11.

Buss, S R, Herbert, A W, Morgan, P, Thornton, S F and Smith J W N. 2004. A review of ammonium attenuation in soil and groundwater.

Connor, J A, Newell, C J and Malander, M W. 1996. Parameter estimation guidelines for risk-based corrective action (RBCA) modelling. NGWA Petroleum Hydrocarbons Conference, Houston, Texas.

Environment Agency (2008) Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values. Science Report SC050021/SR7.

Environment Agency (2002) The effects of contaminant concentration on the potential for natural attenuation.. R&D report P2-228/TR.

Ferris J. G. (1951) Cyclic fluctuations of water level as a basis for determining aquifer transmissibility. IAHS PUBL., 33, 148-155.

Freeze, R. A. and Cherry, J. A. Groundwater. Prentice Hall, 1979.

Fetter, C. W. Applied Hydrogeology, Prentice Hall, 2001.

Gustafson B, Griffith Tell, J and Orem, D. 1997. Selection of Representative TPH Fractions Based on Fate and Transport Considerations. Volume 3 of the Total Petroleum Hydrocarbon Criteria Working Group Series. Amherst Scientific Publishers.

Land Quality Management (LQM) 2009. Generic Assessment Criteria for Human Health Risk Assessment.

Lloyd J W. 1983. Hydrogeology in glaciated terrains. In Eyles, N (Ed). Glacial Geology, an Introduction for Engineers and Earth Scientists. Pergammon.

Meehan, S. 2000. The fate of cyanide in groundwater at gasworks sites in south-eastern Australia. PhD Thesis, School of Earth Sciences, University of Melbourne.

Surampalli, R S, Ong, S K, Seagren, E, Nuno, J and Banerji, S. 2004. Natural Attenuation of Hazardous Wastes. ASCE.

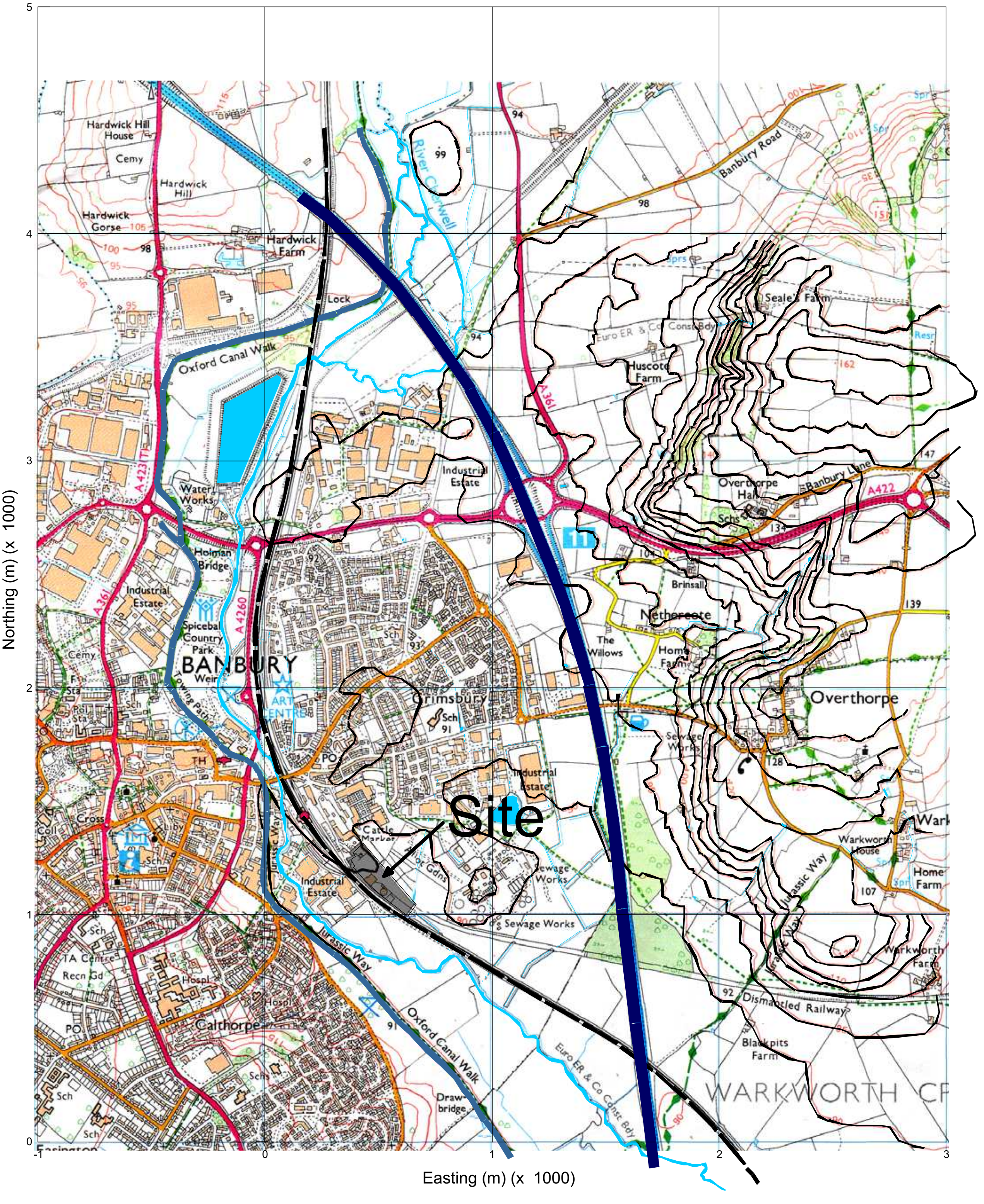
Wiedemeier, T H, Rifal, H S, Newell, C J and Wilson, J T. 1999. Natural attenuation of fuels and chlorinated solvents in the subsurface. Wiley.

Yim, C.S. and Mohsen, M.F.N. 1992. Simulation of tidal effects on contaminant transport in porous media. Groundwater 30(1) 78-86.

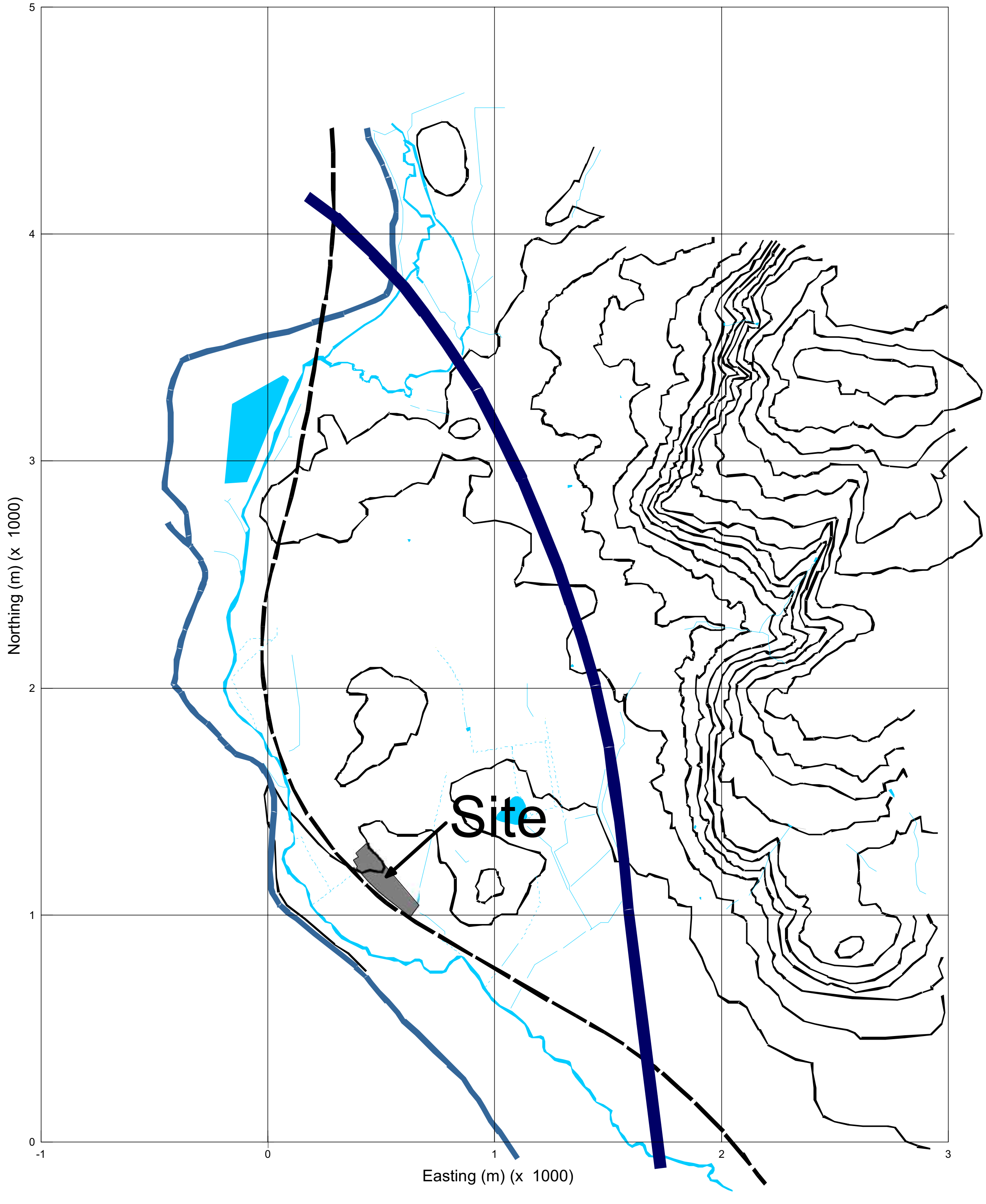
Yong, R.N., Mohamed, A.M.O and Warkentin. 1992. Principles of contaminant transport in soils. Elsevier.

APPENDIX A

FIGURES

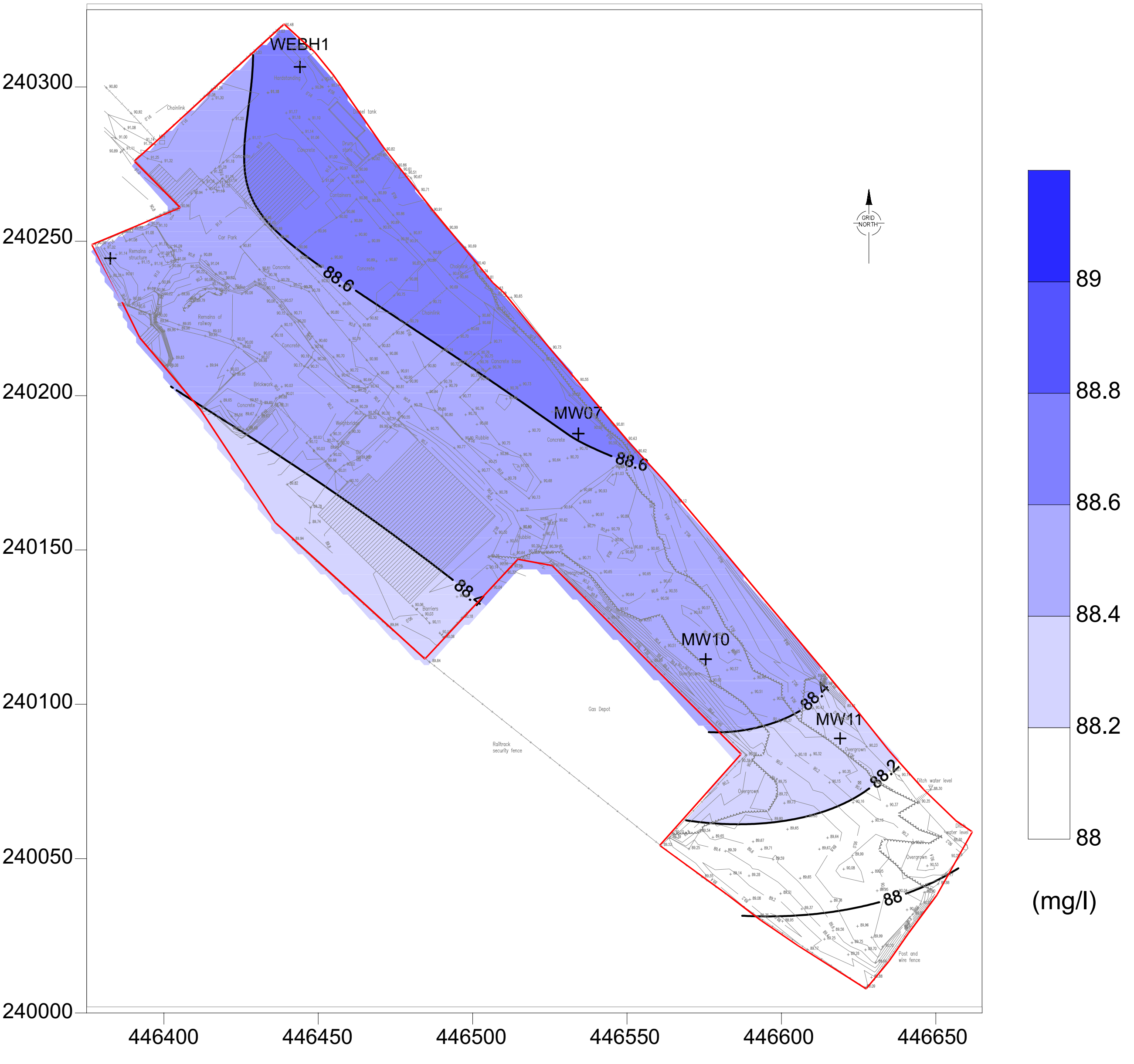


Date: Mar 2011	Scale: NTS	Title: F1 - Site Topographic Setting	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456



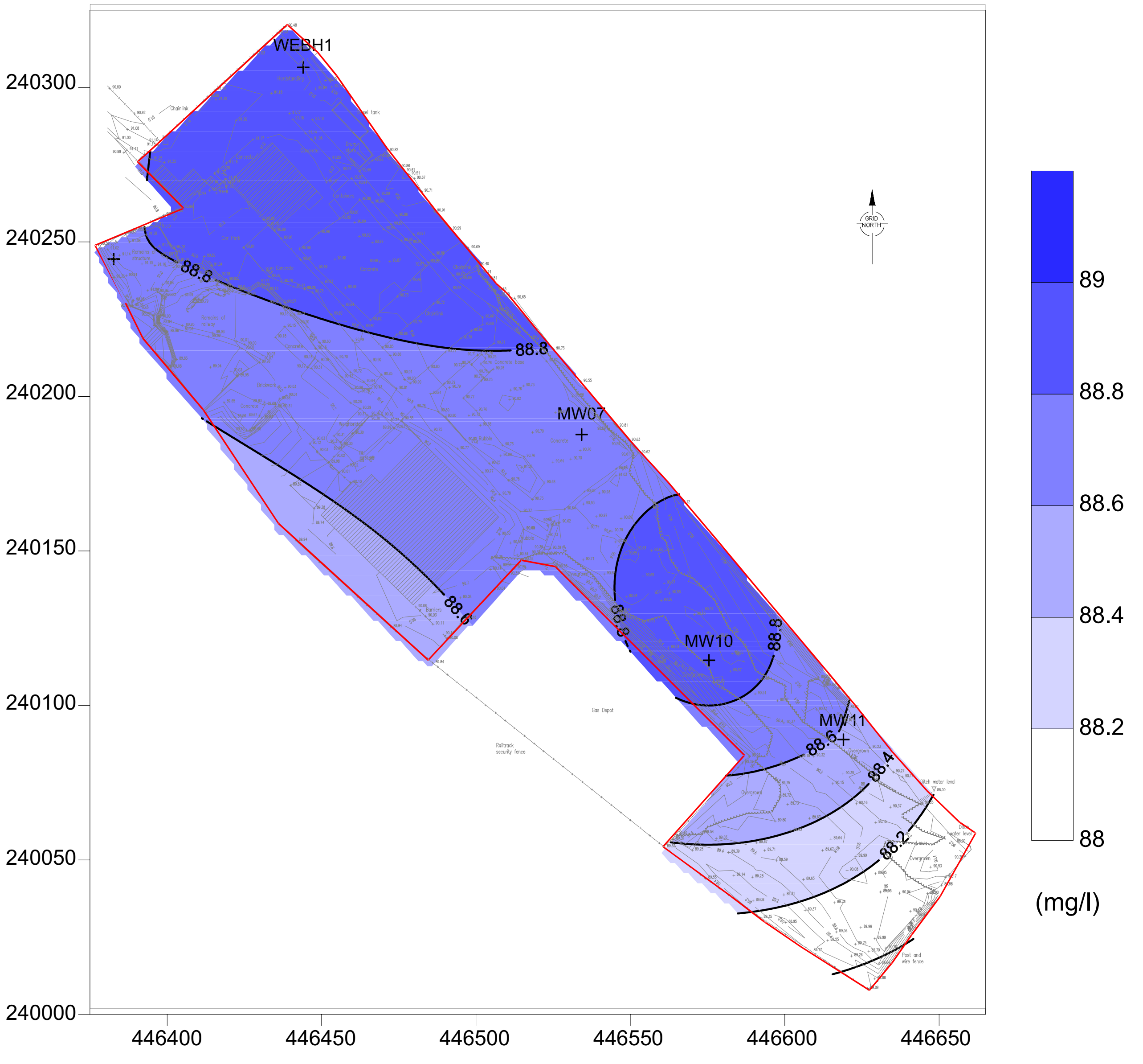
Date: Mar 2011	Scale: NTS	Title: F2 - Surface Water Features in the Vicinity of the Site
Celtic Design and Construct Remediation	Client: Grundon	
	Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456

Merton Street, Banbury: Inferred Contours of 25-Jan-02 Groundwater Level



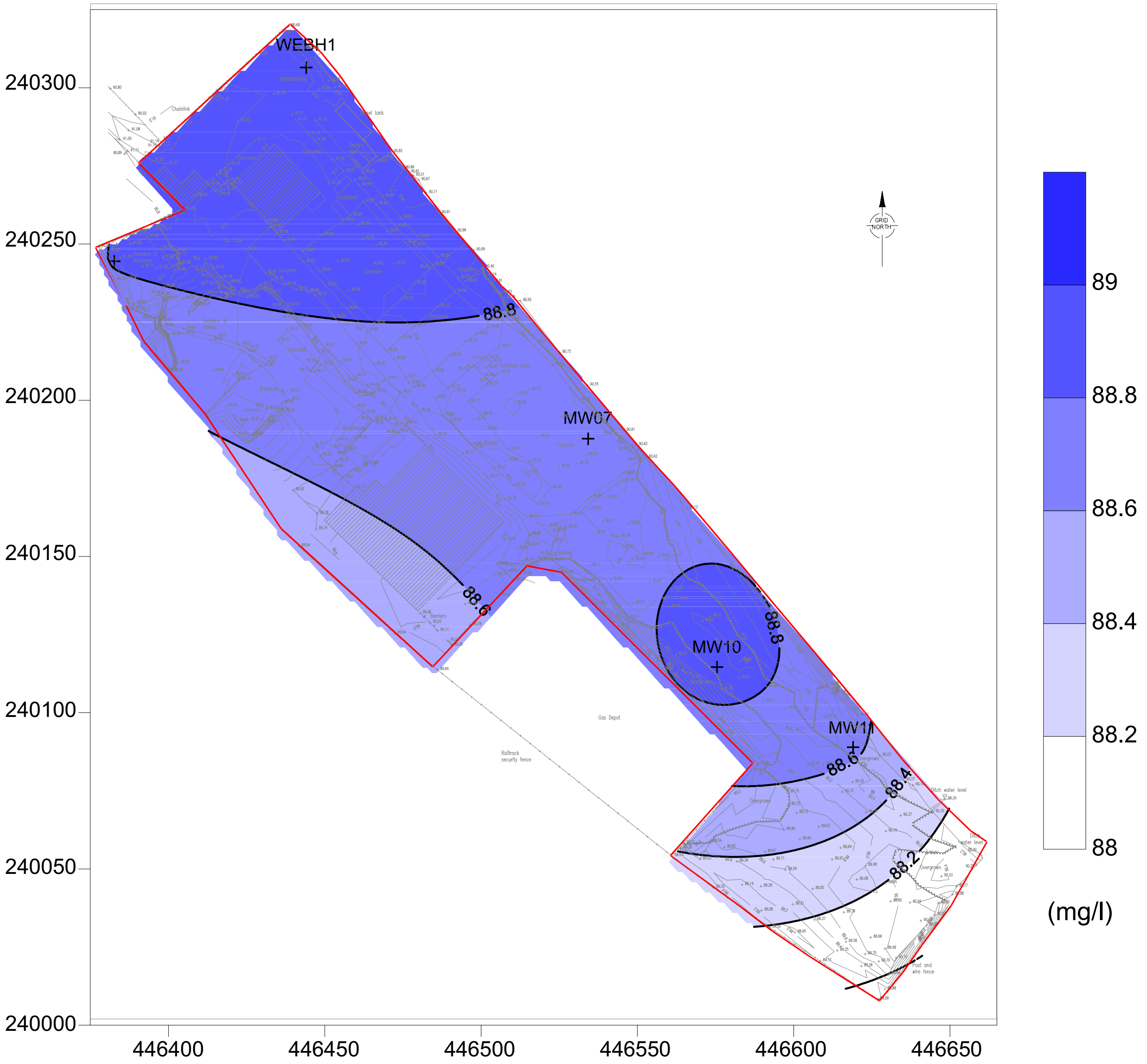
Date: Mar 2011	Scale: NTS	Title: F3b - Inferred Contours of Groundwater Level 25/01/02	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456

Merton Street, Banbury: Inferred Contours of 1-Feb-02 Groundwater Level



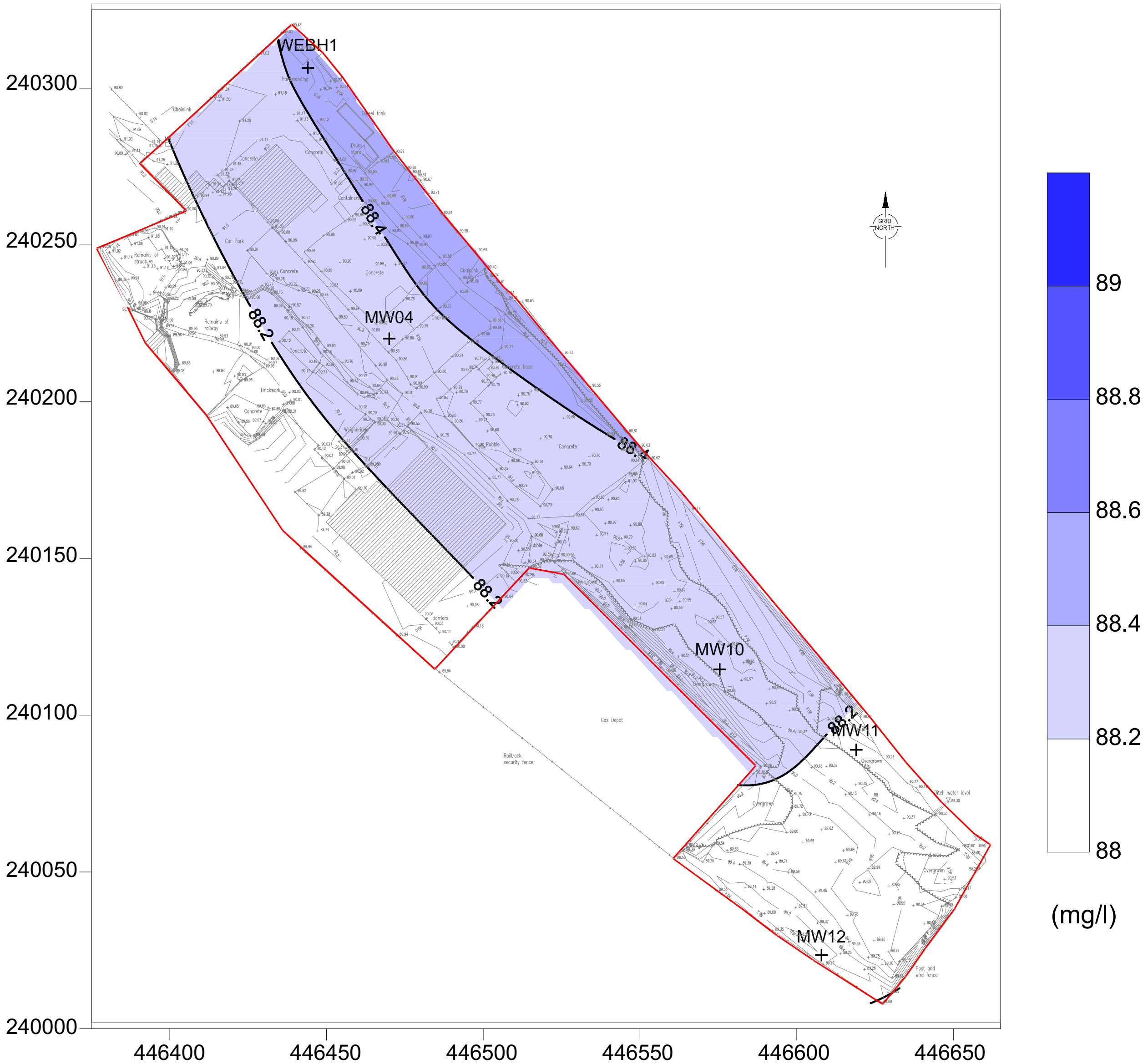
Date: Mar 2011	Scale: NTS	Title: F3c - Inferred Contours of Groundwater Level 02/02/02	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456

Merton Street, Banbury: Inferred Contours of 8-Feb-02 Groundwater Level

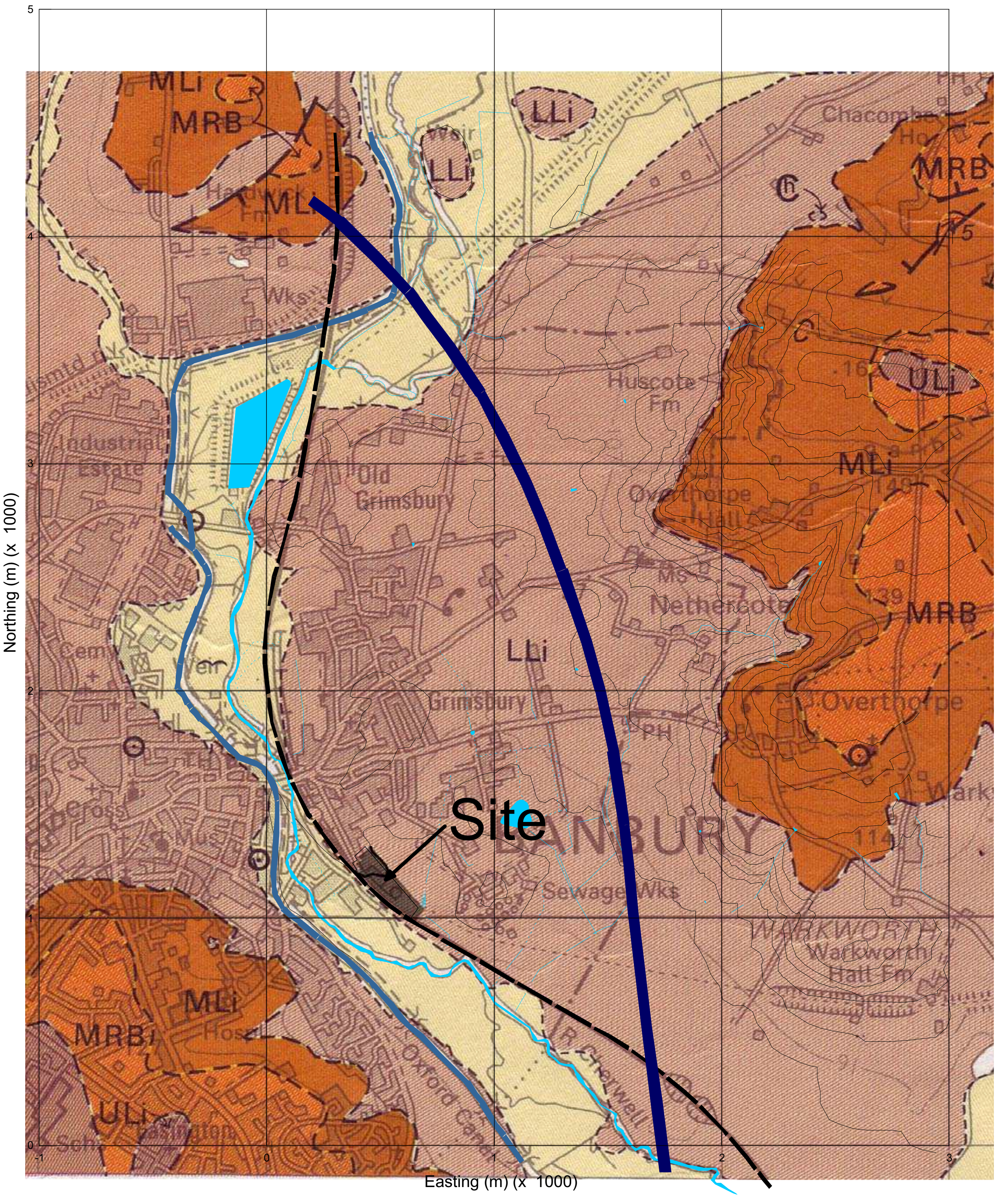


Date: Mar 2011	Scale: NTS	Title: F3d - Inferred Contours of Groundwater Level 08/02/02	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456

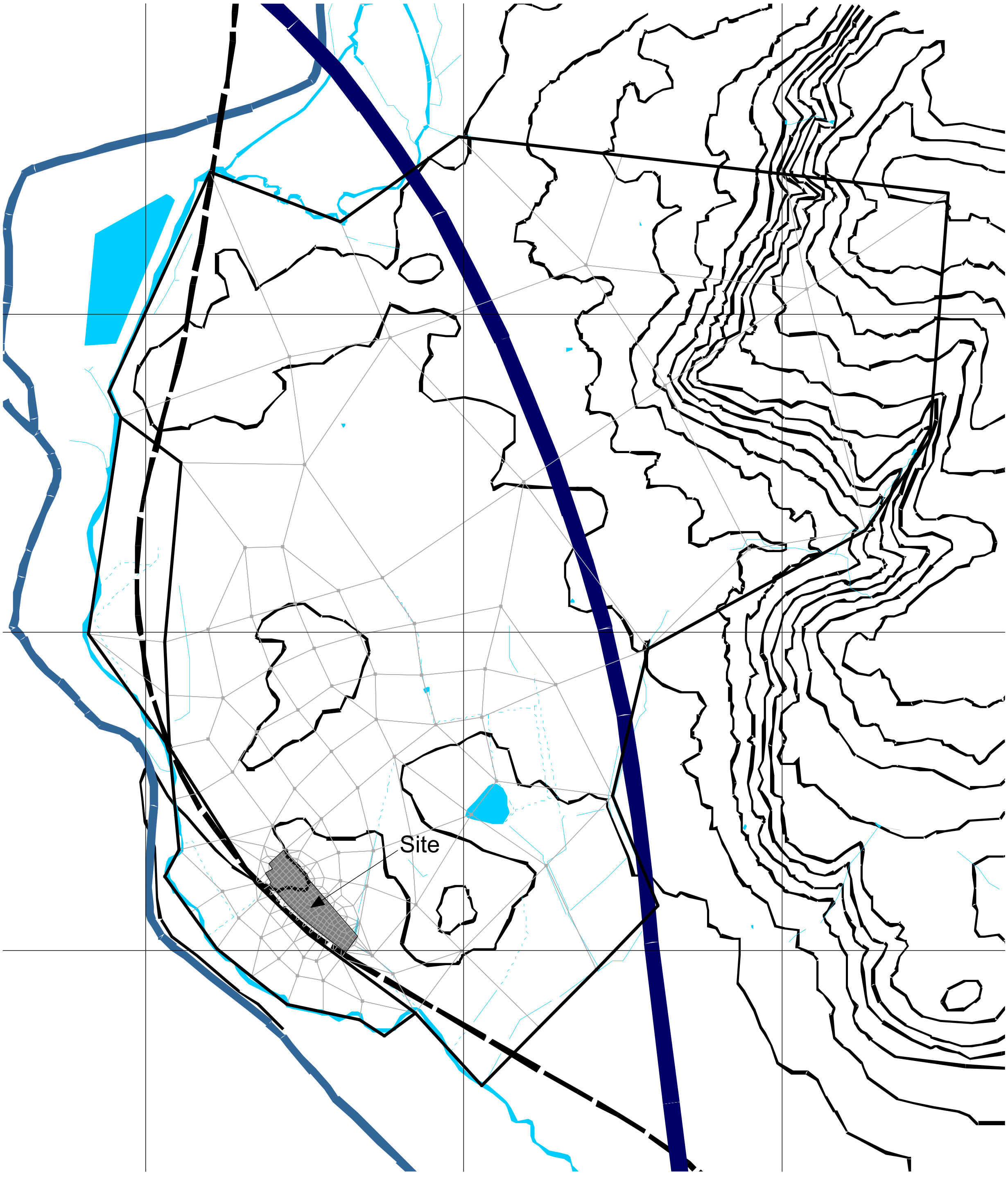
Merton Street, Banbury: Inferred Contours of 17-Feb-11 Groundwater Level



Date: Mar 2011	Scale: NTS	Title: F3e - Inferred Contours of Groundwater Level 17/02/02	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456



Date: Mar 2011	Scale: NTS	Title: F4 - Catchment Geology	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456



Date: Mar 2011	Scale: NTS	Title: F5 - Finite Element Mesh - Plan View Analysis

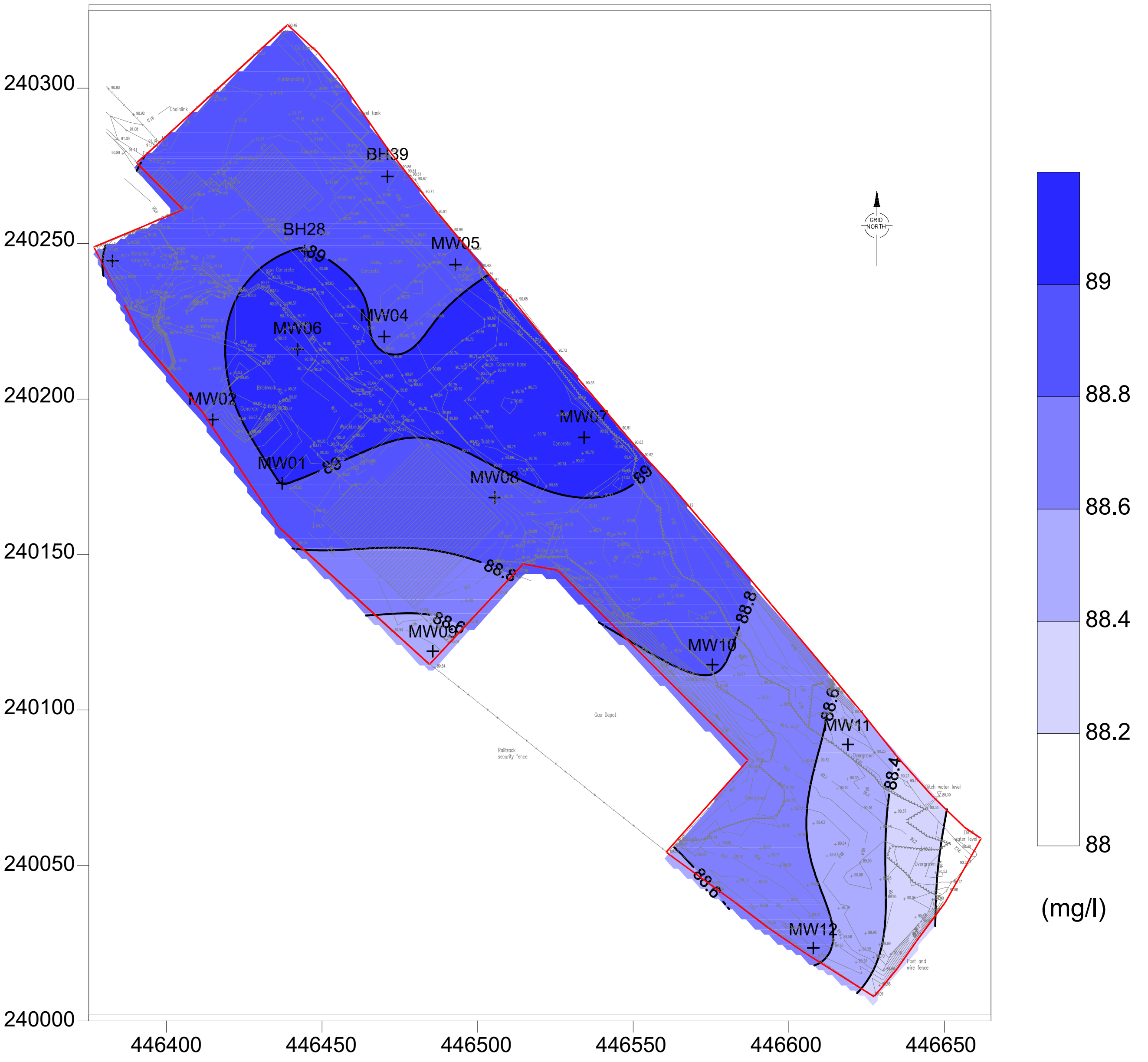
Celtic
Design and Construct Remediation

Client: Grundon

Project: Merton Street Depot, Station Approach
Banbury, Oxon

Contract No.: C1456

Merton Street, Banbury: Inferred Contours of 16-Nov-98 Groundwater Level

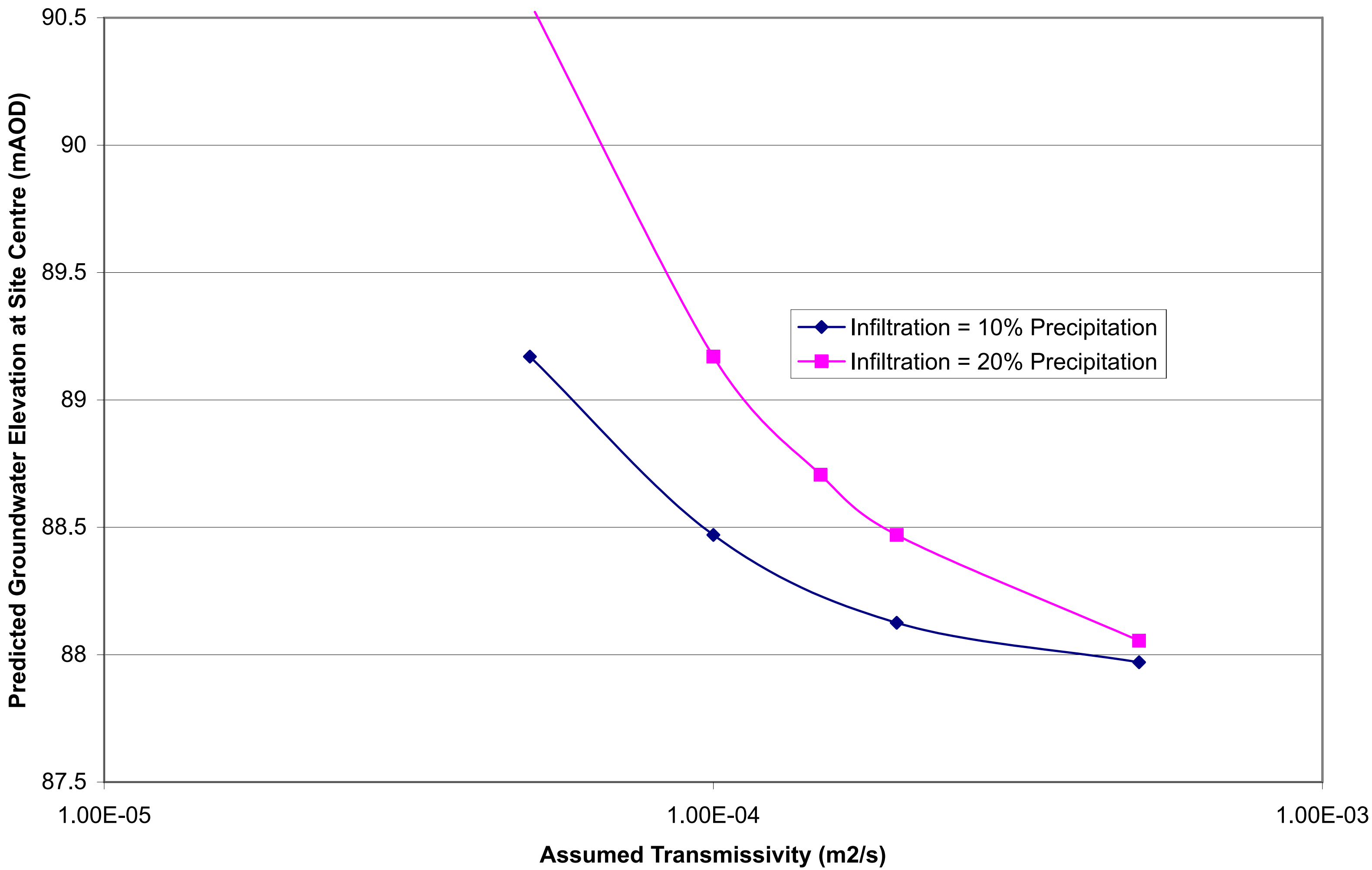


Date: Mar 2011	Scale: NTS	Title: F3a - Inferred Contours of Groundwater Level 16/11/98

Celtic
Design and Construct Remediation

Client: Grundon

Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456



Celtic
Design and Construct Remediation

CELTIC Technologies Ltd
Columbus House
Greenmeadow Springs
Tongwynlais
Cardiff CF15 7NE

TEL. (029) 2036 8636
Fax. (029) 2036 8637

Client: Grundon

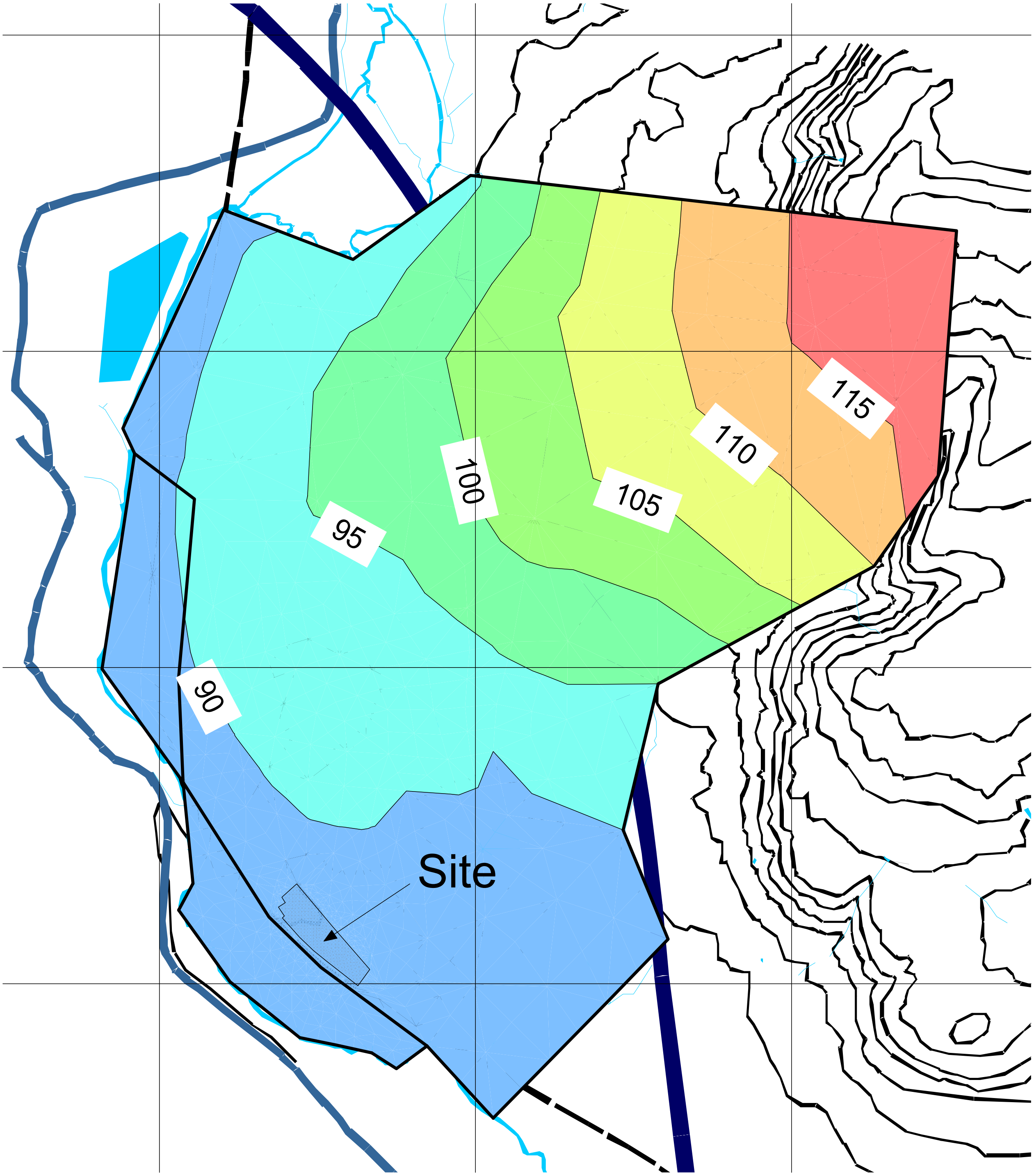
Project: Merton Street Depot, Station Approach, Banbury, Oxon

Contract No. C1456

Title: F6 - Predicted Groundwater Level at Site Centre vs Assumed Transmissivity

Scale: NTS

Date Drawn: March 2011



Date: Mar 2011	Scale: NTS	Title: F7a - Predicted Groundwater Head Contours - Catchment	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456

Date: Mar 2011	Scale: NTS	Title: F7b - Predicted Groundwater Head Contours - Site Area	
Celtic Design and Construct Remediation		Client: Grundon	
		Project: Merton Street Depot, Station Approach Banbury, Oxon	Contract No.: C1456

Celtic
Design and Construct Remediation

CELTIC Technologies Ltd
Columbus House
Greenmeadow Springs
Tongwynlais
Cardiff CF15 7NE

TEL. (029) 2036 8636
Fax. (029) 2036 8637

Client: Grundon

Project: Merton Street Depot, Station Approach, Banbury, Oxon

Contract No. C1456

Title: F8 - Particle Tracking Analysis

Scale: NTS

Date Drawn: March 2011

APPENDIX B

RTM OUTPUTS

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet

Celtic
Design and Construct Remediation

Site Name:	Merton Street
Site Address:	Banbury
Completed by:	JAS
Date:	07 02 11
Case:	1 - 50m to Compliance

Number of Substances = 48

		Compliance Criteria			Site Measured Concentrations		Physiochemical Properties					
Substance	Type	DWS	EQS	Comment	Measured Soil	Measured GW	Kaw (H)	Water solubility	Koc	Kow	Kd	Reference
		$mg\ L^{-1}$	$mg\ L^{-1}$		$mg\ kg^{-1}$	$mg\ L^{-1}$	$cm^3\ cm^{-3}$	$mg\ L^{-1}$	Log ($cm^3\ g^{-1}$)	Log (ratio)	$cm^3\ g^{-1}$	
Benzene	organic		1.00E-02				1.16E-01	1.78E+03	1.83E+00	2.13E+00		SR7
Toluene	organic		5.00E-02				1.15E-01	5.90E+02	2.31E+00	2.73E+00		SR7
Ethylbenzene	organic		5.00E-02				1.39E-01	1.80E+02	2.65E+00	3.15E+00		SR7
m-Xylene	organic		3.00E-02				1.12E-01	2.00E+02	2.69E+00	3.20E+00		SR7
o-Xylene	organic		3.00E-02				9.20E-02	1.73E+02	2.63E+00	3.12E+00		SR7
p-Xylene	organic		3.00E-02				1.07E-01	2.00E+02	2.65E+00	3.15E+00		SR7
Benz[a]anthracene	organic		2.40E-03	EQS Naphthalene			3.16E-05	3.80E-03	4.89E+00	5.91E+00		SR7
Benzo[b]fluoranthene	organic		3.00E-05				2.05E-06	2.00E-03	5.02E+00	6.08E+00		SR7
Benzo[k]fluoranthene	organic		3.00E-05				1.74E-06	8.00E-04	5.17E+00	6.26E+00		SR7
Benzo[ghi]perylene	organic		2.00E-06				2.36E-06	2.64E-04	5.62E+00	6.81E+00		SR7
Benzo[a]pyrene	organic		5.00E-05				1.76E-06	3.80E-03	5.11E+00	6.18E+00		SR7
Chrysene	organic		2.40E-03	EQS Naphthalene			3.18E-06	2.00E-03	4.74E+00	5.73E+00		SR7
Dibenz[ah]anthracene	organic		2.40E-03	EQS Naphthalene			5.40E-06	6.00E-04	5.27E+00	6.38E+00		SR7
Fluoranthene	organic		1.00E-04				6.29E-05	2.30E-01	4.26E+00	5.13E+00		SR7
Indeno[123-cd]pyrene	organic		2.00E-06				2.05E-06	2.00E-04	4.94E+00	5.97E+00		SR7
Naphthalene	organic		2.40E-03				6.62E-03	1.90E+01	2.81E+00	3.34E+00		SR7
Pyrene	organic		2.40E-03	EQS Naphthalene			5.64E-05	1.30E-01	4.21E+00	5.08E+00		SR7
Acenaphthalene	organic		2.40E-03	EQS Naphthalene			3.40E-03	1.61E+01	3.40E+00	4.00E+00		TR1
Acenaphthene	organic		2.40E-03	EQS Naphthalene			4.90E-03	3.80E+00	3.90E+00	3.90E+00		TR1
Flourene	organic		2.40E-03	EQS Naphthalene			3.20E-03	1.90E+00	4.10E+00	4.20E+00		TR1
Phenanthrene	organic		2.40E-03	EQS Naphthalene			1.30E-03	1.10E+00	4.40E+00	4.60E+00		TR1
Anthracene	organic		1.00E-04				1.60E-03	4.50E-02	4.50E+00	4.50E+00		TR1
Phenol	organic		7.70E-03				8.35E-06	8.41E+04	1.46E+00	1.48E+00		SR7/LQM
TPH Aliphatic C5-C6	organic		1.00E-02	Former DWS			2.10E+01	3.60E+01	2.90E+00	3.30E+00		LQM
TPH Aliphatic C6-C8	organic		1.00E-02				2.73E+01	5.40E+00	3.60E+00	4.10E+00		LQM
TPH Aliphatic C8-C10	organic		1.00E-02				4.15E+01	4.30E-01	4.50E+00	5.20E+00		LQM
TPH Aliphatic C10-C12	organic		1.00E-02				6.44E+01	3.40E-02	5.40E+00	6.30E+00		LQM
TPH Aliphatic C12-C16	organic		1.00E-02				1.71E+02	7.60E-04	6.70E+00	7.90E+00		LQM
TPH Aliphatic C16-C21	organic		1.00E-02				1.07E+03	2.50E-06	8.80E+00	1.04E+01		LQM
TPH Aliphatic C21-C34	organic		1.00E-02				1.07E+03	2.50E-06	8.80E+00	1.04E+01		LQM
TPH Aromatic C8-C10	organic		1.00E-02				2.53E-01	6.50E+01	3.20E+00	3.70E+00		LQM
TPH Aromatic C10-C12	organic		1.00E-02				7.22E-02	2.50E+01	3.40E+00	3.90E+00		LQM
TPH Aromatic C12-C16	organic		1.00E-02				1.26E-02	5.80E+00	3.70E+00	4.30E+00		LQM
TPH Aromatic C16-C21	organic		1.00E-02				6.95E-04	6.50E-01	4.20E+00	4.90E+00		LQM
TPH Aromatic C21-C35	organic		1.00E-02				2.48E-05	6.60E-03	5.10E+00	6.00E+00		LQM
Arsenic	inorganic		5.00E-02					1.25E+06			4.19E+03	Site Data
Cadmium	inorganic		2.50E-04					1.62E+06			5.45E+02	Site Data
Copper	inorganic		2.80E-02					1.38E+06			4.46E+03	Site Data
Chromium	inorganic		2.00E-02					5.85E+05			7.18E+03	Site Data
Lead	inorganic		7.20E-03								9.15E+03	Site Data
Inorganic Mercury	inorganic		5.00E-05					7.40E+04			4.30E+02	Site Data
Nickel	inorganic		2.00E-02					2.50E+06			5.64E+03	Site Data
Selenium	inorganic		1.00E-02	DWS				2.17E+06			5.00E+01	EA SGV Report
Zinc	inorganic		1.25E-01					4.32E+06			1.17E+04	Site Data
Water Soluble Boron	inorganic		2.00E+00								1.00E+01	Water Sol
Easily Liberatable Cyanide	inorganic		1.00E-03								2.00E+01	Site Data
Total Cyanide	inorganic		5.00E-02	DWS							1.50E+02	Site Data
Ammonia	inorganic		6.00E-01					8.99E+05			6.50E-01	ea

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	1 - 50m to Compliance

Level 1 - Soil

Soil Parameters				Source of parameter value
Total Porosity	n	0.53	fraction	CLEA Sandy Loam
Fraction of organic carbon (in soil)	foc	1.00E-02	fraction	Reasonable Value
Water filled soil porosity	θ_w	0.2	fraction	CLEA Sandy Loam
Air filled soil porosity	θa	0.33	fraction	CLEA Sandy Loam
Bulk density of soil zone material	ρ	1.21	g/cm^3	CLEA Sandy Loam

= Target Exceeds Solubility

Substance	Kd	Level 1 Remedial Targets: Soil (mg/kg)		Pore Water (mg/l)		Soil Level Exceeds Level 1 Target		Water Level Exceeds Level 1 Target	
	$cm^3 g^{-1}$	DWS	EQS	DWS	EQS	DWS	EQS	DWS	EQS
Benzene	6.76E-01		8.73E-03		1.00E-02				
Toluene	2.04E+00		1.12E-01		5.00E-02				
Ethylbenzene	4.47E+00		2.34E-01		5.00E-02				
m-Xylene	4.90E+00		1.53E-01		3.00E-02				
o-Xylene	4.27E+00		1.34E-01		3.00E-02				
p-Xylene	4.47E+00		1.40E-01		3.00E-02				
Benz[a]anthracene	7.76E+02		1.86E+00		2.40E-03				
Benzo[b]fluoranthene	1.05E+03		3.14E-02		3.00E-05				
Benzo[k]fluoranthene	1.48E+03		4.44E-02		3.00E-05				
Benzo[ghi]perylene	4.17E+03		8.34E-03		2.00E-06				
Benzo[a]pyrene	1.29E+03		6.44E-02		5.00E-05				
Chrysene	5.50E+02		1.32E+00		2.40E-03				
Dibenz[ah]anthracene	1.86E+03		4.47E+00		2.40E-03				
Fluoranthene	1.82E+02		1.82E-02		1.00E-04				
Indeno[123-cd]pyrene	8.71E+02		1.74E-03		2.00E-06				
Naphthalene	6.46E+00		1.59E-02		2.40E-03				
Pyrene	1.62E+02		3.90E-01		2.40E-03				
Acenaphthalene	2.51E+01		6.07E-02		2.40E-03				
Acenaphthene	7.94E+01		1.91E-01		2.40E-03				
Flourene	1.26E+02		3.03E-01		2.40E-03				
Phenanthrene	2.51E+02		6.03E-01		2.40E-03				
Anthracene	3.16E+02		3.16E-02		1.00E-04				
Phenol	2.88E-01		3.49E-03		7.70E-03				
TPH Aliphatic C5-C6	7.94E+00		1.38E-01		1.00E-02				
TPH Aliphatic C6-C8	3.98E+01		4.74E-01		1.00E-02				
TPH Aliphatic C8-C10	3.16E+02		3.28E+00		1.00E-02				
TPH Aliphatic C10-C12	2.51E+03		2.53E+01		1.00E-02				
TPH Aliphatic C12-C16	5.01E+04		5.02E+02		1.00E-02				
TPH Aliphatic C16-C21	6.31E+06		6.31E+04		1.00E-02				
TPH Aliphatic C21-C34	6.31E+06		6.31E+04		1.00E-02				
TPH Aromatic C8-C10	1.58E+01		1.61E-01		1.00E-02				
TPH Aromatic C10-C12	2.51E+01		2.53E-01		1.00E-02				
TPH Aromatic C12-C16	5.01E+01		5.03E-01		1.00E-02				
TPH Aromatic C16-C21	1.58E+02		1.59E+00		1.00E-02				
TPH Aromatic C21-C35	1.26E+03		1.26E+01		1.00E-02				
Arsenic	4.19E+03		2.10E+02		5.00E-02				
Cadmium	5.45E+02		1.36E-01		2.50E-04				
Copper	4.46E+03		1.25E+02		2.80E-02				
Chromium	7.18E+03		1.44E+02		2.00E-02				
Lead	9.15E+03		6.59E+01		7.20E-03				
Inorganic Mercury	4.30E+02		2.15E-02		5.00E-05				
Nickel	5.64E+03		1.13E+02		2.00E-02				
Selenium	5.00E+01		5.02E-01		1.00E-02				
Zinc	1.17E+04		1.46E+03		1.25E-01				
Water Soluble Boron	1.00E+01		2.03E+01		2.00E+00				
Easily Liberatable Cyanide	2.00E+01		2.02E-02		1.00E-03				
Total Cyanide	1.50E+02		7.51E+00		5.00E-02				
Ammonia	6.50E-01		4.89E-01		6.00E-01				

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	1 - 50m to Compliance

Level 2 - Soil (Afu = 1)

Site Parameters				Source of parameter value	Calculated:	
Infiltration:	3.64E-04	m/d	Inf	Estmated Based on 20% Precipitation		
Saturated aquifer thickness:	3	m	da	See Text Discussion	Transmissivity:	17.28
Mixing Zone thickness:	3	m	Mz	See Text Discussion	DF (Cu = 0):	2.04E+00
Hydraulic Gradient:	4.40E-03	fraction	I	Measured	Q = k.i.Mz:	0.076032
Hydraulic conductivity of aquifer:	5.76	m/d	K		L.inf:	7.28E-02
Length of source in direction of flow:	200	m	L	See Text Discussion		

(magenta) = Target Exceeds Solubility

Substance	Background	Dilution Factor		Level 2 Remedial Targets Soil (mg/kg)		Pore Water (mg/l)		Soil Level Exceeds Level 2 Target		Water Level Exceeds Level 2 Target	
	Cu	DWS	EQS	DWS	EQS	DWS	EQS	DWS	EQS	DWS	EQS
Benzene	0		2.04E+00		1.78E-02		2.04E-02				
Toluene	0		2.04E+00		2.29E-01		1.02E-01				
Ethylbenzene	0		2.04E+00		4.77E-01		1.02E-01				
m-Xylene	0		2.04E+00		3.12E-01		6.13E-02				
o-Xylene	0		2.04E+00		2.73E-01		6.13E-02				
p-Xylene	0		2.04E+00		2.86E-01		6.13E-02				
Benz[a]anthracene	0		2.04E+00		3.81E+00		4.91E-03				
Benzo[b]fluoranthene	0		2.04E+00		6.42E-02		6.13E-05				
Benzo[k]fluoranthene	0		2.04E+00		9.07E-02		6.13E-05				
Benzo[ghi]perylene	0		2.04E+00		1.70E-02		4.09E-06				
Benzo[a]pyrene	0		2.04E+00		1.32E-01		1.02E-04				
Chrysene	0		2.04E+00		2.70E+00		4.91E-03				
Dibenz[ah]anthracene	0		2.04E+00		9.14E+00		4.91E-03				
Fluoranthene	0		2.04E+00		3.72E-02		2.04E-04				
Indeno[123-cd]pyrene	0		2.04E+00		3.56E-03		4.09E-06				
Naphthalene	0		2.04E+00		3.25E-02		4.91E-03				
Pyrene	0		2.04E+00		7.97E-01		4.91E-03				
Acenaphthalene	0		2.04E+00		1.24E-01		4.91E-03				
Acenaphthene	0		2.04E+00		3.91E-01		4.91E-03				
Flourene	0		2.04E+00		6.19E-01		4.91E-03				
Phenanthrene	0		2.04E+00		1.23E+00		4.91E-03				
Anthracene	0		2.04E+00		6.47E-02		2.04E-04				
Phenol	0		2.04E+00		7.14E-03		1.57E-02				
TPH Aliphatic C5-C6	0		2.04E+00		2.83E-01		2.04E-02				
TPH Aliphatic C6-C8	0		2.04E+00		9.69E-01		2.04E-02				
TPH Aliphatic C8-C10	0		2.04E+00		6.70E+00		2.04E-02				
TPH Aliphatic C10-C12	0		2.04E+00		5.17E+01		2.04E-02				
TPH Aliphatic C12-C16	0		2.04E+00		1.03E+03		2.04E-02				
TPH Aliphatic C16-C21	0		2.04E+00		1.29E+05		2.04E-02				
TPH Aliphatic C21-C34	0		2.04E+00		1.29E+05		2.04E-02				
TPH Aromatic C8-C10	0		2.04E+00		3.29E-01		2.04E-02				
TPH Aromatic C10-C12	0		2.04E+00		5.17E-01		2.04E-02				
TPH Aromatic C12-C16	0		2.04E+00		1.03E+00		2.04E-02				
TPH Aromatic C16-C21	0		2.04E+00		3.24E+00		2.04E-02				
TPH Aromatic C21-C35	0		2.04E+00		2.57E+01		2.04E-02				
Arsenic	0		2.04E+00		4.28E+02		1.02E-01				
Cadmium	0		2.04E+00		2.79E-01		5.11E-04				
Copper	0		2.04E+00		2.55E+02		5.72E-02				
Chromium	0		2.04E+00		2.94E+02		4.09E-02				
Lead	0		2.04E+00		1.35E+02		1.47E-02				
Inorganic Mercury	0		2.04E+00		4.40E-02		1.02E-04				
Nickel	0		2.04E+00		2.31E+02		4.09E-02				
Selenium	0		2.04E+00		1.03E+00		2.04E-02				
Zinc	0		2.04E+00		2.99E+03		2.56E-01				
Water Soluble Boron	0		2.04E+00		4.16E+01		4.09E+00				
Easily Liberatable Cyanide	0		2.04E+00		4.12E-02		2.04E-03				
Total Cyanide	0		2.04E+00		1.53E+01		1.02E-01				
Ammonia	0		2.04E+00		1.00E+00		1.23E+00				

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	1 - 50m to Compliance

Level 3 - Soil - Domenico Steady State Equation

Site Parameters				Source of parameter value		
Bulk density of aquifer materials:	1.9	g/cm³	ρ	See Text Discussion	Calculated or from Level 2:	
Effective porosity of aquifer:	0.35	fraction	n	"	Hydraulic Gradient:	8.61E-03
Distance to compliance point from site boundary:	50	m		"	Hydraulic Conductivity:	5.76
Width of plume at source:	200	m	Sz	"	Mz = Sy	3
Fraction of organic carbon in aquifer:	0.001			"	Length of source	200
	15		ax	"	Distance from centre of source to comliance x	150
	1.5		az	"		
	0.15		ay	"		

= Target Exceeds Solubility

Substance	Kd	Rf	Apply Decay	u	Half Life		λ	ced/co	AF	Level 3 Remedial Targets: Soil (mg/kg)		Pore Water (mg/l)	
	cm³ g⁻¹	fraction	1 = Dissolved Phase Only	m/d	days	Reference	d⁻¹	fraction	fraction	DWS	EQS	DWS	EQS
Benzene	6.76E-02	1.37E+00		1.04E-01	350	P2-228	1.98E-03	3.38E-02	2.96E+01		5.28E-01		6.05E-01
Toluene	2.04E-01	2.11E+00		6.72E-02	200	P2-228	3.47E-03	2.07E-03	4.83E+02		1.10E+02		4.93E+01
Ethylbenzene	4.47E-01	3.42E+00		4.14E-02	200	P2-228	3.47E-03	2.40E-04	4.17E+03		1.99E+03		4.26E+02
m-Xylene	4.90E-01	3.66E+00		3.87E-02	200	P2-228	3.47E-03	1.70E-04	5.89E+03		1.84E+03		3.61E+02
o-Xylene	4.27E-01	3.32E+00		4.27E-02	200	P2-228	3.47E-03	2.83E-04	3.54E+03		9.67E+02		2.17E+02
p-Xylene	4.47E-01	3.42E+00		4.14E-02	200	P2-228	3.47E-03	2.40E-04	4.17E+03		1.19E+03		2.56E+02
Benz[a]anthracene	7.76E+01	4.22E+02		3.36E-04	3650	See Text	1.90E-04	7.44E-12	1.34E+11		5.12E+11		6.60E+08
Benzo[b]fluoranthene	1.05E+02	5.69E+02		2.49E-04	3650	See Text	1.90E-04	7.22E-14	1.39E+13		8.90E+11		8.50E+08
Benzo[k]fluoranthene	1.48E+02	8.04E+02		1.76E-04	3650	See Text	1.90E-04	1.31E-16	7.61E+15		6.90E+14		4.67E+11
Benzo[ghi]perylene	4.17E+02	2.26E+03		6.26E-05	3650	See Text	1.90E-04	2.16E-28	4.62E+27		7.88E+25		1.89E+22
Benzo[a]pyrene	1.29E+02	7.00E+02		2.02E-04	3650	See Text	1.90E-04	1.87E-15	5.34E+14		7.03E+13		5.45E+10
Chrysene	5.50E+01	2.99E+02		4.74E-04	3650	See Text	1.90E-04	6.90E-10	1.45E+09		3.91E+09		7.11E+06
Dibenz[ah]anthracene	1.86E+02	1.01E+03		1.40E-04	3650	See Text	1.90E-04	1.01E-18	9.87E+17		9.02E+18		4.84E+15
Fluoranthene	1.82E+01	9.98E+01		1.42E-03	3650	See Text	1.90E-04	1.54E-05	6.49E+04		2.42E+03		1.33E+01
Indeno[123-cd]pyrene	8.71E+01	4.74E+02		2.99E-04	3650	See Text	1.90E-04	1.36E-12	7.35E+11		2.62E+09		3.01E+06
Naphthalene	6.46E-01	4.50E+00		3.15E-02	300	P2-228	2.31E-03	4.58E-04	2.18E+03		7.10E+01		1.07E+01
Pyrene	1.62E+01	8.90E+01		1.59E-03	3650	See Text	1.90E-04	3.22E-05	3.11E+04		2.48E+04		1.52E+02
Acenaphthalene	2.51E+00	1.46E+01		9.68E-03	3650	See Text	1.90E-04	3.21E-02	3.12E+01		3.87E+00		1.53E-01
Acenaphthene	7.94E+00	4.41E+01		3.21E-03	3650	See Text	1.90E-04	1.20E-03	8.33E+02		3.25E+02		4.09E+00
Flourene	1.26E+01	6.93E+01		2.04E-03	3650	See Text	1.90E-04	1.39E-04	7.21E+03		4.46E+03		3.54E+01
Phenanthrene	2.51E+01	1.37E+02		1.03E-03	3650	See Text	1.90E-04	1.49E-06	6.69E+05		8.25E+05		3.28E+03
Anthracene	3.16E+01	1.73E+02		8.21E-04	3650	See Text	1.90E-04	2.15E-07	4.64E+06		3.00E+05		9.49E+02
Phenol	2.88E-02	1.16E+00		1.23E-01	100	See Text	6.93E-03	1.44E-03	6.95E+02		4.96E+00		1.09E+01
TPH Aliphatic C5-C6	7.94E-01	5.31E+00		2.67E-02	350	See Text	1.98E-03	4.35E-04	2.30E+03		6.50E+02		4.70E+01
TPH Aliphatic C6-C8	3.98E+00	2.26E+01		6.27E-03	350	See Text	1.98E-03	1.02E-08	9.79E+07		9.49E+07		2.00E+06
TPH Aliphatic C8-C10	3.16E+01	1.73E+02		8.21E-04	700	See Text	9.90E-04	1.29E-17	7.78E+16		5.21E+17		1.59E+15
TPH Aliphatic C10-C12	2.51E+02	1.36E+03		1.04E-04	1750	See Text	3.96E-04	6.20E-32	1.61E+31		8.33E+32		3.29E+29
TPH Aliphatic C12-C16	5.01E+03	2.72E+04		5.21E-06	2450	See Text	2.83E-04	5.47E-123	########		1.88E+125		3.74E+120
TPH Aliphatic C16-C21	6.31E+05	3.43E+06		4.14E-08	3500	See Text	1.98E-04	0.00E+00	9.00E+99		1.16E+105		1.84E+98
TPH Aliphatic C21-C34	6.31E+05	3.43E+06		4.14E-08	3500	See Text	1.98E-04	0.00E+00	9.00E+99		1.16E+105		1.84E+98
TPH Aromatic C8-C10	1.58E+00	9.60E+00		1.48E-02	700	See Text	9.90E-04	6.95E-04	1.44E+03		4.73E+02		2.94E+01
TPH Aromatic C10-C12	2.51E+00	1.46E+01		9.68E-03	1750	See Text	3.96E-04	4.72E-03	2.12E+02		1.10E+02		4.33E+00
TPH Aromatic C12-C16	5.01E+00	2.82E+01		5.03E-03	2450	See Text	2.83E-04	1.47E-03	6.82E+02		7.01E+02		1.39E+01
TPH Aromatic C16-C21	1.58E+01	8.70E+01		1.63E-03	3500	See Text	1.98E-04	2.85E-05	3.51E+04		1.14E+05		7.17E+02
TPH Aromatic C21-C35	1.26E+02	6.84E+02		2.07E-04	3500	See Text	1.98E-04	1.31E-15	7.61E+14		1.96E+16		1.55E+13
Arsenic	4.19E+03	2.27E+04		6.23E-06	9E+09		7.70E-11	3.45E-01	2.90E+00		1.24E+03		2.97E-01
Cadmium	5.45E+02	2.96E+03		4.79E-05	9E+09		7.70E-11	3.45E-01	2.90E+00		8.07E-01		1.48E-03
Copper	4.46E+03	2.42E+04		5.85E-06	9E+09		7.70E-11	3.45E-01	2.90E+00		7.41E+02		1.66E-01
Chromium	7.18E+03	3.90E+04		3.64E-06	9E+09		7.70E-11	3.44E-01	2.91E+00		8.53E+02		1.19E-01
Lead	9.15E+03	4.97E+04		2.85E-06	9E+09		7.70E-11	3.44E-01	2.91E+00		3.92E+02		4.28E-02
Inorganic Mercury	4.30E+02	2.34E+03		6.07E-05	9E+09		7.70E-11	3.45E-01	2.90E+00		1.27E-01		2.96E-04
Nickel	5.64E+03	3.06E+04		4.63E-06	9E+09		7.70E-11	3.44E-01	2.90E+00		6.70E+02		1.19E-01
Selenium	5.00E+01	2.72E+02		5.20E-04	9E+09		7.70E-11	3.45E-01	2.90E+00		2.97E+00		5.92E-02
Zinc	1.17E+04	6.35E+04		2.23E-06	9E+09		7.70E-11	3.43E-01	2.91E+00		8.70E+03		7.44E-01
Water Soluble Boron	1.00E+01	5.53E+01		2.56E-03	9E+09		7.70E-11	3.45E-01	2.90E+00		1.20E+02		1.18E+01
Easily Liberatable Cyanide	2.00E+01	1.10E+02		1.29E-03	3500	See Text	1.98E-04	6.02E-06	1.66E+05		6.85E+03		3.40E+02
Total Cyanide	1.50E+02	8.15E+02		1.74E-04	3.50E+03	See Text	1.98E-04	4.24E-17	2.36E+16		3.62E+17		2.41E+15
Ammonia	6.50E-01	4.53E+00		3.13E-02	1.28E+03	ea/qjeg	5.42E-04	4.07E-02	2.46E+01		2.46E+01		3.01E+01

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	1 - 50m to Compliance

Level 3 - Groundwater - Domenico Steady State Equation

Site Parameters
As Per Soil Level 3

= Remedial Target Exceeds Solubility

Substance		Level 3 Remedial Targets			
	Measured GW	Groundwater (mg/l)		Water Level Exceeds Level 3 Target	
	$mg\ L^{-1}$	DWS	EQS	DWS	EQS
Benzene			2.96E-01		
Toluene			2.41E+01		
Ethylbenzene			2.09E+02		
m-Xylene			1.77E+02		
o-Xylene			1.06E+02		
p-Xylene			1.25E+02		
Benz[a]anthracene			3.23E+08		
Benzo[b]fluoranthene			4.16E+08		
Benzo[k]fluoranthene			2.28E+11		
Benzo[ghi]perylene			9.25E+21		
Benzo[a]pyrene			2.67E+10		
Chrysene			3.48E+06		
Dibenz[ah]anthracene			2.37E+15		
Fluoranthene			6.49E+00		
Indeno[123-cd]pyrene			1.47E+06		
Naphthalene			5.24E+00		
Pyrene			7.46E+01		
Acenaphthalene			7.48E-02		
Acenaphthene			2.00E+00		
Flourene			1.73E+01		
Phenanthrene			1.61E+03		
Anthracene			4.64E+02		
Phenol			5.35E+00		
TPH Aliphatic C5-C6			2.30E+01		
TPH Aliphatic C6-C8			9.79E+05		
TPH Aliphatic C8-C10			7.78E+14		
TPH Aliphatic C10-C12			1.61E+29		
TPH Aliphatic C12-C16			1.83E+120		
TPH Aliphatic C16-C21			9.00E+97		
TPH Aliphatic C21-C34			9.00E+97		
TPH Aromatic C8-C10			1.44E+01		
TPH Aromatic C10-C12			2.12E+00		
TPH Aromatic C12-C16			6.82E+00		
TPH Aromatic C16-C21			3.51E+02		
TPH Aromatic C21-C35			7.61E+12		
Arsenic			1.45E-01		
Cadmium			7.24E-04		
Copper			8.13E-02		
Chromium			5.81E-02		
Lead			2.09E-02		
Inorganic Mercury			1.45E-04		
Nickel			5.81E-02		
Selenium			2.90E-02		
Zinc			3.64E-01		
Water Soluble Boron			5.79E+00		
Easily Liberatable Cyanide			1.66E+02		
Total Cyanide			1.18E+15		
Ammonia			1.47E+01		

Hydrogeological risk assessment for land contamination
Remedial Targets Worksheet

Celtic
Design and Construct Remediation

Site Name:	Merton Street	**Case:**	2 - 200m to Compliance
Site Address:	Banbury		
Completed by:	JAS		
Date:	07 02 11		

Number of Substances = 48

		Compliance Criteria			Site Measured Concentrations		Physiochemical Properties					
Substance	Type	DWS	EQS	Comment	Measured Soil	Measured GW	Kaw (H)	Water solubility	Koc	Kow	Kd	Reference
		$mg\ L^{-1}$	$mg\ L^{-1}$		$mg\ kg^{-1}$	$mg\ L^{-1}$	$cm^3\ cm^{-3}$	$mg\ L^{-1}$	$Log\ (cm^3\ g^{-1})$	Log (ratio)	$cm^3\ g^{-1}$	Reference
Benzene	organic		1.00E-02				1.16E-01	1.78E+03	1.83E+00	2.13E+00		SR7
Toluene	organic		5.00E-02				1.15E-01	5.90E+02	2.31E+00	2.73E+00		SR7
Ethylbenzene	organic		5.00E-02				1.39E-01	1.80E+02	2.65E+00	3.15E+00		SR7
m-Xylene	organic		3.00E-02				1.12E-01	2.00E+02	2.69E+00	3.20E+00		SR7
o-Xylene	organic		3.00E-02				9.20E-02	1.73E+02	2.63E+00	3.12E+00		SR7
p-Xylene	organic		3.00E-02				1.07E-01	2.00E+02	2.65E+00	3.15E+00		SR7
Benz[a]anthracene	organic		2.40E-03	EQS Naphthalene			3.16E-05	3.80E-03	4.89E+00	5.91E+00		SR7
Benzo[b]fluoranthene	organic		3.00E-05				2.05E-06	2.00E-03	5.02E+00	6.08E+00		SR7
Benzo[k]fluoranthene	organic		3.00E-05				1.74E-06	8.00E-04	5.17E+00	6.26E+00		SR7
Benzo[ghi]perylene	organic		2.00E-06				2.36E-06	2.64E-04	5.62E+00	6.81E+00		SR7
Benzo[a]pyrene	organic		5.00E-05				1.76E-06	3.80E-03	5.11E+00	6.18E+00		SR7
Chrysene	organic		2.40E-03	EQS Naphthalene			3.18E-06	2.00E-03	4.74E+00	5.73E+00		SR7
Dibenz[ah]anthracene	organic		2.40E-03	EQS Naphthalene			5.40E-06	6.00E-04	5.27E+00	6.38E+00		SR7
Fluoranthene	organic		1.00E-04				6.29E-05	2.30E-01	4.26E+00	5.13E+00		SR7
Indeno[123-cd]pyrene	organic		2.00E-06				2.05E-06	2.00E-04	4.94E+00	5.97E+00		SR7
Naphthalene	organic		2.40E-03				6.62E-03	1.90E+01	2.81E+00	3.34E+00		SR7
Pyrene	organic		2.40E-03	EQS Naphthalene			5.64E-05	1.30E-01	4.21E+00	5.08E+00		SR7
Acenaphthalene	organic		2.40E-03	EQS Naphthalene			3.40E-03	1.61E+01	3.40E+00	4.00E+00		TR1
Acenaphthene	organic		2.40E-03	EQS Naphthalene			4.90E-03	3.80E+00	3.90E+00	3.90E+00		TR1
Flourene	organic		2.40E-03	EQS Naphthalene			3.20E-03	1.90E+00	4.10E+00	4.20E+00		TR1
Phenanthrene	organic		2.40E-03	EQS Naphthalene			1.30E-03	1.10E+00	4.40E+00	4.60E+00		TR1
Anthracene	organic		1.00E-04				1.60E-03	4.50E-02	4.50E+00	4.50E+00		TR1
Phenol	organic		7.70E-03				8.35E-06	8.41E+04	1.46E+00	1.48E+00		SR7/LQM
TPH Aliphatic C5-C6	organic		1.00E-02	Former DWS			2.10E+01	3.60E+01	2.90E+00	3.30E+00		LQM
TPH Aliphatic C6-C8	organic		1.00E-02				2.73E+01	5.40E+00	3.60E+00	4.10E+00		LQM
TPH Aliphatic C8-C10	organic		1.00E-02				4.15E+01	4.30E-01	4.50E+00	5.20E+00		LQM
TPH Aliphatic C10-C12	organic		1.00E-02				6.44E+01	3.40E-02	5.40E+00	6.30E+00		LQM
TPH Aliphatic C12-C16	organic		1.00E-02				1.71E+02	7.60E-04	6.70E+00	7.90E+00		LQM
TPH Aliphatic C16-C21	organic		1.00E-02				1.07E+03	2.50E-06	8.80E+00	1.04E+01		LQM
TPH Aliphatic C21-C34	organic		1.00E-02				1.07E+03	2.50E-06	8.80E+00	1.04E+01		LQM
TPH Aromatic C8-C10	organic		1.00E-02				2.53E-01	6.50E+01	3.20E+00	3.70E+00		LQM
TPH Aromatic C10-C12	organic		1.00E-02				7.22E-02	2.50E+01	3.40E+00	3.90E+00		LQM
TPH Aromatic C12-C16	organic		1.00E-02				1.26E-02	5.80E+00	3.70E+00	4.30E+00		LQM
TPH Aromatic C16-C21	organic		1.00E-02				6.95E-04	6.50E-01	4.20E+00	4.90E+00		LQM
TPH Aromatic C21-C35	organic		1.00E-02				2.48E-05	6.60E-03	5.10E+00	6.00E+00		LQM
Arsenic	inorganic		5.00E-02					1.25E+06			4.19E+03	Site Data
Cadmium	inorganic		2.50E-04					1.62E+06			5.45E+02	Site Data
Copper	inorganic		2.80E-02					1.38E+06			4.46E+03	Site Data
Chromium	inorganic		2.00E-02					5.85E+05			7.18E+03	Site Data
Lead	inorganic		7.20E-03								9.15E+03	Site Data
Inorganic Mercury	inorganic		5.00E-05					7.40E+04			4.30E+02	Site Data
Nickel	inorganic		2.00E-02					2.50E+06			5.64E+03	Site Data
Selenium	inorganic		1.00E-02	DWS				2.17E+06			5.00E+01	EA SGV Report
Zinc	inorganic		1.25E-01					4.32E+06			1.17E+04	Site Data
Water Soluble Boron	inorganic		2.00E+00								1.00E+01	Water Sol
Easily Liberatable Cyanide	inorganic		1.00E-03								2.00E+01	Site Data
Total Cyanide	inorganic		5.00E-02	DWS							1.50E+02	Site Data
Ammonia	inorganic		6.00E-01					8.99E+05			6.50E-01	ea

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	2 - 200m to Compliance

Level 1 - Soil

Soil Parameters				Source of parameter value
Total Porosity	n	0.53	fraction	CLEA Sandy Loam
Fraction of organic carbon (in soil)	foc	1.00E-02	fraction	Reasonable Value
Water filled soil porosity	θ_w	0.2	fraction	CLEA Sandy Loam
Air filled soil porosity	θ_a	0.33	fraction	CLEA Sandy Loam
Bulk density of soil zone material	ρ	1.21	g/cm^3	CLEA Sandy Loam

= Target Exceeds Solubility

		Level 1 Remedial Targets							
Substance	Kd	Soil (mg/kg)		Pore Water (mg/l)		Soil Level Exceeds Level 1 Target		Water Level Exceeds Level 1 Target	
	$cm^3 g^{-1}$	DWS	EQS	DWS	EQS	DWS	EQS	DWS	EQS
Benzene	6.76E-01		8.73E-03		1.00E-02				
Toluene	2.04E+00		1.12E-01		5.00E-02				
Ethylbenzene	4.47E+00		2.34E-01		5.00E-02				
m-Xylene	4.90E+00		1.53E-01		3.00E-02				
o-Xylene	4.27E+00		1.34E-01		3.00E-02				
p-Xylene	4.47E+00		1.40E-01		3.00E-02				
Benz[a]anthracene	7.76E+02		1.86E+00		2.40E-03				
Benzo[b]fluoranthene	1.05E+03		3.14E-02		3.00E-05				
Benzo[k]fluoranthene	1.48E+03		4.44E-02		3.00E-05				
Benzo[ghi]perylene	4.17E+03		8.34E-03		2.00E-06				
Benzo[a]pyrene	1.29E+03		6.44E-02		5.00E-05				
Chrysene	5.50E+02		1.32E+00		2.40E-03				
Dibenz[ah]anthracene	1.86E+03		4.47E+00		2.40E-03				
Fluoranthene	1.82E+02		1.82E-02		1.00E-04				
Indeno[123-cd]pyrene	8.71E+02		1.74E-03		2.00E-06				
Naphthalene	6.46E+00		1.59E-02		2.40E-03				
Pyrene	1.62E+02		3.90E-01		2.40E-03				
Acenaphthalene	2.51E+01		6.07E-02		2.40E-03				
Acenaphthene	7.94E+01		1.91E-01		2.40E-03				
Flourene	1.26E+02		3.03E-01		2.40E-03				
Phenanthrene	2.51E+02		6.03E-01		2.40E-03				
Anthracene	3.16E+02		3.16E-02		1.00E-04				
Phenol	2.88E-01		3.49E-03		7.70E-03				
TPH Aliphatic C5-C6	7.94E+00		1.38E-01		1.00E-02				
TPH Aliphatic C6-C8	3.98E+01		4.74E-01		1.00E-02				
TPH Aliphatic C8-C10	3.16E+02		3.28E+00		1.00E-02				
TPH Aliphatic C10-C12	2.51E+03		2.53E+01		1.00E-02				
TPH Aliphatic C12-C16	5.01E+04		5.02E+02		1.00E-02				
TPH Aliphatic C16-C21	6.31E+06		6.31E+04		1.00E-02				
TPH Aliphatic C21-C34	6.31E+06		6.31E+04		1.00E-02				
TPH Aromatic C8-C10	1.58E+01		1.61E-01		1.00E-02				
TPH Aromatic C10-C12	2.51E+01		2.53E-01		1.00E-02				
TPH Aromatic C12-C16	5.01E+01		5.03E-01		1.00E-02				
TPH Aromatic C16-C21	1.58E+02		1.59E+00		1.00E-02				
TPH Aromatic C21-C35	1.26E+03		1.26E+01		1.00E-02				
Arsenic	4.19E+03		2.10E+02		5.00E-02				
Cadmium	5.45E+02		1.36E-01		2.50E-04				
Copper	4.46E+03		1.25E+02		2.80E-02				
Chromium	7.18E+03		1.44E+02		2.00E-02				
Lead	9.15E+03		6.59E+01		7.20E-03				
Inorganic Mercury	4.30E+02		2.15E-02		5.00E-05				
Nickel	5.64E+03		1.13E+02		2.00E-02				
Selenium	5.00E+01		5.02E-01		1.00E-02				
Zinc	1.17E+04		1.46E+03		1.25E-01				
Water Soluble Boron	1.00E+01		2.03E+01		2.00E+00				
Easily Liberatable Cyanide	2.00E+01		2.02E-02		1.00E-03				
Total Cyanide	1.50E+02		7.51E+00		5.00E-02				
Ammonia	6.50E-01		4.89E-01		6.00E-01				

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	2 - 200m to Compliance

Level 2 - Soil (Afu = 1)

Site Parameters				Source of parameter value		
Infiltration:	3.64E-04	m/d	Inf	Estmated Based on 20% Precipitation	Calculated:	
Saturated aquifer thickness:	3	m	da	See Text Discussion	Transmissivity:	17.28
Mixing Zone thickness:	3	m	Mz	See Text Discussion	DF (Cu = 0):	2.04E+00
Hydraulic Gradient:	4.40E-03	fraction	I	Measured	Q = k.i.Mz:	0.076032
Hydraulic conductivity of aquifer:	5.76	m/d	K		L.inf:	7.28E-02
Length of source in direction of flow:	200	m	L	See Text Discussion		

[magenta] = Target Exceeds Solubility

Substance	Background	Dilution Factor		Level 2 Remedial Targets Soil (mg/kg)		Pore Water (mg/l)		Soil Level Exceeds Level 2 Target		Water Level Exceeds Level 2 Target	
	Cu	DWS	EQS	DWS	EQS	DWS	EQS	DWS	EQS	DWS	EQS
Benzene	0		2.04E+00		1.78E-02		2.04E-02				
Toluene	0		2.04E+00		2.29E-01		1.02E-01				
Ethylbenzene	0		2.04E+00		4.77E-01		1.02E-01				
m-Xylene	0		2.04E+00		3.12E-01		6.13E-02				
o-Xylene	0		2.04E+00		2.73E-01		6.13E-02				
p-Xylene	0		2.04E+00		2.86E-01		6.13E-02				
Benz[a]anthracene	0		2.04E+00		3.81E+00		4.91E-03				
Benzo[b]fluoranthene	0		2.04E+00		6.42E-02		6.13E-05				
Benzo[k]fluoranthene	0		2.04E+00		9.07E-02		6.13E-05				
Benzo[ghi]perylene	0		2.04E+00		1.70E-02		4.09E-06				
Benzo[a]pyrene	0		2.04E+00		1.32E-01		1.02E-04				
Chrysene	0		2.04E+00		2.70E+00		4.91E-03				
Dibenz[ah]anthracene	0		2.04E+00		9.14E+00		4.91E-03				
Fluoranthene	0		2.04E+00		3.72E-02		2.04E-04				
Indeno[123-cd]pyrene	0		2.04E+00		3.56E-03		4.09E-06				
Naphthalene	0		2.04E+00		3.25E-02		4.91E-03				
Pyrene	0		2.04E+00		7.97E-01		4.91E-03				
Acenaphthalene	0		2.04E+00		1.24E-01		4.91E-03				
Acenaphthene	0		2.04E+00		3.91E-01		4.91E-03				
Flourene	0		2.04E+00		6.19E-01		4.91E-03				
Phenanthrene	0		2.04E+00		1.23E+00		4.91E-03				
Anthracene	0		2.04E+00		6.47E-02		2.04E-04				
Phenol	0		2.04E+00		7.14E-03		1.57E-02				
TPH Aliphatic C5-C6	0		2.04E+00		2.83E-01		2.04E-02				
TPH Aliphatic C6-C8	0		2.04E+00		9.69E-01		2.04E-02				
TPH Aliphatic C8-C10	0		2.04E+00		6.70E+00		2.04E-02				
TPH Aliphatic C10-C12	0		2.04E+00		5.17E+01		2.04E-02				
TPH Aliphatic C12-C16	0		2.04E+00		1.03E+03		2.04E-02				
TPH Aliphatic C16-C21	0		2.04E+00		1.29E+05		2.04E-02				
TPH Aliphatic C21-C34	0		2.04E+00		1.29E+05		2.04E-02				
TPH Aromatic C8-C10	0		2.04E+00		3.29E-01		2.04E-02				
TPH Aromatic C10-C12	0		2.04E+00		5.17E-01		2.04E-02				
TPH Aromatic C12-C16	0		2.04E+00		1.03E+00		2.04E-02				
TPH Aromatic C16-C21	0		2.04E+00		3.24E+00		2.04E-02				
TPH Aromatic C21-C35	0		2.04E+00		2.57E+01		2.04E-02				
Arsenic	0		2.04E+00		4.28E+02		1.02E-01				
Cadmium	0		2.04E+00		2.79E-01		5.11E-04				
Copper	0		2.04E+00		2.55E+02		5.72E-02				
Chromium	0		2.04E+00		2.94E+02		4.09E-02				
Lead	0		2.04E+00		1.35E+02		1.47E-02				
Inorganic Mercury	0		2.04E+00		4.40E-02		1.02E-04				
Nickel	0		2.04E+00		2.31E+02		4.09E-02				
Selenium	0		2.04E+00		1.03E+00		2.04E-02				
Zinc	0		2.04E+00		2.99E+03		2.56E-01				
Water Soluble Boron	0		2.04E+00		4.16E+01		4.09E+00				
Easily Liberatable Cyanide	0		2.04E+00		4.12E-02		2.04E-03				
Total Cyanide	0		2.04E+00		1.53E+01		1.02E-01				
Ammonia	0		2.04E+00		1.00E+00		1.23E+00				

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	2 - 200m to Compliance

Level 3 - Soil - Domenico Steady State Equation

Site Parameters				Source of parameter value		
Bulk density of aquifer materials:	1.9	g/cm^3	ρ	See Text Discussion	Calculated or from Level 2:	
Effective porosity of aquifer:	0.35	fraction	n	"	Hydraulic Gradient:	8.61E-03
Distance to compliance point from site boundary:	200	m		"	Hydraulic Conductivity:	5.76
Width of plume at source:	200	m	Sz	"	Mz = Sy	3
Fraction of organic carbon in aquifer:	0.001			"	Length of source	200
	30		ax	"	Distance from centre of source to comliance x	300
	3		az	"		
	0.3		ay	"		

= Target Exceeds Solubility

Level 3 Remedial Targets

Substance	Kd	Rf	Apply Decay	u	Half Life		λ	ced/co	AF	Soil (mg/kg)		Pore Water (mg/l)	
	$cm^3\ g^{-1}$	fraction	1 = Dissolved Phase Only	m/d	days	Reference	d^{-1}	fraction	fraction	DWS	EQS	DWS	EQS
Benzene	6.76E-02	1.37E+00		1.04E-01	350	P2-228	1.98E-03	2.96E-03	3.38E+02		6.03E+00		6.91E+00
Toluene	2.04E-01	2.11E+00		6.72E-02	200	P2-228	3.47E-03	3.89E-05	2.57E+04		5.88E+03		2.63E+03
Ethylbenzene	4.47E-01	3.42E+00		4.14E-02	200	P2-228	3.47E-03	1.56E-06	6.41E+05		3.06E+05		6.55E+04
m-Xylene	4.90E-01	3.66E+00		3.87E-02	200	P2-228	3.47E-03	9.39E-07	1.07E+06		3.33E+05		6.53E+04
o-Xylene	4.27E-01	3.32E+00		4.27E-02	200	P2-228	3.47E-03	1.99E-06	5.03E+05		1.37E+05		3.08E+04
p-Xylene	4.47E-01	3.42E+00		4.14E-02	200	P2-228	3.47E-03	1.56E-06	6.41E+05		1.83E+05		3.93E+04
Benz[a]anthracene	7.76E+01	4.22E+02		3.36E-04	3650	See Text	1.90E-04	2.43E-17	4.12E+16		1.57E+17		2.02E+14
Benzo[b]fluoranthene	1.05E+02	5.69E+02		2.49E-04	3650	See Text	1.90E-04	3.32E-20	3.01E+19		1.93E+18		1.85E+15
Benzo[k]fluoranthene	1.48E+02	8.04E+02		1.76E-04	3650	See Text	1.90E-04	4.25E-24	2.35E+23		2.13E+22		1.44E+19
Benzo[ghi]perylene	4.17E+02	2.26E+03		6.26E-05	3650	See Text	1.90E-04	8.44E-41	1.19E+40		2.02E+38		4.85E+34
Benzo[a]pyrene	1.29E+02	7.00E+02		2.02E-04	3650	See Text	1.90E-04	1.85E-22	5.40E+21		7.11E+20		5.52E+17
Chrysene	5.50E+01	2.99E+02		4.74E-04	3650	See Text	1.90E-04	1.56E-14	6.43E+13		1.73E+14		3.15E+11
Dibenz[ah]anthracene	1.86E+02	1.01E+03		1.40E-04	3650	See Text	1.90E-04	4.27E-27	2.34E+26		2.14E+27		1.15E+24
Fluoranthene	1.82E+01	9.98E+01		1.42E-03	3650	See Text	1.90E-04	2.80E-08	3.57E+07		1.33E+06		7.31E+03
Indeno[123-cd]pyrene	8.71E+01	4.74E+02		2.99E-04	3650	See Text	1.90E-04	2.16E-18	4.62E+17		1.65E+15		1.89E+12
Naphthalene	6.46E-01	4.50E+00		3.15E-02	300	P2-228	2.31E-03	4.07E-06	2.46E+05		7.99E+03		1.21E+03
Pyrene	1.62E+01	8.90E+01		1.59E-03	3650	See Text	1.90E-04	8.19E-08	1.22E+07		9.73E+06		5.99E+04
Acenaphthalene	2.51E+00	1.46E+01		9.68E-03	3650	See Text	1.90E-04	2.72E-03	3.67E+02		4.56E+01		1.80E+00
Acenaphthene	7.94E+00	4.41E+01		3.21E-03	3650	See Text	1.90E-04	1.71E-05	5.84E+04		2.28E+04		2.87E+02
Flourene	1.26E+01	6.93E+01		2.04E-03	3650	See Text	1.90E-04	6.96E-07	1.44E+06		8.88E+05		7.05E+03
Phenanthrene	2.51E+01	1.37E+02		1.03E-03	3650	See Text	1.90E-04	9.51E-10	1.05E+09		1.30E+09		5.16E+06
Anthracene	3.16E+01	1.73E+02		8.21E-04	3650	See Text	1.90E-04	5.83E-11	1.71E+10		1.11E+09		3.50E+06
Phenol	2.88E-02	1.16E+00		1.23E-01	100	See Text	6.93E-03	2.25E-05	4.45E+04		3.18E+02		7.00E+02
TPH Aliphatic C5-C6	7.94E-01	5.31E+00		2.67E-02	350	See Text	1.98E-03	3.77E-06	2.65E+05		7.50E+04		5.42E+03
TPH Aliphatic C6-C8	3.98E+00	2.26E+01		6.27E-03	350	See Text	1.98E-03	7.34E-13	1.36E+12		1.32E+12		2.78E+10
TPH Aliphatic C8-C10	3.16E+01	1.73E+02		8.21E-04	700	See Text	9.90E-04	1.57E-25	6.37E+24		4.27E+25		1.30E+23
TPH Aliphatic C10-C12	2.51E+02	1.36E+03		1.04E-04	1750	See Text	3.96E-04	8.13E-46	1.23E+45		6.36E+46		2.51E+43
TPH Aliphatic C12-C16	5.01E+03	2.72E+04		5.21E-06	2450	See Text	2.83E-04	1.26E-174	########		8.11E+176		1.62E+172
TPH Aliphatic C16-C21	6.31E+05	3.43E+06		4.14E-08	3500	See Text	1.98E-04	0.00E+00	9.00E+99		1.16E+105		1.84E+98
TPH Aliphatic C21-C34	6.31E+05	3.43E+06		4.14E-08	3500	See Text	1.98E-04	0.00E+00	9.00E+99		1.16E+105		1.84E+98
TPH Aromatic C8-C10	1.58E+00	9.60E+00		1.48E-02	700	See Text	9.90E-04	7.56E-06	1.32E+05		4.35E+04		2.70E+03
TPH Aromatic C10-C12	2.51E+00	1.46E+01		9.68E-03	1750	See Text	3.96E-04	1.36E-04	7.36E+03		3.81E+03		1.50E+02
TPH Aromatic C12-C16	5.01E+00	2.82E+01		5.03E-03	2450	See Text	2.83E-04	2.31E-05	4.33E+04		4.45E+04		8.85E+02
TPH Aromatic C16-C21	1.58E+01	8.70E+01		1.63E-03	3500	See Text	1.98E-04	6.86E-08	1.46E+07		4.73E+07		2.98E+05
TPH Aromatic C21-C35	1.26E+02	6.84E+02		2.07E-04	3500	See Text	1.98E-04	1.12E-22	8.93E+21		2.30E+23		1.83E+20
Arsenic	4.19E+03	2.27E+04		6.23E-06	9E+09		7.70E-11	1.73E-01	5.78E+00		2.48E+03		5.91E-01
Cadmium	5.45E+02	2.96E+03		4.79E-05	9E+09		7.70E-11	1.74E-01	5.76E+00		1.61E+00		2.94E-03
Copper	4.46E+03	2.42E+04		5.85E-06	9E+09		7.70E-11	1.73E-01	5.78E+00		1.48E+03		3.31E-01
Chromium	7.18E+03	3.90E+04		3.64E-06	9E+09		7.70E-11	1.73E-01	5.79E+00		1.70E+03		2.37E-01
Lead	9.15E+03	4.97E+04		2.85E-06	9E+09		7.70E-11	1.72E-01	5.80E+00		7.82E+02		8.54E-02
Inorganic Mercury	4.30E+02	2.34E+03		6.07E-05	9E+09		7.70E-11	1.74E-01	5.76E+00		2.53E-01		5.89E-04
Nickel	5.64E+03	3.06E+04		4.63E-06	9E+09		7.70E-11	1.73E-01	5.79E+00		1.33E+03		2.37E-01
Selenium	5.00E+01	2.72E+02		5.20E-04	9E+09		7.70E-11	1.74E-01	5.76E+00		5.91E+00		1.18E-01
Zinc	1.17E+04	6.35E+04		2.23E-06	9E+09		7.70E-11	1.72E-01	5.82E+00		1.74E+04		1.49E+00
Water Soluble Boron	1.00E+01	5.53E+01		2.56E-03	9E+09		7.70E-11	1.74E-01	5.76E+00		2.39E+02		2.35E+01
Easily Liberatable Cyanide	2.00E+01	1.10E+02		1.29E-03	3500	See Text	1.98E-04	7.15E-09	1.40E+08		5.77E+06		2.86E+05
Total Cyanide	1.50E+02	8.15E+02		1.74E-04	3.50E+03	See Text	1.98E-04	8.53E-25	1.17E+24		1.80E+25		1.20E+23
Ammonia	6.50E-01	4.53E+00		3.13E-02	1.28E+03	ea/qjeg	5.42E-04	4.01E-03	2.50E+02		2.50E+02		3.06E+02

Remedial Targets Worksheet

Site Name:	Merton Street	Case:	2 - 200m to Compliance

Level 3 - Groundwater - Domenico Steady State Equation

Site Parameters
As Per Soil Level 3

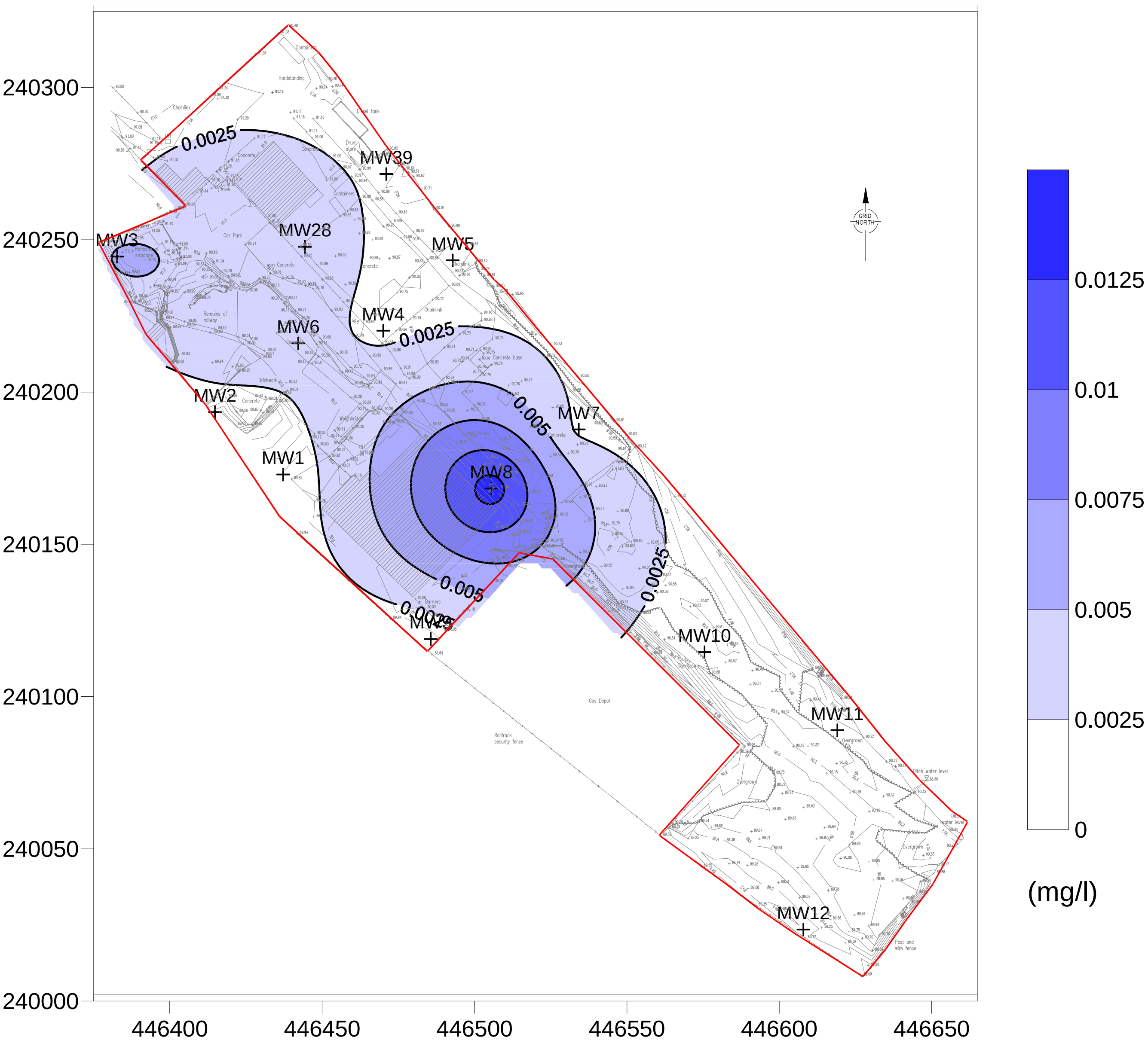
= Remedial Target Exceeds Solubility

Substance		Level 3 Remedial Targets			
	Measured GW	Groundwater (mg/l)		Water Level Exceeds Level 3 Target	
	mg L^{-1}	DWS	EQS	DWS	EQS
Benzene			3.38E+00		
Toluene			1.28E+03		
Ethylbenzene			3.20E+04		
m-Xylene			3.20E+04		
o-Xylene			1.51E+04		
p-Xylene			1.92E+04		
Benz[a]anthracene			9.88E+13		
Benzo[b]fluoranthene			9.04E+14		
Benzo[k]fluoranthene			7.05E+18		
Benzo[ghi]perylene			2.37E+34		
Benzo[a]pyrene			2.70E+17		
Chrysene			1.54E+11		
Dibenz[ah]anthracene			5.62E+23		
Fluoranthene			3.57E+03		
Indeno[123-cd]pyrene			9.25E+11		
Naphthalene			5.90E+02		
Pyrene			2.93E+04		
Acenaphthalene			8.82E-01		
Acenaphthene			1.40E+02		
Flourene			3.45E+03		
Phenanthrene			2.52E+06		
Anthracene			1.71E+06		
Phenol			3.43E+02		
TPH Aliphatic C5-C6			2.65E+03		
TPH Aliphatic C6-C8			1.36E+10		
TPH Aliphatic C8-C10			6.37E+22		
TPH Aliphatic C10-C12			1.23E+43		
TPH Aliphatic C12-C16			7.91E+171		
TPH Aliphatic C16-C21			9.00E+97		
TPH Aliphatic C21-C34			9.00E+97		
TPH Aromatic C8-C10			1.32E+03		
TPH Aromatic C10-C12			7.36E+01		
TPH Aromatic C12-C16			4.33E+02		
TPH Aromatic C16-C21			1.46E+05		
TPH Aromatic C21-C35			8.93E+19		
Arsenic			2.89E-01		
Cadmium			1.44E-03		
Copper			1.62E-01		
Chromium			1.16E-01		
Lead			4.18E-02		
Inorganic Mercury			2.88E-04		
Nickel			1.16E-01		
Selenium			5.76E-02		
Zinc			7.27E-01		
Water Soluble Boron			1.15E+01		
Easily Liberatable Cyanide			1.40E+05		
Total Cyanide			5.86E+22		
Ammonia			1.50E+02		

APPENDIX C

CONTOURS OF POTENTIAL CONTAMINANT CONCENTRATION - GROUNDWATER

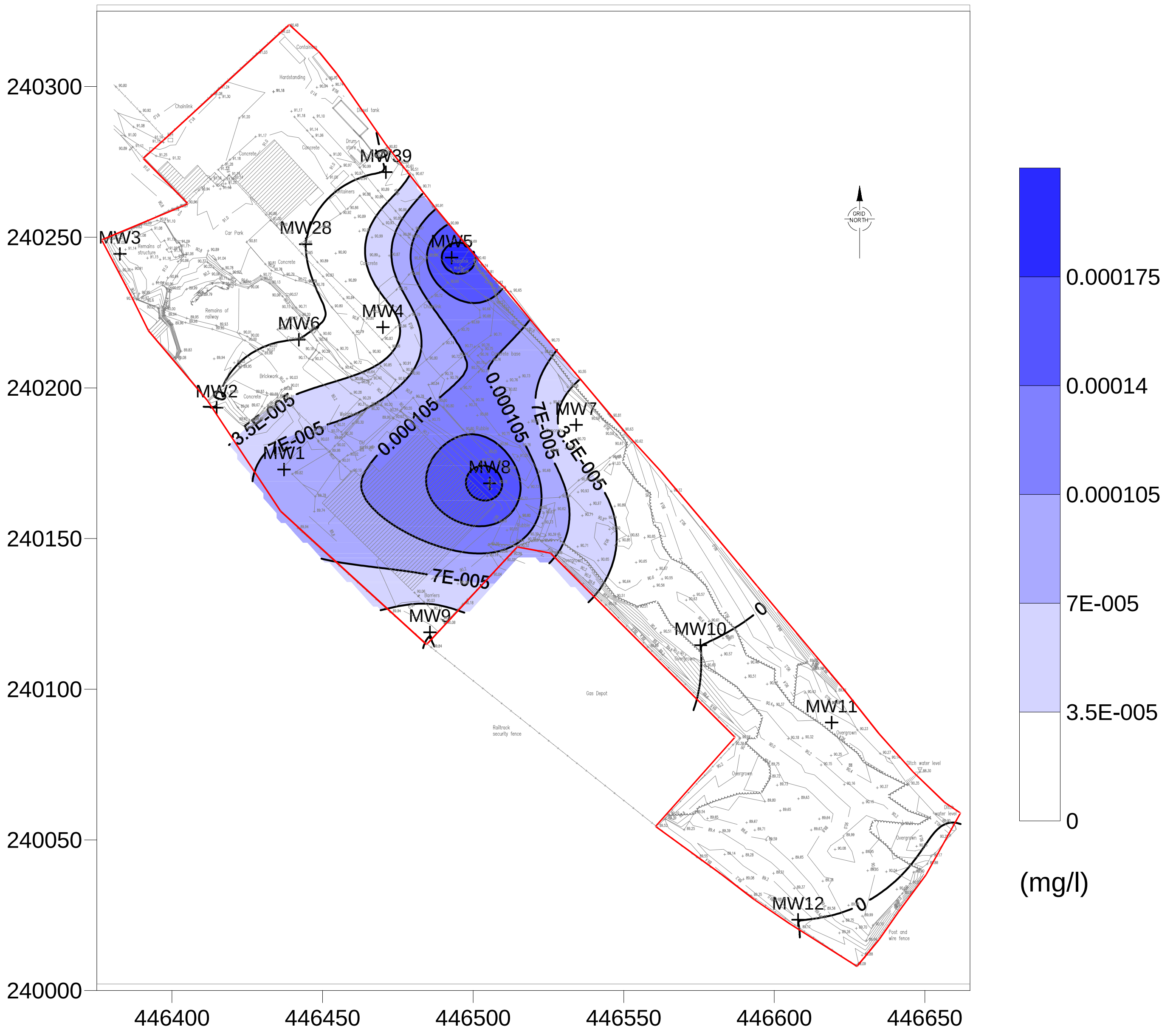
Merton Street: Inferred Contours of Arsenic in Groundwater Jan 1999



EQS = 0.05 (mg/l) : EQS Exceeds Data Maximum Value

Data Maximum Value = 0.014 (mg/l)

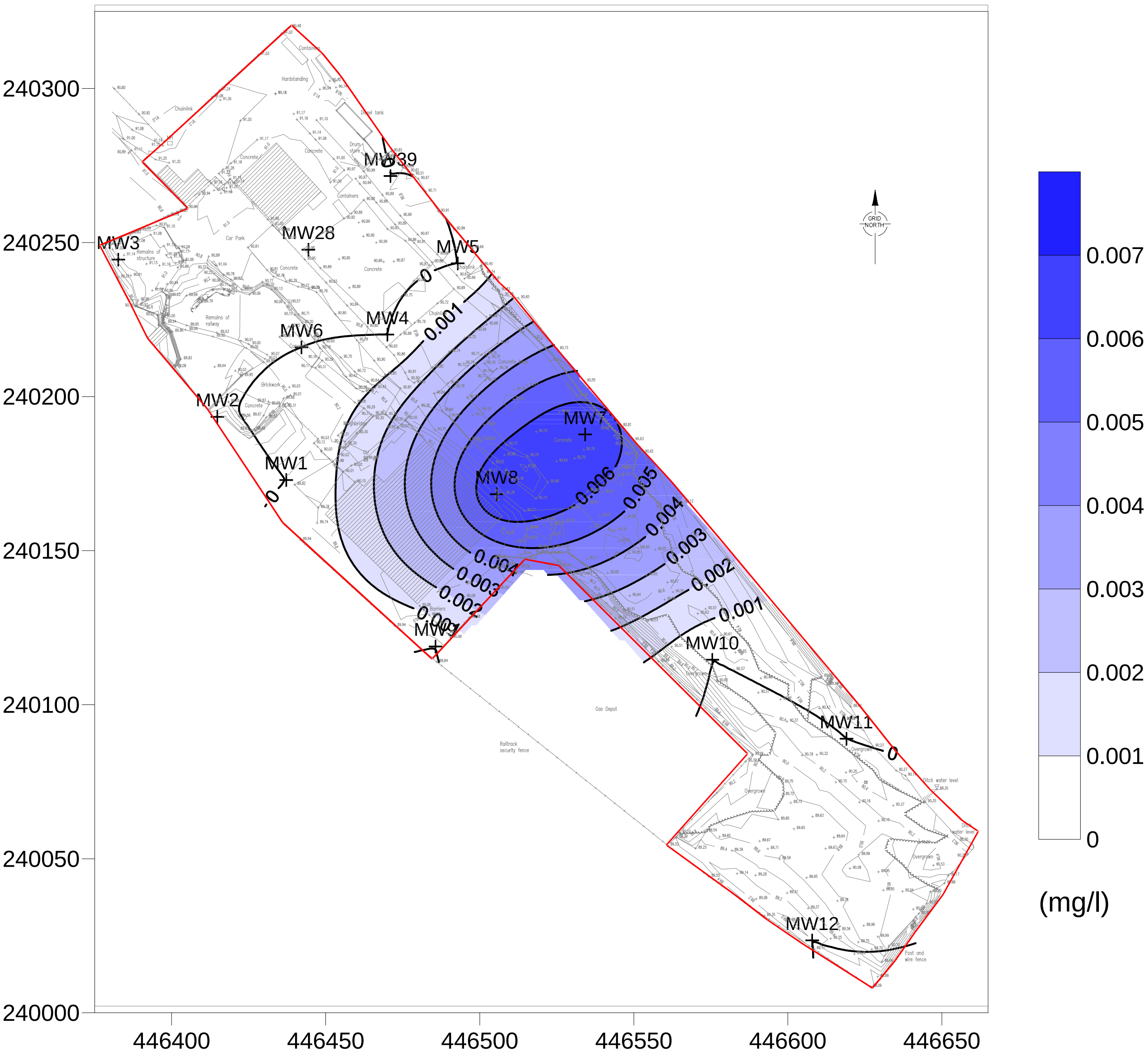
Merton Street: Inferred Contours of Cadmium in Groundwater Jan 1999



EQS = 0.00025 (mg/l) : EQS Exceeds Data Maximum Value

Data Maximum Value = 0.0002 (mg/l)

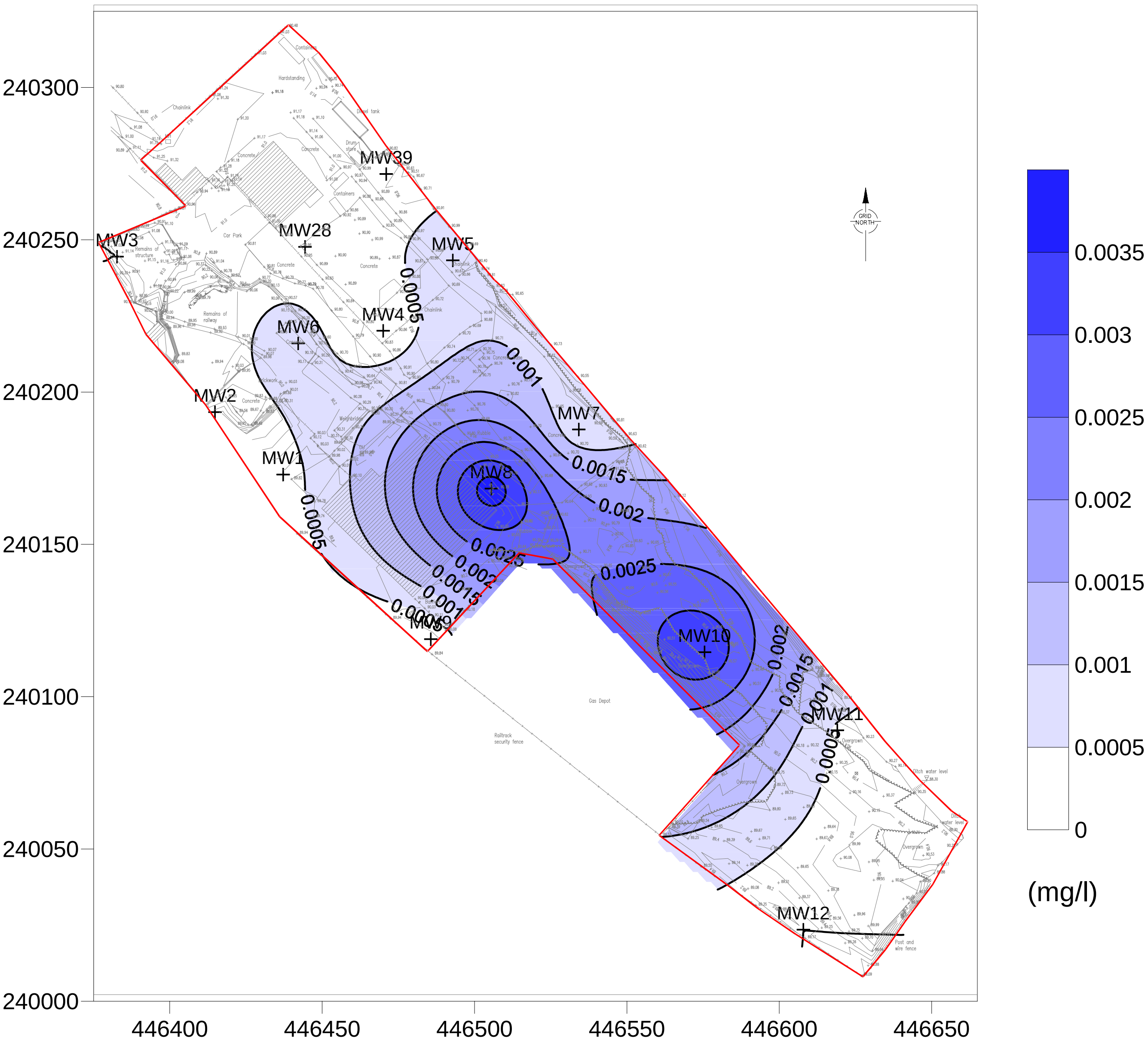
Merton Street: Inferred Contours of Copper in Groundwater Jan 1999



EQS = 0.028 (mg/l) : EQS Exceeds Data Maximum Value

Data Maximum Value = 0.007 (mg/l)

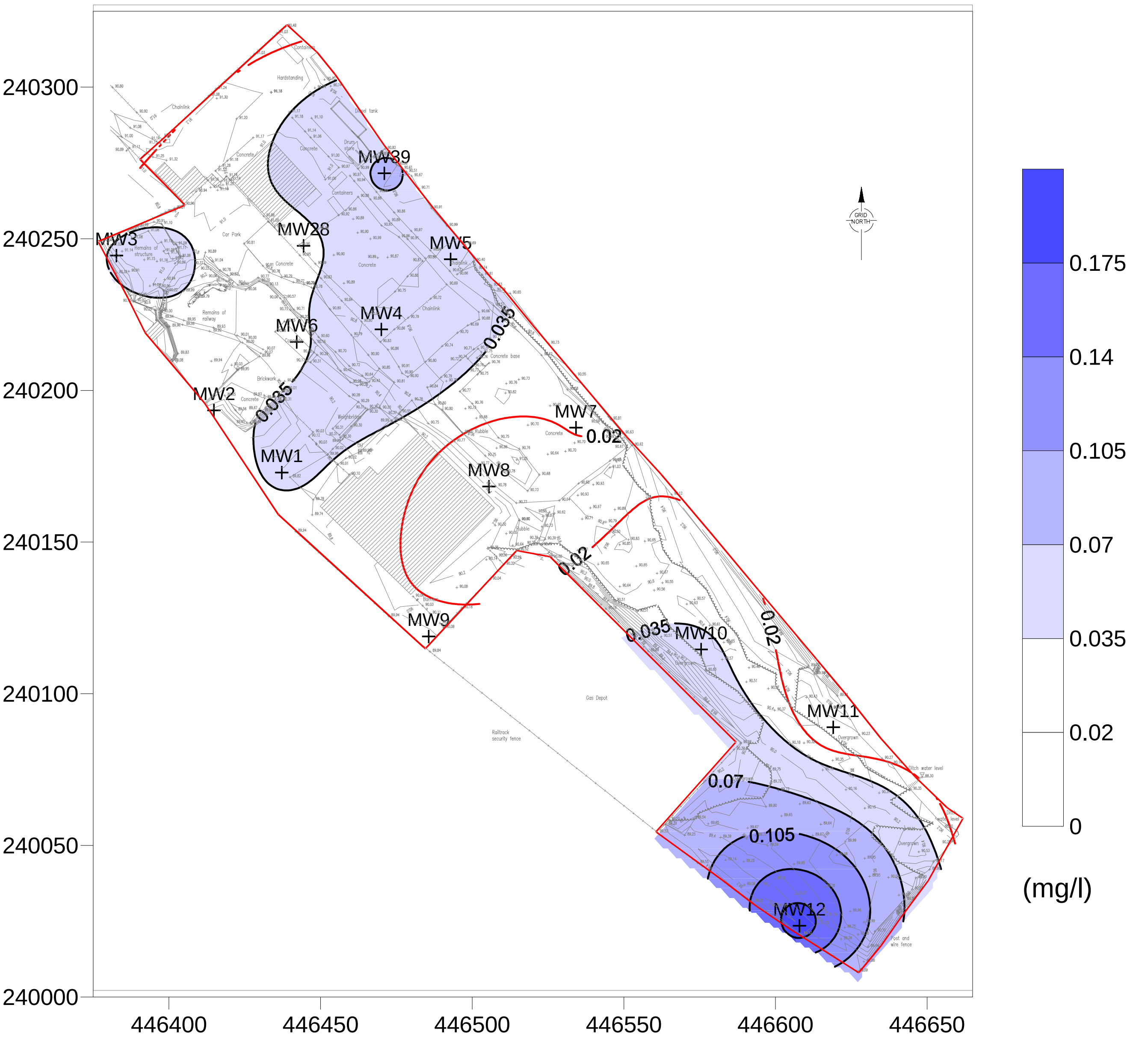
Merton Street: Inferred Contours of Lead in Groundwater Jan 1999



EQS = 0.0072 (mg/l) : EQS Exceeds Data Maximum Value

Data Maximum Value = 0.0039 (mg/l)

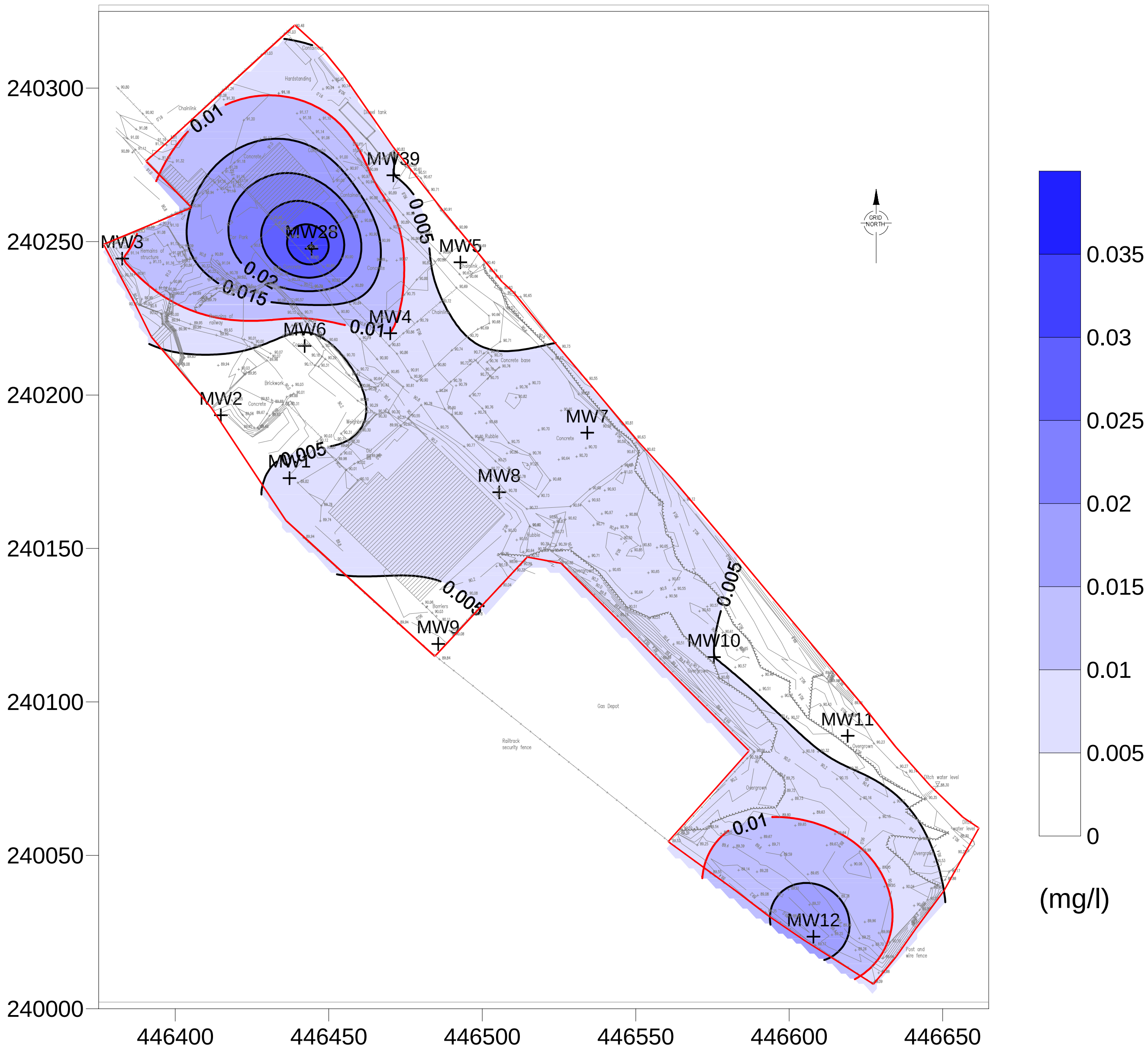
Merton Street: Inferred Contours of Nickel in Groundwater Jan 1999



EQS = 0.02 (mg/l)

Data Maximum Value = 0.2 (mg/l)

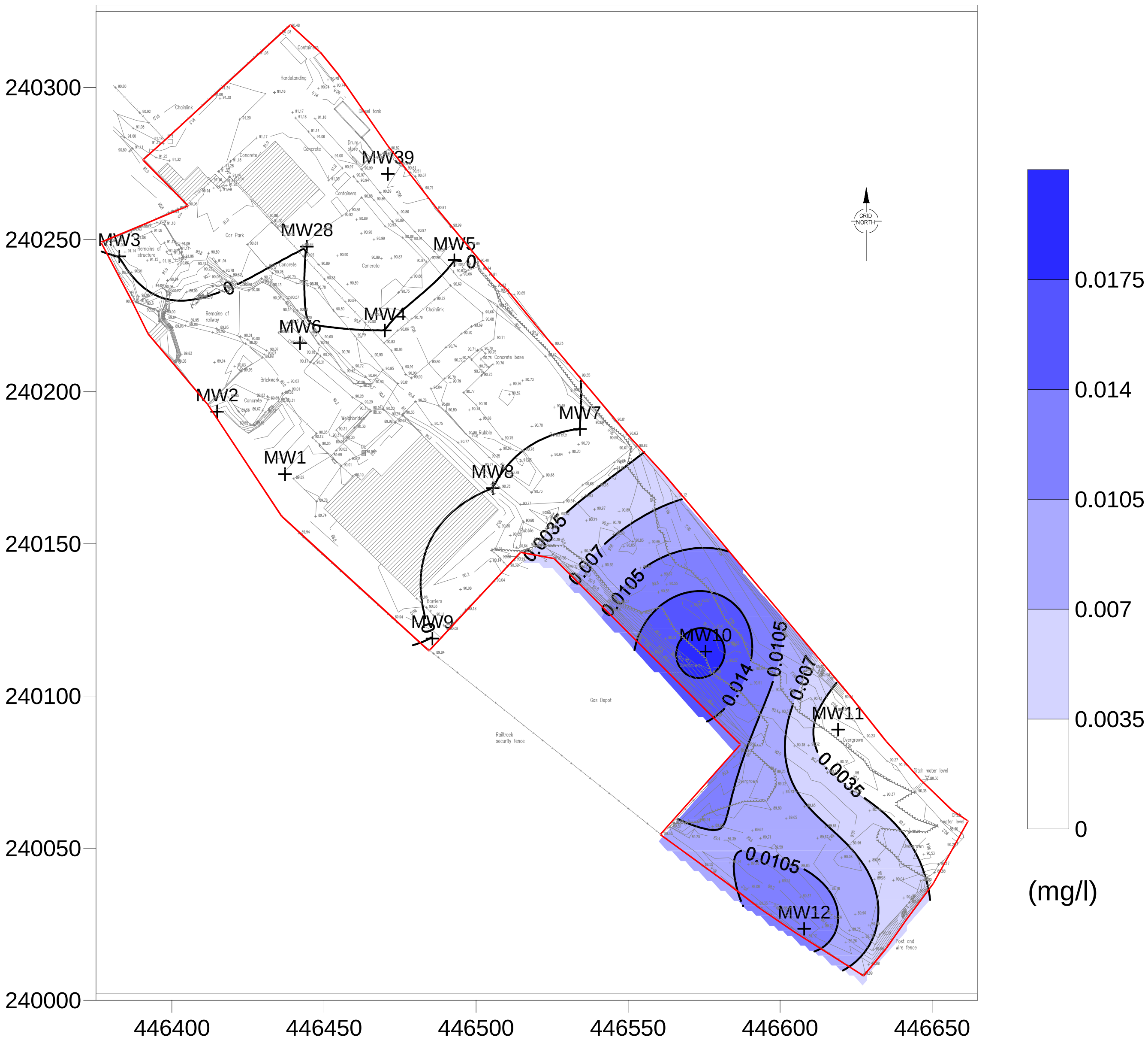
Merton Street: Inferred Contours of Selenium in Groundwater Jan 1999



EQS = 0.01 (mg/l)

Data Maximum Value = 0.036 (mg/l)

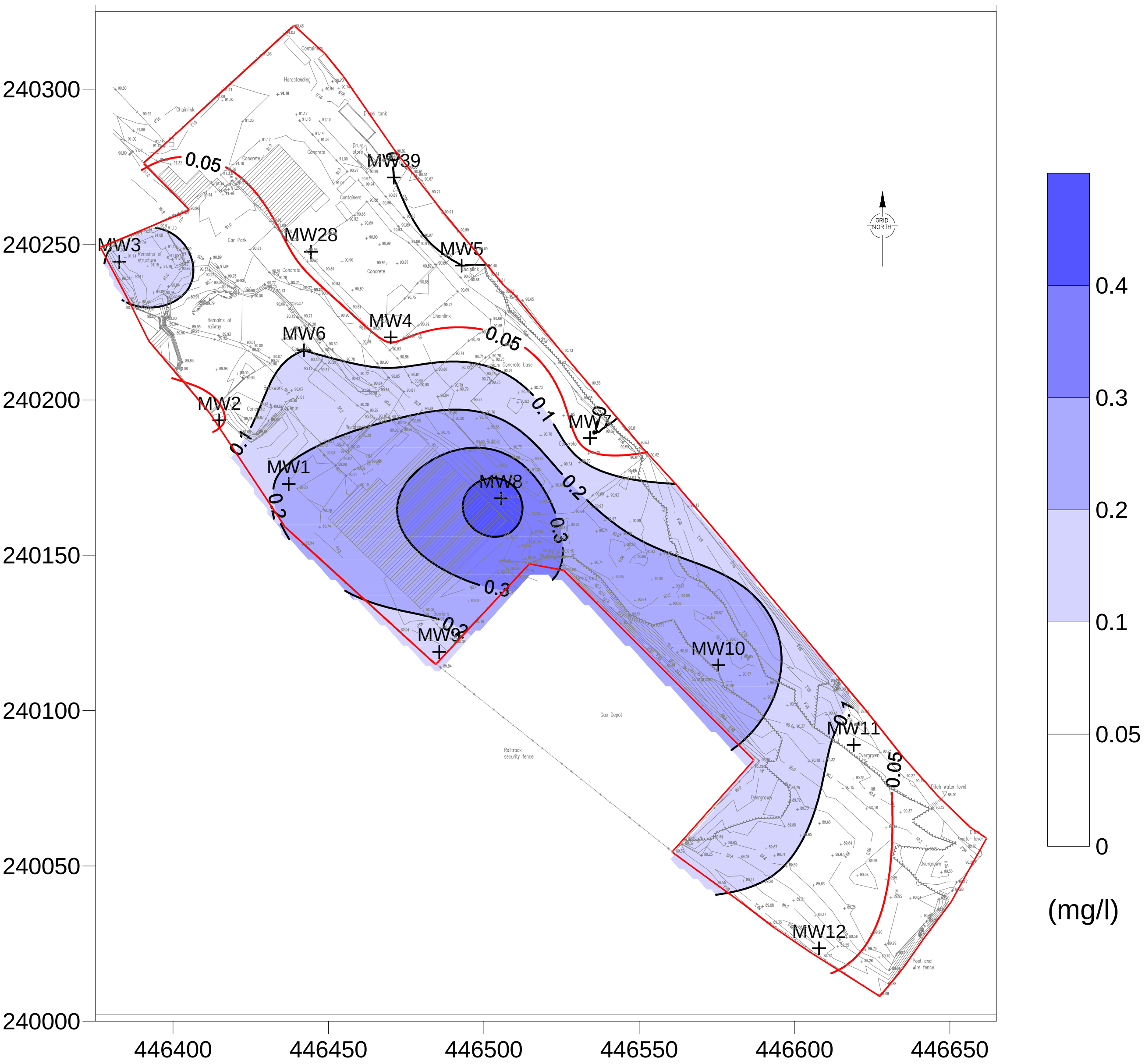
Merton Street: Inferred Contours of Zinc in Groundwater Jan 1999



EQS = 0.125 (mg/l) : EQS Exceeds Data Maximum Value

Data Maximum Value = 0.02 (mg/l)

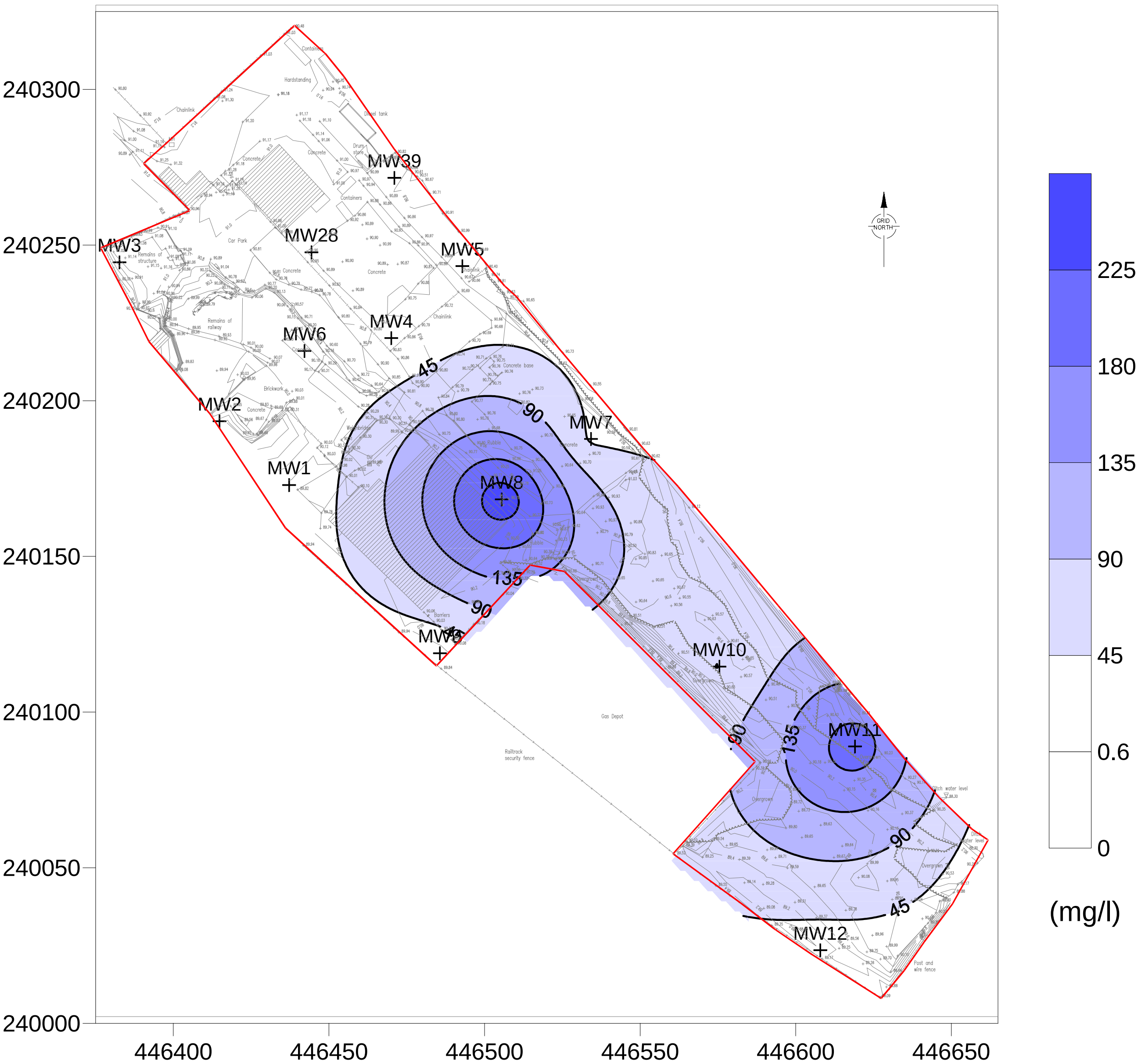
Merton Street: Inferred Contours of Total Cyanide in Groundwater Jan 1999



EQS = 0.05 (mg/l)

Data Maximum Value = 0.48 (mg/l)

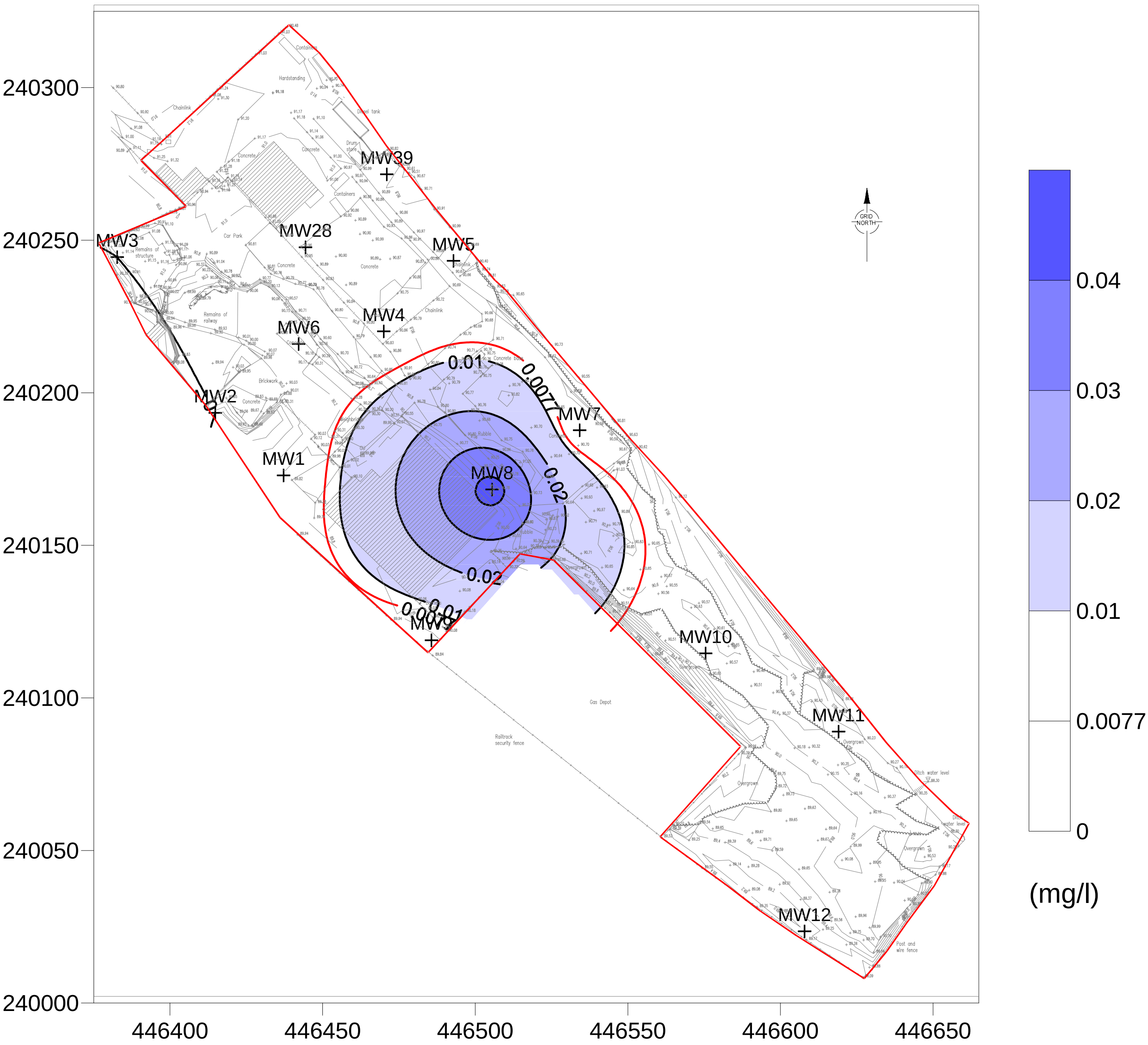
Merton Street: Inferred Contours of Ammonia in Groundwater Jan 1999



EQS = 0.6 (mg/l)

Data Maximum Value = 260 (mg/l)

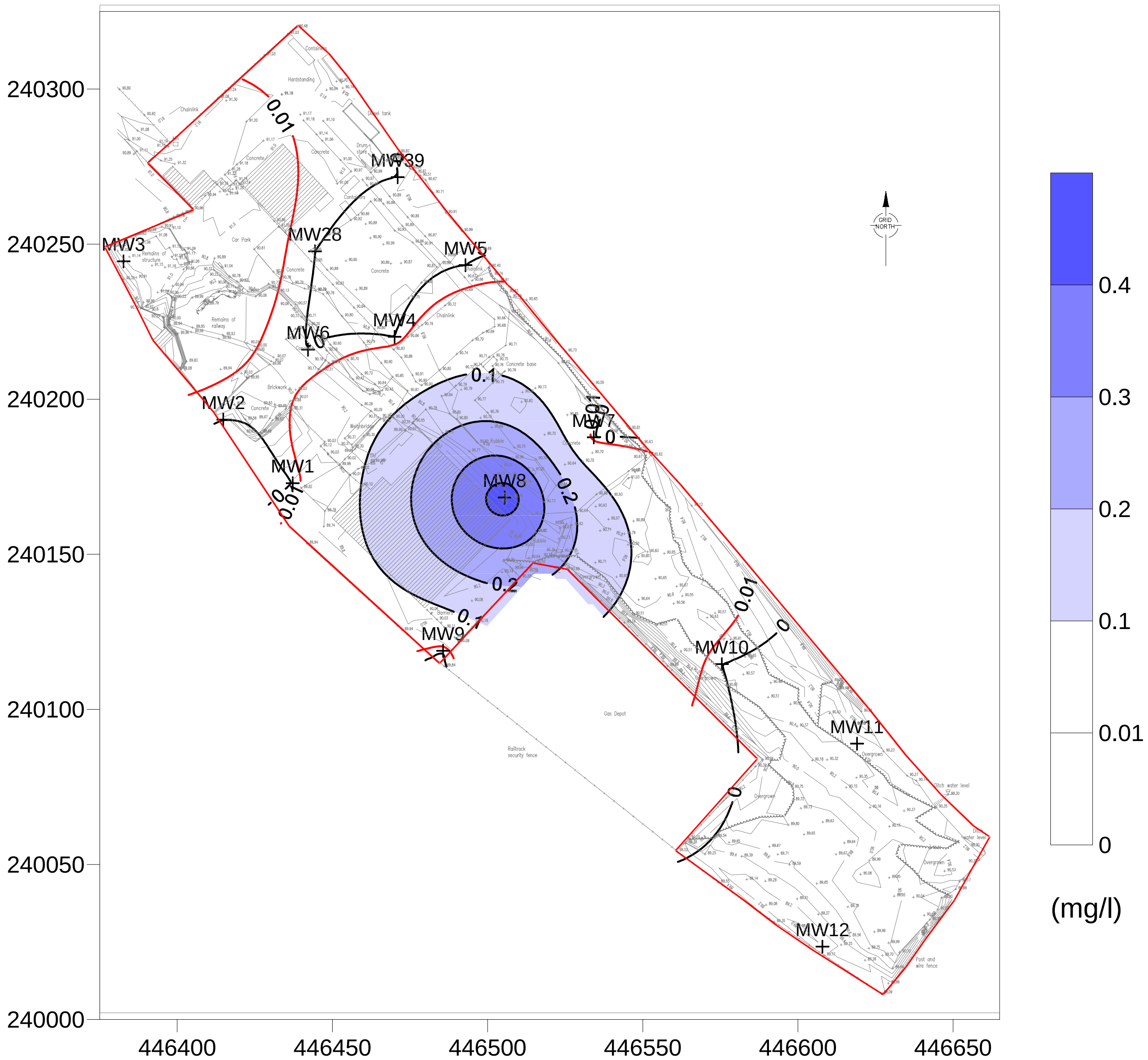
Merton Street: Inferred Contours of Phenol in Groundwater Jan 1999



EQS = 0.0077 (mg/l)

Data Maximum Value = 0.045 (mg/l)

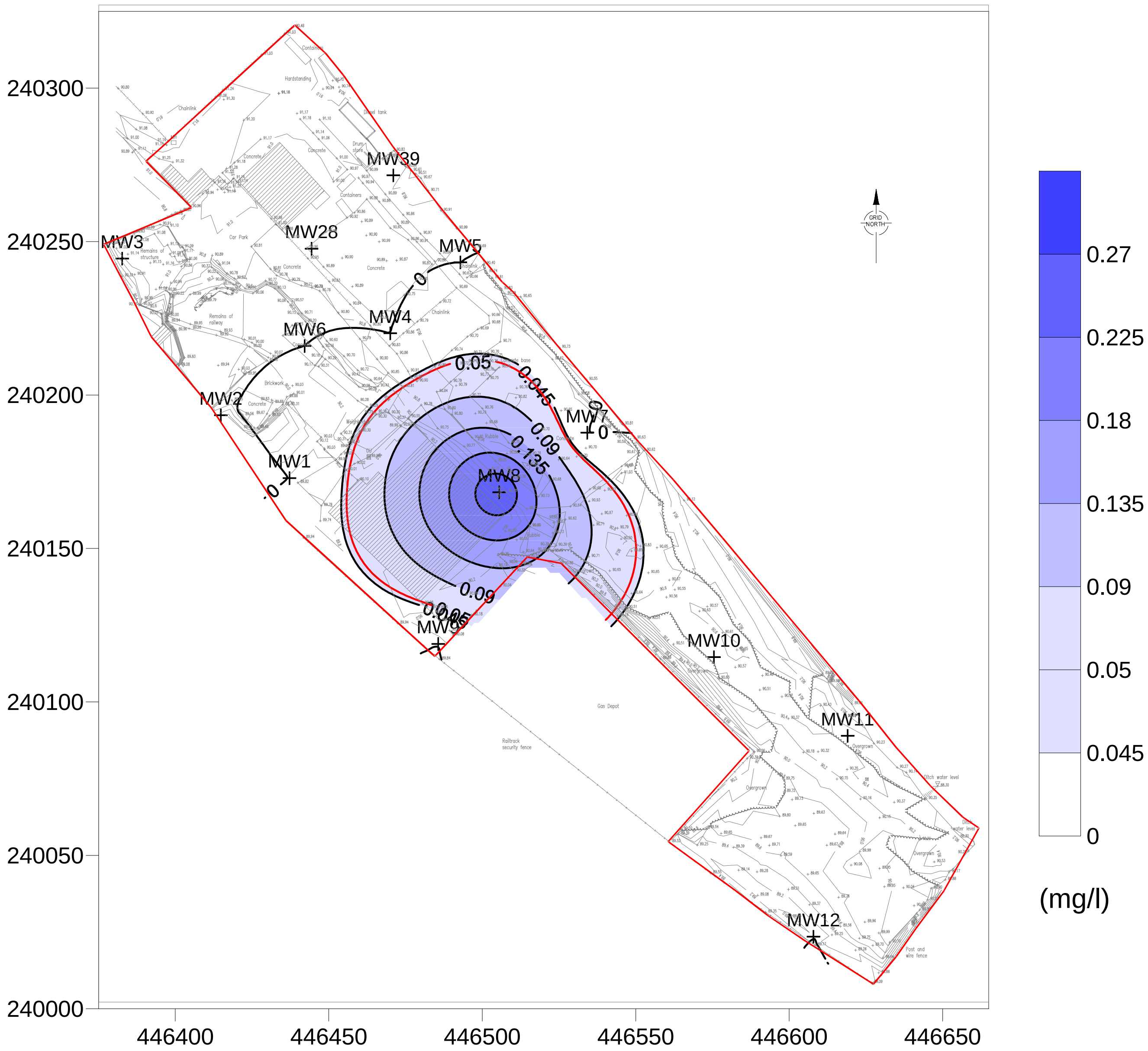
Merton Street: Inferred Contours of Benzene in Groundwater Jan 1999



EQS = 0.01 (mg/l)

Data Maximum Value = 0.46 (mg/l)

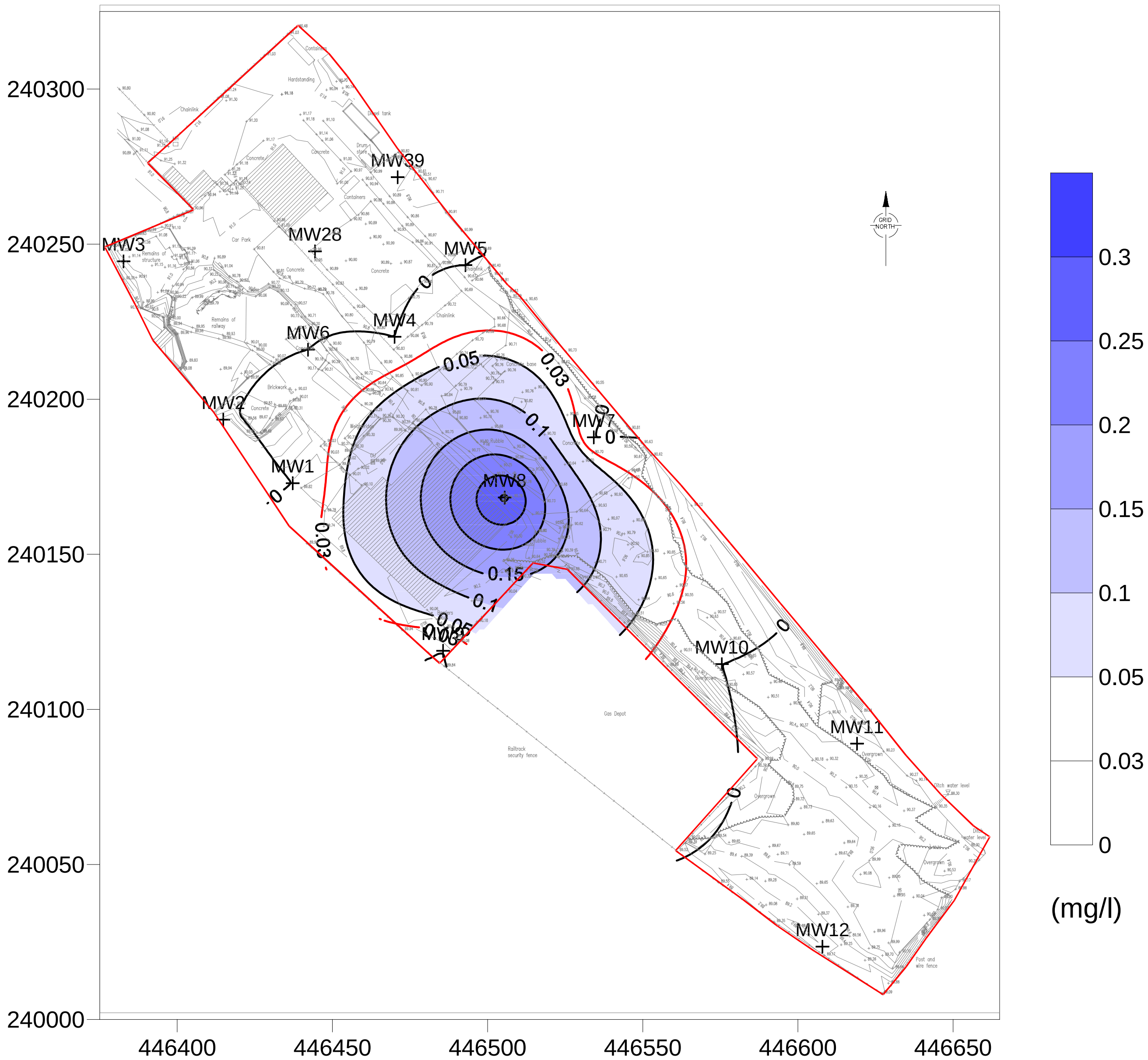
Merton Street: Inferred Contours of Toluene in Groundwater Jan 1999



EQS = 0.05 (mg/l)

Data Maximum Value = 0.27 (mg/l)

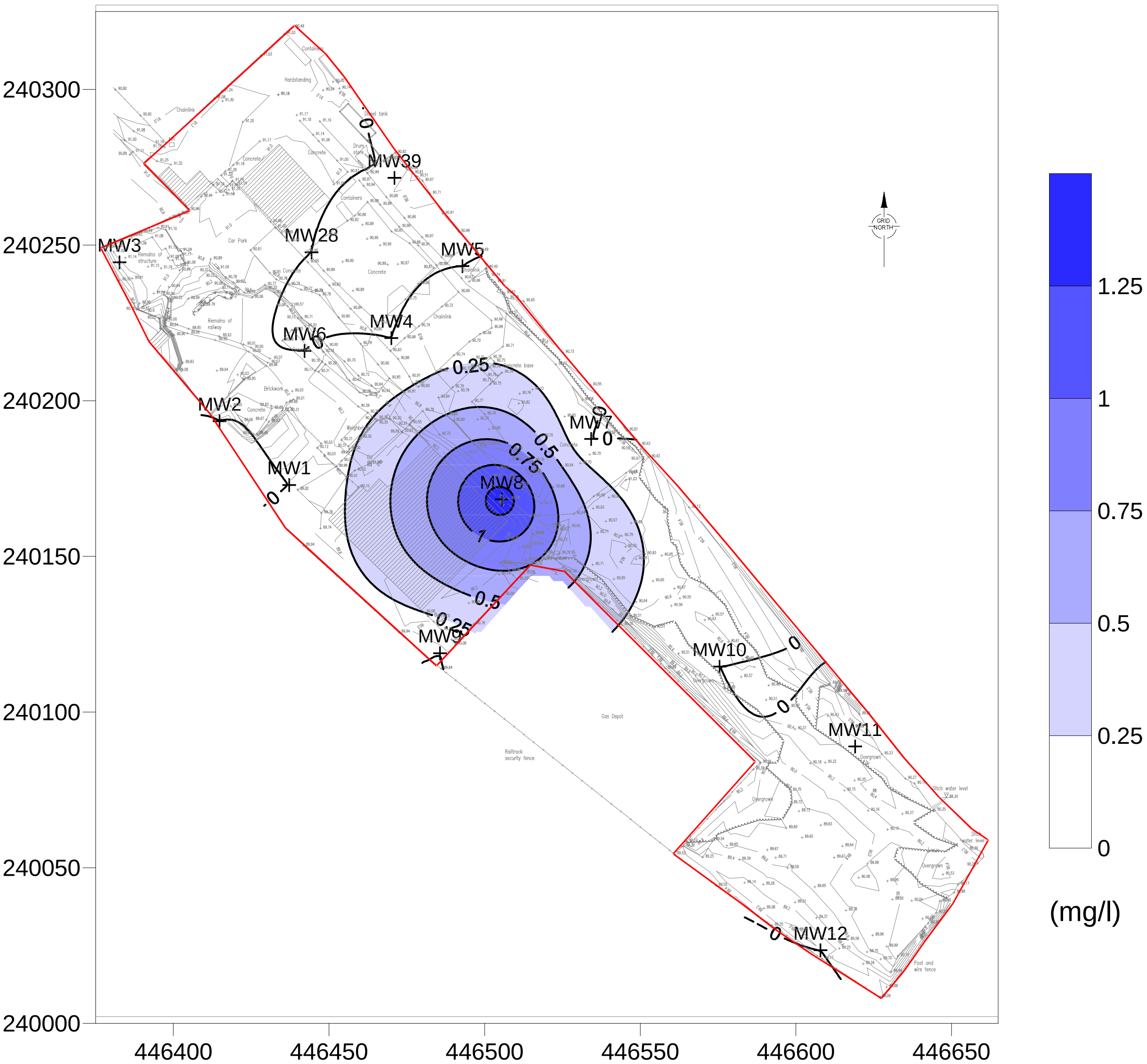
Merton Street: Inferred Contours of Total Xylenes in Groundwater Jan 1999



EQS = 0.03 (mg/l)

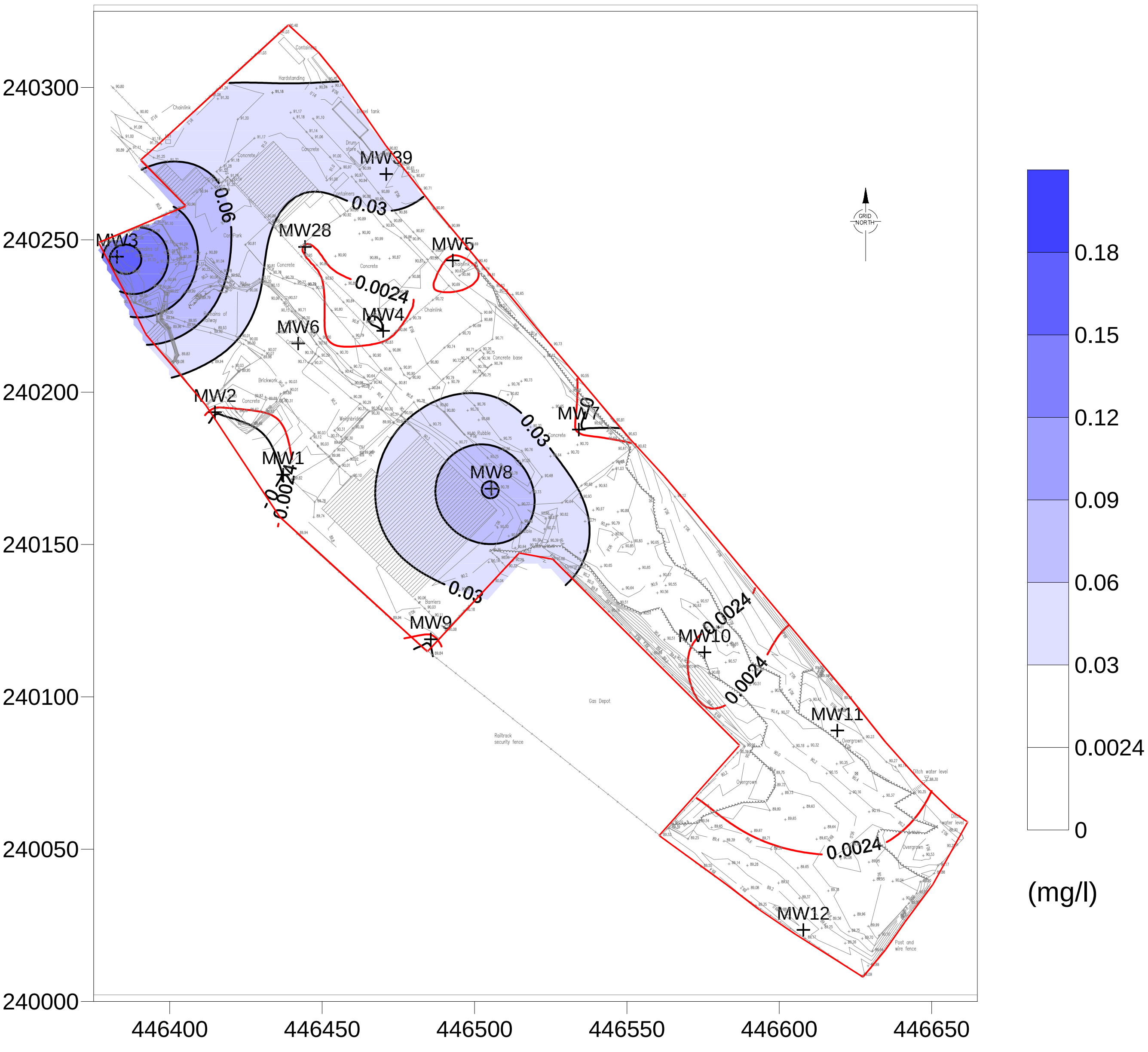
Data Maximum Value = 0.31 (mg/l)

Merton Street: Inferred Contours of Total BTEX in Groundwater Jan 1999



Data Maximum Value = 1.41 (mg/l)

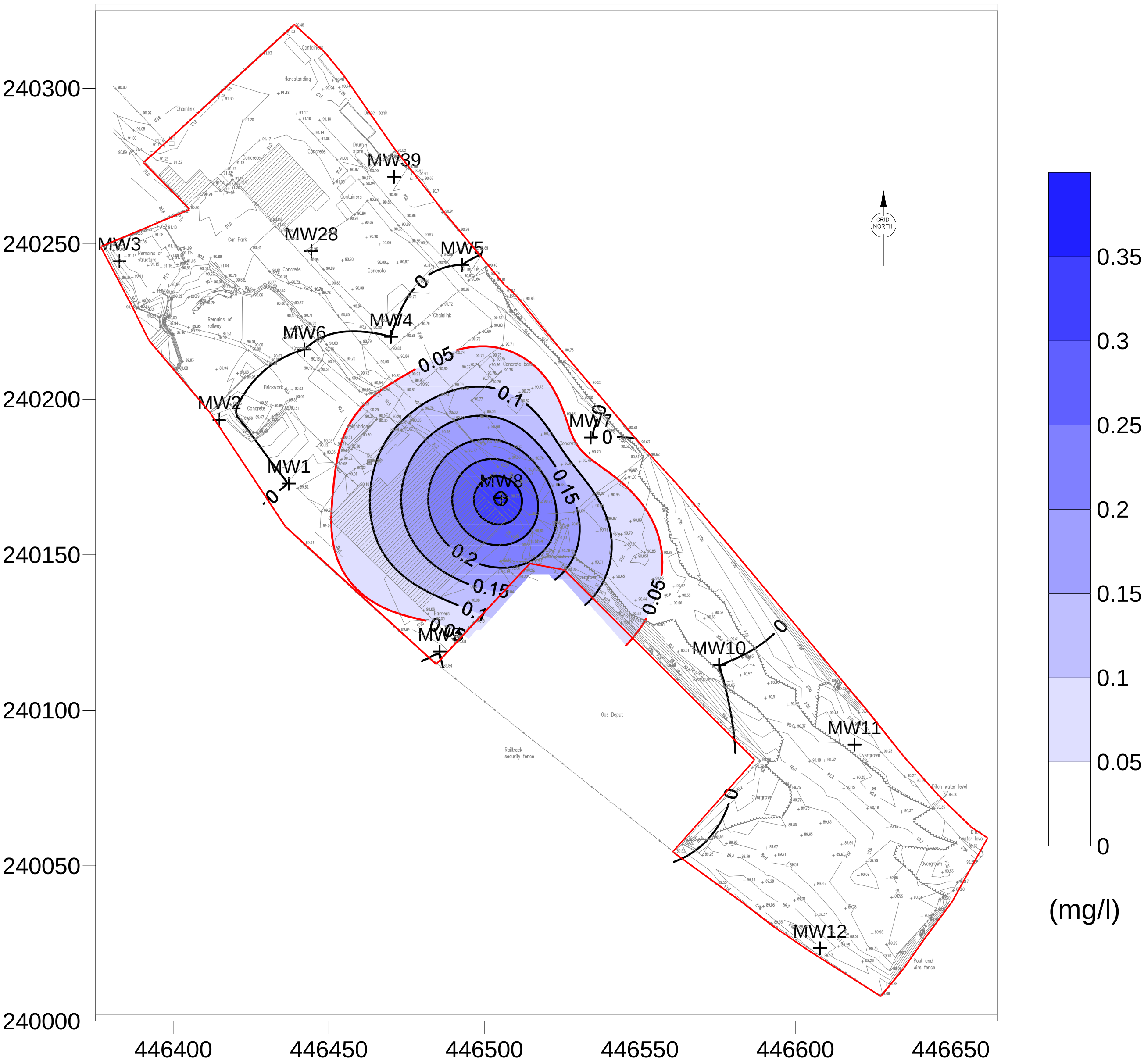
Merton Street: Inferred Contours of Acenaphthylene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.18 (mg/l)

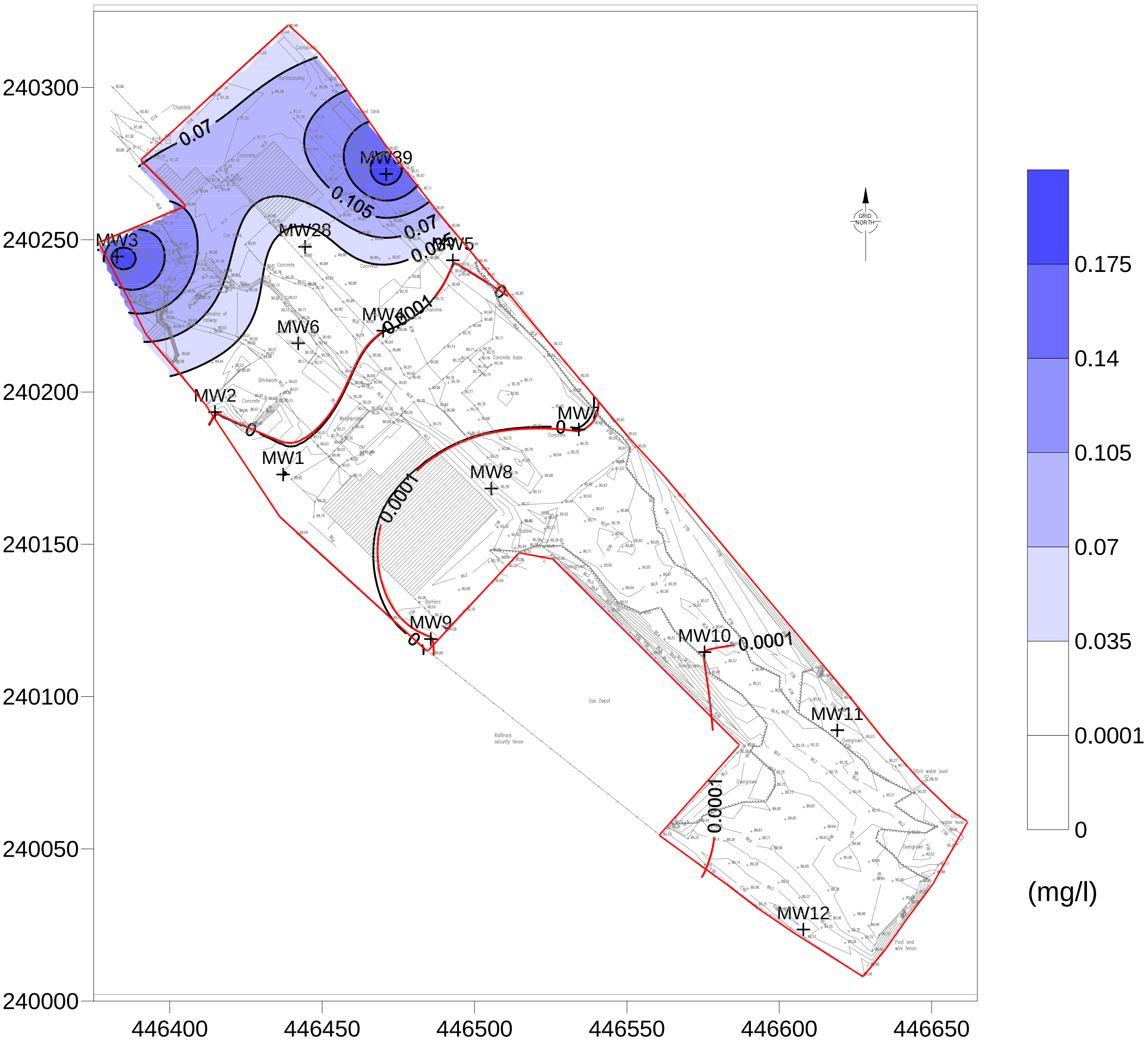
Merton Street: Inferred Contours of Ethylbenzene in Groundwater Jan 1999



EQS = 0.05 (mg/l)

Data Maximum Value = 0.37 (mg/l)

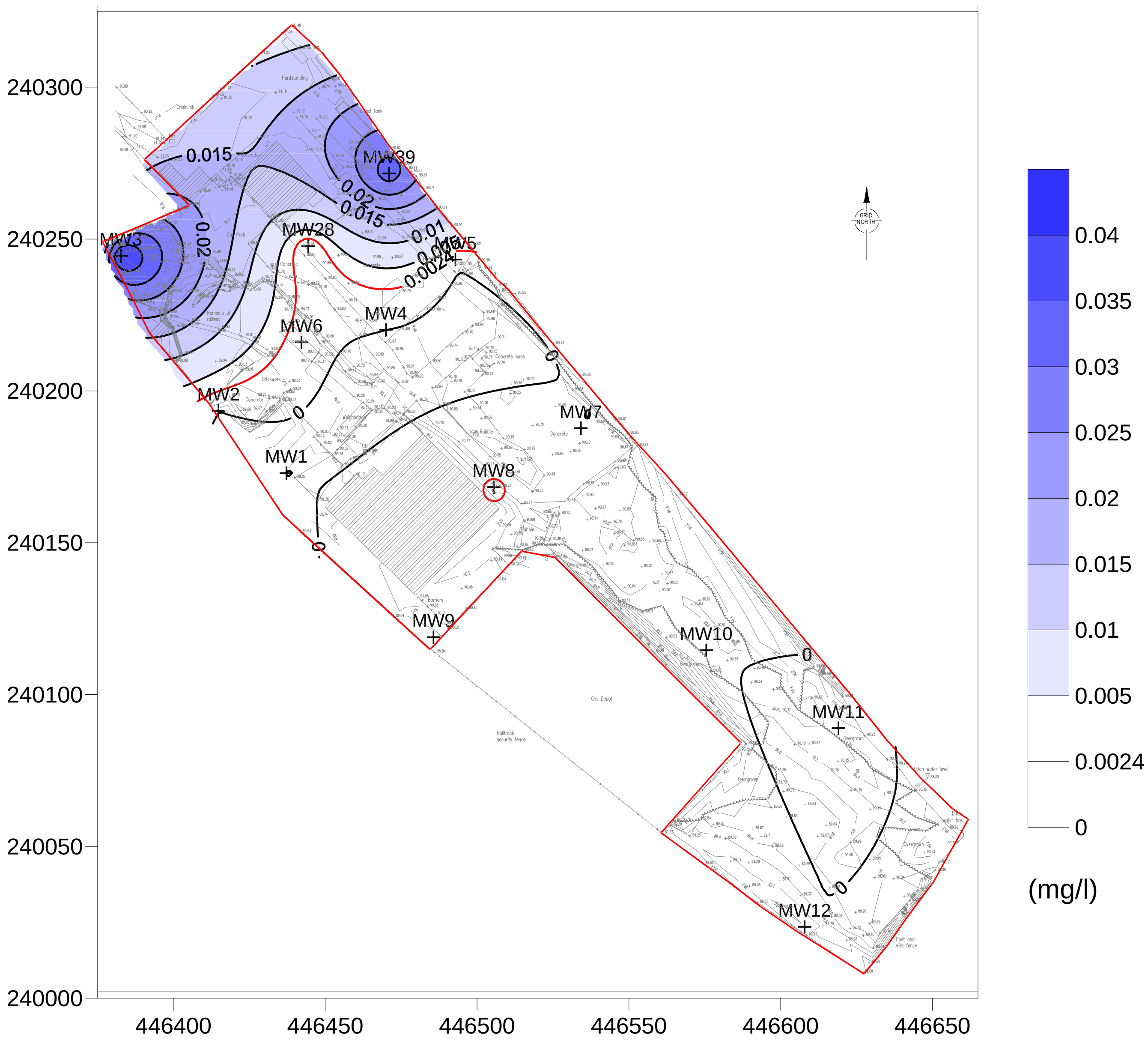
Merton Street: Inferred Contours of Anthracene in Groundwater Jan 1999



EQS = 0.0001 (mg/l)

Data Maximum Value = 0.2 (mg/l)

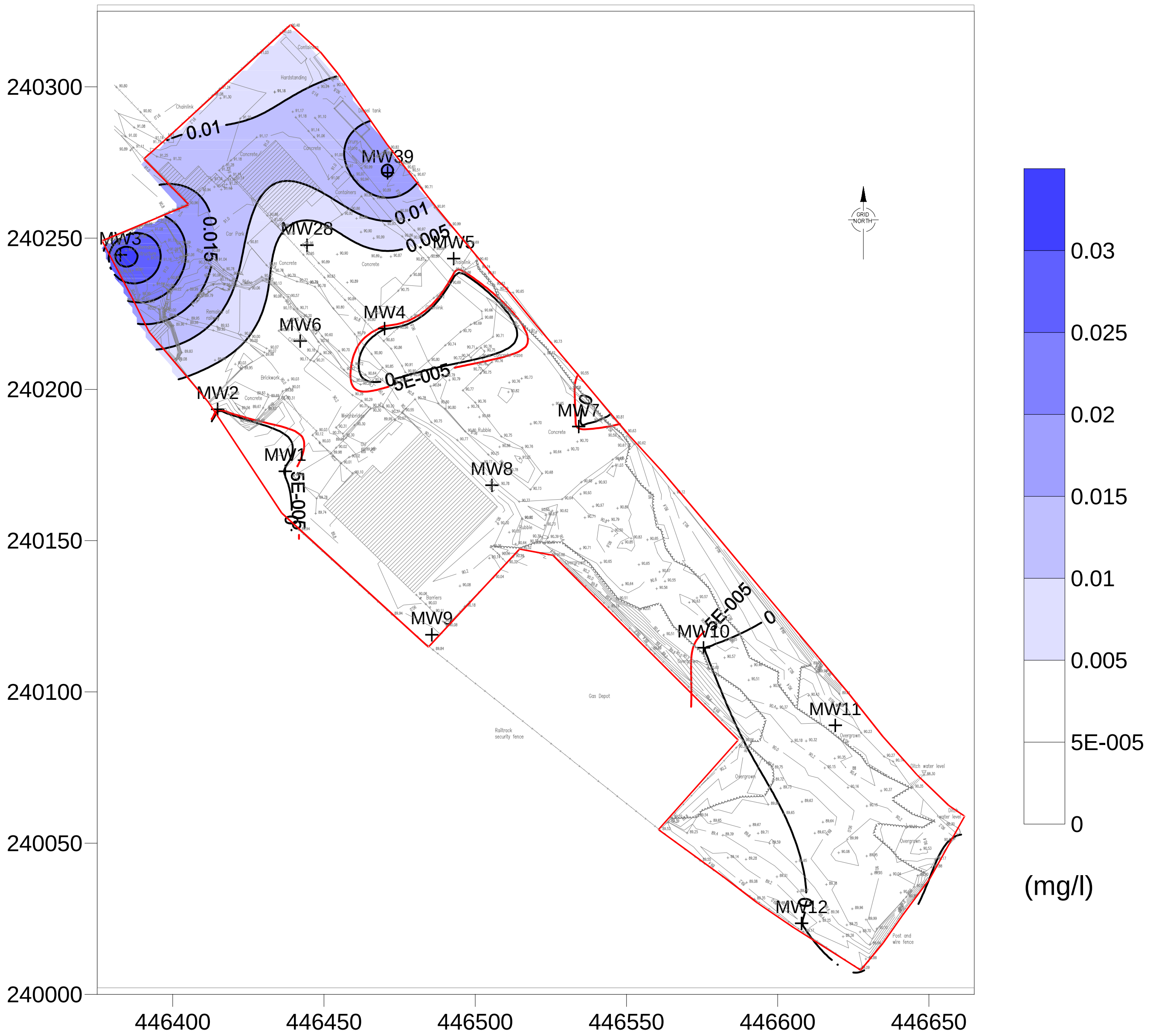
Merton Street: Inferred Contours of Benzo(a)anthracene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.041 (mg/l)

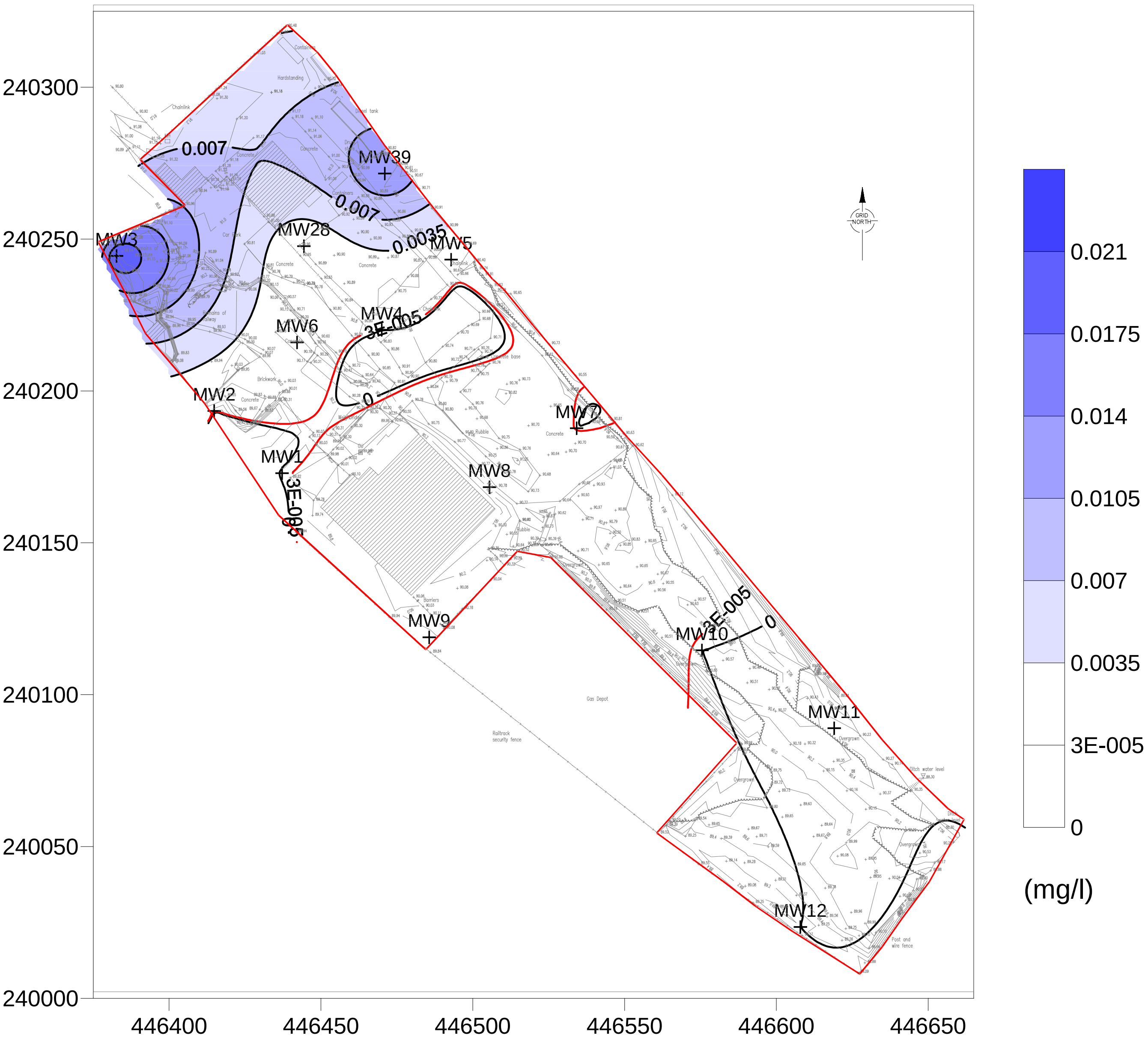
Merton Street: Inferred Contours of Benzo(a)pyrene in Groundwater Jan 1999



EQS = 0.00005 (mg/l)

Data Maximum Value = 0.034 (mg/l)

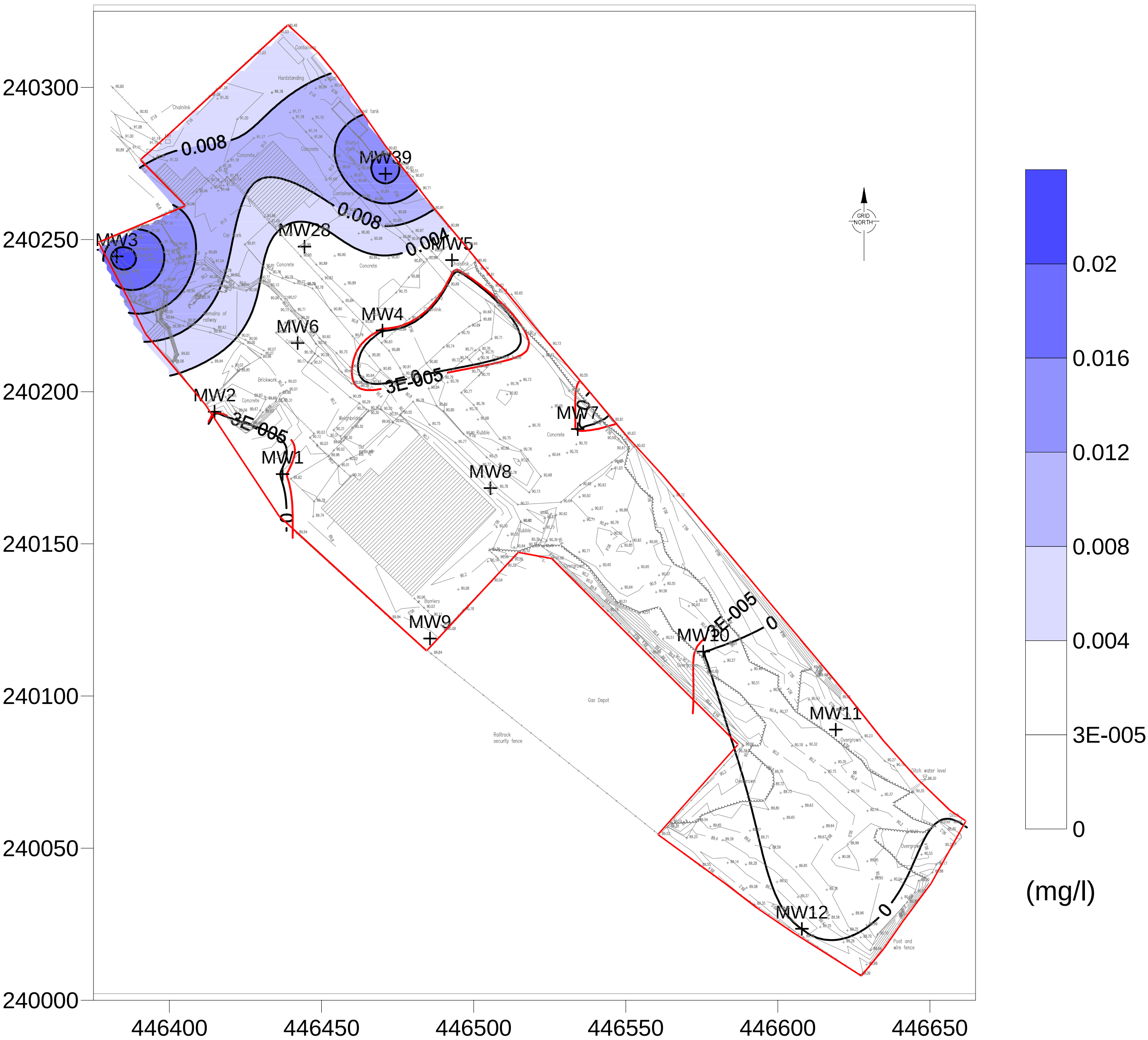
Merton Street: Inferred Contours of Benzo(b)flournthene in Groundwater Jan 1999



EQS = 0.00003 (mg/l)

Data Maximum Value = 0.021 (mg/l)

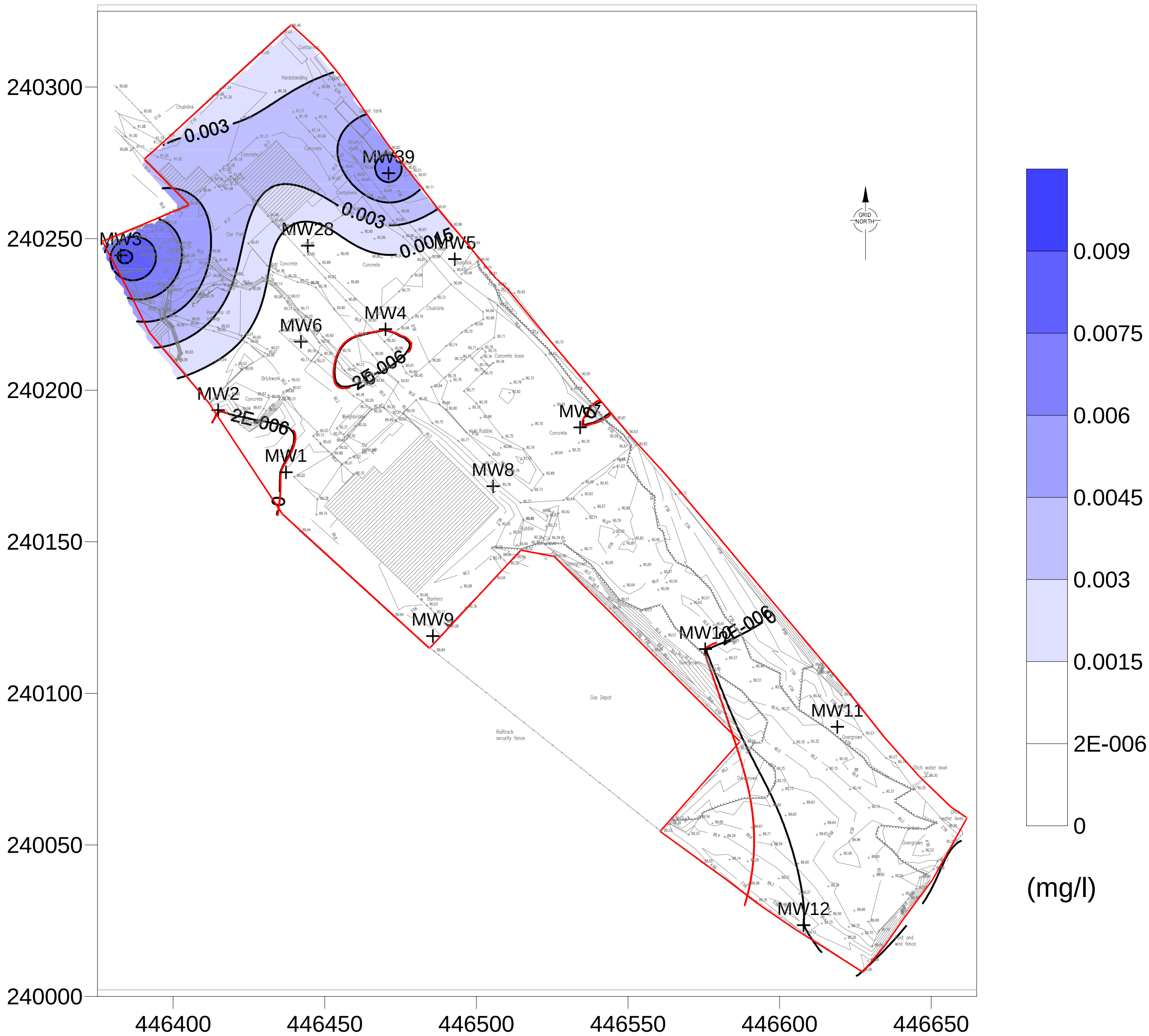
Merton Street: Inferred Contours of Benzo(k)flournthene in Groundwater Jan 1999



EQS = 0.00003 (mg/l)

Data Maximum Value = 0.023 (mg/l)

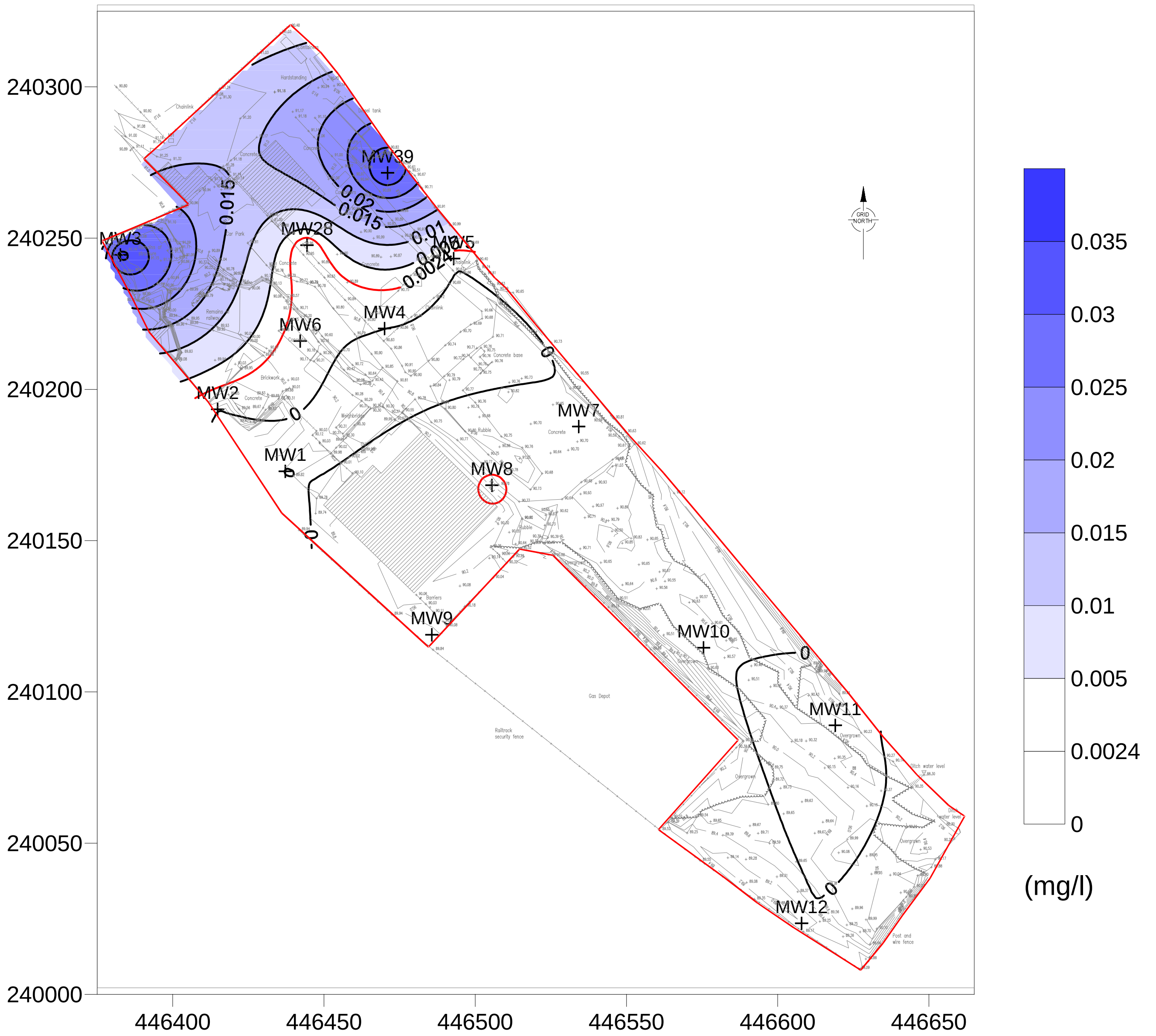
Merton Street: Inferred Contours of Benzo[g,h,i]perylene in Groundwater Jan 1999



EQS = 0.000002 (mg/l)

Data Maximum Value = 0.0098 (mg/l)

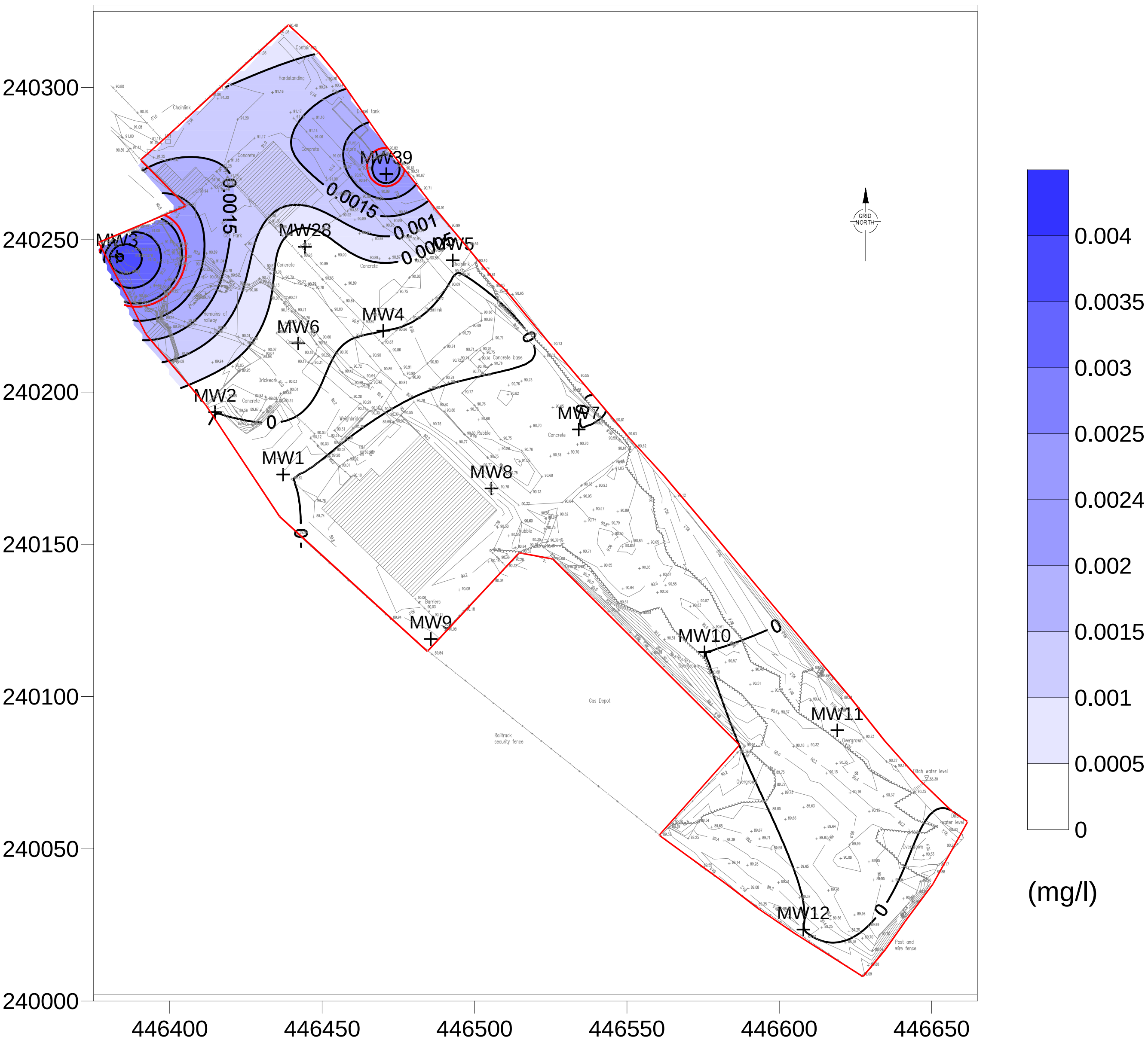
Merton Street: Inferred Contours of Chrysene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.037 (mg/l)

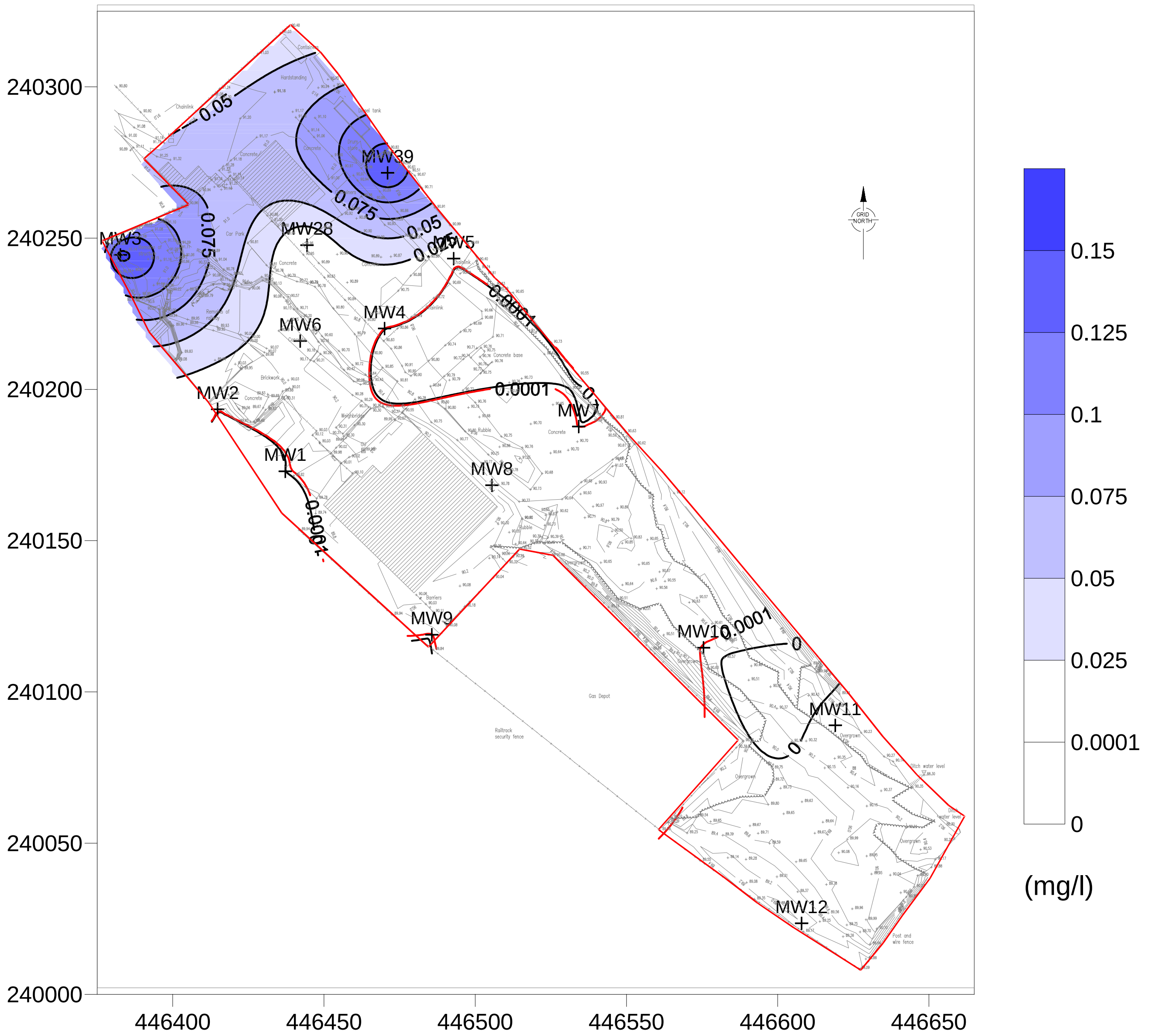
Merton Street: Inferred Contours of Dibenzo(ah-ac)anthracene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.0042 (mg/l)

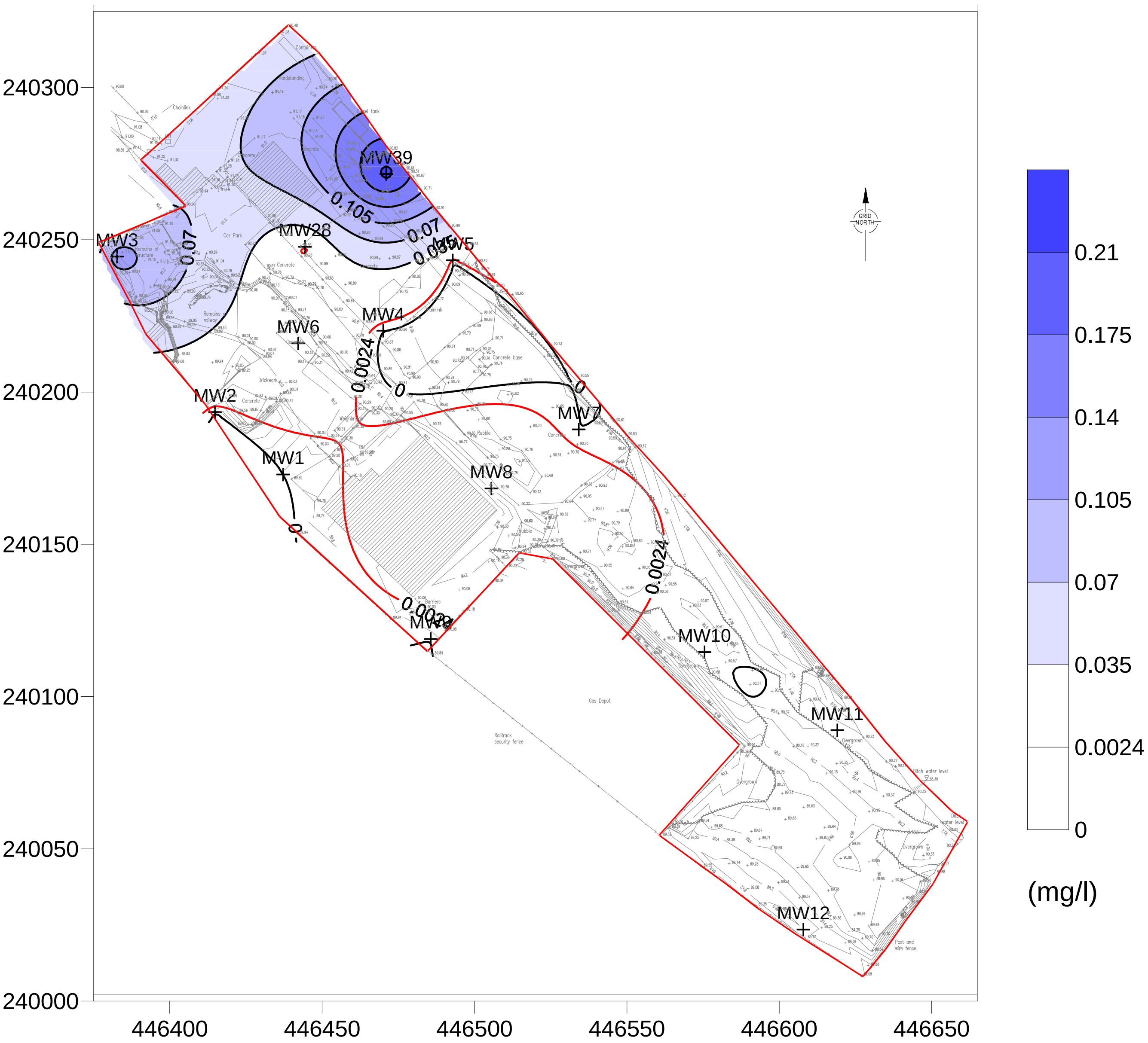
Merton Street: Inferred Contours of Flouranthene in Groundwater Jan 1999



EQS = 0.0001 (mg/l)

Data Maximum Value = 0.16 (mg/l)

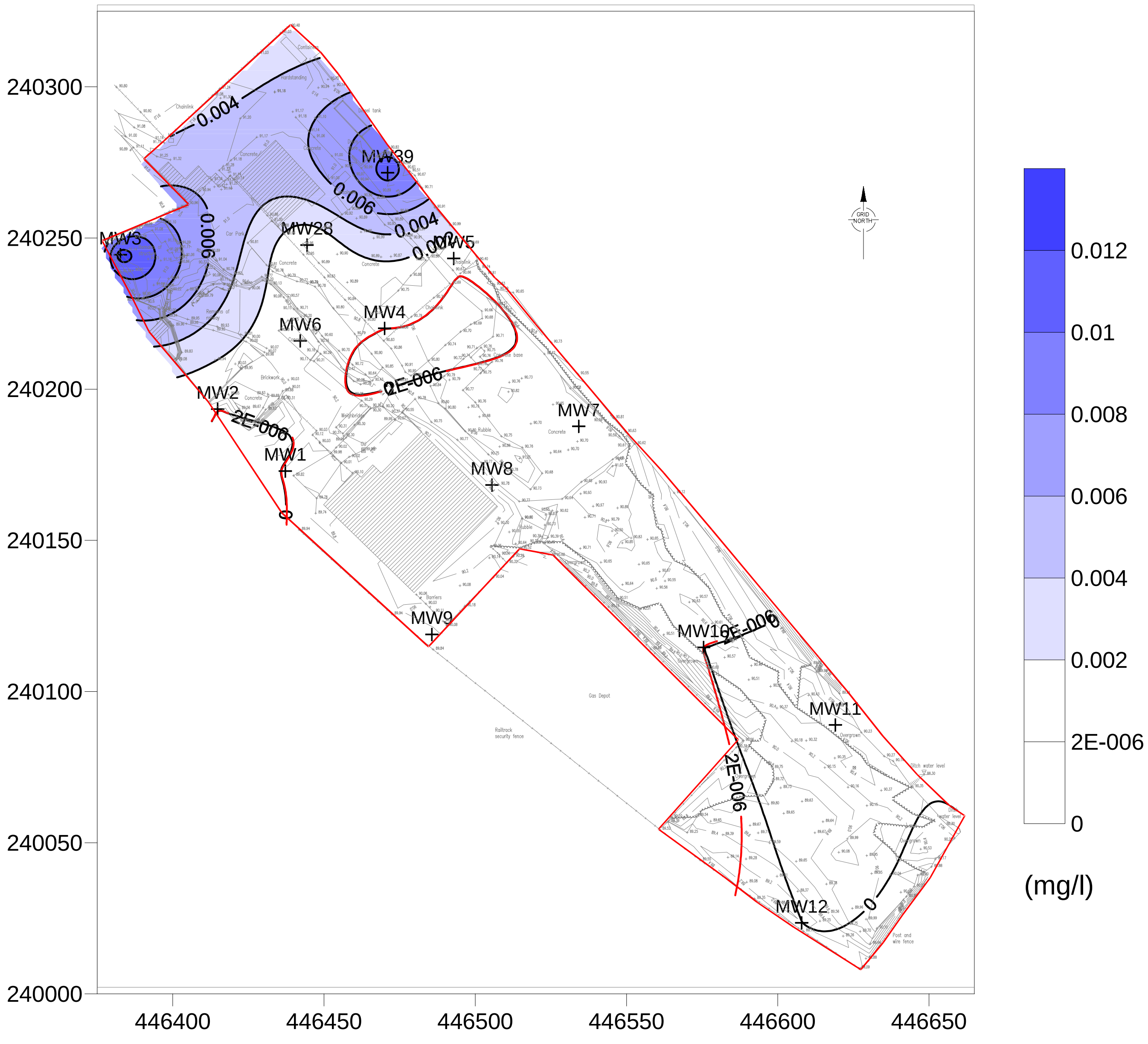
Merton Street: Inferred Contours of Flourene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.22 (mg/l)

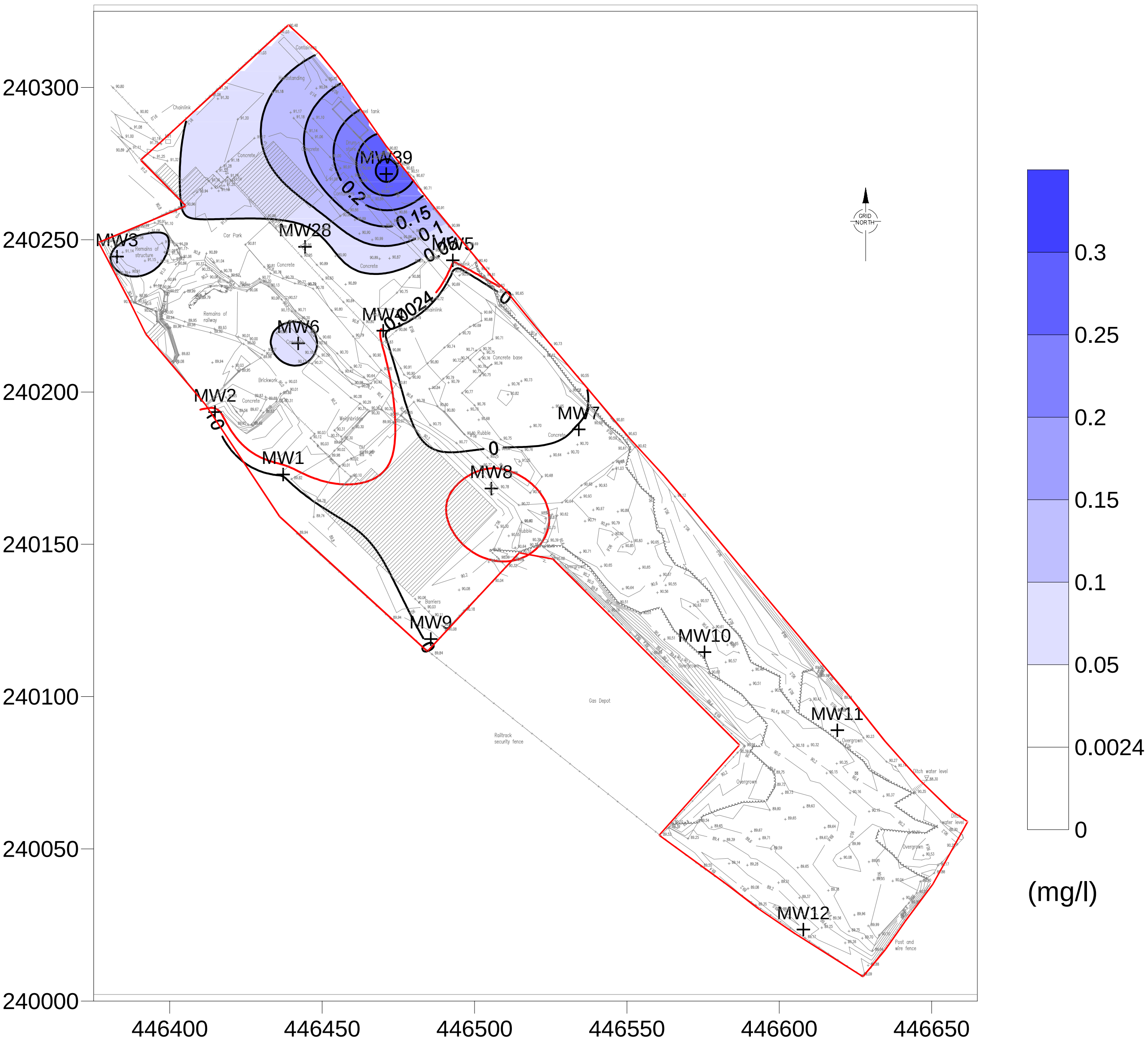
Merton Street: Inferred Contours of Indenopyrene in Groundwater Jan 1999



EQS = 0.000002 (mg/l)

Data Maximum Value = 0.013 (mg/l)

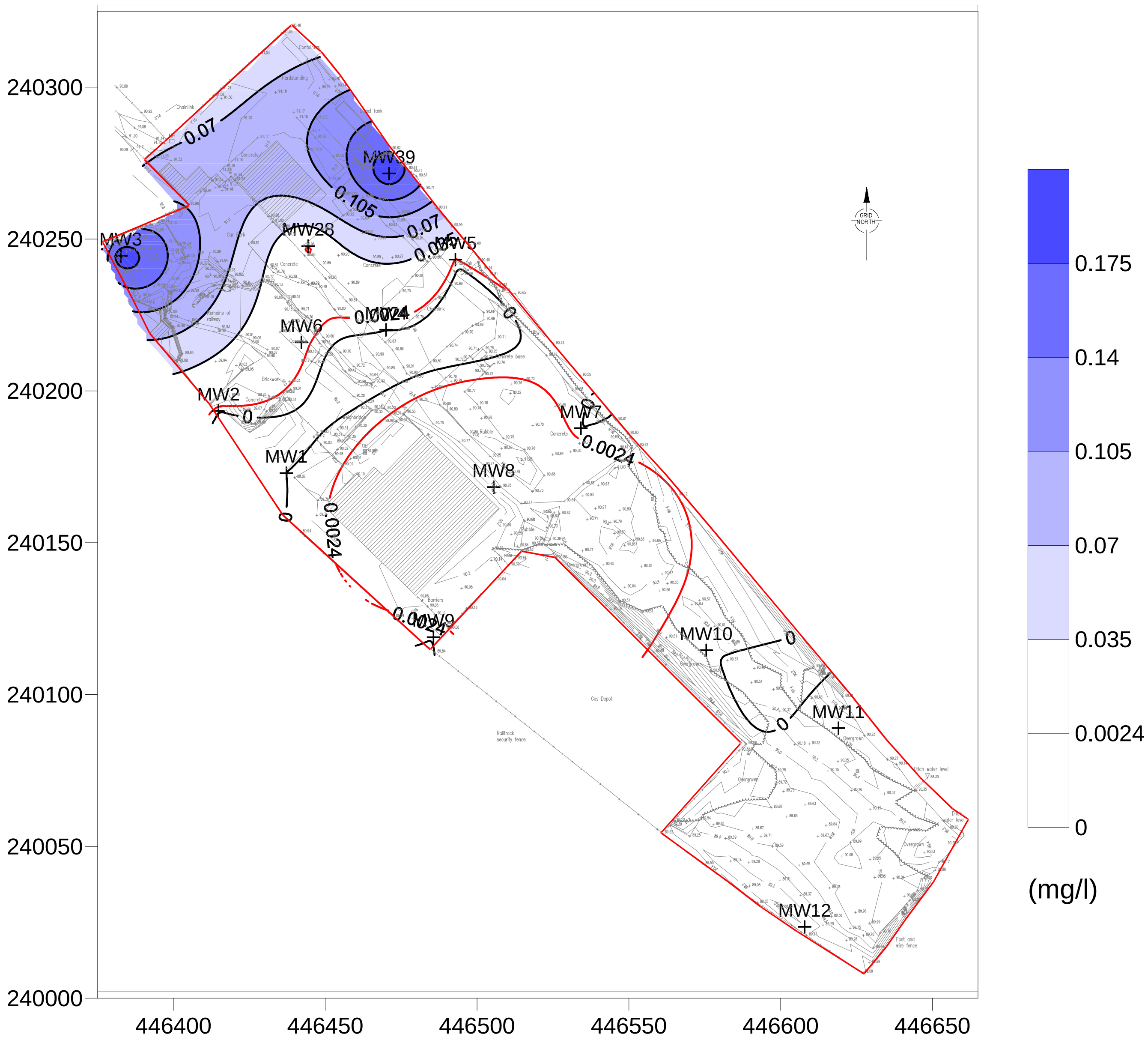
Merton Street: Inferred Contours of Naphthalene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.33 (mg/l)

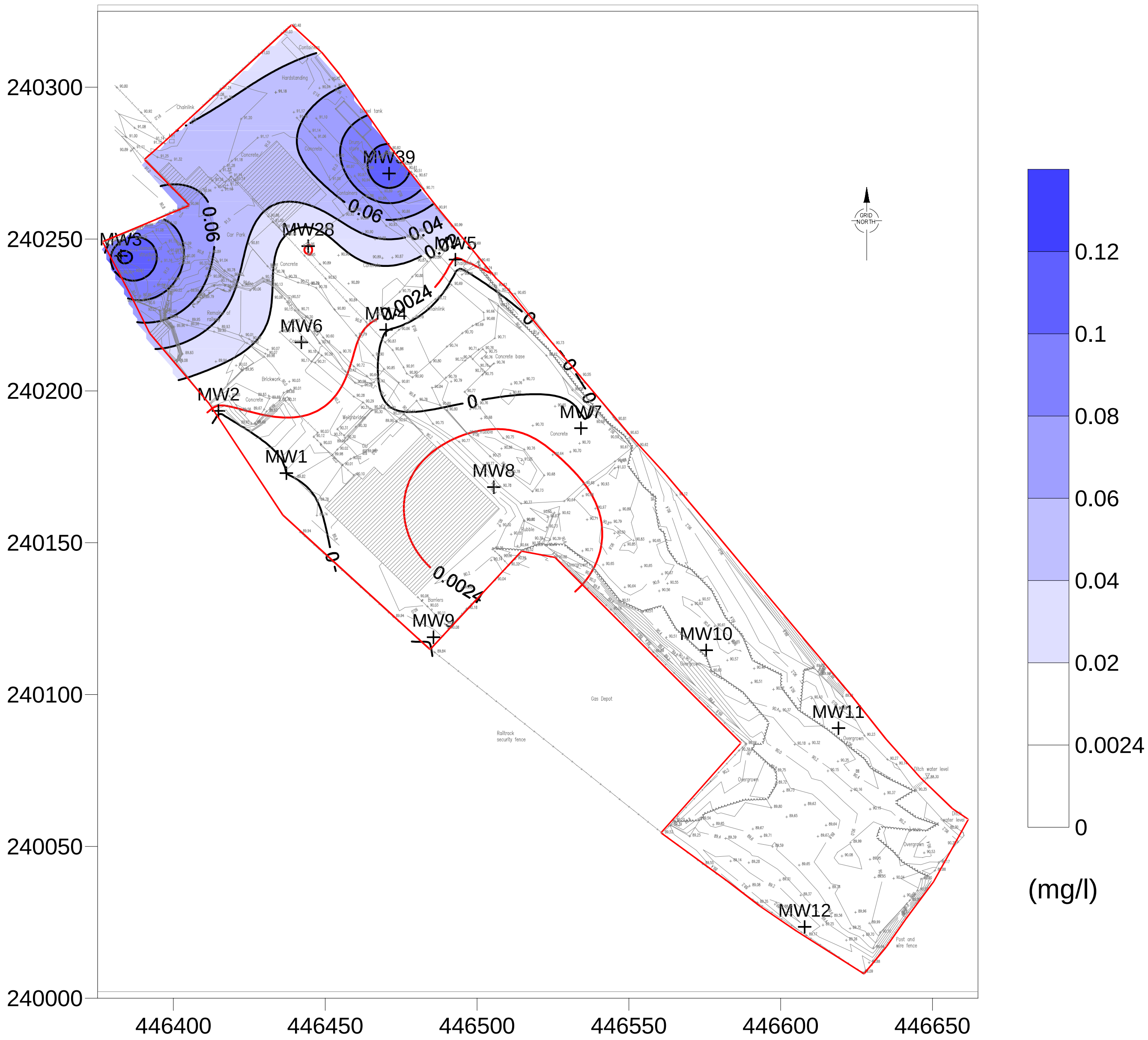
Merton Street: Inferred Contours of Phenanthrene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.2 (mg/l)

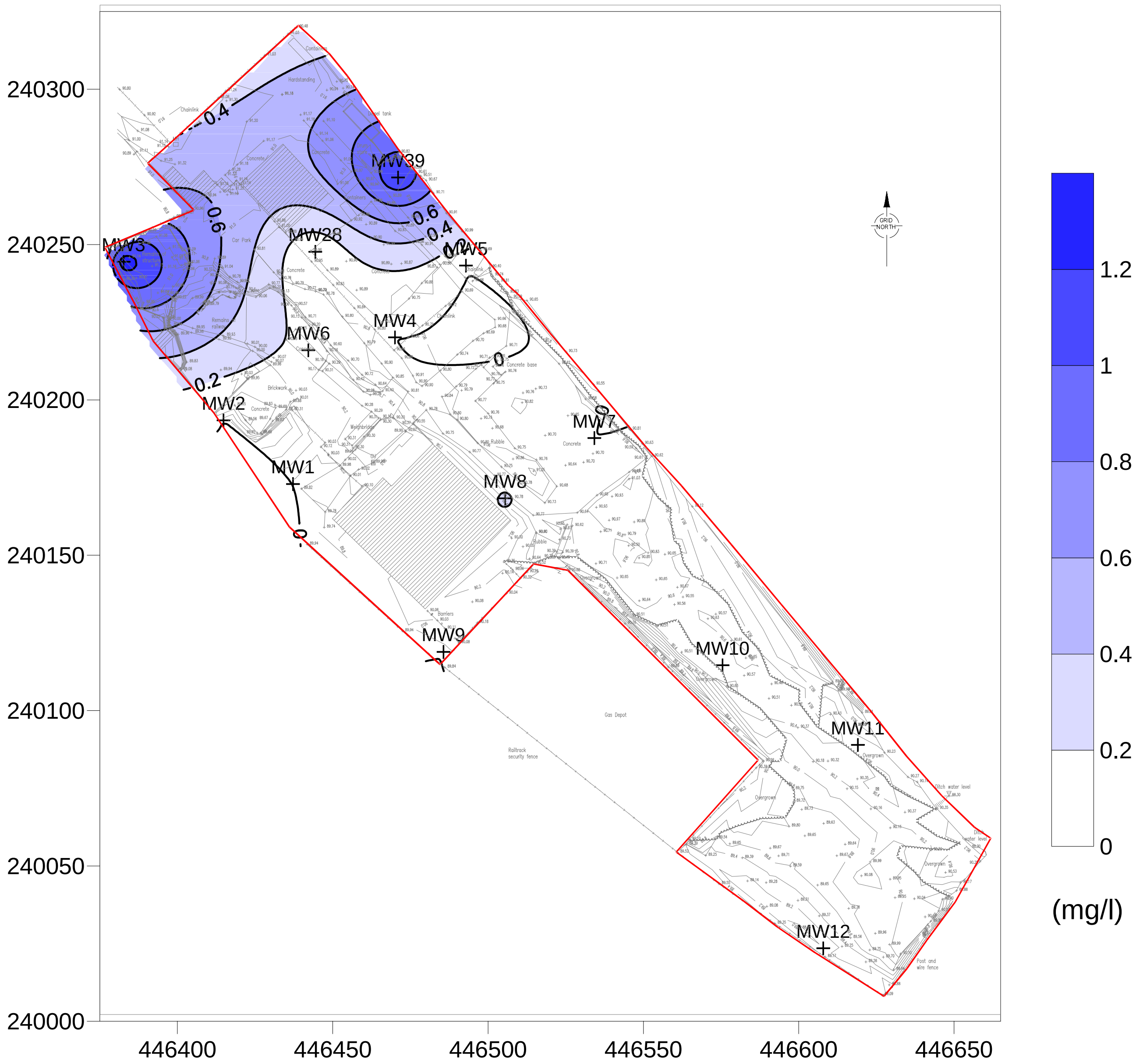
Merton Street: Inferred Contours of Pyrene in Groundwater Jan 1999



EQS = 0.0024 (mg/l)

Data Maximum Value = 0.13 (mg/l)

Merton Street: Inferred Contours of Total PAH in Groundwater Jan 1999

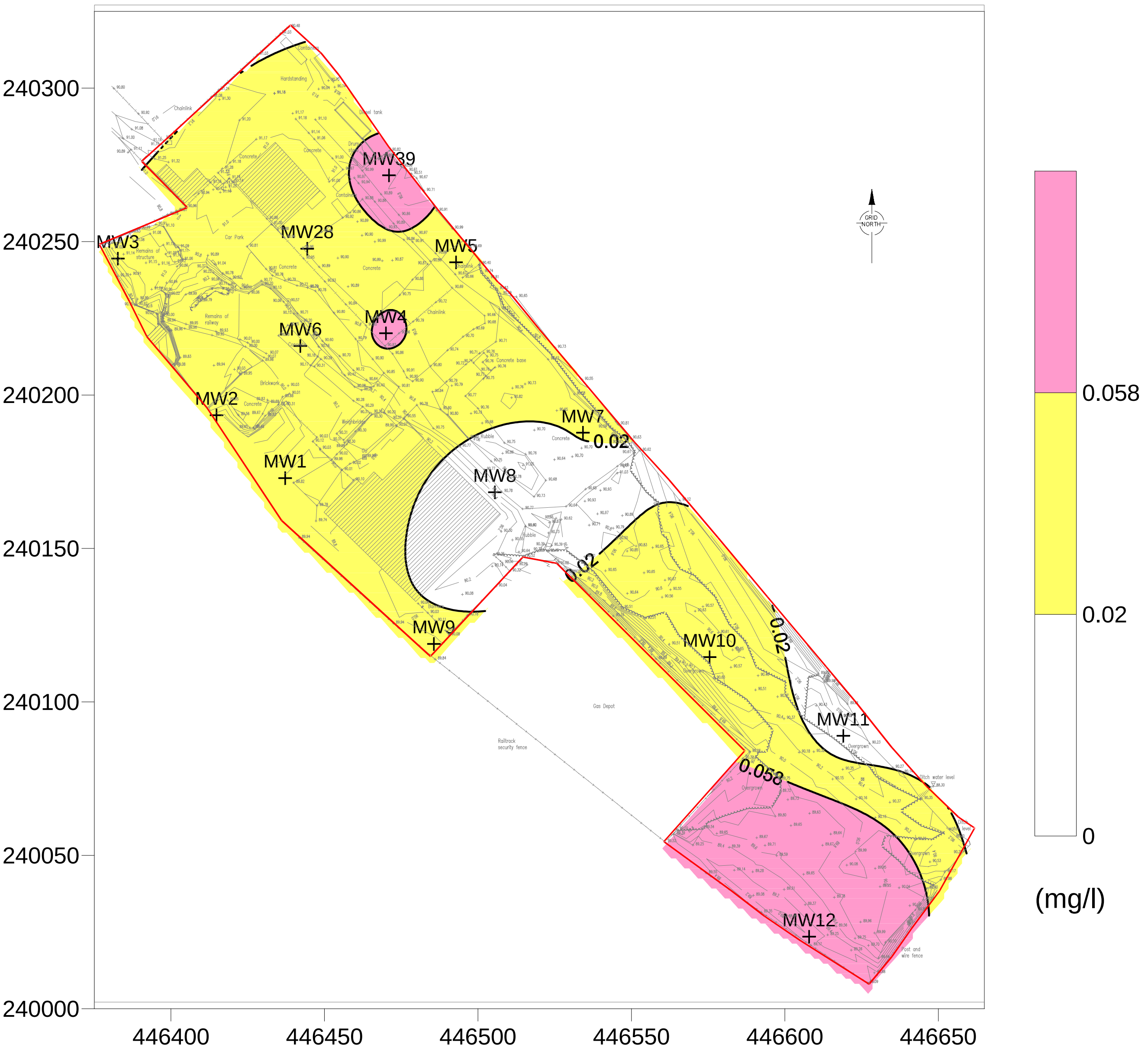


Data Maximum Value = 1.311 (mg/l)

APPENDIX D

COMPARISON OF MEASURED GROUNDWATER CONCENTRATIONS WITH DERIVED REMEDIAL TARGETS

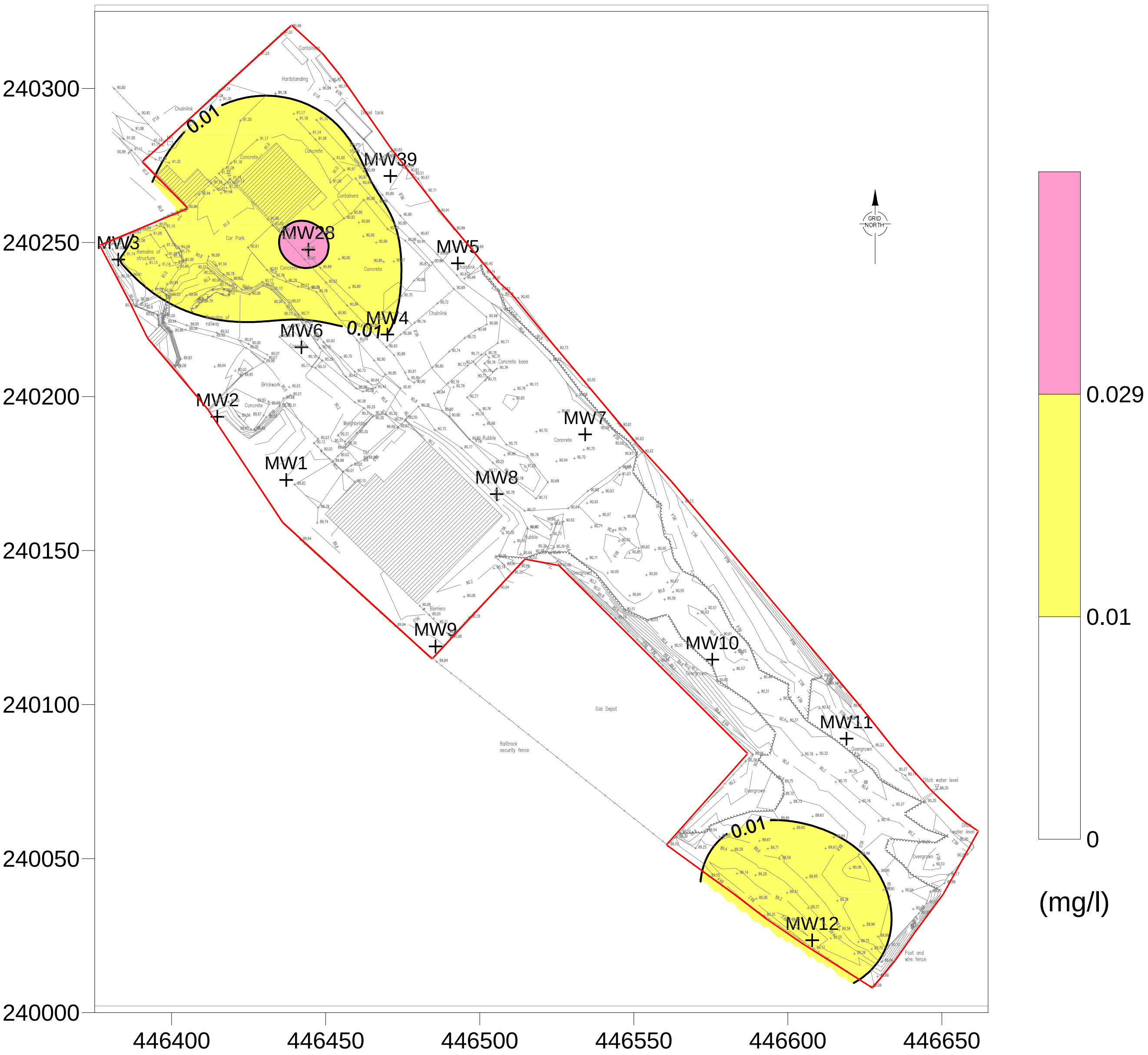
Merton Street: Inferred Contours of Nickel in Groundwater Jan 1999



EQS = 0.02 (mg/l) Target = 0.058 (mg/l)

Data Maximum Value = 0.2 (mg/l)

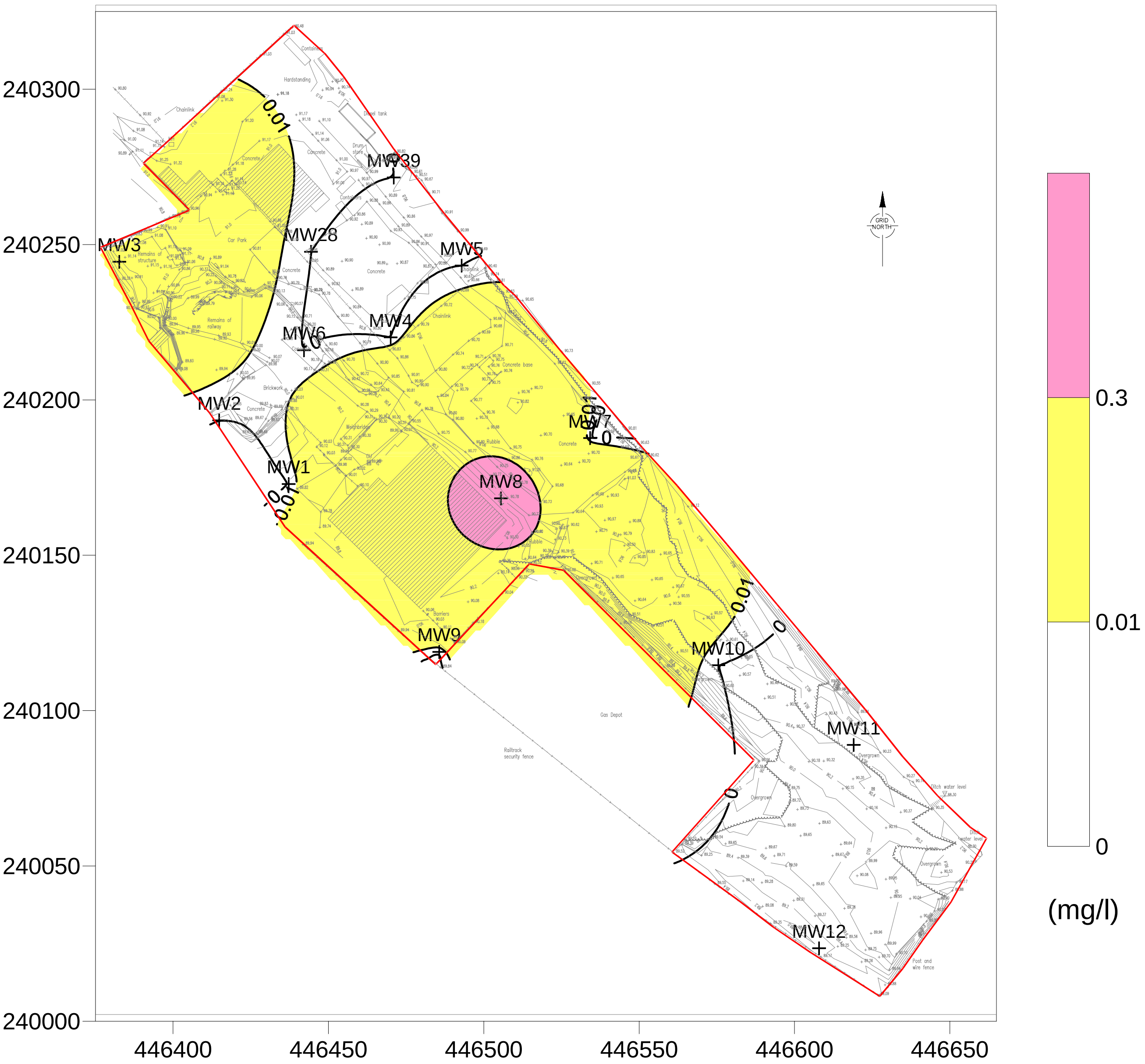
Merton Street: Inferred Contours of Selenium in Groundwater Jan 1999



EQS = 0.01 (mg/l) Target = 0.029 (mg/l)

Data Maximum Value = 0.036 (mg/l)

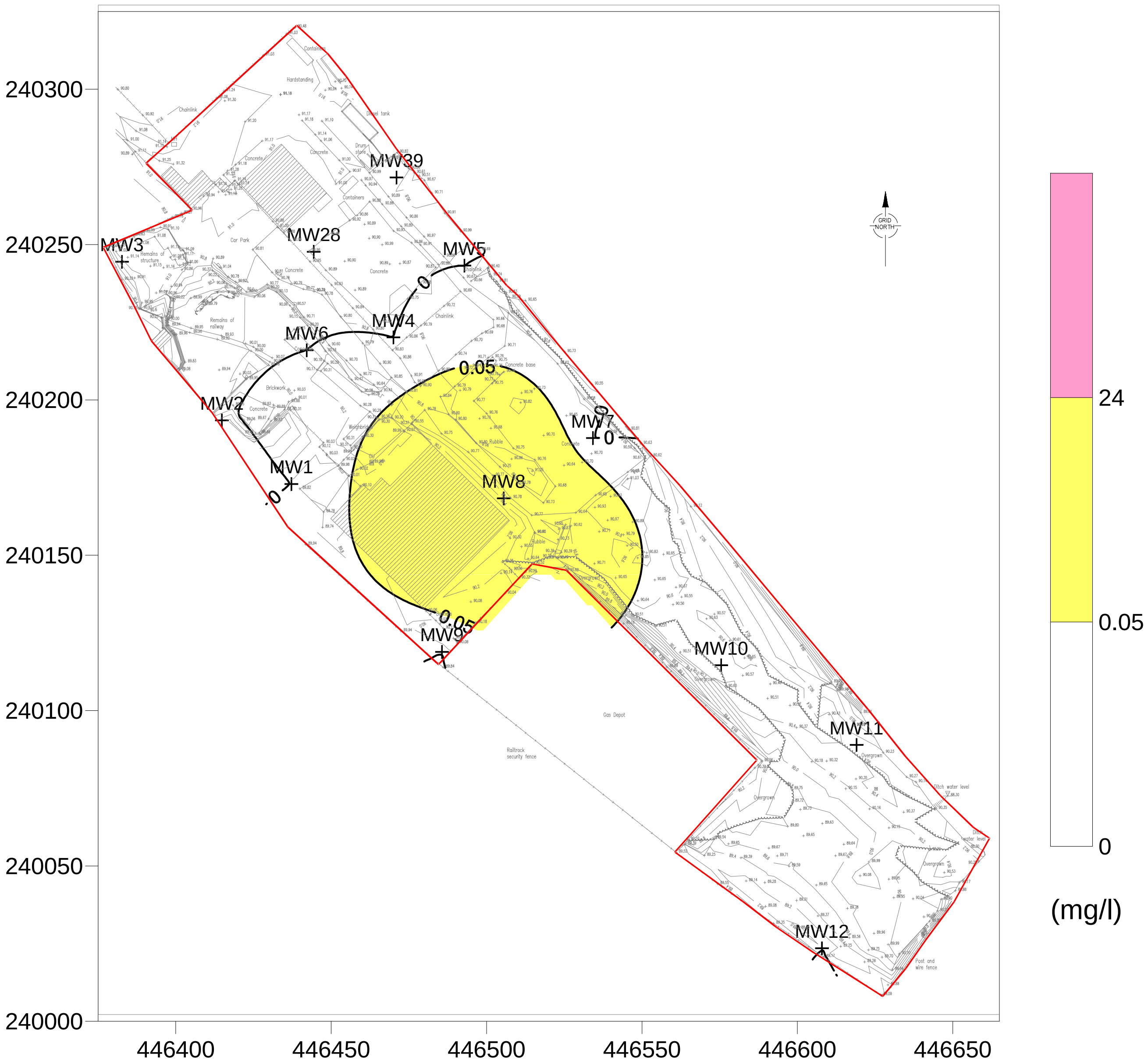
Merton Street: Inferred Contours of Benzene in Groundwater Jan 1999



EQS = 0.01 (mg/l) Target = 0.3 (mg/l)

Data Maximum Value = 0.46 (mg/l)

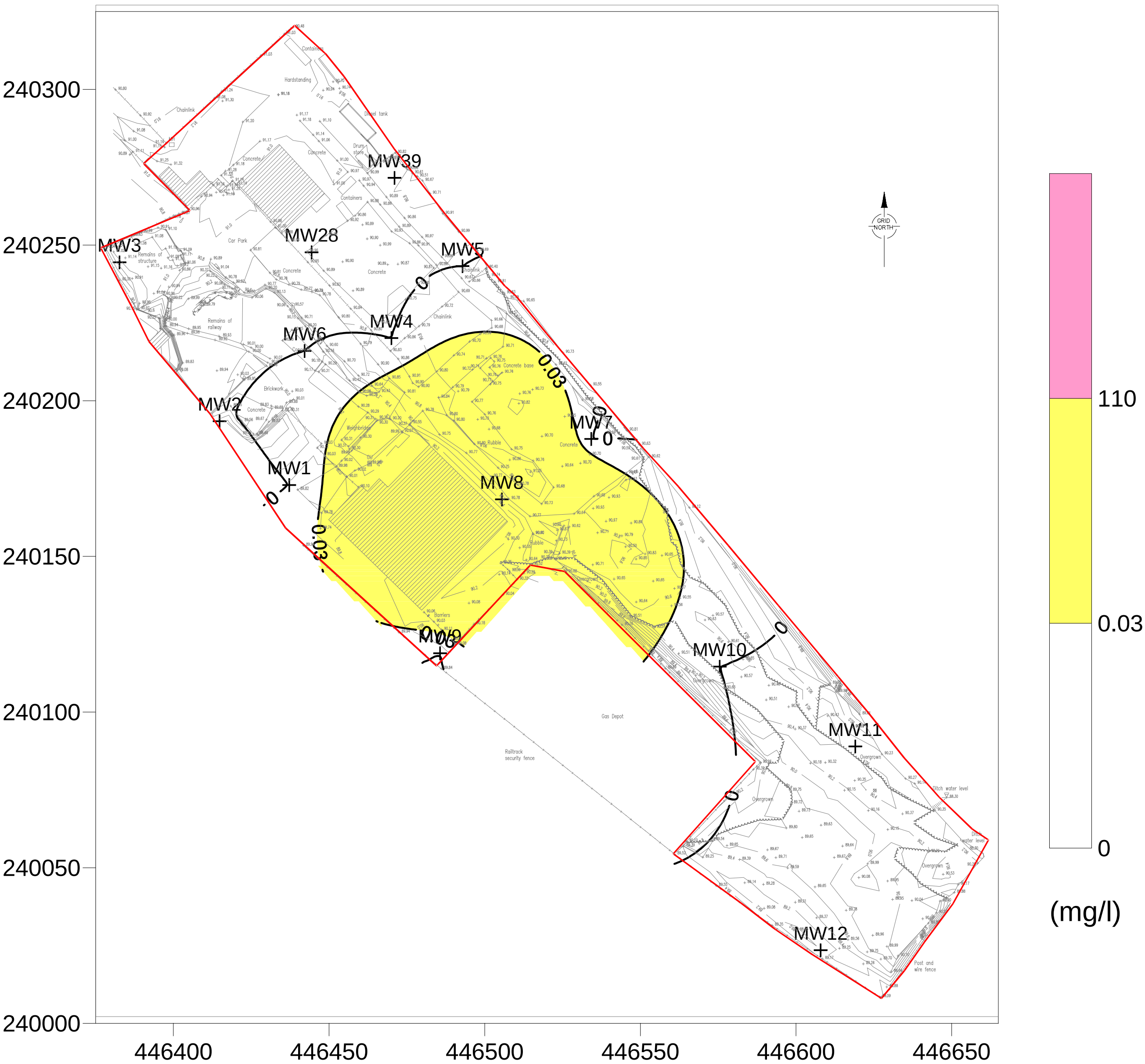
Merton Street: Inferred Contours of Toluene in Groundwater Jan 1999



EQS = 0.05 (mg/l) Target = 24 (mg/l)

Data Maximum Value = 0.27 (mg/l) : Target Exceeds Data Maximum Value

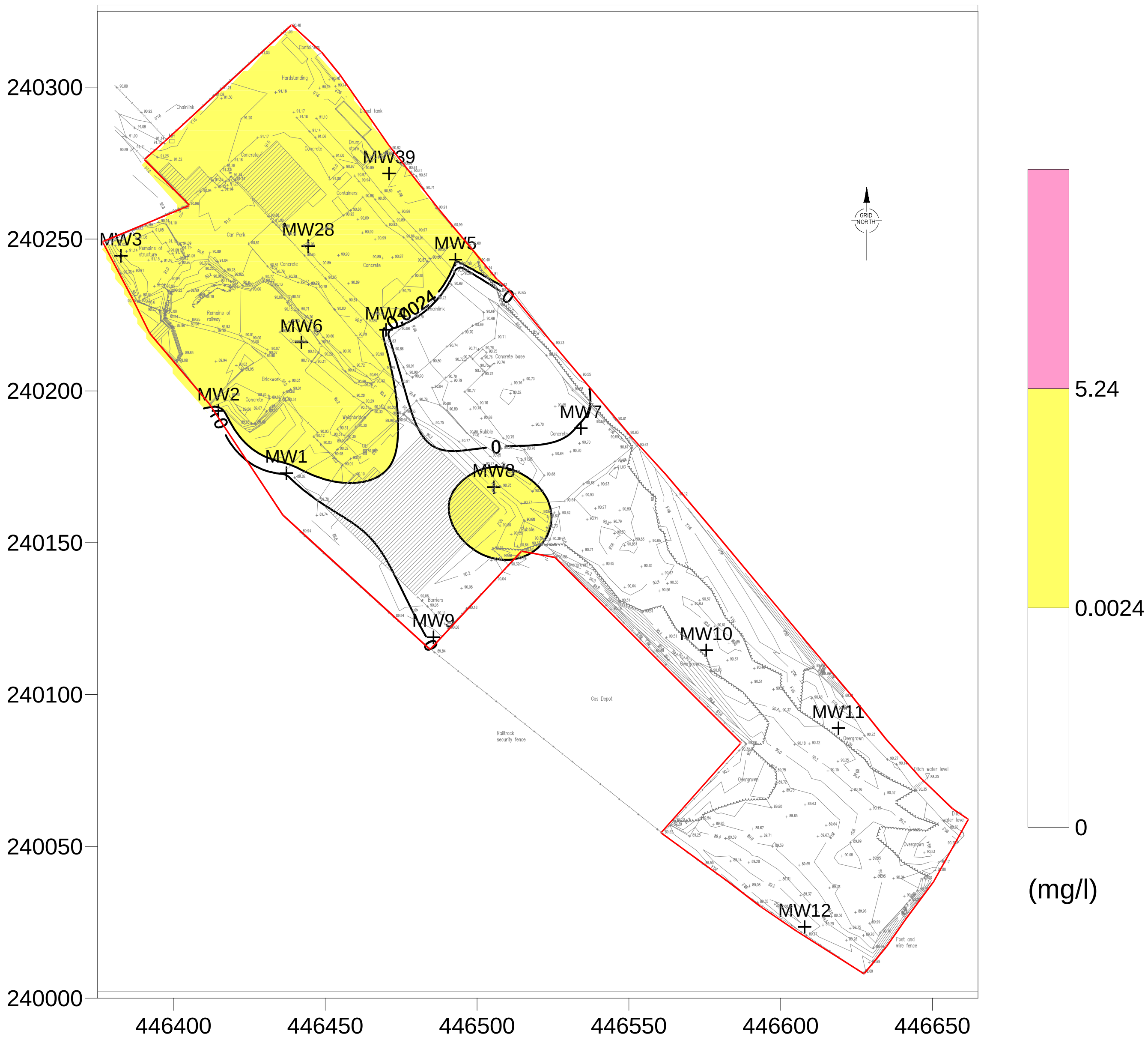
Merton Street: Inferred Contours of Total Xylenes in Groundwater Jan 1999



EQS = 0.03 (mg/l) Target = 110 (mg/l)

Data Maximum Value = 0.31 (mg/l) : Target Exceeds Data Maximum Value

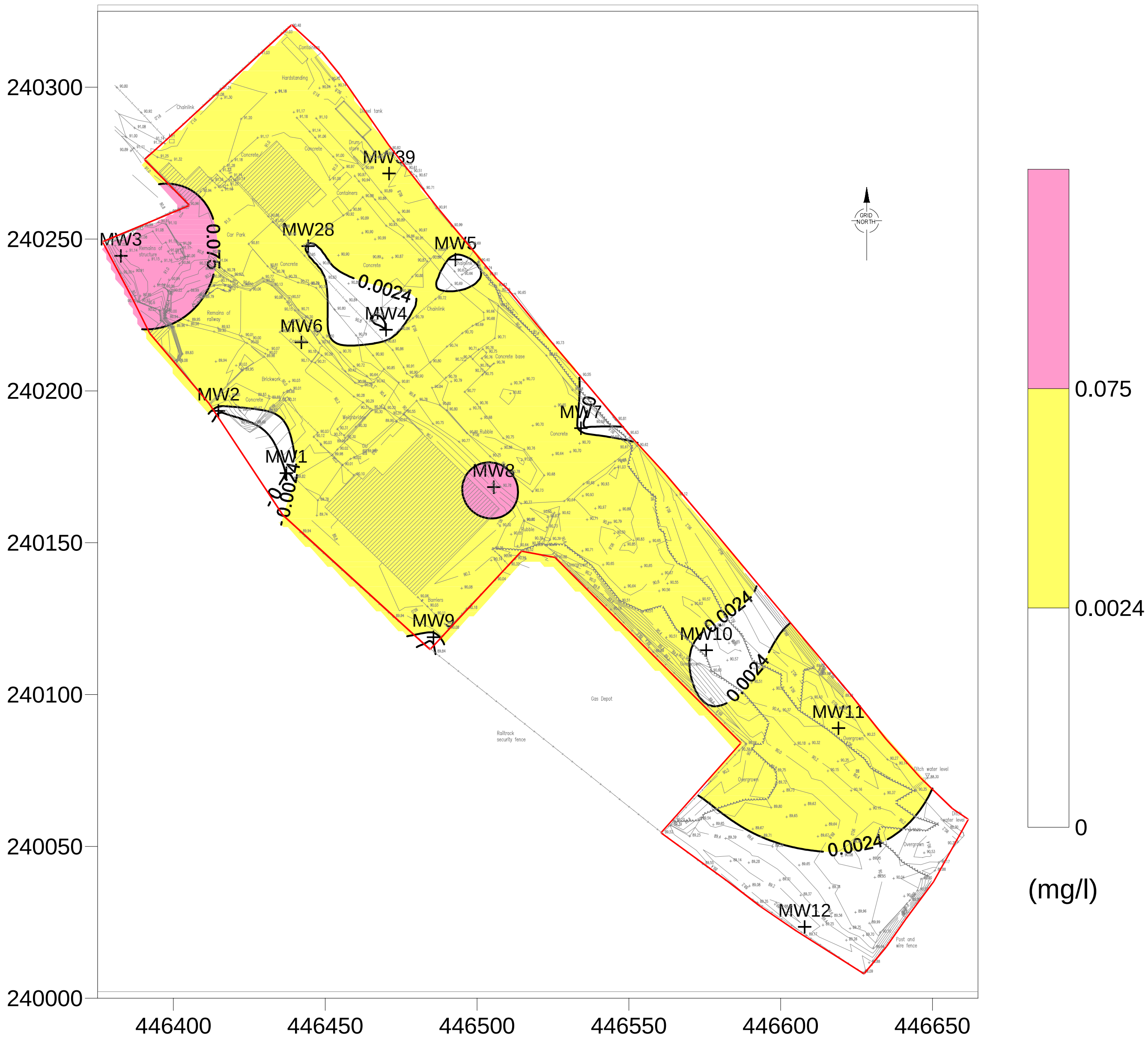
Merton Street: Inferred Contours of Naphthalene in Groundwater Jan 1999



EQS = 0.0024 (mg/l) Target = 5.24 (mg/l)

Data Maximum Value = 0.33 (mg/l) : Target Exceeds Data Maximum Value

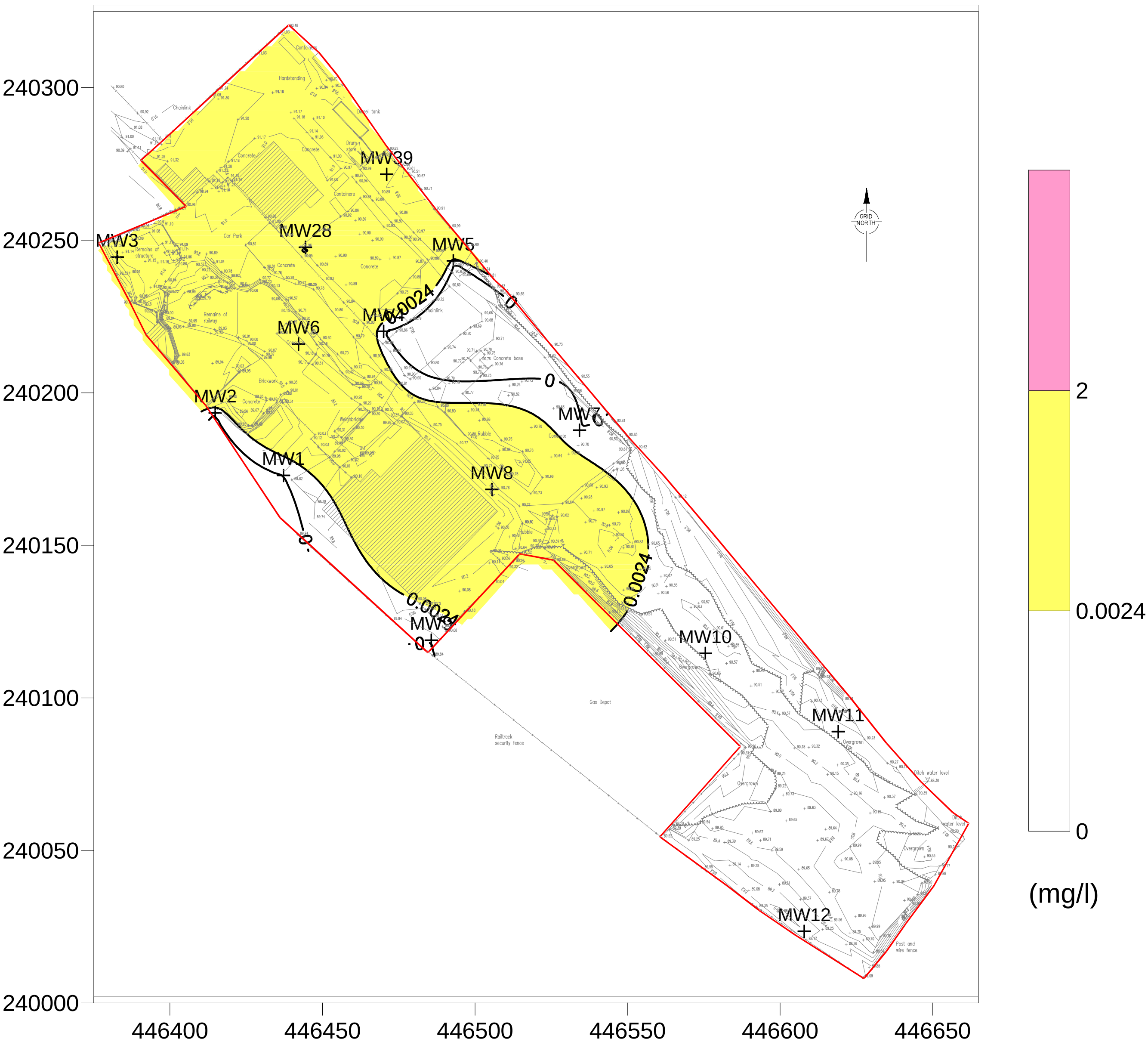
Merton Street: Inferred Contours of Acenaphthylene in Groundwater Jan 1999



EQS = 0.0024 (mg/l) Target = 0.075 (mg/l)

Data Maximum Value = 0.18 (mg/l)

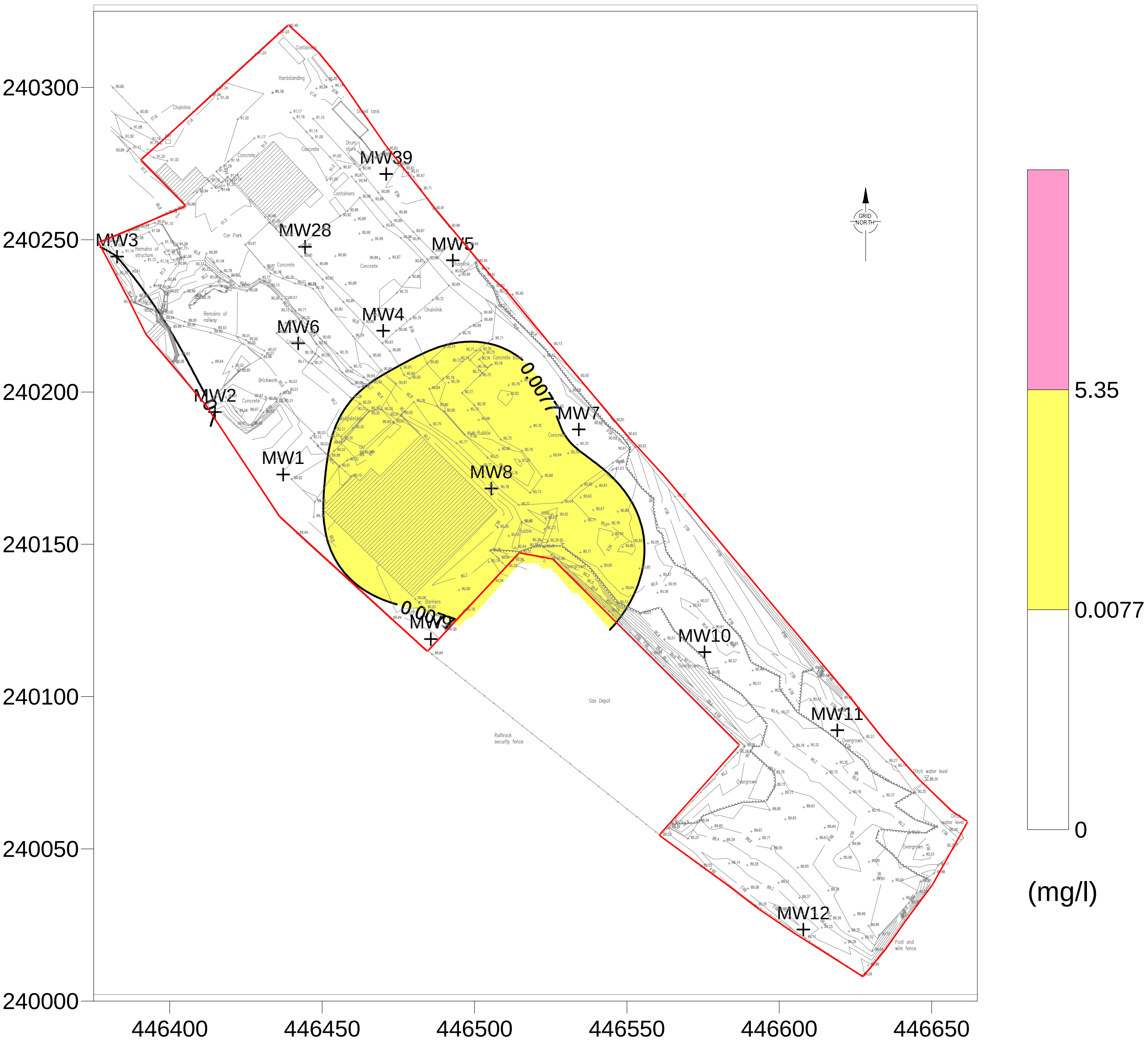
Merton Street: Inferred Contours of Acenaphthene in Groundwater Jan 1999



EQS = 0.0024 (mg/l) Target = 2 (mg/l)

Data Maximum Value = 0.15 (mg/l) : Target Exceeds Data Maximum Value

Merton Street: Inferred Contours of Phenol in Groundwater Jan 1999



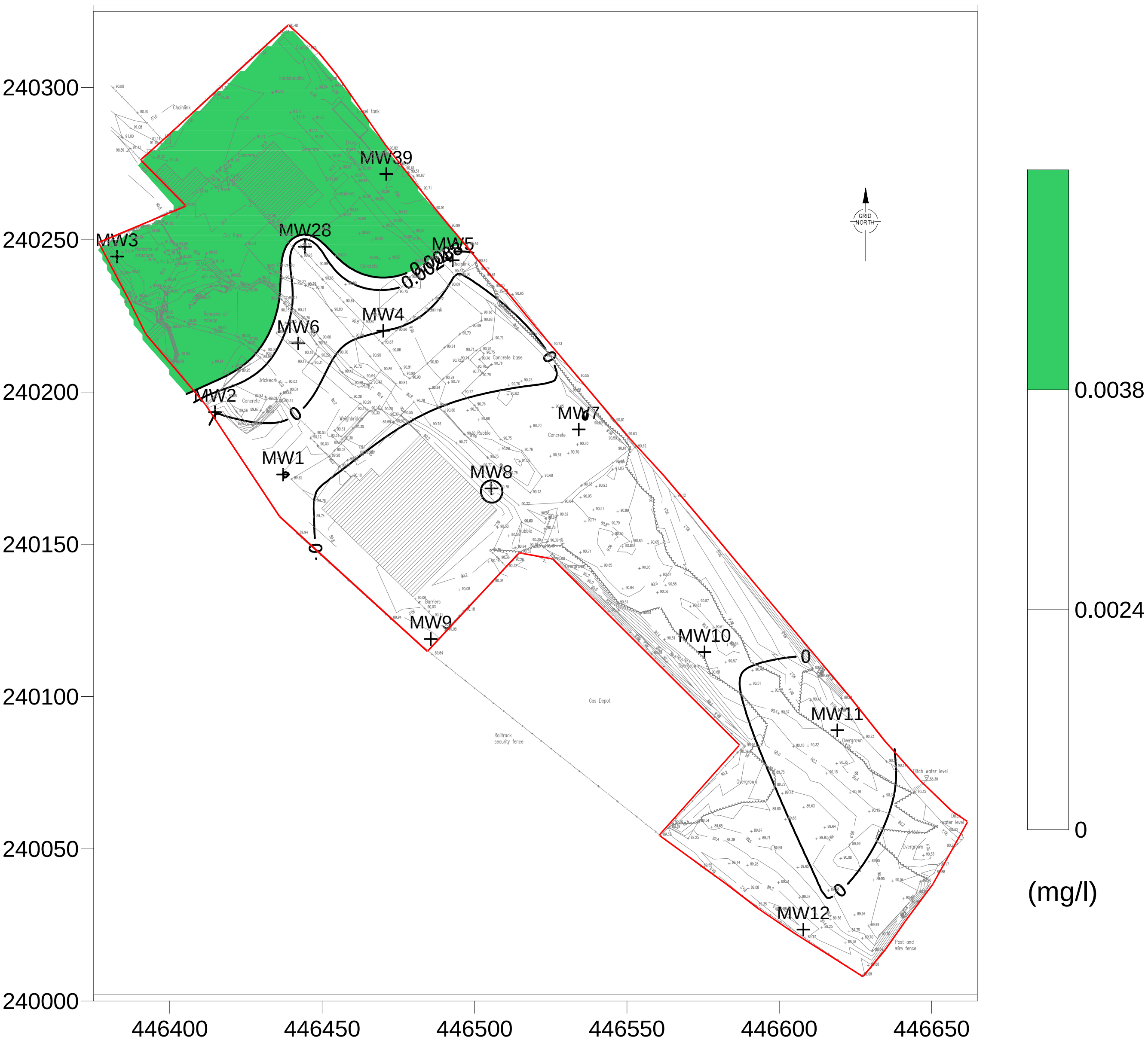
EQS = 0.0077 (mg/l) Target = 5.35 (mg/l)

Data Maximum Value = 0.045 (mg/l) : Target Exceeds Data Maximum Value

APPENDIX E

COMPARISON OF MEASURED GROUNDWATER CONCENTRATIONS WITH SOLUBILITY VALUES

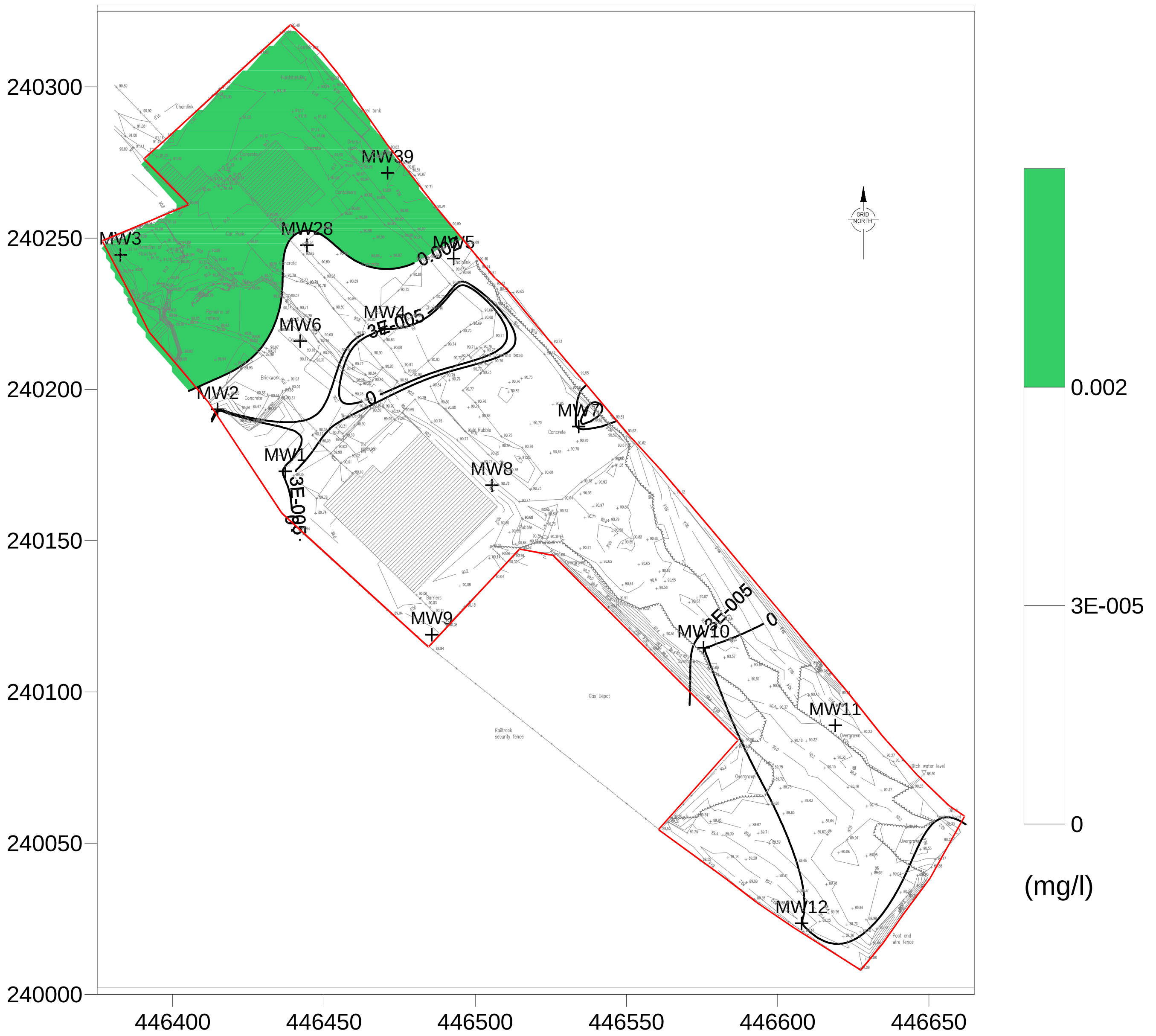
Merton Street: Inferred Contours of Benzo(a)anthracene in Groundwater Jan 1999



EQS = 0.0024 (mg/l) Solubility = 0.0038 (mg/l)

Data Maximum Value = 0.041 (mg/l)

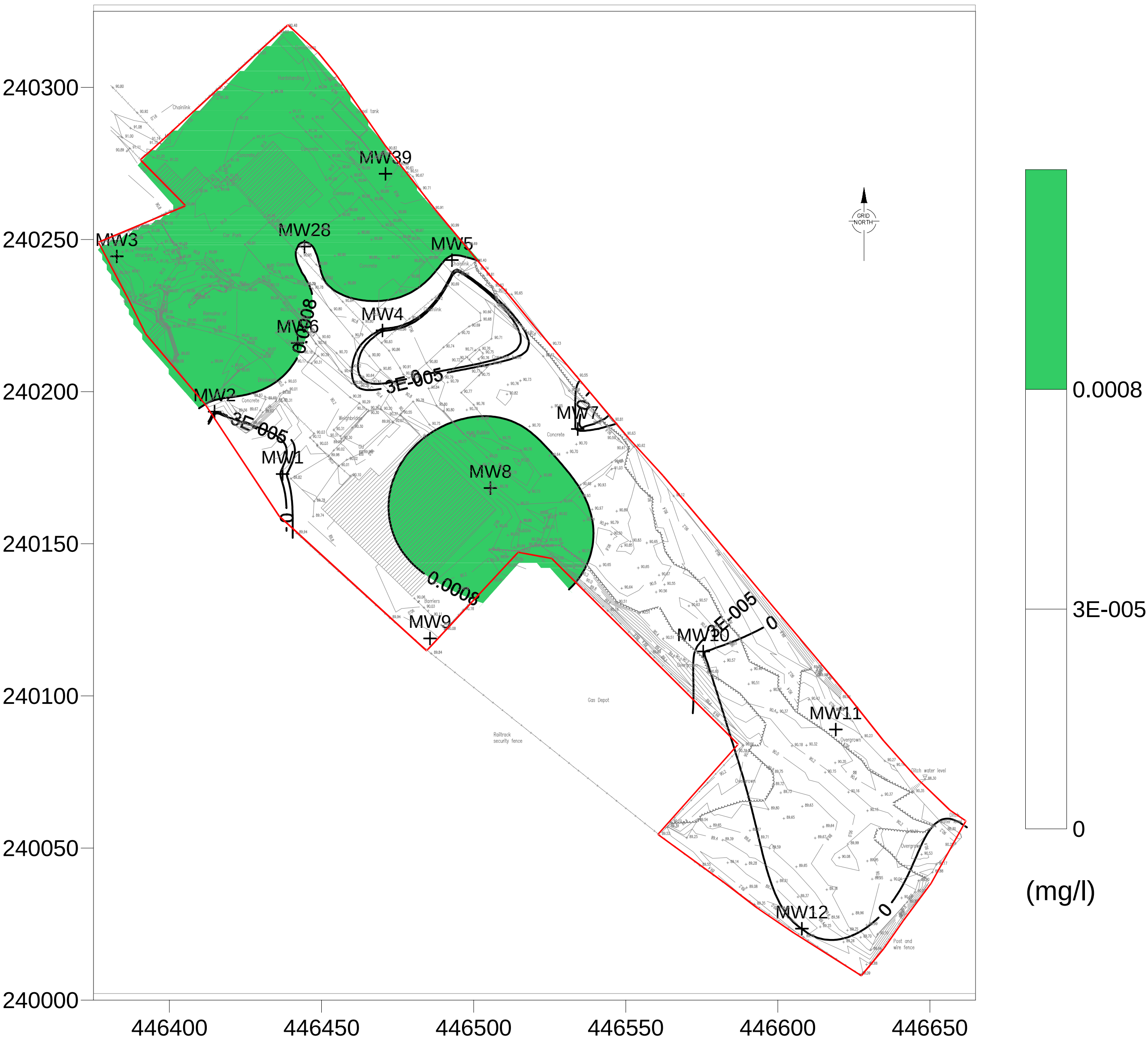
Merton Street: Inferred Contours of Benzo(b)flournthene in Groundwater Jan 1999



EQS = 0.00003 (mg/l) Solubility = 0.002 (mg/l)

Data Maximum Value = 0.021 (mg/l)

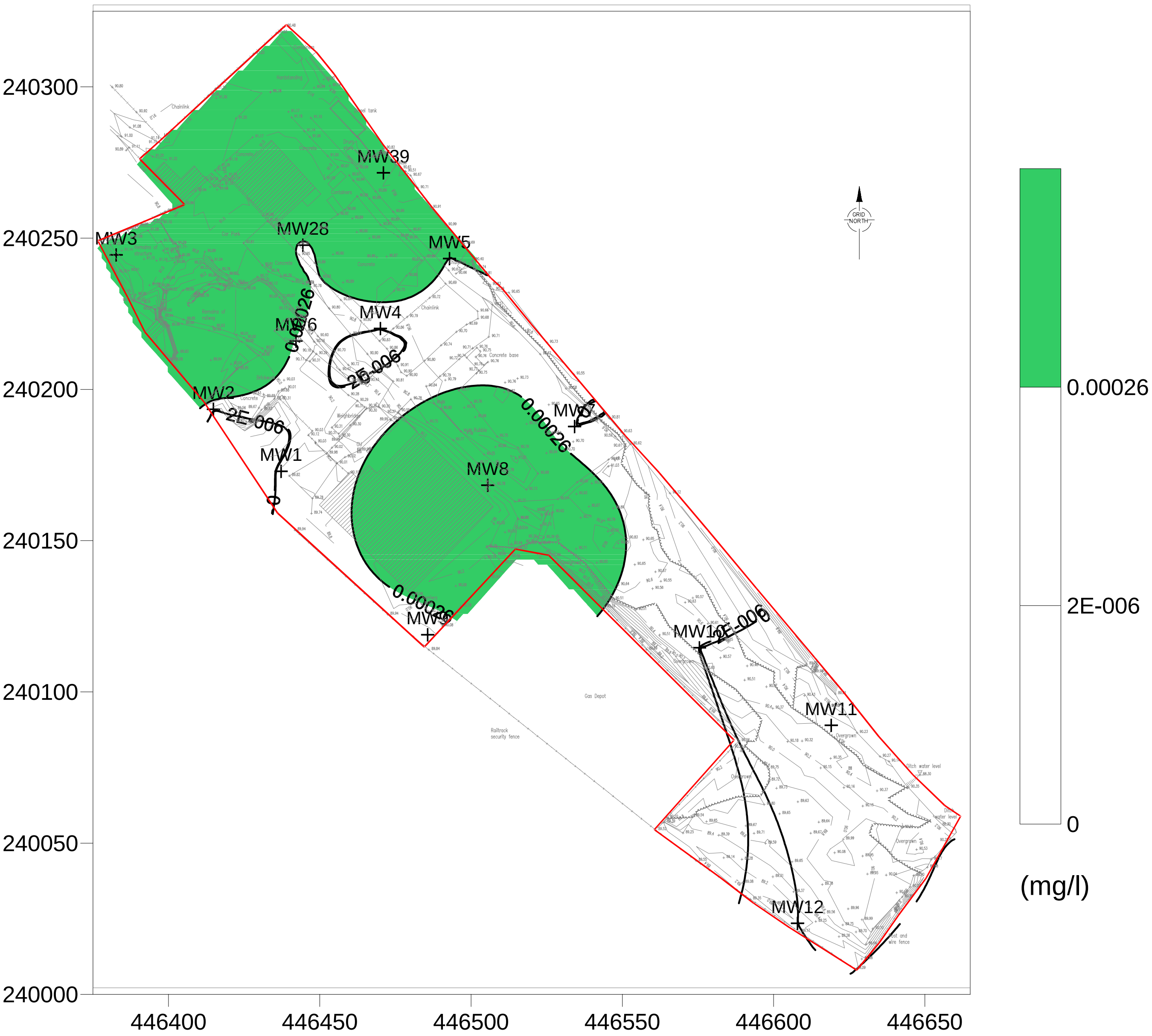
Merton Street: Inferred Contours of Benzo(k)flournthene in Groundwater Jan 1999



EQS = 0.00003 (mg/l) Solubility = 0.0008 (mg/l)

Data Maximum Value = 0.023 (mg/l)

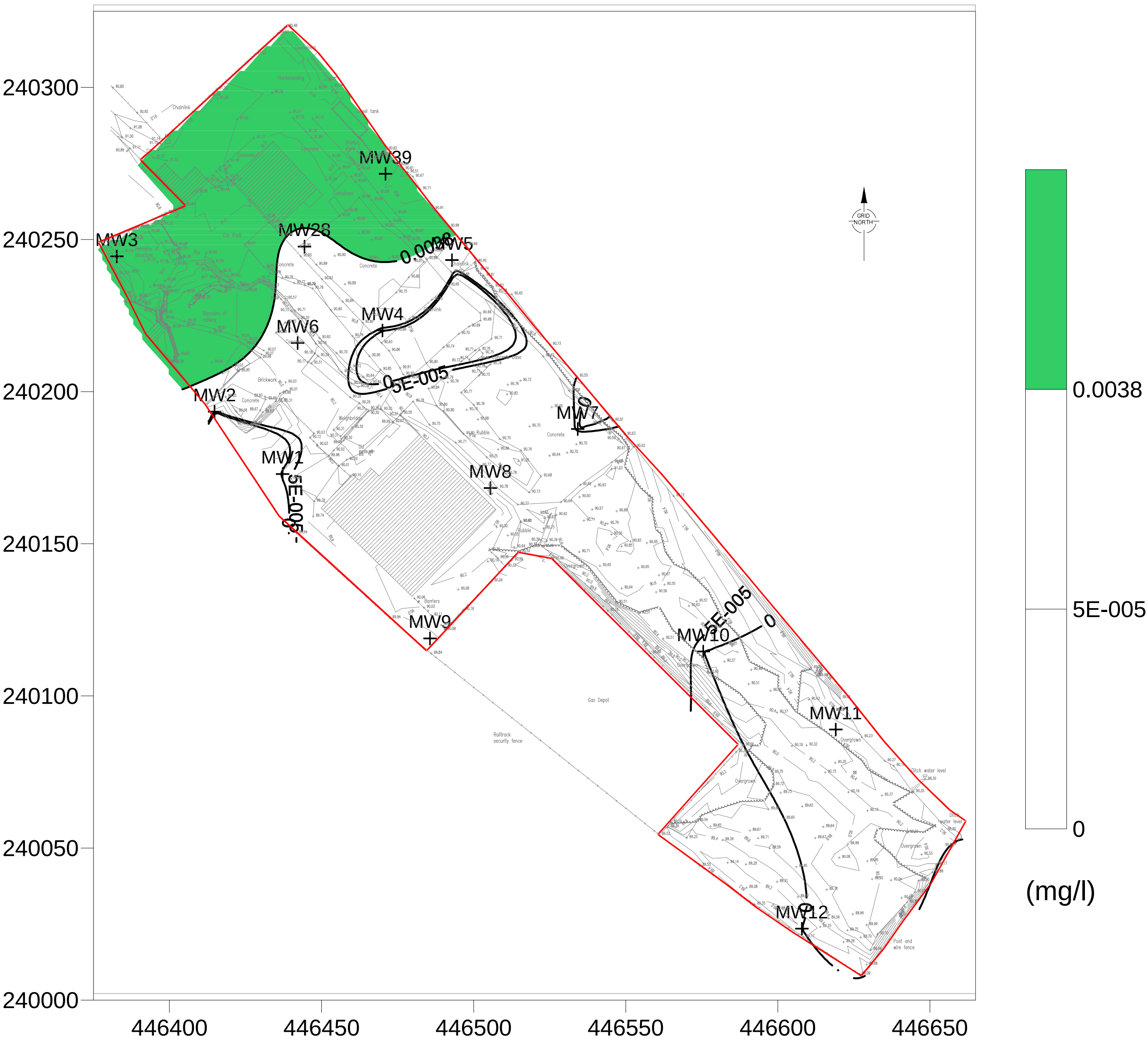
Merton Street: Inferred Contours of Benzo[g,h,i]perylene in Groundwater Jan 1999



EQS = 0.000002 (mg/l) Solubility = 0.00026 (mg/l)

Data Maximum Value = 0.0098 (mg/l)

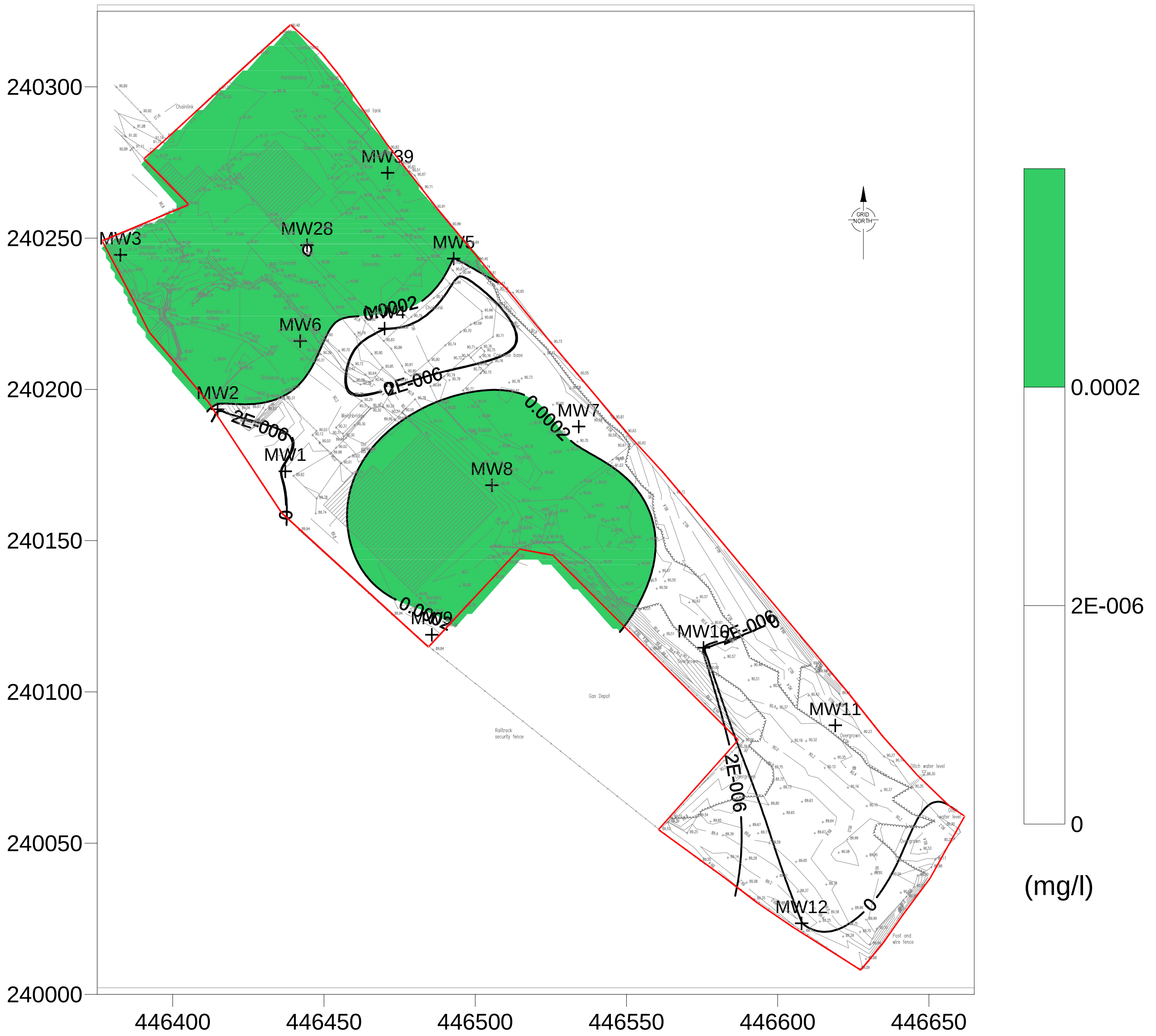
Merton Street: Inferred Contours of Benzo(a)pyrene in Groundwater Jan 1999



EQS = 0.00005 (mg/l) Solubility = 0.0038 (mg/l)

Data Maximum Value = 0.034 (mg/l)

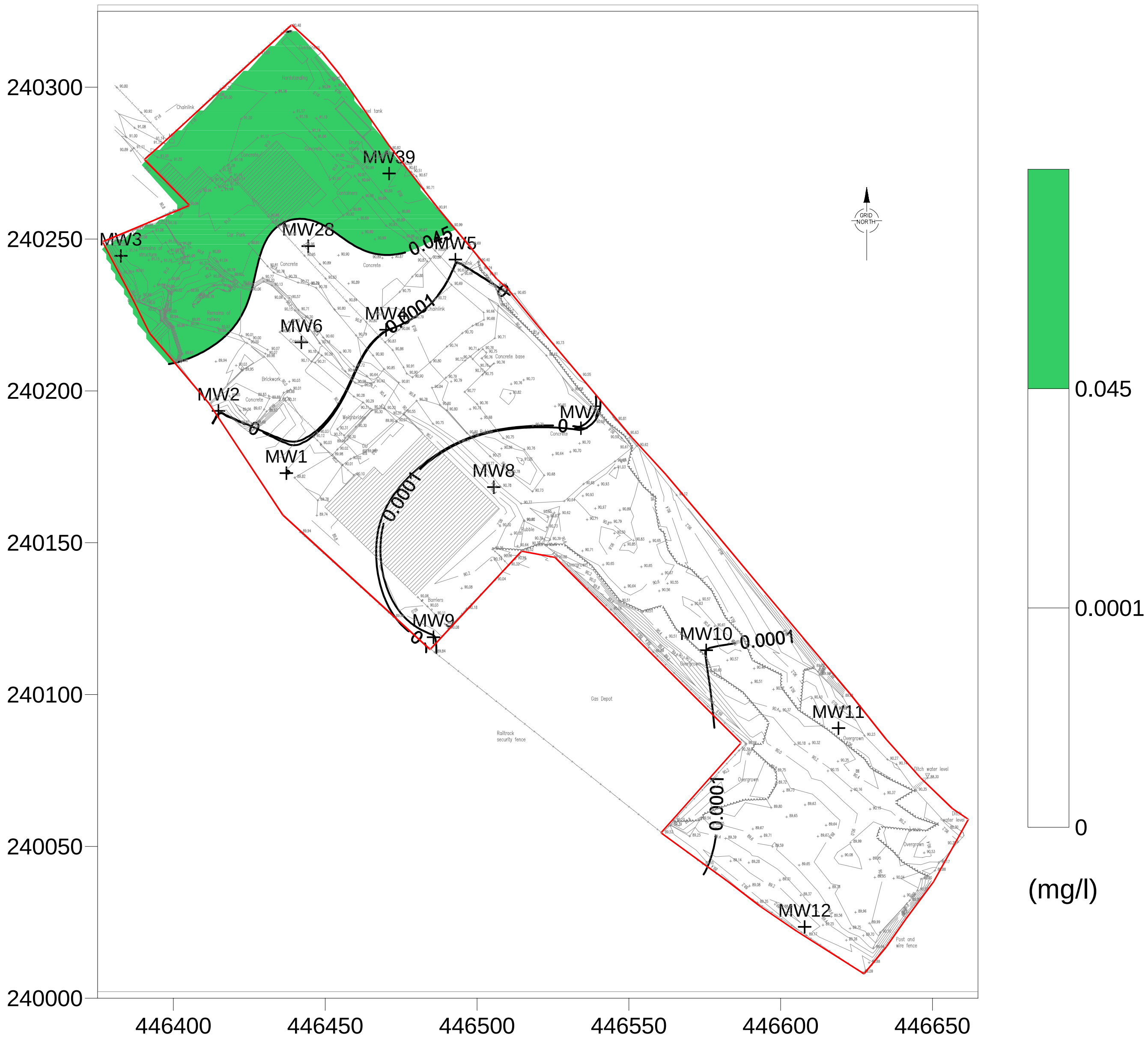
Merton Street: Inferred Contours of Indenopyrene in Groundwater Jan 1999



EQS = 0.000002 (mg/l) Solubility = 0.0002 (mg/l)

Data Maximum Value = 0.013 (mg/l)

Merton Street: Inferred Contours of Anthracene in Groundwater Jan 1999



EQS = 0.0001 (mg/l) Solubility = 0.045 (mg/l)

Data Maximum Value = 0.2 (mg/l)