Mid & West Wales Fire Service

EARLSWOOD TRAINING FACILITY, JERSEY MARINE, NEATH

Supplementary Site Investigation Report and Controlled Waters Risk Assessment

14050/LW/25/SSI/RevB

Intégral
Géotechnique

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1.0 INTRODUCTION

1.1 GENERAL

Mid & West Wales Fire Service have constructed a new training facility within the existing site at the Earlswood Training Centre in Jersey Marine, Neath for commercial end-use.

A Phase 1 Desk Study of the site was previously undertaken by Earth Science Partnership, and reference should be made to the following report:

- Proposed Training Facility (Commercial) Development Mid & West Fire Service, Earlswood Depot, Neath, Geotechnical and Geoenvironmental Desk Study, Report No. ESP.8178.3720 dated June 2022.

Intégral Géotechnique (Wales) Limited were instructed to undertake intrusive site investigation works at the site, and reference should be made to the following report:

- Earlswood Burn House, Jersey Marine, Neath, Site Investigation Report, Report No. 14050/LS/22/SI/RevC dated January 2024.

Following review of the above site investigation report, NRW requested that further information was provided, and a specific Controlled Waters Risk Assessment was carried out. Reference should be made to the following report:

- Earlswood Burn House, Jersey Marine, Neath, Controlled Waters Risk Assessment, Report No. 14050/LW/RevA dated 24 January 2024.

On review of the above, NRW still required further information in order for them to consider the discharge of Condition 4 (Intrusive Site Investigation Report) and 5 (Remediation Strategy Report) of Planning Permission P2022/0589.

Further site investigation works were therefore recommended in order to obtain further data and to undertake a detailed controlled waters risk assessment.

Intégral Géotechnique (Wales) Limited were appointed as the Geoenvironmental Engineers to undertake the recommended supplementary site investigation works to enable a geoenvironmental appraisal of the site and provide an updated controlled waters risk assessment.

1.1 GENERAL (CONTINUED)

This report presents the findings of the supplementary site investigation and controlled waters risk assessment, and gives recommendations for the geoenvironmental aspects of the project.

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1.2 PROPOSED DEVELOPMENT

The development comprises the construction of a new training facility, consisting of a carbonaceous fire behaviour training facility within an existing structure. External to the pre-existing building a control room, smoke filter housing and fan will be constructed.

It is important to note that the new facility has a closed drainage system for the plain water used in training exercises. This system contains all water run off and collects it into a tank where it is either re-used and/or tankered off site. None of the water percolates into the ground.

1.3 SCOPE OF WORKS

The work instructed included a supplementary intrusive investigation to specifically address Condition 4 (Intrusive Site Investigation Report) of Planning Permission P2022/0589 and to address Natural Resources Wales (NRW) queries within their letter referenced CAS-247805-T9Y1 dated 23 February 2024 (see Section 2.5).

The supplementary intrusive investigation was followed by laboratory testing, on site monitoring, controlled waters risk assessment and geoenvironmental reporting.

1.3 SCOPE OF WORKS (CONTINUED)

The supplementary site investigation was designed in accordance with BS 5930:2015+A1:2020, the Code of Practice for Site Investigations, BS10175:2011+A2:2017, the Code of Practice for Investigation of potentially contaminated sites, Land contamination risk management (LCRM), 'Development of Land Affected by Contamination: A Guide for Developers' prepared by Welsh Local Government Association (WLGA)/Natural Resources Wales (NRW) Land Contamination Working Group, 2023, and Environment Agency's 'Approach to groundwater Protection (2017)'.

The supplementary site investigation included:

- An intrusive investigation carried out during April 2025 comprising the drilling of six windowless sample boreholes.
- Sampling of soil/fill for laboratory chemical testing.
- Sampling of drainage water, surface water and groundwater for laboratory chemical testing.

1.4 LIMITATIONS

This document is intended to be a working document for further development in discussion with all concerned including the Local Planning Authority, Natural Resources Wales, and the appropriate building control as appropriate.

"Contamination" is taken throughout the report to mean the "presence of one or more potentially harmful substances as a result of human activity". The use of the term in this way does not imply that harm is being or might be caused by the contamination. It should be noted that "contamination" can have different meanings under different regulatory regimes, for example, planning, building control and Part IIA of the Environmental Protection Act 1990. Naturally elevated concentrations of potentially harmful substances may also be of concern and the significance of any that have been found is also evaluated in this report.

It is important to recognise that there may be areas of contamination that have not been found, or that contaminants are present at concentrations above those that have been found. It is also important to recognise that contamination may be localised and that no investigation, however comprehensive, is capable of finding such occurrences other than by chance.

It should also be noted that vertical and lateral changes in ground conditions may be present between exploratory hole locations.

1.4 LIMITATIONS (CONTINUED)

Access for the intrusive site investigation was partially limited at the time due to active buildings, areas of hardstanding and buried services.

2.0 THE SITE

2.1 SITE LOCATION AND DESCRIPTION

The site is located in Neath, west of Briton Ferry at a National Grid Reference of 273109, 194177, see Figure 1.

The site is roughly rectangular in shape and occupies an area of approximately 0.09 hectares. The boundaries of the site are defined by the wider Earlswood Training Centre site to the north and west, an access road and small wooded area to the east, an access road to the south. A site plan is presented in Figure 2.

The site is situated on relatively flat ground at an approximate elevation of 6.5m AOD.

The site itself comprises largely of a pre-existing building, containing the carbonaceous fire behaviour training facility. Outside the footprint of the building, the site comprises areas of hardstanding of predominantly concrete (in an overall good condition) or locally gravel.

2.2 SITE OPERATIONS

The site is occupied by a carbonaceous fire behaviour training facility surrounded by areas of predominantly concrete hardstanding.

It is important to note that the new facility has a closed drainage system for the plain water used in training exercises. This system contains all water run off and collects it into a tank where it is either re-used and/or tankered off site. None of the water percolates into the ground.

2.3 SURROUNDING LAND USE

Surrounding the Earlswood Training centre is a combination of undeveloped fields/wooded area and some residential and commercial properties. The M4 is present to the south of the site and the A48 is present to the north of the site. The River Neath is located some 140m east of the site at it closest point.

2.4 AVAILABLE SITE INVESTIGATION DATA

Intégral Géotechnique (Wales) Limited have previously provided the following reports for the site:

- Earlswood Burn House, Jersey Marine, Neath, Site Investigation Report, Report No. 14050/LS/22/SI/RevC dated January 2024.
- Earlswood Burn House, Jersey Marine, Neath, Controlled Waters Risk Assessment, Report No. 14050/LW/RevA dated 24 January 2024.

It should be noted that the Site Investigation Report referenced above included a summary of the following Phase 1 Desk Study report produced by Earth Science Partnership:

- Proposed Training Facility (Commercial) Development Mid & West Fire Service, Earlswood Depot, Neath, Geotechnical and Geoenvironmental Desk Study, Report No. ESP.8178.3720 dated June 2022.

The above referenced reports should be read in conjunction with this Supplementary Site Investigation Report.

A summary of the previous Site Investigation Report and Controlled Waters Risk Assessment is provided below.

2.4.1 Site Investigation Report Summary

An initial site investigation was undertaken in July and September 2022 and comprised the drilling of five windowless sample boreholes to a maximum depth of 5m below existing ground level (bgl) and coring of the existing concrete floor slab at three locations within the existing building.

The ground conditions beneath the site generally consisted of variable made ground to depths of between 1.0m and 2.2m bgl. The made ground was underlain by superficial soils consisting of loose yellow beige, light brown, orange dark brown, dark grey fine to coarse sand, locally with cohesive bands.

Groundwater was typically encountered at depths of between 2.0 and 3.0m bgl, locally shallower at between 1.0m and 2.0m bgl.

A total of 12No. representative soil samples of the made ground obtained during the investigation were tested for a range of contaminants, including petroleum hydrocarbons and PFOA/PFOS, identified as contaminants of potential concern within the Earth Science Partnership Phase 1 Desk Study Report.

2.4 AVAILABLE SITE INVESTIGATION DATA (CONTINUED)

Within the made ground deposits the majority of the analysed chemical elements or compounds were present at concentrations below the appropriate thresholds for a commercial end use. However, initial screening indicated exceedances of arsenic and lead.

The results of the laboratory testing for perfluorooctane sulfonic acid and perfluorooctanoic acid (PFOS and PFOA) indicated that the concentrations were present at concentrations below the appropriate thresholds.

Asbestos was detected within two made ground samples at <0.001% asbestos by weight.

No visual or olfactory evidence of contamination was identified within the natural superficial deposits.

The report concluded that the site surface covering of hardstanding, with no areas of soft landscaping provided an effective capping layer, breaking the pathway between the made ground and site users.

The report concluded that the risk to controlled waters was considered to be low given the site covering of hardstanding with formal drainage, reducing the infiltration into the ground minimising the potential for leachate generation.

2.4.2 Controlled Waters Risk Assessment Summary

Following the submission of the Site Investigation Report, Natural Resources Wales (NRW) requested that the potential risk to controlled waters was further investigated and assessed.

Therefore, a programme of groundwater sampling and testing commenced in September 2023. A total of three rounds of groundwater sampling and testing was undertaken to establish baseline conditions.

The representative samples of the groundwater were tested for a range of contamination including petroleum hydrocarbons and PFOS.

The results indicated exceedances of copper, lead and PFOS and localised exceedances of petroleum hydrocarbons, and the PAH compounds fluoranthene and benzo(a)pyrene.

Based on the results of the groundwater monitoring programme, the potential risk to controlled waters from petroleum hydrocarbons, fluoranthene and benzo(a)pyrene was considered to be low given the occasional exceedance detected during the monitoring programme.

2.4 AVAILABLE SITE INVESTIGATION DATA (CONTINUED)

The concentrations of copper and lead were fairly consistent during the three monitoring rounds, and the concentrations were not significantly elevated and the potential risk to controlled waters was considered to be low given the distance to the River Neath.

The concentrations of PFOS indicated an overall reducing trend over the three monitoring rounds. Although the concentrations of PFOS recorded during the monitoring rounds were elevated above the Annual Average EQS threshold and the Environment Agency alternative Annual Average threshold, the recorded concentrations were significantly below the Maximum Acceptable Concentration EQS and the groundwater annual average threshold. The recorded PFOS concentrations were also significantly below known background levels in rivers.

The site is covered by either the building footprint or areas of hardstanding with formal drainage. It was considered that the potential for rainfall infiltration into the ground, leachate generation from the made ground and the potential for vertical migration to impact on the underlying groundwater was considered to be low.

Further to be above, it was noted that there is no on site source of PFOS within the site, given that the use of PFOS (>0.001wt%) within firefighting foam was prohibited since June 2017 and as stated above the made ground located beneath the site is encapsulated below the proposed building and areas of hardstanding.

It was therefore considered that the overall risk to controlled waters from copper, lead and PFOS was considered to be low.

2.5 CONSULTATIONS WITH REGULATORS

As stated in Section 1.3, Natural Resources Wales (NRW) have previously raised queries relating to planning application P2022/0589. The following referenced correspondence have been received from NRW Planning Department:

- CAS-217758-F5G9 dated 23 May 2023
- CAS-220818-C8X7 dated 14 July 2023
- CAS-247805-T9Y1 dated 23 February 2024

For ease of reference, the queries raised in the latest correspondence are cited in italics below, and highlighted in bold the additional information requested:

2.5 CONSULTATIONS WITH REGULATORS (CONTINUED)

Poly- and Per-Fluoroalkyl Substances (PFAS)

Historically, a key ingredient of Aqueous film-forming foams (AFFF) was Perfluorooctane Sulfonate (PFOS). Following the discontinuance of PFOS based foaming agents, fire departments have relied on foam containing fluorinated and hydrocarbon-based products. These foaming agents still contain PFOAs. See CL:AIRE publishes new Technical Bulletin (TB22) on the uses of PFAS to assist with identification of sites of concern (claire.co.uk) for further information. ***The applicant should provide an indication as to which PFAS compounds are expected to be encountered at the site and where on site based upon information gathered from the desk stop study*** *(i.e. were details of the firefighting foams stored on site available in the site history and were certain PFAS compounds used on site at certain periods of time?). This should inform a targeted intrusive investigation and sampling regime as well as inform the suite of analysis used withing the site investigation. This information has not yet been provided.*

Given the ubiquitous nature of PFAS, ***we would welcome specific details as to what precautions were taken to reduce as far as possible the risk of cross-contamination when installing monitoring equipment and carrying out sampling across the site****. This has not been provided in detail.*

It is understood that given the hydrophobic and hydrophilic parts within PFAS structures it's likely that PFAS would sit at the water table. Some initial research recommends that when undertaking groundwater sampling for the purpose of assessing PFAS, it is prudent to select a number of boreholes which are screened as close to the water table as possible at varying depths to enable the collection of samples at varying depth increments (ideally different increments within different boreholes to avoid cross contamination). It is unclear whether the water table and groundwater at differing intervals has been targeted for sampling of PFAS on site. ***We would recommend that groundwater at the water table and soils near to the saturated zone be sampled to understand source term associated with this site.***

It is considered that concrete and drainage channels can be important secondary sources of PFAS. Based on this, ***sampling of drainage areas / network including residue silt or sediment is recommended****. There is no evidence of this as of yet.*

2.5 CONSULTATIONS WITH REGULATORS (CONTINUED)

It should be made clear that our comments and advice relating to PFAS in this response are based on the current understanding of any guidance and standards which are relevant at the time of writing. PFAS contamination management as a topic is of high priority across the industry at the moment, and therefore the regulatory position on classification, standards, guidance and management are likely to change in future as additional information, learning, experience and decision making is undertaken. As this topic rapidly progresses regulatory advice and position may change.

Given the intended continued use of the site as a firefighting training ground, we strongly ***recommend that the applicant provides information explaining the pollution prevention measures that are to be implemented as part of the development to prevent ongoing / re-contamination of soils and groundwater with PFAS substances****.*

Other Contaminants

It is noted that Copper, Lead, Fluoranthene, Benzo(a)pyrene have been detected in groundwater at concentrations and occurrences that suggest ***further assessment of the risk posed by these substances to controlled waters is warranted****.*

It is noted within the discussion that 'the down hydraulic gradient concentrations are typically greater than the up gradient concentrations'. Please provide further context to this as there has been no previous discussion of predicted groundwater flow directions provided*. It is noted that groundwater levels have been recorded within the original 5 WS locations as well as the additional 2 WS locations.* ***Could this information be interpreted to provide an indication of groundwater flows****?*

The discussion suggests 'the concentrations are not significantly elevated and the potential risk to controlled waters is considered to be low given the distance to the River Neath.' There is similar discussion for the elevated concentrations of PAHs encountered. ***Please provide further context and stronger evidence to justify why the concentrations encountered are not considered to pose a risk to controlled waters****.*

Overall, NRW do not consider the risk to controlled waters to be sufficiently understood nor has it been sufficiently assessed. On this basis, we do not recommend conditions 4 or 5 be discharged.

In order to address the above comments the following works have been completed and reported within this report:

2.5 CONSULTATIONS WITH REGULATORS (CONTINUED)

- Consultations with Mid and West Fire Service – to gain an understanding of the historical and current use of Aqueous Film Forming Foams (AFFF) at the site and the broader Earlswood Training Facility.

- Soil sampling and testing – in order to refine the conceptual model and included the soil sampling for a range of contamination within the western half of the site (previously not investigated), soil sampling of the unsaturated and saturated zone for an extended suite of PFAS.

- Drainage system – in order to determine if the drainage system is a source of secondary PFAS contamination.

- Groundwater sampling and testing – groundwater monitoring standpipes were installed within boreholes with response zones to reflect encountered groundwater depths. The groundwater levels have been monitored and groundwater sampled for laboratory testing.

- Surface water sampling and testing (River Neath) – surface water samples were collected where safely possible for laboratory testing.

- Controlled waters risk assessment carried out.

2.6 CONSULTATIONS WITH MID AND WEST WALES FIRE SERVICE

Consultations have been undertaken with the Mid and West Wales Fire Service (MAWWFIRE) in regard to the historical and current use of Aqueous Film Forming Foams (AFFF) at the broader Earlswood Training Facility.

It is important to note that the MAWWFIRE has no records of any AFFFF being stored within the site, however it cannot be ruled out. Historically and currently, firefighting foams have been stored at the wider training facility, typically in sealed 25litre drums, prior to being distributed to fire stations for operational replenishment.

Prior to 2011, AFFF products were known to contain per- and polyfluoroalkyl substances (PFAS), particularly long chained compounds such as perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), long chained compounds such as 8:2FTS may have been also present in these foams.

2.6 CONSULTATIONS WITH MID AND WEST WALES FIRE SERVICE (CONTINUED)

MAWWFIRE does not hold any written records confirming which or if any legacy AFFF products were stored or used within the site or wider Earlswood Training Centre. However, they have indicated that FP70, a legacy AFFF product, was used in service prior to 2011.

It is possible that FP70 was stored at the site and within the wider training facility. If present, this foam would have been stored in 25-litre drums. If used for training purposes, this would have taken place within the former drill ground, which is not located within development site red line site boundary in question. FP70 was removed from service in 2011, in line with regulatory restrictions on the use of long-chain PFAS compounds such as PFOS.

Subsequently, following the regulatory phase-out of long PFAS compounds in firefighting foams, shorter-chain alternatives such as 6:2 FTS have been used in some products, unless the foam is certified as fluorine-free.

In recent years the following AFFF have been stored within the wider training centre.

- FREEFOR SF2: This foam was stored at the wider training centre within sealed 25-litre drums and has been in operational use for the past five years. However, it is no longer stored at the training facility and has not been used in training exercises at the site. The available data sheet for FREEFOR SF2 does confirm whether it is fluorine free, therefore the presence of PFAS compounds such as 6:2 FTS cannot be ruled out.

- Respondol ATF 33: This is the current foam product stored at the wider training facility. It is held in an Intermediate Bulk Container (IBC) and used to refill bowsers at operational fire stations. It is not used for training purposes at the Earlswood Training Centre. According to the available Safety Data Sheet, Respondol ATF 33 is fluorine-free.

2.7 BACKGROUND ON PFAS USE IN AFFF

PFAS are a group of several million synthetic chemicals. PFAS comprise molecules where all (per) or some (poly) of the chain of carbon atoms within their structure are fully fluorinated, i.e. the hydrocarbon atoms bonded to carbon atoms have been replaced by fluorine atoms. The C-F bond’s strength imparts great resistance to chemical attack and biological degradation.

2.7 BACKGROUND ON PFAS USE IN AFFF (CONTINUED)

PFAS have historically been widely used in industrial and consumer products due to their unique ability to repel water, oil and resist heat. One of the most prominent applications of PFAS have been in AFFF, which are used for rapid suppression of flammable liquid fibres.

In 2023 ITRC described two categories of legacy foam and one category of modern foam:

- Legacy PFOS AFFF: contain PFOS and other compounds such as PFHxS. Can also contain perfluorooctane sulfonyl fluoride (POSF), which transforms to PFOS. Typically phased out of production in 2002 and banned in the EU since June 2011.
- Legacy fluorotelomer AFFF: contain polyfluorinated precursors such as 8:2 FTS, which has the potential to transform to PFOA.
- Modern fluorotelomer AFFF: contain only short-chain (C6) fluorotelomer based fluorosurfactants. These foams neither contain nor transform in the environment to PFOS or PFOA, but can transform, to PFHxA, PFPeA and 5:2 FTCA.

3.0 PRELIMINARY CONCEPTUAL SITE MODEL

3.1 RISK ASSESSMENT FRAMEWORK

In order to be consistent with current UK government policies and legislation, it is necessary to identify, assess, estimate, evaluate, and take appropriate action to deal with land contamination, in accordance with the procedures specified in the Environment Agency guidance Land Contamination Risk Management (LCRM) published in October 2020. This replaces the now withdrawn 'Model Procedures for the Management of Land Contamination CLR-11' (Environment Agency 2004).

The risk assessment process is designed to provide a reasoned, structured and pragmatic mechanism for the identification of any potential human health and controlled waters risks associated with land contamination and where necessary to develop a robust remediation strategy to ensure protection of the sensitive receptors (human health of future residents, controlled waters, etc).

In accordance with LCRM, the term 'land contamination' is defined as:

- All land affected by contamination – land that might have contamination present which may, or may or may not, meet the statutory definition of contaminated land,
- Land determined as contaminated land under Part 2A of the Environmental Protection Act 1990.

LCRM provides a tiered approach to risk assessment, comprising a preliminary risk assessment (including the development of an initial conceptual site model), a generic quantitative risk assessment and a detailed quantitative risk assessment. For each tier of risk assessment, the following steps must be followed:

1. Identify the hazard - establish contaminant sources,
2. Assess the hazard – use a source-pathway-receptor linkage approach to determine if there is potential for unacceptable risk,
3. Estimate the risk – predict what degree of harm or pollution may result and how likely it is to occur, and
4. Evaluate the risk – decide whether a risk is unacceptable.

LCRM also provides definitions of the following terms:

- Hazard – a property or situation that in particular circumstances could lead to harm or pollution,

3.1 RISK ASSESSMENT FRAMEWORK (CONTINUED)

- Risk – a combination of the probability, or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence,
- Risk assessment – the formal process of identifying, assessing and evaluating the health and environmental risks that may be associated with a hazard,
- Risk management – the formal process to identify, assess and determine the risks, and to select and take action to mitigate them.

The three essential elements to any risk are defined by LCRM as follows:

- A contaminant, or pollutant, that is in, on, or under the land and that has the potential to cause harm, or pollution (Source)
- A route by which a receptor is, or could be affected by a contaminant (Pathway)
- A receptor, i.e. something that could be adversely affected by a contaminant, for example a person, controlled waters, an organism, an ecosystem, or Part 2A receptors such as buildings, crops or animals (Receptor).

In order for there to be a potential risk, all three of the above elements must be present. If there is a source of contamination and a receptor (for example a resident or site user), then there is only a potential risk if there is a pathway linking the two. Such an active pathway is known as a relevant pollutant linkage. It is possible for the same contaminant to be linked to a receptor via a number of pathways, and hence it is important that all relevant pollutant linkages, to both human health and controlled waters, are separately identified on a site in order that a comprehensive conceptual model can be formed and ultimately a robust remediation strategy designed.

Current practice during Generic Quantitative Risk Assessment of land affected by contamination is to use generic soil screening values based on the appropriate proposed end use. These usually comprise risk-based Soil Guideline values (SGVs) or Generic Assessment Criteria (GACs) derived by the Environment Agency's Contaminated Land Exposure Assessment Model (CLEA). The SGVs and the supporting technical guidance were developed in order to assist in the assessment of long-term risk to human health from the exposure to contaminated soils.

Revised Statutory Guidance, published in 2012, to support Part 2A of the Environmental Protection Act 1990, introduced a new four category system for classifying land under Part 2A. Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is considered to be acceptably low. Under Part 2A, land would be determined as contaminated if it falls within Categories 1 or 2.

3.1 RISK ASSESSMENT FRAMEWORK (CONTINUED)

The revised Part 2A Statutory Guidance was accompanied by an Impact Assessment that identified a role for new 'Category 4 Screening Levels' (C4SLs) that would provide a simple test for determining when land is suitable for use and definitely not contaminated land. A Policy Companion Document including the C4SLs was published in March 2014 (England) and May 2014 (Wales).

The C4SLs have been based on the CLEA methodology and derived using the CLEA model, with modified toxicological and exposure parameters. To date, C4SLs have been released for six substances (arsenic, cadmium, chromium (VI), lead, benzo(a)pyrene and benzene).

The C4SLs have been derived on the assumption that where they exist, they will be used as generic screening criteria within generic quantitative risk assessment.

Following publication of the C4SLs, Land Quality Management (LQM), in conjunction with the Chartered Institute for Environmental Health (CIEH) released Suitable 4 Use Levels (S4ULs) in January 2015.

The S4ULs have been derived in accordance with UK legislation and using a modified version of the Environment Agency's CLEA software. As such, the S4ULs are based on the concept of minimal or tolerable risk as described in Human Health Toxicological Assessment of Contaminants in Soil (Science Report SR2, Environment Agency 2009a).

S4ULs have been derived for a wider number of substances.

In addition to the existing SGVs, C4SLs and S4ULs, Atkins ATRISK^{soil} also provide a set of Soil Screening Values. These are currently intended to be used in conjunction with SGVs, although they intend to update these values in line with the C4SLs in due course.

We have reviewed all sets of values and intend to use the most appropriate assessment criteria as Tier 1 screening values in the first instance. Where a published S4UL is available, and considered appropriate, this will be used in the first instance.

3.2 CONCEPTUAL MODEL FRAMEWORK

The preliminary stage of the risk assessment process is to develop and define a conceptual site model, based on the desk study and any existing site investigation data. This is used to establish any potential contaminant sources, identify existing and future receptors and assess if there are any potentially active pathways by which a potential risk may be present.

The preliminary conceptual site model will be developed and refined as site specific data is gathered, such as actual ground conditions and chemical data, resulting in a more robust conceptual understanding of the site.

3.3 CRITICAL SENSITIVE RECEPTOR – HUMAN HEALTH

The redevelopment of the site is for a commercial end use. Therefore, the critical sensitive receptor from a human health perspective is an on-site commercial receptor.

In accordance with S4UL/C4SL and CLEA guidance for a standard commercial scenario, the critical sensitive receptor for a commercial end use risk assessment is a female adult, with exposure from 16 to 65 years.

The standard commercial end-use conceptual model defined by S4UL/C4SL and CLEA is assumed to be suitable for the purposes of this assessment.

3.4 CRITICAL SENSITIVE RECEPTOR – CONTROLLED WATERS

Based on the redevelopment of the site for a commercial end use, and the findings of the desk study, the critical sensitive receptor from a controlled water perspective is groundwater within the near surface alluvium and the Secondary A Aquifer of the Upper Coal Measures.

By considering groundwater as the critical sensitive receptor for controlled waters, the groundwater/hydrogeological risk assessment will also be protective of the small channel to the west of the site and the River Neath to the east of the site.

3.5 POTENTIAL CONTAMINANT SOURCES

As identified in the desk study, the historical land uses at the site since the 1880's has resulted in a list of potentially contaminative uses that include, the railway line which ran through the site, the building of the Earlswood Training Facility and the current use by the Fire Service. Significant made ground materials are also anticipated.

3.5 POTENTIAL CONTAMINANT SOURCES (CONTINUED)

The potential types of contaminants of concern are listed below:

- Metals, semi-metals, and inorganics within the shallow made ground and shallow groundwater
- Polyaromatic hydrocarbons (PAH) within the shallow made ground and shallow groundwater
- Petroleum Hydrocarbons (VPH/EPH) within the shallow made ground and shallow groundwater. Also beneath the former above ground storage tank.
- Asbestos within the shallow made ground
- PFAS within the shallow made ground and shallow groundwater.

3.6 POTENTIAL EXPOSURE PATHWAYS

Potential exposure pathways for the critical receptors (both human health and controlled waters) are listed below:

- Dermal contact with soil and/or soil derived dust
- Ingestion of soil
- Inhalation of soil derived dust
- Inhalation of vapours – indoor and outdoor air
- Leaching of contaminants from made ground to groundwater
- Transportation of contaminants within groundwater.

In addition, the following exposure pathways have also been considered:

- Ground gas generation and migration
- Building materials durability.

3.7 SUMMARY OF CONCEPTUAL EXPOSURE MODEL

A preliminary conceptual exposure model has been developed for the site. This is based on the findings of the desk study, historical review and site walk over and includes all potential sources, pathways and receptors that may be present on site. Those that have been identified as being potentially active require further investigation in the form of sampling and testing of soils and groundwater, followed by appropriate risk assessment.

The preliminary conceptual exposure model will be reviewed and refined following the completion of the site works and laboratory testing.

3.7 SUMMARY OF CONCEPTUAL EXPOSURE MODEL (CONTINUED)

The preliminary conceptual exposure model is presented below in Table 1.

Table 1: Preliminary Conceptual Exposure Model (Updated)

Source		Receptor	Pathway	Potentially Active Pathway?
Origin	Contaminant			
Made Ground of unknown origin and historical land uses	Metals, semi-metals, non-metals, PAH, petroleum hydrocarbons, asbestos, PFAS	Future Commercial Site User – human health	Dermal Contact with made ground/dust	✓
			Ingestion of soil	✓
			Inhalation of dust	✓
			Inhalation of vapours – indoor/outdoor	✓
	Metals, semi-metals, inorganics, PAH, petroleum hydrocarbons and PFAS	Groundwater quality	Leaching from made ground	✓
	Metals, semi-metals, inorganics, PAH, petroleum hydrocarbons and PFAS	Surface water quality	Transportation within groundwater	✓
Above ground storage tank	Petroleum hydrocarbons	Future Commercial Site User – human health	Dermal Contact with made ground/dust	✓
			Ingestion of soil	✓
			Inhalation of dust	✓
			Inhalation of vapours – indoor/outdoor	✓
	Petroleum hydrocarbons	Groundwater quality	Localised spillage	✓
	Petroleum hydrocarbons	Surface water quality	Transportation within groundwater	✓
Made Ground of unknown origin and natural ground	pH and water soluble sulphate	Building Materials Durability	Direct contact	✓[1]
Ground Gas – organic, gas producing materials	Methane, carbon dioxide	Human health	Accumulation of gases in confined spaces, and/or migration off site, leading to asphyxiation, or risk of explosion	✓[2]

1. The risk to building and material durability was assessed and appropriate remedial measures recommended within the Site Investigation Report, Report No. 14050/LS/22/SI/RevC dated January 2024 and therefore no additional consideration is included within this report.

3.7 SUMMARY OF CONCEPTUAL EXPOSURE MODEL (CONTINUED)

2. The ground gas was assessed and concluded within the Site Investigation Report, Report No. 14050/LS/22/SI/RevC dated January 2024 and therefore no additional consideration is included within this report.

4.0 THE SITE INVESTIGATION

4.1 FIELDWORKS

A site investigation was designed in accordance with BS 5930:2015+A1:2020, the Code of Practice for Site Investigations, BS10175:2011+A2:2017, the Code of Practice for Investigation of Potentially Contaminated Sites, Land Contamination Risk Management (LCRM), 'Development of Land Affected by Contamination: A Guide for Developers' prepared by Welsh Local Government Association (WLGA)/Natural Resources Wales (NRW) Land Contamination Working Group, 2023, and Environment Agency's 'Approach to groundwater Protection (2017)'..

The supplementary site investigation was also designed to provide information to support and refine the preliminary conceptual site model/conceptual exposure model and address the queries raised by NRW.

A supplementary investigation comprising the drilling of six windowless sample boreholes, was carried out during April 2025.

The windowless sample boreholes were located across the site and drilled to a maximum depth of 4.0m below existing ground level.

The purpose of the windowless sample boreholes was to prove the shallow ground conditions and allow an assessment including the presence and depth of the groundwater and to allow soil samples to be obtained.

Groundwater monitoring standpipes were installed within three of the boreholes to allow both groundwater to be monitored, sampled and tested.

Representative soil samples were taken from the windowless sample boreholes for laboratory chemical testing and placed in the appropriate sample containers deemed suitable for the analysis required. Strict protocols were adopted during this process to limit the cross contamination of samples. The protocols adopted are further discussed in Section 4.2.

Following the installation of the standpipes, groundwater was sampled for laboratory chemical testing.

4.1 FIELDWORKS (CONTINUED)

The fieldworks were supervised by a qualified Geotechnical Engineer from Intégral Géotechnique (Wales) Limited who also logged the windowless sample boreholes and prepared their detailed engineering logs in accordance with the requirements of BS5930:2015+A1:2020. The engineering logs provide descriptions of the materials encountered in accordance with BSEN ISO 14688-1 (2002) and 14689-1 (2003) for soils and rocks respectively.

The approximate locations of the windowless sample boreholes are shown on Figure 2, while their logs are presented in Appendix B.

Rising head permeability testing was undertaken within selected boreholes and the calculation sheets are presented in Appendix C.

It should be noted that all soil and groundwater sampling equipment, groundwater monitoring installations and drilling techniques utilised materials that were free from PFAS.

4.2 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Sampling principles and techniques used for soils and/or groundwater to be tested for PFAS are consistent with conventional sampling techniques used during site investigations. However, additional measures and specific consideration is required to prevent any soil or water samples from coming into contact with materials or equipment to prevent cross-contamination from one location to the other.

Therefore, the site investigation was undertaken in accordance with Intégral Géotechnique (Wales) Limited Standard Operating Procedures: Sampling for Per and Polyfluoroalkyl Substances (PFAS).

Many materials, including personal protective equipment (PPE), drilling materials and equipment and general field equipment and supplies used in the course of the sampling procedure have the potential to contain PFAS. Therefore, materials which have the potential to contain PFAS such as Teflon™, polytetrafluoroethylene (PTFE), fluorinated ethylene propylene, ethylene tetrafluoroethylene (ETFE), low density polyethylene (LDPE), polyvinylidene fluoride (PVDF) and waterproof coating containing PFAS were avoided. Individual product specification should be examined closely, and alternative equipment and materials used.

4.2 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC) (CONTINUED)

Focus was undertaken on materials that come into direct contact with field samples and have a plausible pathway for impacting the concentrations of PFAS at levels of concern.

Prior to undertaking of any sampling (soil, drain water, groundwater and surface water) a site-specific sampling work plan was implemented.

Quality Assurance and Quality Control (QA/QC) procedures were undertaken to confirm the reliability and robustness of the sampling procedures, testing and the data produced. The sampling and testing measures deemed appropriate for the site investigation included:

- Duplicate Soil or Water Sample: A duplicate soil or water sample to verify the sampling and laboratory precision.
- Field Blank Sample: To demonstrate the sampling site environment does not introduce PFAS cross contamination during the sampling event including from ambient air and verified laboratory accuracy.
- Equipment Rinsate Sample: To demonstrate the soil sampling equipment has been sufficiently decontaminated between sample locations.

A 10% rule is widely applied to QC sampling (i.e., the number of QC samples should be 10% of the total number of samples taken). During the investigation this was exceeded to demonstrate the reliability and robustness of the sapling procedures, testing and data produced.

4.3 FIELD OBSERVATIONS

No visual or olfactory evidence of any gross contamination was observed during the drilling of the windowless sample boreholes.

Made ground of varying thickness was encountered within each exploratory location.

4.4 LABORATORY CHEMICAL TESTING - SOILS

Representative soil samples were taken from windowless sample boreholes across the site, stored at the appropriate temperature and dispatched to the laboratories of i2 Analytical for laboratory chemical testing within 24 hours.

The samples were tested for a range of contaminants that reflects the historical use of the site, the findings of the desk study and the preliminary conceptual site model/conceptual exposure model. A summary and list of the soil testing carried out is given below:

4.4 LABORATORY CHEMICAL TESTING – SOILS (CONTINUED)

4.4.1 Additional Area – WS201 to WS204

During the initial site investigation the area of hardstanding covering the western half of the site was outside the area of investigation. Therefore, a total of 4No. samples from the western half of the site were taken and tested for the following contaminants:

Beryllium	Cadmium
Total Chromium	Hexavalent Chromium (VI)
Copper	Lead
Mercury	Nickel
Vanadium	Zinc
Arsenic	Boron
Selenium	Elemental Sulphur
Total Cyanide	Total Sulphate
Sulphide	Water Soluble Sulphate
pH	Monohydric Phenol
Polyaromatic Hydrocarbons (PAH)	Petroleum Hydrocarbons (VPH/EPH)

Samples were also screened for asbestos.

4.4.2 Entire Site Area – PFAS only

Across the entire site area, a total of 15No. soil samples were taken and tested for an extended suite of PFAS substances.

The samples were obtained at varying depths, with a representative sample obtained from both the unsaturated and saturated zones across the site area.

The results of all the soil testing are presented in Appendices D.

4.5 LABORATORY CHEMICAL TESTING – SURFACE WATER DRAINAGE

A number of surface water drains cross the site. Where water was present within the surface water drainage system at the time of the site works, a representative sample was obtained for laboratory testing.

It should be noted that during the intrusive investigation no silt/sediment was encountered within the drainage system and therefore no sample of any silt/sediment was obtained.

4.5 LABORATORY CHEMICAL TESTING – SURFACE WATER DRAINAGE (CONTINUED)

A total of 2No. drainage water samples were obtained from the surface water drainage system in the centre of the site.

The samples were dispatched to the laboratories of i2 Analytical and tested for an extended suite of PFAS substances.

The results of the surface water drainage testing are presented in Appendix E and the testing locations are shown on Figure 2.

4.6 LABORATORY CHEMICAL TESTING – RIVER SURFACE WATER AND GROUNDWATER

Upon completion of the drilling works, groundwater was sampled from the monitoring wells (with response zones located within the superficial deposits) installed within three of the windowless sample boreholes.

During the monitoring rounds samples were also obtained from the River Neath. A representative sample was obtained from both upstream and downstream.

The groundwater and river surface water samples were dispatched to the laboratories of i2 Analytical and tested for a similar suite of contaminants as the soils including the extended suite of PFAS substances.

Three rounds of river surface water and groundwater sampling and testing was undertaken to establish baseline conditions.

The results of the groundwater and river surface water testing are presented in Appendix F and G, respectively.

The surface water sampling location are shown on Figure 2.

4.7 LABORATORY CHEMICAL TESTING – QUALITY CONTROL SAMPLING

As previously discussed in Section 4.2, Quality Control (QC) sampling was undertaken to confirm the reliability and robustness of the sampling procedures, testing and the data produced. The measures deemed appropriate for the site investigation included duplicate samples (soil and water), equipment rinsate samples and field blank samples.

Quality Control samples were obtained during the soil sampling and water sampling of the surface water drainage, watercourse sampling and groundwater sampling.

4.7 LABORATORY CHEMICAL TESTING – QUALITY CONTROL SAMPLING (CONTINUED)

All samples were dispatched to the laboratories of i2 Analytical and tested for an extended suite of PFAS substances.

4.8 SUMMARY OF SAMPLES AND JUSTIFICATION

As stated previously in Section 2.6, historical PFAS containing AFFF has not been used within the development site boundary itself but may have been potentially used within the former fire training area to the northwest of the current development site. However, there is potential that historical and/or 'modern' AFFF has been stored within the site in sealed containers prior to the site's redevelopment as a fire-training facility.

Based on the information received from the MAWWFIRE and a site walkover, there was no definitive point source for PFAS (i.e. not currently used or stocked on site). Therefore, it was considered that the best approach to determine the potential risk from PFAS contamination was a series of windowless sample boreholes alongside each side of the building to obtain soil samples from various depths, including within the unsaturated and saturated zones of the encountered groundwater bodies.

One exploratory location, WS202, targeted the area of the former above ground storage tank, previously situated on the central western site boundary. This above ground tank has subsequently been removed and there was no visual evidence of any hydrocarbon staining on the surface hardstanding.

It should be noted that the positions of the exploratory locations were highly restricted by the presence of buried services that cross beneath the site.

A summary of all representative sampling undertaken at the site, together with an explanation/justification for taking that particular sample is outlined below:

4.8 SUMMARY OF SAMPLES AND JUSTIFICATION (CONTINUED)

Table 2: Summary of Soil Samples			
Sample Matrix	**Sample Number**	**Depth (m)**	**Justification**
Soil Samples			
Soil	WS201	0.9	To obtain coverage of the western half of the site. Sample tested for a range of contamination as listed in Section 6.3.1.
Soil	WS202	0.5	Target the former above ground storage tank. Sample tested for a range of contamination as listed in Section 6.3.1.
Soil	WS203	0.4	To obtain coverage of the western half of the site. Sample tested for a range of contamination as listed in Section 6.3.1.
Soil	WS204	0.6	To obtain coverage of the western half of the site. Sample tested for a range of contamination as listed in Section 6.3.1.
Soil	WS201	0.9	Targeting the unsaturated zone of the localised perched groundwater encountered within the made ground. Sample tested for the PFAS suite only.
Soil	WS201	1.4	Targeting the saturated zone of the localised perched groundwater encountered within the made ground. Sample tested for the PFAS suite only.
Soil	WS201	3.0	Targeting the unsaturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS201	3.7	Targeting the saturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS202	1.5	Targeting the unsaturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS202	2.3	Targeting the saturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS203	2.0	Targeting the unsaturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS203	3.0	Targeting the saturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS204	0.8	Targeting the unsaturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS204	1.4	Targeting the saturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS205	2.0	Targeting the unsaturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS205	2.8	Targeting the saturated zone within the superficial deposits. Sample tested for the PFAS suite only.

4.8 SUMMARY OF SAMPLES AND JUSTIFICATION (CONTINUED)

Table 2: Summary of Soil Samples (Continued)

Sample Matrix	Sample Number	Depth (m)	Justification
Soil	WS206	0.8	Targeting the unsaturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	WS206	1.8	Targeting the saturated zone within the superficial deposits. Sample tested for the PFAS suite only.
Soil	QC 3	3.6	QC sample consisting of a duplicate of WS201 at 3.6m.
Water	QC 1	-	QC sample consisting of a field blank.
Water	QC 2	-	QC sample consisting of a rinsate of the equipment utilised during the soil sampling process.
Surface Water Drainage System			
Water	SWD 1	-	Water sample obtained from surface water drain located to the west of the existing building. Sample tested for the PFAS suite only.
Water	SWD 2	-	Water sample obtained from surface water drain located to the west of the existing building. Sample tested for the PFAS suite only.
Groundwater			
Water	WS203	-	Sample of the shallow groundwater (up-gradient). Tested for full suite of contaminants and PFAS. Three rounds of samples obtained.
Water	WS205	-	Sample of the shallow groundwater. Tested for full suite of contaminants and PFAS. Three rounds of samples obtained.
Water	WS206	-	Sample of the shallow groundwater (down-gradient). Tested for full suite of contaminants and PFAS. Three rounds of samples obtained.
Water	WS205A	-	QC sample consisting of a duplicate sample of WS205 obtained during the first round of monitoring. Tested for PFAS suite only.
Water	WS203A	-	QC sample consisting of a duplicate sample of WS203 obtained during the second round of monitoring. Tested for PFAS suite only.
River Neath			
Water	RSC 01	-	Surface water sample obtained from the River Neath (up-gradient). Tested for full suite of contaminants and PFAS. Three rounds of samples obtained.
Water	RMD 01	-	Surface water sample obtained from the River Neath (down-gradient). Tested for full suite of contaminants and PFAS. Three rounds of samples obtained.

4.8 SUMMARY OF SAMPLES AND JUSTIFICATION (CONTINUED)

Table 2: Summary of Soil Samples (Continued)			
Sample Matrix	**Sample Number**	**Depth (m)**	**Justification**
Quality Control During Monitoring Visits			
Water	SPF 01 (14/05/2025)	-	QC sample obtained during first monitoring visit consisting of a rinsate equipment sample.
Water	SPF 01 (04/06/2025)	-	QC sample obtained during second monitoring visit consisting of a rinsate equipment sample.

4.9 GROUNDWATER MONITORING

During each groundwater monitoring round, the groundwater levels were checked and recorded. The boreholes were then purged of approximately three times the well volume using a bailer.

Each well was monitored in situ during purging for groundwater parameters pH, temperature, conductivity, total dissolved solids and salinity using a Hanna Multi Parameter Water Quality Meter. Representative samples of ground water were then collected and stored in the correct sample bottles during transportation to the laboratory.

It should be noted that all sampling equipment was checked to confirm it was PFAS free prior to use on site. The sampling equipment was cleaned between boreholes to prevent cross contamination between boreholes. Care was also taken to ensure the sampling equipment did not become contaminated at the ground surface.

Upon completion of the sampling, the rate of recovery of the groundwater level in the borehole was observed.

A copy of the groundwater monitoring results is presented in Appendix H.

5.0 GROUND CONDITIONS

The ground conditions encountered beneath the site were consistent with those previously encountered during the initial site investigation. The ground conditions typically consist of made ground of a variable composition and thickness over predominantly granular superficial deposits.

5.1 SURFACE HARDSTANDING

A surface covering of reinforced concrete was encountered at most of the exploratory locations at a thickness of between 0.15m and 0.4m thick.

Windowless sample borehole WS206 was drilled outside the area of hardstanding, with limestone gravel encountered from ground level to a depth of 0.3m below existing ground level (bgl).

5.2 MADE GROUND

Made ground was encountered at each exploratory location with the exception of WS206.

The made ground was variable in thickness and composition, with the made ground typically thicker within the western half of the site.

The made ground consisted of black to dark grey slightly silty gravelly sand and/or sandy gravel. The gravel typically consisted of limestone, ash, slag, brick and clinker.

The made ground was encountered to depths of between 0.5m and 3.0m bgl.

5.3 SUPERFICIAL SOILS

The made ground (or surface covering of gravel at WS206) was underlain by superficial soils consisting of greyish brown fine to coarse sand. Locally the superficial soils contained sandstone gravel and/or bands of clay.

Locally within WS205 a band of peat was encountered at the interface between the made ground and superficial soils at a depth of between 1.45m and 1.65m.

Instability was noted within the superficial soils with casing required to advance the boreholes.

5.3 SUPERFICIAL SOILS (CONTINUED)

The superficial soils were proven to depths of between >3.0m and >4.0m bgl. It should be noted that the base of the superficial soils was not proven within the achieved depths of the windowless sample holes.

5.4 GROUNDWATER

During the recent intrusive investigation, groundwater was encountered at the following depths:

Tabe 3: Groundwater Levels Encountered During the Site Works

Exploratory Location	Depth to Groundwater(mbgl)	Strata
WS201	1.2	Made Ground
WS201	3.4	Superficial Soils
WS202	2	Superficial Soils
WS203	2.4	Superficial Soils
WS204	1.2	Superficial Soils
WS205	2.5	Superficial Soils
WS206	1.5	Superficial Soils

The groundwater conditions are based on observations made at the time of the fieldwork. It should be noted that groundwater levels may vary due to seasonal and other effects.

Groundwater levels were also measured during visits to site to sample groundwater. The depth range from the monitoring visit is summarised in Table 4 below. The depth to groundwater has been converted to a groundwater level with respect to ordnance datum.

Table 4: Summary of Groundwater Levels

Exploratory Location	Depth to Groundwater (mbgl)	Approximate Ground Level (mAOD)	Approximate Groundwater Level (mAOD)
WS203	0.83 – 0.86	6.5	5.68 – 5.65
WS205	0.84 – 0.87	6.5	5.76 – 5.53
WS206	0.75 – 0.81	6.8	6.05 – 5.99

5.4 GROUNDWATER (CONTINUED)

Based on the groundwater level summary above, variations in the groundwater level and flow have been observed beneath the site. This is likely due to a combination of:

- The sudden increase in ground level to the northwest of the Earlswood Training Centre, resulting in possible sub-artesian conditions.
- Variations in the thickness of made ground beneath the site. The made ground was encountered at a greater thickness in the northwestern area of the site, where the shallow groundwater body of the superficial soils was encountered at a deeper depth.
- Presence of drains crossing the site and the presence of soakaway to the south of the site area.

The River Neath is located approximately 200m to the southeast of the site, flowing to the south. Groundwater levels within the site are likely to be in hydraulic continuity with the river, which is tidally influenced. Assuming an average groundwater level below the site of 5.7m AOD and a river level of 1.0m AOD, a hydraulic gradient of 0.02 can be calculated for modelling purposes.

5.5 CONCEPTUAL SITE MODEL

Based on the findings of the site investigation, an indicative conceptual site model has been produced, based on a north-south section through the site. The model is presented in Figure 3.

It should be noted that the vertical scale has been exaggerated in order to demonstrate some of the features present beneath the site.

6.0 CONTAMINATION

6.1 AVERAGING AREAS

In order to assess the laboratory test results reliably and in context, the data have been grouped into an averaging area. An averaging area (or area of interest) is that area of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions. This may be an area of historical industrial usage, a soil type, or a specific proposed end use.

In the case of this analysis, the averaging area has been determined according to the proposed commercial end use.

6.2 SOIL CONTAMINATION – WESTERN AREA ONLY (EXCLUDING PFAS TESTING)

The Suitable 4 Use Levels (S4ULs) published by LQM have been adopted as critical concentrations against which soil contaminant concentrations can be compared. In the absence of additional published S4ULs, the Category 4 Screening Levels (C4SLs) derived by DEFRA and Soil Screening Values (SSVs) derived by Atkins ATRISK^{soil} for a commercial end use have been adopted, where considered appropriate.

Since the results of the testing indicate total organic carbon content (TOC) in the range of 0.2% to 4.4%, the results have been compared to the respective guidelines, where applicable, for 1% soil organic matter content.

The soil test results for made ground and have been summarised and are shown in Appendix I.

The results of the laboratory testing indicate that most of the analysed chemical elements or compounds are present at concentrations below the appropriate thresholds. However, the initial screening indicates exceedances of lead within the made ground.

Lead was detected at elevated concentrations within three out of the four made ground samples at concentrations between 1200mg/kg and 5200mg/kg, exceeding the relevant threshold of 200mg/kg.

The laboratory testing for petroleum hydrocarbons indicates that the analysed bands are either below the laboratory limit of detection or the relevant threshold.

Asbestos was not detected within the made ground samples.

6.2 SOIL CONTAMINATION – WESTERN AREA ONLY (EXCLUDING PFAS TESTING) (CONTINUED)

During the intrusive investigation, windowless sample borehole, WS202, was located in the location of the former above ground storage tank. No visual or olfactory evidence of petroleum hydrocarbon was encountered within the soil or groundwater during the drilling of the borehole. Additionally as stated above the results of the laboratory testing for petroleum hydrocarbon indicates that all analysed hydrocarbon bands within the sample obtained from WS202 are either below the laboratory limit of detection or the relevant threshold for a commercial end use.

6.3 SOIL CONTAMINATION – ENTIRE SITE AREA (PFAS TESTING ONLY)

The results of the laboratory testing indicate that the majority of the PFAS substances are below the laboratory limit of detection.

Concentrations of PFAS substances above the laboratory limit of detection was recorded within windowless sample borehole WS201 only.

Soil screening values are not readily available for PFAS substances. The PFAS substances recorded at concentrations above the laboratory limit of detection within WS201 consist of:

- Perfluorooctanesulfonic Acid (PFOS)
- Perfluorohexanesulfonic Acid (PFHxS)
- 6:2 Fluorotelomer Sulfonic Acid (6:2FTS)
- 8:2 Fluorotelomer Sulfonic Acid (8:2FTS)

A summary of the samples and test results obtained from WS201 is provided below:

6.3 SOIL CONTAMINATION – ENTIRE SITE AREA (PFAS TESTING ONLY) (CONTINUED)

Depth	Description	PFOS	PFHxS	6:2FTS	8:2FTS
0.9m	Made ground sample from unsaturated zone of the localised perched groundwater body	12ug/kg	0.3ug/kg	2.9ug/kg	5ug/kg
1.4m	Made ground sample from saturated zone of the localised perched groundwater body	1.9ug/kg	<0.1ug/kg	0.2ug/kg	<0.1ug/kg
3.0m	Superficial deposits sample from unsaturated zone of the shallow groundwater body	0.5ug/kg	<0.1ug/kg	0.2ug/kg	<0.1ug/kg
3.7m	Superficial deposits sample from saturated zone of the shallow groundwater	<0.1 ug/kg	<0.1ug/kg	<0.1ug/kg	<0.1ug/kg

In the first instance the concentrations of PFOS and PFHxS were assessed against the recently published C4SL for commercial end use of 600ug/kg.

The concentrations of PFOS and PFHxS recorded within WS201 are below the C4SL screening value and are not considered to present a potential risk.

The C4SLs are used in conjunction with a Hazard Index Approach to ensure that total exposure from the four PFAS compounds (PFOA, PFOS, PFHxS and PFNA) combined does not exceed the $LLTC_{oral}$. The hazard index (HI) of the sum of the hazard quotients (HQ) for the four PFAS compounds. The hazard quotient is derived by dividing the recorded soil concentration by the screening limit.

$$\mathbf{HI = HQ_{PFOA} + HQ_{PFOS} + HQ_{PFHxS} + HQ_{PFNA}}$$

The risk is considered acceptable provided that the hazard quotient for each PFAS compound and the hazard index do not exceed 1. A hazard quotient or index greater than 1 signifies that further assessment or consideration of risk is required.

For the soil samples obtained from WS201, the HI has been calculated below based on the highest concentration of each compound:

6.3 SOIL CONTAMINATION – ENTIRE SITE AREA (PFAS TESTING ONLY) (CONTINUED)

$$HI = (0.1/600) + (12/600) + (0.3/600) + (0.1/600)$$
$$HI = 0.00016 + 0.02 + 0.0005 + 0.00016$$
$$HI = 0.02$$

Therefore, the HI, is <1 and the concentrations of PFAS within the soil samples are not considered to present a potential risk to human health for a commercial end use.

There are currently no published screening values for 6:2 Fluorotelomer Sulfonic Acid (6:2FTS) and 8:2 Fluorotelomer Sulfonic Acid (8:2FTS).

The concentrations of 6:2FTS and 8:2FTS are not considered to be significantly elevated above the laboratory limit of detection and were localised to one sample of made ground. No vertical migration of the compounds was observed within the soil. The concentrations of 6:2FTS and 8:2FTS are not considered to pose a risk to the future end users.

Furthermore, within certain environmental conditions 6:2FTS has the potential to transform into PFHxA and 8:2FTS has the potential to transform into PFOA. No concentrations of either PFOA and PFHxA have been detected above the laboratory limit of detection in any tested soil samples.

6.4 SURFACE WATER DRAINAGE CONTAMINATION

Where water was present at the time of the intrusive investigation, representative samples were obtained from the surface water drains that cross the site.

The laboratory test results are presented in Appendix E.

The results of the laboratory testing indicate that all of the PFAS substances are below the laboratory limit of detection.

As previously stated, at the time of the intrusive investigation no silt/sediment was encountered within the surface water drains.

6.5 GROUNDWATER CONTAMINATION

Groundwater samples were taken from the monitoring wells installed within the three selected windowless sample boreholes across the site and analysed at the laboratories of i2 Analytical for the similar suite of elements and compounds as the soils. Copies of the three rounds of groundwater test results have been included in Appendix F.

The results have been screened against UK Drinking Water Standards and Freshwater EQS based on typical hardness values for the River Neath of >250mg/l $CaCO_3$.

As part of a 'Tier 1' screening exercise, the results of the groundwater analysis have been compared against the Annual Average Environmental Quality Standards (AA-EQS) for freshwater in the first instance. Where no AA-EQS values are available, the results have been compared against the Maximum Allowable Concentration Environmental Quality Standards (MAC-EQS) for freshwater. Where no EQS values are available, the results have been compared against UK and WHO drinking water standards, in hierarchy order.

Review of Water Quality Standards for General Contaminants		
Water Quality Standard	Source	Applicability
Annual Average Environmental Quality Standard (AA-EQS)	Environment Agency freshwater priority hazardous substances, priority substances and other pollutants and Environment Agency freshwater specific pollutants and operational environmental quality standards.	Applicable for the following analysed contaminants: Phenols, Boron, Arsenic, Cadmium, Copper, Lead, Nickel, Vanadium, Zinc, Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Fluoranthene, Petroleum Hydrocarbons
Maximum Allowable Concentration Environmental Quality Standards (MAC-EQS)	Environment Agency freshwater priority hazardous substances, priority substances and other pollutants and Environment Agency freshwater specific pollutants and operational environmental quality standards.	Applicable for the following analysed contaminants: Mercury, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Benzo(ghi)pyrene. Due to the absence of published MAC-EQS.
UK Drinking Water Standard	The Drinking Water Inspectorate (DWI) Drinking Water Standards	Applicable for the following analysed contaminants: Chromium, Selenium Due to the absence of published AA-EQS and MAC-EQS

6.5 GROUNDWATER CONTAMINATION (CONTINUED)

A summary of the groundwater test results and comparison with the screening criteria values is presented in Appendix J.

6.5.1 ASSESSMENT OF GENERAL CONTAMINANTS IN GROUNDWATER

The majority of the results were below the adopted guideline values. It should be noted that the results of the PFAS compounds will be discussed separately below.

In Round 1 of the testing the following exceedances were detected:

- Arsenic was detected at an elevated concentration of 51.5ug/l in WS205 only, marginally elevated above the AA-EQS threshold of 50ug/l.
- Copper was detected at elevated concentrations in WS203 and WS208 at concentrations of 3.2ug/l and 1.4ug/l, elevated above the AA-EQS threshold of 1ug/l.
- Lead was detected at elevated concentrations in WS203 and WS205 at concentrations of 1.6ug/l and 15ug/l, respectively, elevated above the AA-EQS threshold of 1.2ug/l.
- Zinc was detected at an elevated concentration of 28ug/l in WS203 only, elevated above the AA-EQS threshold of 10ug/l.

In Round 2 of the testing the following exceedances were detected:

- Arsenic was detected at an elevated concentration of 62.1ug/l in WS205 only, elevated above the AA-EQS threshold of 50ug/l.
- Copper was detected at elevated concentrations within each sample at concentrations of between 1.6ug/l and 1.8ug/l, elevated above the AA-EQS threshold of 1ug/l.
- Lead was detected at an elevated concentration of 6.4ug/l in WS205 only, elevated above the AA-EQS threshold of 1.2ug/l.
- Fluoranthene was detected at elevated concentrations in WS203 and WS205 at 0.11ug/l and 0.21ug/l respectively, elevated above the AA-EQS threshold of 0.01ug/l.
- Petroleum hydrocarbon band aliphatic C10-C12 and C12-C16 was detected at elevated concentrations in WS205 only at concentrations of 43ug/l and 160ug/l respectively, elevated above the AA-EQS threshold of 10ug/l.
- Petroleum hydrocarbon band aliphatic C16-C21 was detected at elevated concentrations in WS203 and WS205 at concentrations of 32ug/l and 170ug/l respectively, elevated above the AA-EQS threshold of 10ug/l.

6.5 GROUNDWATER CONTAMINATION (CONTINUED)

- Petroleum hydrocarbon band aliphatic C21-C35 was detected at elevated concentrations in WS203 and WS205 at concentrations of 330ug/l and 130ug/l respectively, elevated above the AA-EQS threshold of 10ug/l.

In Round 3 of the testing the following exceedances were detected:

- Lead was detected at elevated concentrations in WS203 and WS205 at concentrations of 3.8ug/l and 1.6ug/l, respectively, elevated above the AA-EQS threshold of 1.2ug/l.
- Copper was detected at elevated concentrations within each sample at concentrations of between 1.5ug/l and 6ug/l, elevated above the AA-EQS threshold of 1ug/l.
- Zinc was detected at an elevated concentration of 23ug/l in WS206 only, elevated above the AA-EQS threshold of 10ug/l.
- Petroleum hydrocarbon band aliphatic C10-C12 was detected at elevated concentrations within each location at concentrations between 16ug/l and 23ug/l respectively, elevated above the AA-EQS threshold of 10ug/l.
- Petroleum hydrocarbon band aliphatic C12-C16 was detected at elevated concentrations within each location at concentrations between 55ug/l and 150ug/l respectively, elevated above the AA-EQS threshold of 10ug/l.
- Petroleum hydrocarbon band aliphatic C16-C21 was detected at elevated concentrations within each location at concentrations between 16ug/l and 23ug/l respectively, elevated above the AA-EQS threshold of 10ug/l.
- Petroleum hydrocarbon band aliphatic C21-C35 was detected at elevated concentrations in WS203 and WS205 at concentrations of 490ug/l and 1200ug/l respectively, elevated above the AA-EQS threshold of 10ug/l.

Based on the results of the three rounds of groundwater monitoring site specific PNECs (Predicated No-Effect Concentrations) have been calculated for lead with the Water Framework Directive M-BAT (Metal Bioavailability) Tool (using a function of dissolved organic carbon (DOC)) and for zinc and copper using a function of DOC, calcium and pH.

Site specific PNECs of between 4.21ug/l and 11.99ug/l have been calculated for the elevated lead concentrations. Therefore, two recorded concentrations remain elevated above their respective calculated PNEC.

Site specific PNECs of 33.27ug/l and 17.85ug/l have been calculated for the elevated zinc concentrations. Therefore, the concentration of zinc within WS206 during the third monitoring round remains elevated above its calculated PNEC.

6.5 GROUNDWATER CONTAMINATION (CONTINUED)

Site specific PNECs of 5.08ug/l and 37.73ug/l have been calculated for the elevated copper concentrations. Therefore, all concentrations are below their respective PNECs.

6.5.2 ASSESSMENT OF PFAS IN GROUNDWATER

The groundwater samples were also tested for an extended suite of PFAS compounds. The results of the laboratory testing for PFAS are discussed separately below.

The majority of the compounds were below the laboratory limit of detection. PFAS compounds detected above the laboratory limit of detection for each of the three monitoring rounds are discussed below.

In Round 1 of the testing the following concentrations were detected above the laboratory limit of detection:

- 6:2 Fluorotelomer sulfonic acid (6:2FTS) was detected above the laboratory limit of detection (<0.05ug/l) in WS205 only at a concentration of 0.38ug/l.
- Perfluoropentonic acid (PFPeA) was detected above the laboratory limit of detection (<0.05ug/l) in WS205 only at a concentration of 0.13ug/l.
- Total perfluorooctanoic acid (PFOA) was detected above the laboratory limit within each sample at concentrations between 8.7ng/l and 24.6ng/l.
- Total perfluorooctanesulfonic acid (PFOS) was detected above the laboratory limit of detection within each groundwater sample at concentrations between 5.3ng/l and 36.3ng/l.

In Round 2 of the testing the following concentrations were detected above the laboratory limit of detection:

- 6:2 Fluorotelomer sulfonic acid (6:2FTS) was detected above the laboratory limit of detection (<0.05ug/l) in WS205 only at a concentration of 0.75ug/l.
- 8:2 Fluorotelomer sulfonic acid (8:2FTS) was detected slightly above the laboratory limit of detection (<0.05ug/l) in WS205 only at a concentration of 0.11ug/l.
- Perfluorohexanoic acid (PFHxA) was detected at the laboratory limit of detection of 0.05ug/l in WS205.
- Total perfluorooctanoic acid (PFOA) was detected above the laboratory limit within WS203 and WS205 at a concentration of 2.37ng/l and 24.7ng/l, respectively.
- Total perfluorooctanesulfonic acid (PFOS) was detected above the laboratory limit of detection within WS203 and WS205 at concentrations of 4.08ng/l and 23.2ng/l respectively.

6.5 GROUNDWATER CONTAMINATION (CONTINUED)

In Round 3 of the testing the following concentrations were detected above the laboratory limit of detection:

- 6:2 Fluorotelomer sulfonic acid (6:2FTS) was detected above the laboratory limit of detection (<0.05ug/l) in WS205 only at a concentration of 1.3ug/l.
- 8:2 Fluorotelomer sulfonic acid (8:2FTS) was detected marginally above the laboratory limit of detection (<0.05ug/l) in WS205 only at a concentration of 0.09ug/l.
- Total perfluorooctanoic acid (PFOA) was detected above the laboratory limit within WS203 and WS205 at a concentration of 5.51ng/l and 32.4ng/l, respectively.
- Total perfluorooctanesulfonic acid (PFOS) was detected above the laboratory limit of detection within WS203 and WS205 at concentrations of 5.75ng/l and 28ng/l respectively.

It should be noted that published guideline values are not readily available for the majority of the PFAS compounds. To date EQS values are only available for PFOS.

The PFAS compound PFPeA was only encountered marginally above the laboratory limit of detection concentration in WS205 during the first monitoring round only. No concentrations above the laboratory limit were detected within either of the wells during the second and third monitoring round.

The PFAS compound PFHxA was encountered at the laboratory limit of detection concentration within WS205 during the second monitoring round only. No concentrations elevated above the laboratory limit of detection was recorded in either well during the first and third monitoring rounds.

Based on the above, the PFAS compounds PFPeA and PFHxA are not considered to be contaminants of concern.

There is ongoing debate regarding what criterion should be used when undertaking controlled water risk assessments. The current water quality standards which could potentially be used to assess the risk presented by the concentrations of PFOS in the shallow groundwater is presented in below.

6.5 GROUNDWATER CONTAMINATION (CONTINUED)

Review of Water Quality Standards for PFAS		
Water Quality Standard	Source	Applicability
0.00065ug/l (Annual Average) 36ug/l (Maximum Allowable)	Priority Substances Directive (2013/39/EU). PFOS is classed as a Water Framework Directive priority hazardous substance and as a ubiquitous persistent, bioaccumulative and toxic substance.	Annual average has been calculated from the biota EQS, which was derived primarily by secondary poisoning of humans through consumption of fish. Significant safety factors incorporated. The Environment Agency (2019)[1] used the annual average as an 'initial assessment of risk' as 'the thresholds are based on toxicological data but as subject some uncertainty'.
0.003ug/l (Annual Average)	Environment Agency (2019)[1] Proposed alternative to the 0.00065ug/l annual average threshold	The comparison of water column and fish residue data, (derived from sampling of surface water and groundwater since the mid 2000s,) collected in the same river reaches, suggested the 0.00065ug/l annual average threshold may over predict the likely failure of biota standard observed in fish living in the same stretch of river. The EA proposed an empirical derived threshold in water of 0.003ug/l.
1ug/l (Annual mean in groundwater)	UK Technical Advisory Group	The concentration in groundwater below which the danger of deterioration in the quality of the receiving groundwater is avoided.
Concentration <0.01ug/l – Tier 1 requires monitoring Concentrations <0.1ug/l Tier 2 require a plan to reduce Concentrations >0.1ug/l Tier 3 required rapid action	Drinking Water Inspectorate (2025)	The DWI have taken a precautionary approach and produced tiered guideline values. It should be noted that the site is not located within a Source Protection Zone.

[1]Environment Agency, Perfluorooctane sulfonate (PFOS) and related substances: sources, pathways and environmental data, dated October 2019.

6.5 GROUNDWATER CONTAMINATION (CONTINUED)

During the three groundwater monitoring rounds, PFOS concentrations were detected at a minimum concentration of 4.08ng/l (0.00408ug/l) and a maximum concentration of 36.3ng/l (0.0363ug/l) and with an average concentration of 14.9ng/l (0.0149ug/l) within the shallow groundwater.

The PFOS concentrations detected during the groundwater programme exceed the AA-EQS threshold of 0.65ng/l, however, the PFOS concentrations are below the MAC-EQS of 36ug/l.

The PFOS concentrations exceed the alternative annual average of 0.003ug/l proposed by the Environment Agency.

The PFOS concentrations do not exceed the groundwater annual mean threshold of 1ug/l proposed by the UK Technical Advisory Group.

When compared to the Drinking Water Inspectorate, the average PFOS concentration slightly exceeds the Tier 1 criteria which requires monitoring but all PFOS concentrations do not exceed Tiers 2 and 3. As previously stated, the site does not lie within a Source Protection Zone.

During the monitoring rounds, PFOA was detected at a minimum concentration of 1.39ng/l (0.00139ug/l) and a maximum concentration of 32.4ng/l (0.0324ug/l), with an average concentration of 14.2ng/l (0.0142ug/l).

When compared to the Drinking Water Inspectorate, the average PFOA concentration slightly exceeds the Tier 1 criteria which requires monitoring but all PFOA concentrations do not exceed Tiers 2 and 3. As previously stated, the site does not lie within a Source Protection Zone.

6.5.3 GROUNDWATER CONTAMINANTS OF CONCERN

Based on the screening of groundwater concentrations recorded over three rounds of monitoring, the following potential contaminants of concern have been identified that require further assessment/consideration:

- Arsenic
- Lead
- Zinc
- Fluoranthene
- Petroleum hydrocarbons – Aliphatic C10-C12, C12-C16, C16-C21 and C21-C35

6.5 GROUNDWATER CONTAMINATION (CONTINUED)

- PFOS
- 6:2 FTS
- 8:2 FTS

6.6 SURFACE WATER CONTAMINATION – RIVER NEATH

Surface water samples were taken from the River Neath at two locations (upgradient and downgradient, at the most reasonable and safe locations as possible) and analysed at the laboratories of i2 Analytical for the similar suite of elements and compounds as the groundwater and soils. Copies of the three rounds of surface water test results have been included in Appendix G.

The results have been screened against UK Drinking Water Standards and Freshwater EQS based on typical hardness values for the River Neath of >250mg/l $CaCO_3$.

As part of a 'Tier 1' screening exercise, the results of the surface water analysis have been compared against the Annual Average Environmental Quality Standards (AA-EQS) for freshwater in the first instance. Where no AA-EQS values are available, the results have been compared against the Maximum Allowable Concentration Environmental Quality Standards (MAC-EQS) for freshwater. Where no EQS values are available, the results have been compared against UK and WHO drinking water standards, in hierarchy order.

A summary of the surface water test results and comparison with the screening criteria values is presented in Appendix K.

The majority of the results were below the adopted guideline values. It should be noted that the results of the PFAS compounds will be discussed separately below.

In Round 1 of the testing the following exceedances were detected:

- Phenol was detected at an elevated concentration within both samples at concentration of 230ug/l and 69ug/l, elevated above the AA-EQS threshold of 7.7ug/l.
- Boron was detected at an elevated concentration within both samples at concentration of 3700ug/l and 3300ug/l, elevated above the AA-EQS threshold of 2000ug/l.
- Copper was detected at an elevated concentration within both samples at concentration of 8.4ug/l and 9.2ug/l, elevated above the AA-EQS threshold of 1ug/l.

6.6 SURFACE WATER CONTAMINATION – RIVER NEATH (CONTINUED)

In Round 2 of the testing the following exceedances were detected:

- Phenol was detected at an elevated concentration within both samples at concentration of 72ug/l and 62ug/l, elevated above the AA-EQS threshold of 7.7ug/l.
- Copper was detected at an elevated concentration within both samples at concentration of 9.9ug/l and 9.5ug/l, elevated above the AA-EQS threshold of 1ug/l.

In Round 3 of the testing the following exceedances were detected:

- Phenol was detected at an elevated concentration within both samples at concentration of 35ug/l and 18ug/l, elevated above the AA-EQS threshold of 7.7ug/l.
- Boron was detected at an elevated concentration within both samples at concentration of 3300ug/l and 3400ug/l, elevated above the AA-EQS threshold of 2000ug/l.
- Copper was detected at an elevated concentration within both samples at concentration of 18ug/l and 15ug/l, elevated above the AA-EQS threshold of 1ug/l.
- Nickel was detected at an elevated concentration within both samples at concentration 4.6ug/l and 7.1ug/l, elevated above the AA-EQS threshold of 4ug/l.
- Zinc was detected at an elevated concentration within both samples at concentration of 26ug/l and 38ug/l, elevated above the AA-EQS threshold of 10ug/l.
- The following aliphatic petroleum hydrocarbon bands were detected above the relevant AA-EQS threshold of 10ug/l within sample RMD 01, C10-C12 at 12ug/l, C12-C16 at 48ug/l, C16-C21 at 25ug/l and C21-C35 at 50ug/l.

The majority of the compounds were below the laboratory limit of detection. PFAS compounds detected above the laboratory limit of detection for each of the three monitoring rounds are discussed below.

As previously stated, published guidelines values are not readily available for the majority of the PFAS compounds.

In Round 1 of the testing no PFAS compounds were detected above the laboratory limit of detection.

6.6 SURFACE WATER CONTAMINATION – RIVER NEATH (CONTINUED)

In Round 2 of the testing, only PFOS was detected at an elevated concentration in RMD 01 only, at a concentration of 0.79ng/l, elevated above the AA-EQS threshold of 0.65ng/l.

In Round 3 of the testing no PFAS compounds were detected above the laboratory limit of detection.

The results of the sampling and testing of the surface water from the River Neath has indicated elevated concentrations of phenol and copper in all three monitoring rounds, boron in rounds 1 and 2 only, nickel, zinc and petroleum hydrocarbons in round 3 only and PFOS in round 2 only.

Phenol, boron, copper, and nickel have not been identified as potential contaminants of concern on site and therefore the recorded concentrations of these within the river are likely to be representative of background concentrations and may be associated with various industrial sites along the riverbank upstream of the sampling locations.

Zinc, petroleum hydrocarbons and PFOS have been recorded on site and are subject to furthermore detailed risk assessments.

6.7 QUALITY CONTROL RESULTS

Quality Control samples were undertaken to demonstrate that the sampling environment and procedures do not results in any cross contamination.

The results of the quality control samples indicated that the sampling environment and procedures did not result in any cross contamination, with soil and water duplicates mirroring the replicated samples and the equipment rinsates and field blanks testing indicated recorded concentrations below the laboratory limit of detection.

7.0 REVISED CONCEPTUAL EXPOSURE MODEL

The preliminary conceptual exposure model has been reviewed and revised to reflect the findings of the site investigation and the results of the laboratory testing of soils, groundwater and surface water. Pathways identified as a relevant pollutant linkage require appropriate risk assessment or mitigation measures (see Section 10).

Table 5: Revised Conceptual Exposure Model

Source		Receptor	Pathway	Preliminary Active Pathway? (see Sect. 5.7)	Relevant Pollutant Linkage	Justification/ Mitigation
Origin	Contaminant					
Made Ground of unknown origin and historical land uses	Metals, semi-metals, non-metals, PAH, petroleum hydrocarbons, PFAS, asbestos	Future commercial site user – human health	Dermal Contact with made ground/dust	✓	✓	Elevated concentrations of lead identified within the made ground – risk assess.
			Ingestion of soil	✓	✓	
			Inhalation of dust	✓	✓	
			Inhalation of vapours – indoor/outdoor	✓	X	No sufficiently volatile contaminants identified.
	Metals, semi-metals, inorganics, PAH, petroleum hydrocarbons, PFAS	Groundwater quality	Leaching from made ground	✓	✓	Elevated concentrations of arsenic, lead, zinc, fluoranthene, petroleum hydrocarbons and PFOS detected within the shallow groundwater body.
	Metals, semi-metals, inorganics, PAH, petroleum hydrocarbons, PFAS	Surface water quality	Transportation within groundwater	✓	✓	

7.0 REVISED CONCEPTUAL EXPOSURE MODEL (CONTINUED)

Table 5: Revised Conceptual Exposure Model (Continued)

Source		Receptor	Pathway	Preliminary Active Pathway?	Relevant Pollutant Linkage	Justification/ Mitigation
Origin	Contaminant					
Former above ground storage tank	Petroleum hydrocarbons	Future commercial site user – human health	Dermal Contact with made ground/dust	✓	X	No olfactory or visual evidence of any petroleum hydrocarbon within the soils. No elevated soil concentrations identified.
			Ingestion of soil	✓	X	
			Inhalation of dust	✓	X	
			Inhalation of vapours – indoor/outdoor	✓	X	No sufficiently volatile contaminants identified.
	Petroleum hydrocarbons	Groundwater quality	Localised spillage	✓	X	Elevated concentrations of petroleum hydrocarbons detected within the shallow groundwater. However former above ground tank is not considered to be the source.
	Petroleum hydrocarbons	Surface water quality	Transportation within groundwater	✓	X	

1. The risk to building and material durability was assessed, and appropriate remedial measures recommended within the Site Investigation Report, Report No. 14050/LS/22/SI/RevC dated January 2024 and therefore no additional consideration is included within this report.

2. The ground gas was assessed and concluded within the Site Investigation Report, Report No. 14050/LS/22/SI/RevC dated January 2024 and therefore no additional consideration is included within this report.

8.0 RISK ASSESSMENT

8.1 METHODOLOGY

The risk of pollution, health effects or environmental harm occurring as a result of ground contamination is dependent upon three principal factors:

- The scale of the contamination sources;
- The presence of sensitive “receptors”, eg Humans: health of the general public, site occupiers, redevelopment workers. Environment: flora, fauna, etc;
- The existence of migration pathways by which contaminants can reach the sensitive receptors.

This section assesses each of these factors in order to evaluate the overall level of risk and potential harm to receptors. The receptor may be human, a water resource, an eco-system or construction materials. Pathways connecting a perceived hazard to a receptor are referred to as exposure pathways.

The sources of contamination and the links connecting the hazards to the sensitive receptors will represent the basis for the risk assessment.

8.2 SOURCE-PATHWAY-RECEPTOR MODEL

The preliminary conceptual site model was based on the findings of the desk study. This was later reviewed and refined according to the findings of the site investigation, allowing for the ground conditions encountered and the results of laboratory testing of soil and groundwater. Any pathways considered to be inactive were removed from the model and all remaining potentially active pathways require risk assessment.

The pathways shown as potentially active in the Revised Conceptual Site Model in Section 9.0 above have been assessed below.

8.3 HUMAN HEALTH RISK ASSESSMENT

8.3.1 Site in its Present Condition

The site does not pose any risks to casual visitors or trespassers. The site is largely covered by concrete and is secure.

8.3 HUMAN HEALTH RISK ASSESSMENT (CONTINUED)

8.3.2 Future Site Users

The supplementary contamination test results and investigation observations show elevated concentration levels in the made ground of lead. Previously elevated concentrations of arsenic were detected within the made ground and chrysotile asbestos fibres.

The supplementary contamination testing did not record any concentrations of PFOS elevated above the published C4SL or above the Hazard Index for a commercial end use.

There are currently no published screening values for 6:2 Fluorotelomer Sulfonic Acid (6:2FTS) and 8:2 Fluorotelomer Sulfonic Acid (8:2FTS).

The concentrations of 6:2FTS and 8:2FTS are not considered to be significantly elevated above the laboratory limit of detection and were localised to one sample of made ground. No vertical migration of the compounds was observed within the soil. The concentrations of 6:2FTS and 8:2FTS are not considered to pose a risk to the future end users.

Furthermore, within certain environmental conditions 6:2FTS has the potential to transform into PFHxA and 8:2FTS has the potential to transform into PFOA. No concentrations of either PFOA or PFHxA have been detected above the laboratory limit of detection in any tested soil samples.

It is therefore considered that the concentration of PFAS compounds within the made ground does not pose a significant risk to the future site users at the site.

However, given the elevated lead concentrations within the general made ground encountered across the site, and previously the concentrations of arsenic and the presence of asbestos fibres, it is considered that a potential risk to human health may exist via the following relevant pollutant linkages:

- Dermal contact,
- Ingestion of soil or soil derived dust,
- Inhalation of soil bourn dust.

The inhalation of vapours pathways (indoor and outdoor air) are not considered to be active since the contaminants of concern identified are not sufficiently volatile.

8.3 HUMAN HEALTH RISK ASSESSMENT (CONTINUED)

It is therefore considered necessary to protect end users from the elevated concentrations of lead and arsenic and the presence of asbestos fibres in the shallow made ground. It is considered necessary to break the above listed relevant pollutant linkages in order to remove the potential risk.

In the developed state, the site is covered by predominantly the building footprint, areas of concrete hardstanding and very localised areas of gravel at the rear of the building which provides an effective capping layer, breaking the pathway between the made ground and site users.

No areas of soft landscaping are proposed.

The integrity of the hardstanding and very localised surface covering of gravel should be maintained at all times. Any areas where this surface is broken or absent should be repaired and/or extended.

It is therefore considered that the potential risk to end users is low and no further remedial mitigation measures are required.

8.4 CONTROLLED WATERS RISK ASSESSMENT

8.4.1 Hydrological Setting

The groundwater regime beneath the site generally comprises localised occurrence of perched groundwater in areas of thicker made ground and a separate shallow and likely continuous groundwater body present within the underlying superficial deposits.

The site investigation data suggests that the observed localised occurrences of perched groundwater are not representative of a continuous groundwater body beneath the site. The majority of the boreholes were drilled dry through the made ground, with the shallow groundwater encountered within the underlying superficial deposits. Based on these observations, the localised perched groundwater occurrence that was observed is considered to be representative of laterally impersistent pockets within the areas of thicker made ground.

During the site investigation, shallow groundwater was encountered at varying depths within the underlying superficial deposits. The variations in the groundwater level and flow observed is likely due to a combination of:

8.4 CONTROLLED WATERS RISK ASSESSMENT (CONTINUED)

- The sudden increase in ground level to the northwest of the Earlswood Training Centre, resulting in possible sub-artesian conditions.
- Variations in the thickness of made ground beneath the site. The made ground was encountered at a greater thickness in the northwestern area of the site, where the shallow groundwater body of the superficial soils was encountered at a greater depth.
- Presence of drains crossing the site and the presence of a soakaway to the south of the site area.

The above conditions across the site are likely to impact on localised variations in groundwater levels over short distances and therefore for conceptual site modelling purposes it is more appropriate to consider typical/average groundwater levels at the site in context with the nearby River Neath.

The River Neath is located approximately 200m to the southeast of the site, flowing to the south. Groundwater levels within the site are likely to be in hydraulic continuity with the river, which is tidally influenced. Assuming an average groundwater level below the site of 5.7m AOD and a river level of 1.0m AOD, a hydraulic gradient of 0.02 can be calculated for modelling purposes.

An illustrative conceptual model is shown in Figure 3.

Due to the discontinuous/impersistent nature of the perched groundwater occurrences beneath the site, the localised occurrences of the perched groundwater are not considered to present a risk to off-site environmental receptors such as the River Neath.

It is therefore considered that the main groundwater body beneath the site lies at a shallow depth within the superficial deposits. Any lateral groundwater migration is anticipated to occur in this stratum.

8.4.2 Shallow Groundwater

The test results for samples of the shallow groundwater recovered from each of the three installations recorded elevated concentrations of arsenic, lead, fluoranthene, petroleum hydrocarbons and PFOS. The PFAS compounds 6:2FTS and 8:2FTS were recorded at concentrations above the laboratory limit of detection, however, published environmental quality thresholds are currently unavailable for these compounds.

8.4 CONTROLLED WATERS RISK ASSESSMENT (CONTINUED)

The elevated concentrations of arsenic, lead and fluoranthene are likely due the historical nature of the site and the wider area and not due to an onsite source. No potential source of petroleum hydrocarbon was identified on site. Although an above ground storage tank was formerly located onsite, the concentrations were firstly detected within the second round of monitoring and upgradient of the former above ground tank. Further to this no visual evidence of petroleum hydrocarbon contamination was encountered in the soil or groundwater beneath the former tank. Therefore, it is reasonable to conclude that the petroleum hydrocarbon contamination was flowing beneath the site from an offsite source.

In order to assess the potential risk of these contaminants to groundwater quality and the River Neath a detailed quantitative risk assessment (DQRA) using the Environment Agency Remedial Targets Methodology (RTM) Worksheet has been completed.

This methodology allows modelling of one-dimensional flow, including degradation, dispersion and sorption to define target remedial levels. The RTM adopts three levels of assessment, as detailed below:

- Level 1 Soil: The compliance point is taken as the soil zone. Only the partitioning of a chemical between soil and water (Kd) is considered.
- Level 2 Soil: Incorporates dilution below the source which takes account of hydraulic conductivity, hydraulic gradient and mixing zone thickness but excludes attenuation in the unsaturated zone and attenuation and biodegradation down-gradient of the site. The compliance point is taken as the groundwater below the source area.
- Level 3 Soil and Groundwater: Includes attenuation (dilution, degradation, dispersion and sorption) along the flow path to the receptor.

The RTM has been applied at Level 3 only for the groundwater assessment, whereby remedial target values have been derived and compared to the site investigation data.

The model parameters adopted, and their justification are shown in Table 6 below.

8.4 CONTROLLED WATERS RISK ASSESSMENT (CONTINUED)

Table 6: Parameter Summary

Parameter	Value Used	Justification
Half-life for degradation of contaminant in water (days)	Variable see justification	A half-life of $9.9x10^{+99}$ for arsenic, lead and zinc due to their non-biodegradable nature. A half-life of $9.9x10^{+99}$ based on a worst case scenario for PFOS, 6:2FTS and 8:2FTS due to their persistent nature. A half-life of between $2.1x10^{+1}$ and $1.0x10^{+3}$ for the petroleum hydrocarbon bands based on published data (TPH CWGS Volume 3 Selection of representative TPH fractions based on fate and transport considerations). A half-life of $1.0x10^{+3}$ for fluoranthene based on a range of available published data.
Decay Rate (days)	Variable see justification	Calculated within the worksheets, where applicable based on the half-life for each contaminant of concern. Decay rate = 0.693 / Half-life
Plume width in aquifer (m)	20/40	A plume width of 20m for PFAS compounds based on the measured distance perpendicular to the groundwater flow of the area where PFAS compounds were stored and used. A site width of 40m for all other contaminants of concern based on the measured distance of the onsite made ground source.
Plume thickness at source (m)	1	Based on the relatively shallow aquifer consisting of unconsolidated strata, together with laboratory chemical testing of the soil profile.
Saturated aquifer thickness (m)	4	Maximum known thickness
Bulk density of aquifer materials (g/cm^3)	1.6	Estimate of typical silty clayey sand bulk density
Effective porosity of aquifer (fraction)	0.16	Typical silty clayey sand porosity
Hydraulic gradient (fraction)	0.02	Calculated from site data
Hydraulic conductivity (m/day)	0.04	Calculated from site data
Distance to compliance point (m)	50/200	Based on a 50m default compliance point for hazardous substance. Also based on a 200m compliance point from site boundary to River Neath. Site data demonstrates groundwater to be in a south easterly direction

The calculation worksheets are presented in Appendix L.

8.4 CONTROLLED WATERS RISK ASSESSMENT (CONTINUED)

As previously stated, published environmental quality standards are unavailable for 6:2FTS and 8:2FTS. Therefore, in this instance, given the site is not located within a source protection zone the DWI Tier 2 threshold was deemed the most appropriate to determine the Groundwater T3 Remedial Target.

As discussed in Section 6.5, there is ongoing debate regarding what criterion should be used when undertaking controlled waters risk assessments for PFOS. Given Environment Agency uncertainty with regard to the Annual Average EQS, the Environment Agency Alternative Annual Average EQS have been deemed the most appropriate to determine the Groundwater T3 Remedial Target. It should be noted that the recorded concentrations of PFOS were significantly below the Maximum Acceptable Concentration EQS and the groundwater annual average threshold.

The results of the RTM are summarised in Table 7.

Table 7: Groundwater Remedial Target Values

Contaminant	Max Concentration (mg/l)	Location of Max Concentration	GW T3 Remedial Target at 200m Compliance Point (mg/l)	Exceedance (Yes/No)	GW T3 Remedial Target at 50m Compliance Point (mg/l)	Exceedance (Yes/No)
Arsenic	0.0621	WS205	1.08	No	0.145	No
Zinc	0.023	WS205	0.216	No	0.029* *Not a hazardous substance	No
Lead	0.015	WS205	0.0259	No	0.00349	Yes
Aliphatic C10-C12	0.043	WS205	$1.30x10^{+47}$	No	$2.18x10^{+21}$	No
Aliphatic C12-C16	0.16	WS205	$3.77x10^{+29}$	No	$4.05x10^{+12}$	No
Aliphatic C16-C21	0.38	WS205	51,700	No	3.24	No
Aliphatic C21-C35	1.2	WS205	97,500	No	4.31	No
Fluoranthene	0.00021	WS205	5.1710^{+01}	No	0.00324	No
PFOS	0.0000360	WS205	0.000122	No	0.0000103	Yes
6:2FTS	0.0012	WS205	0.0041	No	0.000344	Yes
8:2FTS	0.00011	WS205	0.0041	No	0.000344	No

8.4 CONTROLLED WATERS RISK ASSESSMENT (CONTINUED)

The results indicate that maximum detected concentration of lead, PFOS and 6:2FTS exceed the derived remedial target concentration at a 50m compliance point for hazardous substances.

However, the results indicate that the maximum detected concentration of each of identified potential contaminants of concern in groundwater do not exceed the derived remedial target concentration for the 200m compliance point consisting of the River Neath.

Although the concentrations of lead, PFOS and 6:2FTS exceed the derived remedial target concentration at a 50m compliance point, the results indicate that the concentrations are not considered to pose a risk to the water quality of the River Neath.

Based on the results of the groundwater and soil testing, and subsequent DQRA, the overall level of risk to controlled waters from site sourced contamination is considered to be low and no groundwater remedial measure are considered to be necessary at the site.

8.4.3 Sensitivity Analysis

A sensitivity analysis has been undertaken to determine how different input parameters affect the derived remedial target concentrations at a 50m and 200m compliance point.

The following input parameters have been systematically changed to determine how the remedial target concentrations alter between a silty clayey fine to coarse sand aquifer material and a fine to coarse sand aquifer material, with the higher values representing coarser aquifer material.

- Bulk density of aquifer material
- Effective porosity of aquifer

Additionally, the hydraulic gradient and hydraulic conductivity values were also changed in the analysis to demonstrate the effect of varying these parameters on the remedial targets. However, it should noted that the original input parameters were derived from the results of the intrusive investigation.

The results of the sensitivity analysis are presented within Appendix M.

Variations to the bulk density, effective porosity, hydraulic gradient and hydraulic conductivity do not have an overall effect on the remedial target concentrations for arsenic, lead, zinc and the PFAS compounds.

8.4 CONTROLLED WATERS RISK ASSESSMENT (CONTINUED)

The results of the sensitivity analysis for the petroleum hydrocarbon chains of concern indicated that the results were mainly significantly below the revised remedial target concentrations.

The only exception to this was the petroleum hydrocarbon band aliphatic C21-C35 where the maximum detected concentration exceeded the revised remedial target concentrations with an increase in hydraulic gradient and hydraulic conductivity.

However, as previously stated the existing/original model incorporated hydraulic gradient and hydraulic conductivity parameters that were calculated using site specific data obtained during the intrusive investigation.

The results of the sensitivity analysis indicates that the original model parameters were suitable and any alternative parameters for a coarser aquifer material does not have an overall effect on the original derived remedial targets for the contaminants of concern.

8.4.4 PFAS Compounds Precursors and End Products

PFOS

The concentrations of PFOS precursors and intermediates such as the FOSAs, FOSAAs and FOSEs are all below the laboratory limit of detections in the soil and groundwater. This indicates that if the precursors were included during production in any legacy foams potentially used (offsite) or stored at the site, they have already degraded/transformed into PFOS.

8:2FTS

Within certain environmental and/or biological conditions, 8:2FTS has the ability to 'transform' into PFOA**.** The transformation is not direct and consists of a sequence of intermediates such as 8:2FTCA and 8:2 FTUCA, which are commonly detected in the environmental process. During both the soil and groundwater laboratory testing, the concentrations of the intermediates are below the laboratory limit of detection and the concentrations of PFOA and 8:2FTS were generally constant, possibly indicating transformation is not ongoing.

6:2FTS

6:2 FTS was utilised as a replacement in 'modern' day AFFF as it does not have the ability to transform or degrade into PFOS. 6:2 FTS does have the potential to transform/degrade into PFHxA under certain environmental conditions however, the recorded concentrations of PFHxA have been recorded below or locally at the laboratory limit of detection during the laboratory testing of the soil and groundwater.

8.4 CONTROLLED WATERS RISK ASSESSMENT (CONTINUED)

Based on the results of the groundwater and soil testing, and subsequent DQRA, the overall level of risk to controlled waters from site sourced PFAS contamination is considered to be low, and no groundwater remedial measure are considered to be necessary at the site.

8.4.5 River Neath

As previously discussed, the results of the sampling and testing of the surface water from the River Neath has indicated elevated concentrations of phenol and copper in all three monitoring rounds, boron in rounds 1 and 2 only, nickel, zinc and petroleum hydrocarbons in round 3 only and PFOS in round 2 only.

Phenol, boron, copper, and nickel have not been identified as potential contaminants of concern on site and therefore the recorded concentrations of these within the river are likely to be representative of background concentrations and may be associated with various industrial sites along the riverbank upstream of the sampling locations.

Although zinc, petroleum hydrocarbons and PFOS have been recorded on site, the DQRA has determined that the concentrations recorded on site do not pose a potential risk to the River Neath.

Additionally, During the surface water monitoring programme of the River Neath, the PFAS compounds, 6:2FTS and 8.2FTS were absent.

Therefore, the concentrations detected within the surface water samples are not considered to be reflective of the concentrations detected within the groundwater beneath the site and it is therefore considered that the site source contamination is not impacting the water quality of the River Neath.

8.5 UNCERTAINTIES

It is important to recognise that there may be areas of contamination within the site that have not been found or that contaminants may be present at concentrations above those that have been found. It is also important to recognise that contamination may be localised and that no investigation, however comprehensive, is capable of finding such occurrences, other than by chance.

9.0 CONCLUSION

9.1 HUMAN HEALTH

The supplementary contamination test results and investigation observations show elevated concentration levels in the made ground of lead. Previously elevated concentrations of arsenic were detected within the made ground and chrysotile asbestos fibres.

The supplementary contamination testing did not record any concentrations of PFOS elevated above the published C4SL or above the Hazard Index for a commercial end use.

There are currently no published screening values for 6:2 Fluorotelomer Sulfonic Acid (6:2FTS) and 8:2 Fluorotelomer Sulfonic Acid (8:2FTS).

The concentrations of 6:2FTS and 8:2FTS are not considered to be significantly elevated above the laboratory limit of detection and were localised to one sample of made ground. No vertical migration of the compounds was observed within the soil. The concentrations of 6:2FTS and 8:2FTS are not considered to pose a risk to the future end users.

Furthermore, within certain environmental conditions 6:2FTS has the potential to transform into PFHxA and 8:2FTS has the potential to transform into PFOA. No concentrations of either PFOA or PFHxA have been detected above the laboratory limit of detection in any tested soil samples.

It is therefore considered that the concentration of PFAS compounds within the made ground does not pose a significant risk to the future site users at the site.

Due to the elevated concentrations of lead and arsenic, along with the presence of asbestos fibres, it is considered necessary to protect end users from the elevated concentrations of lead and arsenic and the presence of asbestos fibres in the shallow made ground by breaking the identified relevant pollutant linkages in order to remove the potential risk.

In the developed state, made ground is not present at the site surface. The site is covered by predominantly the building footprint, areas of concrete hardstanding and very localised areas of gravel at the rear of the building which provides an effective capping layer, breaking the pathway between the made ground and site users.

No areas of soft landscaping are present or proposed.

9.1 HUMAN HEALTH (CONTINUED)

It is therefore considered that the potential risk to end users is low and no further remedial mitigation measures are required.

9.2 CONTROLLED WATERS

The results of the groundwater sampling and testing carried out at the site, subsequent detailed quantitative risk assessment and sampling and testing of the River Neath indicate that the potential risks to controlled waters from site sourced contamination are considered to be low.

Additionally, the results of the groundwater monitoring programme indicated that the precursors and/or end products of PFOS, 6:2FTS and 8:2FTS are not considered to pose a risk to controlled waters.

Whilst some elevated concentrations of lead, PFOS and 6:2FTS exceed the derived remedial target concentration at a 50m compliance point, the modelling indicates that these do not exceed the remedial target concentrations at the River Neath.

As previously stated, PFAS containing AFFF is no longer used or stored on site, along with the use of PFOS (>0.001wt%) containing firefighting foam being prohibited since June 2017. Therefore, there is not considered to be a source of PFOS within the site, apart from any localised low-level soil/groundwater contamination associated with the historical use. As discussed above, the residual PFOS contaminated soils and groundwater are not considered to present a significant risk to end users and/or controlled waters.

The following existing mitigation measures are present at the site:

- Made ground is encapsulated by existing hardstanding and buildings, with no made ground exposed at the surface,
- Formal drainage is present across the site, controlling surface water run-off and reducing/preventing water ingress into the ground and generation of leachates,
- The new facility operates a closed drainage system whereby water used in fire training activities is collected and recirculated and/or tankered off site.

9.2 CONTROLLED WATERS (CONTINUED)

It is therefore considered that since the PFAS containing materials are no longer used/stored on site, the site benefits from existing hardstanding with formal drainage and the new training facility encapsulates and recirculates water, reducing infiltration into the ground, that all reasonable and practicable measures have been taken to minimise/reduce the impact on controlled waters.

Given the extremely low concentrations of PFAS compounds recorded, and as described above, the existing mitigation measures in place to limit and prevent entry of water into the ground, and any subsequent generation of leachate, physical remediation works are not only considered impractical but also unlikely to be achieved at reasonable cost, if remediation of such low levels of PFAS is even possible.

Therefore, taking all factors into consideration, the overall potential risk to controlled waters is considered to be low and no further remedial works are required.

APPENDIX A

AFFF DATA SHEETS

FREEFOR SF

Wetting and Foaming Agent Fluorine Free Solvent Free

PHYSICAL DATA

	FREEFOR SF		
	SF1	SF2	SF3
Appearance /colour		Light red liquid	
Concentration for wetting application	0.1-0.3%	0.1-0.5%	0.1-1%
Concentration for foaming application	0.3-0.5%	0.5-1%	1-3%
Specific Gravity at 20°C (Kg/dm3)	1.07	1.03	1.01
Viscosity at 20°C (cStokes)	10	5	3
Freezing point	-10°C	-8°C	-5°C
Ph at 20°C		7	
Sediments after ageing		0 %	
Surface tension (mN/m)		25	

FOAM QUALITY

Low Expansion	8
Drainage Time 25% / 50%	2 min. / 4 min.
Medium Expansion	100
High Expansion	600

Foam Expansion values depend on the equipment

PERFORMANCE & WARRANTY

FREEFOR SF meets international requirements
EN 1568-1 & 2: Pass
EN 1568-3: Class IIIC
Marine: BV

FREEFOR SF can be used for all structural fires with tap water, sea water and brackish water.

FREEFOR SF has a 10 years warranty in its original packaging and at storage temperatures -30°C / +60°C.



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TF3 Training Foam

Safety Data Sheet

according to the REACH Regulation (EC) 1907/2006 amended by Regulation (EU) 2020/878

Issue date: 17/05/2010 Revision date: 17/03/2023 Supersedes version of: 16/04/2021

Version: 3.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture

Product name : TF3 Training Foam

UFI : 55C0-P0CS-8004-D994

Product code : FC 01 30

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Industrial/Professional use spec : Industrial
For professional use only

Use of the substance/mixture : Training foam

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

ANGUS FIRE Ltd
Station Road
LA2 7NA Bentham - United Kingdom
T +44(0) 1524 264000 - F +44(0)1524 264180
general.enquiries@angus.co.uk - www.angusfire.co.uk

1.4. Emergency telephone number

Emergency number : +44(0) 1524 264000 (Standard office hours: Monday to Friday 8:30am - 4:30pm GMT)
Contact person: EH&S Manager

Country	Organisation/Company	Address	Emergency number	Comment
United Kingdom	National Poisons Information Service (Birmingham Centre) City Hospital	Dudley Road B18 7QH Birmingham	0344 892 0111	Only for healthcare professionals

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Reproductive toxicity, Category 2 H361

Full text of H- and EUH-statements: see section 16

Adverse physicochemical, human health and environmental effects

No additional information available

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :



GHS08

Signal word (CLP) : Warning

Hazardous ingredients : 2-methyl-2,4-pentanediol

Hazard statements (CLP) : H361 - Suspected of damaging the unborn child.

Precautionary statements (CLP) : P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P280 - Wear eye protection, protective clothing, protective gloves
P308+P313 - IF exposed or concerned: Get medical advice/attention.
P405 - Store locked up.
P501 - Dispose in a safe manner in accordance with local/national regulations

2.3. Other hazards

PBT: not relevant – no registration required

vPvB: not relevant – no registration required

Contains no PBT/vPvB substances ≥ 0.1% assessed in accordance with REACH Annex XIII

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
2-methyl-2,4-pentanediol substance with national workplace exposure limit(s) (BE, FR, GB)	(CAS-No.) 107-41-5 (EC-No.) 203-489-0 (EC Index-No.) 603-053-00-3 (REACH-no) 01-2119539582-35	4 – 10	Skin Irrit. 2, H315 Eye Irrit. 2, H319 Repr. 2, H361d

Full text of H- and EUH-statements: see section 16

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. IF exposed or concerned: Get medical advice/attention.

First-aid measures after inhalation : Allow affected person to breathe fresh air. Allow the victim to rest.

First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse.

First-aid measures after eye contact : Rinse immediately with plenty of water. Obtain medical attention if pain, blinking or redness persists.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/effects : Suspected of damaging the unborn child.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : No specific measures are necessary.

Unsuitable extinguishing media : Not applicable.

5.2. Special hazards arising from the substance or mixture

Fire hazard : No fire hazard.

5.3. Advice for firefighters

Firefighting instructions : Not applicable.

Protection during firefighting : Not applicable.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

8. Exposure controls/personal protection. 13. Disposal considerations.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Avoid contact with skin and eyes. Wear recommended personal protective equipment. Read and follow manufacturer's recommendations. Handle in accordance with good industrial hygiene and safety procedures. Read and follow the Safety Data Sheet (SDS) before use. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.

Hygiene measures : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in original container. Keep container tightly closed. Store at temperatures not exceeding 60°C (140°F) (intermittent). Protect from sunlight. Protect from freezing. Keep/Store away from incompatible materials.

7.3. Specific end use(s)

Training foam.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

2-methyl-2,4-pentanediol (107-41-5)		
Belgium	OEL TWA	123 mg/m³
Belgium	OEL TWA [ppm]	25 ppm
France	VLE (OEL C/STEL)	125 mg/m³
France	VLE (OEL C/STEL) [ppm]	25 ppm
United Kingdom	WEL TWA (OEL TWA) [1]	123 mg/m³
United Kingdom	WEL TWA (OEL TWA) [2]	25 ppm
United Kingdom	WEL STEL (OEL STEL)	123 mg/m³
United Kingdom	WEL STEL (OEL STEL) [ppm]	25 ppm
USA - ACGIH	ACGIH OEL TWA [ppm]	25 ppm (Vapor fraction)
USA - ACGIH	ACGIH OEL STEL	10 mg/m³ (Inhalable fraction, Aerosol only)
USA - ACGIH	ACGIH OEL STEL [ppm]	50 ppm (Vapor fraction)

8.2. Exposure controls

Appropriate engineering controls:

Ensure adequate ventilation. Follow the exposure limits given on this material safety data sheet.

Personal protective equipment:

Wear recommended personal protective equipment.

Hand protection:

Wear protective gloves (Recommended: Protective index 6, corresponding > 480 minutes of permeation time according to EN 374): nitrile rubber (NBR) - 0.2 mm coating thickness

Eye protection:

Sealed safety goggles

Skin and body protection:

Wear suitable protective clothing

Respiratory protection:

In case of insufficient ventilation, wear suitable respiratory equipment (recommended filter type A2/P2)



Thermal hazard protection:

Wear thermal protective clothing, when necessary.

Environmental exposure controls:

Contain spills. Prevent releases. Observe national regulations on emissions. Ensure all national/local regulations are observed.

Other information:

Do not eat, drink or smoke when using this product.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Colour	:	Brown.
Odour	:	Characteristic.
Odour threshold	:	No data available
pH	:	6.5 – 8
Relative evaporation rate (butylacetate=1)	:	No data available
Melting point	:	No data available
Freezing point	:	-13 °C
Boiling point	:	No data available
Flash point	:	> 100 °C
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Flammability	:	No data available
Vapour pressure	:	No data available
Relative vapour density at 20°C	:	No data available
Relative density	:	No data available
Density	:	1.13 – 1.16
Solubility	:	No data available
Partition coefficient n-octanol/water (Log Pow)	:	No data available
Viscosity, kinematic	:	10 mm²/s
Viscosity, dynamic	:	No data available
Explosive properties	:	No data available
Oxidising properties	:	No data available
Explosive limits	:	No data available

9.2. Other information

SECTION 10: Stability and reactivity

10.1. Reactivity

The product is stable and non reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

Incompatible materials. Extremely high or low temperatures.

10.5. Incompatible materials

Alkali metals. Oxidizing agent. Water reactive substances.

10.6. Hazardous decomposition products

Carbon oxides. Sulphur oxides. Nitrogen oxides (NOx). Sodium oxides.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

2-methyl-2,4-pentanediol (107-41-5)	
LD50 oral rat	> 2000 mg/kg bodyweight (OECD 420: Acute Oral toxicity – Acute Toxic Class Method, Rat, Male / female, Experimental value, Oral, 15 day(s))
LD50 dermal rat	> 2000 mg/kg bodyweight (OECD 402: Acute Dermal Toxicity, 24 h, Rat, Male / female, Experimental value, Dermal, 15 day(s))
LC50 Inhalation - Rat	> 55 mg/l (Equivalent or similar to OECD 403, 8 h, Rat, Male, Experimental value, Inhalation (vapours), 14 day(s))

Skin corrosion/irritation : Not classified
pH: 6.5 – 8

Serious eye damage/irritation : Not classified
pH: 6.5 – 8

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Suspected of damaging the unborn child.

STOT-single exposure : Not classified

STOT-repeated exposure : Not classified

Aspiration hazard : Not classified

TF3 Training Foam	
Viscosity, kinematic	10 mm²/s

SECTION 12: Ecological information

12.1. Toxicity

TF3 Training Foam	
LC50 - Fish [1]	> 10000 mg/l (Mysid shrimp)
EC50 - Crustacea [1]	> 10000 mg/l (Daphnia magna)

2-methyl-2,4-pentanediol (107-41-5)	
LC50 - Fish [1]	9450 mg/l (Equivalent or similar to OECD 203, 96 h, Oncorhynchus mykiss, Flow-through system, Fresh water, Experimental value, Lethal)
EC50 - Crustacea [1]	5410 mg/l (Equivalent or similar to OECD 202, 48 h, Daphnia magna, Static system, Fresh water, Experimental value, Locomotor effect)
EC50 72h - Algae [1]	> 429 mg/l (OECD 201: Alga, Growth Inhibition Test, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value, Growth rate)

12.2. Persistence and degradability

TF3 Training Foam	
Biochemical oxygen demand (BOD)	0.059 g O_2 /g substance (5 days)
Chemical oxygen demand (COD)	0.42 g O_2 /g substance
Biodegradation	71.3 % (28 days)

2-methyl-2,4-pentanediol (107-41-5)	
Persistence and degradability	Readily biodegradable in water.
Biochemical oxygen demand (BOD)	0.02 g O_2 /g substance
Chemical oxygen demand (COD)	2.2 g O_2 /g substance
ThOD	2.3 g O_2 /g substance

12.3. Bioaccumulative potential

TF3 Training Foam	
Bioaccumulative potential	The product is not expected to bioaccumulate.

2-methyl-2,4-pentanediol (107-41-5)	
Partition coefficient n-octanol/water (Log Pow)	0.58 (QSAR, KOWWIN)
Bioaccumulative potential	Low potential for bioaccumulation (Log Kow < 4).

12.4. Mobility in soil

2-methyl-2,4-pentanediol (107-41-5)	
Organic Carbon Normalized Adsorption Coefficient (Log Koc)	0 (log Koc, Calculated value)
Ecology - soil	Highly mobile in soil.

12.5. Results of PBT and vPvB assessment

TF3 Training Foam
PBT: not relevant – no registration required
vPvB: not relevant – no registration required

Component	
2-methyl-2,4-pentanediol (107-41-5)	This substance/mixture does not meet the PBT criteria of REACH regulation, annex XIII This substance/mixture does not meet the vPvB criteria of REACH regulation, annex XIII

12.6. Other adverse effects

Other adverse effects : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Concentrate

Prevent foam concentrate from entering ground water, surface water or storm drains. Small quantities of foam concentrate may be collected on absorbents which can then be disposed of. Disposal should be made in accordance with local, state and federal regulations.

Foam/Foam Solution

Prevent foam/foam solution from entering ground water, surface water or storm drains. Small quantities of foam solution may be collected on absorbents which can then be disposed of. Disposal should be made in accordance with local, state and federal regulations.

NOTE: Please consult Angus Fire for additional information regarding the disposal of foam concentrates and foam solutions or visit https://angusfire.co.uk/use-discharge-and-disposal-of-firefighting-foam-products/.

Product/Packaging disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

Ecology - waste materials : Avoid release to the environment.

European List of Waste (LoW) code : 16 03 05* - organic wastes containing dangerous substances

SECTION 14: Transport information

In accordance with ADR / IMDG / IATA / ADN / RID

ADR	IMDG	IATA	ADN	RID
14.1. UN number				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.2. UN proper shipping name				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.3. Transport hazard class(es)				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.4. Packing group				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.5. Environmental hazards				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
No supplementary information available				

14.6. Special precautions for user

- Overland transport

Not applicable

- Transport by sea

Not applicable

- Air transport

Not applicable

- Inland waterway transport

Not applicable

- Rail transport

Not applicable

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

Listed on REACH Annex XVII (Restriction Conditions). The following restrictions are applicable:	
3(b) Substances or mixtures fulfilling the criteria for any of the following hazard classes or categories set out in Annex I to Regulation (EC) No 1272/2008: Hazard classes 3.1 to 3.6, 3.7 adverse effects on sexual function and fertility or on development, 3.8 effects other than narcotic effects, 3.9 and 3.10	2-methyl-2,4-pentanediol

Contains no substance(s) listed on the REACH Candidate List

Contains no substance(s) listed on REACH Annex XIV (Authorisation List)

15.1.2. National regulations

France

Occupational diseases : RG 84 - Affections engendrées par les solvants organiques liquides à usage professionnel

Germany

Regulatory reference : WGK 1, Slightly hazardous to water (Classification according to AwSV, Annex 1)

Hazardous Incident Ordinance (12. BImSchV) : Is not subject of the 12. BImSchV (Hazardous Incident Ordinance)

Netherlands

SZW-lijst van kankerverwekkende stoffen : None of the components are listed

SZW-lijst van mutagene stoffen : None of the components are listed

SZW-lijst van reprotoxische stoffen – Borstvoeding : None of the components are listed

SZW-lijst van reprotoxische stoffen – Vruchtbaarheid : None of the components are listed

SZW-lijst van reprotoxische stoffen – Ontwikkeling : None of the components are listed

Denmark

Recommendations Danish Regulation : Young people below the age of 18 years are not allowed to use the product

Pregnant/breastfeeding women working with the product must not be in direct contact with the product

15.2. Chemical safety assessment

No additional information available

SECTION 16: Other information

Data sources : REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Full text of H- and EUH-statements:	
Eye Irrit. 2	Serious eye damage/eye irritation, Category 2
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H361	Suspected of damaging fertility or the unborn child.
H361d	Suspected of damaging the unborn child
Repr. 2	Reproductive toxicity, Category 2
Skin Irrit. 2	Skin corrosion/irritation, Category 2

SDS EU (REACH Annex II) - Angus Fire

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Respondol ATF 3/3

Safety Data Sheet

according to the REACH Regulation (EC) 1907/2006 amended by Regulation (EU) 2020/878
Issue date: 15/02/2016 Revision date: 06/06/2024 Supersedes version of: 21/05/2024 Version: 4.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture
Product name : Respondol ATF 3/3
UFI : 6RE1-K080-000M-1S4C
Product code : FNC 05 21
Type of product : Firefighting foam concentrate (Fluorine Free)

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Main use category : Industrial use,Professional use
Industrial/Professional use spec : Industrial
For professional use only
Use of the substance/mixture : Firefighting foam concentrate

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

ANGUS FIRE Ltd
Station Road
LA2 7NA Bentham
United Kingdom
T +44(0) 1524 264000, F +44(0)1524 264180
general.enquiries@angus.co.uk, www.angusfire.co.uk

1.4. Emergency telephone number

Emergency number : +44(0) 1524 264000 (Standard office hours: Monday to Friday 8:30am - 4:30pm GMT)
Contact person: EH&S Manager

Country/Area	Organisation/Company	Address	Emergency number	Comment
United Kingdom	National Poisons Information Service (Birmingham Centre) City Hospital	Dudley Road B18 7QH	0344 892 0111	Only for healthcare professionals

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Skin corrosion/irritation, Category 2 H315
Serious eye damage/eye irritation, Category 2 H319
Full text of H- and EUH-statements: see section 16

Adverse physicochemical, human health and environmental effects

No additional information available

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :



GHS07

Signal word (CLP) : Warning

Hazard statements (CLP) : H315 - Causes skin irritation.
H319 - Causes serious eye irritation.

Precautionary statements (CLP) : P264 - Wash hands thoroughly after handling.
P280 - Wear eye protection, protective clothing, protective gloves.
P302+P352 - IF ON SKIN: Wash with plenty of water.
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332+P313 - If skin irritation occurs: Get medical advice/attention.
P362+P364 - Take off contaminated clothing and wash it before reuse.

2.3. Other hazards

PBT: not relevant – no registration required
vPvB: not relevant – no registration required
Contains no PBT and/or vPvB substances ≥ 0.1% assessed in accordance with REACH Annex XIII

Component	
Substance(s) not meeting the PBT criteria of REACH regulation, in accordance with Annex XIII	1-dodecanol (112-53-8), 1-tetradecanol (112-72-1), 1-butoxy-2-propanol (5131-66-8), 1,2-propanediol (57-55-6), Sodium laureth sulphate (68891-38-3)
Substance(s) not meeting the vPvB criteria of REACH regulation, in accordance with Annex XIII	1-dodecanol (112-53-8), 1-tetradecanol (112-72-1), 1-butoxy-2-propanol (5131-66-8), 1,2-propanediol (57-55-6), Sodium laureth sulphate (68891-38-3)

The mixture does not contain substance(s) included in the list established in accordance with Article 59(1) of REACH for having endocrine disrupting properties, or substance(s) are not identified as having endocrine disrupting properties in accordance with the criteria set out in Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at a concentration equal to or greater than 0,1 %

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
1,2-propanediol substance with national workplace exposure limit(s) (GB)	CAS-No.: 57-55-6 EC-No.: 200-338-0 REACH-no: 01-2119456809-23	4 – 10	Not classified
1-butoxy-2-propanol	CAS-No.: 5131-66-8 EC-No.: 225-878-4 EC Index-No.: 603-052-00-8 REACH-no: 01-2119475527-28	4 – 10	Eye Irrit. 2, H319 Skin Irrit. 2, H315
Sulfuric acid, mono-C8-10 (even numbered)-alkyl esters, sodium salts	CAS-No.: 85338-42-7 EC-No.: 939-332-4 REACH-no: 01-2119972287-26	1 – 4	Acute Tox. 4 (Oral), H302 Skin Irrit. 2, H315 Eye Dam. 1, H318
Sodium laureth sulphate	CAS-No.: 68891-38-3 EC-No.: 500-234-8 REACH-no: 01-2119488639-16	1 – 4	Skin Irrit. 2, H315 Eye Dam. 1, H318 STOT RE 2, H373 Aquatic Chronic 3, H412

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
1-dodecanol	CAS-No.: 112-53-8 EC-No.: 203-982-0 REACH-no: 01-2119485976-15	0.1 – 1	Eye Irrit. 2, H319 Aquatic Acute 1, H400 Aquatic Chronic 2, H411
1-tetradecanol	CAS-No.: 112-72-1 EC-No.: 204-000-3 REACH-no: 01-2119485910-33	0.1 – 1	Eye Irrit. 2, H319 Aquatic Chronic 1, H410

Specific concentration limits:		
Name	**Product identifier**	**Specific concentration limits (%)**
Sulfuric acid, mono-C8-10 (even numbered)-alkyl esters, sodium salts	CAS-No.: 85338-42-7 EC-No.: 939-332-4 REACH-no: 01-2119972287-26	(10 ≤ C < 20) Eye Irrit. 2, H319 (20 ≤ C < 100) Eye Dam. 1, H318
Sodium laureth sulphate	CAS-No.: 68891-38-3 EC-No.: 500-234-8 REACH-no: 01-2119488639-16	(5 ≤ C < 10) Eye Irrit. 2, H319 (10 ≤ C < 100) Eye Dam. 1, H318

Full text of H- and EUH-statements: see section 16

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation : Allow affected person to breathe fresh air. Allow the victim to rest.

First-aid measures after skin contact : Wash with plenty of water. Wash contaminated clothing before reuse. If skin irritation occurs: Get medical advice/attention.

First-aid measures after eye contact : Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/effects after skin contact : Causes skin irritation.

Symptoms/effects after eye contact : Causes serious eye irritation.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : No specific measures are necessary. This product is a fire extinguishing medium.

Unsuitable extinguishing media : Not applicable.

5.2. Special hazards arising from the substance or mixture

Fire hazard : No fire hazard.

5.3. Advice for firefighters

Firefighting instructions : Not applicable.
Protection during firefighting : Not applicable.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

8. Exposure controls/personal protection. 13. Disposal considerations.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Avoid contact with skin and eyes. Wear recommended personal protective equipment. Read and follow manufacturer's recommendations. Handle in accordance with good industrial hygiene and safety procedures. Read and follow the Safety Data Sheet (SDS) before use.
Hygiene measures : Wash hands thoroughly after handling.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in original container. Keep container tightly closed. Store at temperatures not exceeding 60°C (140°F) (intermittent). Protect from sunlight. Protect from freezing. Keep/Store away from incompatible materials.

7.3. Specific end use(s)

Firefighting foam concentrate.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.1.1 National occupational exposure and biological limit values

1,2-propanediol (57-55-6)	
United Kingdom - Occupational Exposure Limits	
WEL TWA (OEL TWA)	474 mg/m³ 10 mg/m³
	150 ppm

8.1.2. Recommended monitoring procedures

No additional information available

8.1.3. Air contaminants formed

No additional information available

8.1.4. DNEL and PNEC

No additional information available

8.1.5. Control banding

No additional information available

8.2. Exposure controls

8.2.1. Appropriate engineering controls

Appropriate engineering controls:
Ensure adequate ventilation. Follow the exposure limits given on this material safety data sheet.

8.2.2. Personal protection equipment

Personal protective equipment:
Wear recommended personal protective equipment.

Personal protective equipment symbol(s):



8.2.2.1. Eye and face protection

Eye protection:
Sealed safety goggles

8.2.2.2. Skin protection

Skin and body protection:
Wear suitable protective clothing. Wear suitable protective clothing

Hand protection:
Wear protective gloves (Recommended: Protective index 6, corresponding > 480 minutes of permeation time according to EN 374): nitrile rubber (NBR) - 0.2 mm coating thickness

8.2.2.3. Respiratory protection

Respiratory protection:
In case of insufficient ventilation, wear suitable respiratory equipment (recommended filter type A2/P2)

8.2.2.4. Thermal hazards

Thermal hazard protection:
Wear thermal protective clothing, when necessary.

8.2.3. Environmental exposure controls

Environmental exposure controls:
Contain spills. Prevent releases. Observe national regulations on emissions. Ensure all national/local regulations are observed.

Other information:
Do not eat, drink or smoke when using this product.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Colour	:	Yellow.
Odour	:	Characteristic.
Odour threshold	:	Not available
Melting point	:	Not available
Freezing point	:	-6 °C

Boiling point	:	Not available
Flammability	:	Not available
Lower explosion limit	:	Not available
Upper explosion limit	:	Not available
Flash point	:	> 100 °C
Auto-ignition temperature	:	Not available
Decomposition temperature	:	Not available
pH	:	7 – 8
Viscosity, kinematic	:	Not available
Solubility	:	Not available
Partition coefficient n-octanol/water (Log Kow)	:	Not available
Vapour pressure	:	Not available
Vapour pressure at 50°C	:	Not available
Density	:	1.02 – 1.04
Relative density	:	Not available
Relative vapour density at 20°C	:	Not available
Particle characteristics	:	Not applicable

9.2. Other information

9.2.1. Information with regard to physical hazard classes

No additional information available

9.2.2. Other safety characteristics

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

The product is stable and non reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

Incompatible materials. Extremely high or low temperatures.

10.5. Incompatible materials

Alkali metals. Oxidizing agent. Water reactive substances.

10.6. Hazardous decomposition products

Carbon oxides. Sulphur oxides. Nitrogen oxides (NOx). Sodium oxides.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity (oral)	:	Not classified
Acute toxicity (dermal)	:	Not classified
Acute toxicity (inhalation)	:	Not classified

1-dodecanol (112-53-8)	
LD50 oral	8000 mg/kg bodyweight (24 h, Rabbit, Male / female, Experimental value, Oral)
LD50 dermal rabbit	8000 – 12000 mg/kg bodyweight (Equivalent or similar to OECD 402, 24 h, Rabbit, Male / female, Experimental value, Dermal)

1-dodecanol (112-53-8)	
LC50 Inhalation - Rat	> 71 mg/l (1 h, Rat, Male / female, Experimental value of similar product, Inhalation (mist), 14 day(s))

1-tetradecanol (112-72-1)	
LD50 oral rat	> 2000 mg/kg bodyweight (OECD 401: Acute Oral Toxicity, Rat, Male / female, Experimental value, Oral)
LD50 dermal rabbit	8000 mg/kg bodyweight (24 h, Rabbit, Male / female, Experimental value, Dermal)
LC50 Inhalation - Rat	> 1.5 mg/l air (1 h, Rat, Male / female, Experimental value, Inhalation (vapours))

1-butoxy-2-propanol (5131-66-8)	
LD50 oral rat	3300 mg/kg bodyweight (OECD 401: Acute Oral Toxicity, Rat, Male / female, Experimental value, Oral, 14 day(s))
LD50 dermal rat	> 2000 mg/kg bodyweight (OECD 402: Acute Dermal Toxicity, 24 h, Rat, Male / female, Experimental value, Dermal, 14 day(s))

1,2-propanediol (57-55-6)	
LD50 oral rat	22000 mg/kg (Rat, Male / female, Experimental value, Oral)
LD50 dermal rabbit	> 2000 mg/kg bodyweight (24 h, Rabbit, Experimental value, Dermal, 14 day(s))
LC50 Inhalation - Rat	> 44.9 mg/l (4 h, Rat, Male / female, Experimental value, Inhalation (aerosol), 7 day(s))

Sodium laureth sulphate (68891-38-3)	
LD50 oral rat	4100 mg/kg bodyweight (OECD 401: Acute Oral Toxicity, Rat, Male / female, Experimental value, Oral)
LD50 dermal rat	> 2000 mg/kg bodyweight (OECD 402: Acute Dermal Toxicity, 24 h, Rat, Male / female, Experimental value, Dermal, 14 day(s))

Skin corrosion/irritation : Causes skin irritation.
pH: 7 – 8

1-tetradecanol (112-72-1)	
pH	5.5 (1.3E-3 g/l, 23 °C)

1,2-propanediol (57-55-6)	
pH	6.5 – 7.5 (50 %)

Sodium laureth sulphate (68891-38-3)	
pH	No data available in the literature

Serious eye damage/irritation : Causes serious eye irritation.
pH: 7 – 8

1-tetradecanol (112-72-1)	
pH	5.5 (1.3E-3 g/l, 23 °C)

1,2-propanediol (57-55-6)	
pH	6.5 – 7.5 (50 %)

Sodium laureth sulphate (68891-38-3)	
pH	No data available in the literature

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

STOT-single exposure : Not classified

STOT-repeated exposure : Not classified

Sodium laureth sulphate (68891-38-3)	
LOAEL (oral, rat, 90 days)	25 mg/kg bodyweight Animal: rat, Guideline: OECD Guideline 408 (Repeated Dose 90-Day Oral Toxicity Study in Rodents), Remarks on results: other:
NOAEL (oral, rat, 90 days)	> 225 mg/kg bodyweight Animal: rat, Guideline: OECD Guideline 408 (Repeated Dose 90-Day Oral Toxicity Study in Rodents), Remarks on results: other:
STOT-repeated exposure	May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard : Not classified

1-dodecanol (112-53-8)	
Viscosity, kinematic	11 mm²/s (40 °C, ASTM D445: Capillary viscometer, Test data)

1-tetradecanol (112-72-1)	
Viscosity, kinematic	2.845 mm²/s (100 °C, ASTM D445: Capillary viscometer)

1-butoxy-2-propanol (5131-66-8)	
Viscosity, kinematic	3.85 mm²/s (20 °C, DIN 51562: Capillary viscometer)

1,2-propanediol (57-55-6)	
Viscosity, kinematic	55.77 mm²/s (20 °C, No data available in the literature)

Sodium laureth sulphate (68891-38-3)	
Viscosity, kinematic	Not applicable (solid)

11.2. Information on other hazards

No additional information available

SECTION 12: Ecological information

12.1. Toxicity

Hazardous to the aquatic environment, short–term (acute) : Not classified

Hazardous to the aquatic environment, long–term (chronic) : Not classified

Respondol ATF 3/3	
LC50 - Fish [1]	> 100 mg/l (96h; Brachydanio rerio)
EC50 - Crustacea [1]	139 mg/l (24h; Daphnia Magna)
EC50 - Crustacea [2]	100 mg/l (48h; Daphnia Magna)
ErC50 algae	348 mg/l (72h; Pseudokirchneriella subcapitata)
NOEC chronic algae	100 mg/l (72h; Pseudokirchneriella subcapitata)

1-dodecanol (112-53-8)	
LC50 - Fish [1]	1.01 mg/l (US EPA, 96 h, Pimephales promelas, Flow-through system, Fresh water, Experimental value, Lethal)
EC50 - Crustacea [1]	0.765 mg/l (DIN 38412: German standard methods for the examination of water, waste water and sludge, 48 h, Daphnia magna, Static system, Fresh water, Experimental value, GLP)
ErC50 algae	0.66 mg/l (Equivalent or similar to OECD 201, 72 h, Desmodesmus subspicatus, Static system, Fresh water, Experimental value, Nominal concentration)

1-tetradecanol (112-72-1)	
LC50 - Fish [1]	> 1 mg/l (OECD 203: Fish, Acute Toxicity Test, 96 h, Oncorhynchus mykiss, Semi-static system, Fresh water, Experimental value)
EC50 - Crustacea [1]	3.2 mg/l (OECD 202: Daphnia sp. Acute Immobilisation Test, 48 h, Daphnia magna, Semi-static system, Fresh water, Experimental value)

1-butoxy-2-propanol (5131-66-8)	
LC50 - Fish [1]	560 – 1000 mg/l (OECD 203: Fish, Acute Toxicity Test, 96 h, Poecilia reticulata, Static system, Fresh water, Experimental value, GLP)
EC50 - Crustacea [1]	> 1000 mg/l (OECD 202: Daphnia sp. Acute Immobilisation Test, 48 h, Daphnia magna, Static system, Fresh water, Experimental value, GLP)
EC50 96h - Algae [1]	> 1000 mg/l (Other, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value, GLP)

1,2-propanediol (57-55-6)	
LC50 - Fish [1]	40613 mg/l (96 h, Oncorhynchus mykiss, Static system, Fresh water, Experimental value)
ErC50 algae	24200 mg/l (OECD 201: Alga, Growth Inhibition Test, 72 h, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value, GLP)

Sodium laureth sulphate (68891-38-3)	
LC50 - Fish [1]	7.1 mg/l (OECD 203: Fish, Acute Toxicity Test, 96 h, Brachydanio rerio, Flow-through system, Fresh water, Experimental value, GLP)
EC50 - Crustacea [1]	7.4 mg/l (OECD 202: Daphnia sp. Acute Immobilisation Test, 48 h, Daphnia magna, Static system, Fresh water, Experimental value, Locomotor effect)
EC50 72h - Algae [1]	27.7 mg/l Test organisms (species): Desmodesmus subspicatus (previous name: Scenedesmus subspicatus)
ErC50 algae	27.7 mg/l (OECD 201: Alga, Growth Inhibition Test, 72 h, Desmodesmus subspicatus, Static system, Fresh water, Experimental value, GLP)
NOEC (chronic)	0.27 mg/l Test organisms (species): Daphnia magna Duration: '21 d'
NOEC chronic fish	0.14 mg/l Test organisms (species): Oncorhynchus mykiss (previous name: Salmo gairdneri) Duration: '28 d'

12.2. Persistence and degradability

Respondol ATF 3/3	
Persistence and degradability	The product is readily biodegradable.
Biochemical oxygen demand (BOD)	67.5 g O2/l (5 days)
Chemical oxygen demand (COD)	449.9 g O2/l
Biodegradation	97 % (28 days)

1-dodecanol (112-53-8)	
Persistence and degradability	Biodegradable in the soil,Readily biodegradable in water.
ThOD	3.09 g O_2 /g substance

1-tetradecanol (112-72-1)	
Persistence and degradability	Readily biodegradable in water.
ThOD	3.13 g O_2 /g substance

1-butoxy-2-propanol (5131-66-8)	
Persistence and degradability	Readily biodegradable in water.

1,2-propanediol (57-55-6)	
Persistence and degradability	Biodegradable in the soil,Readily biodegradable in water.
Biochemical oxygen demand (BOD)	0.96 – 1.08 g O_2 /g substance
Chemical oxygen demand (COD)	1.63 g O_2 /g substance
ThOD	1.69 g O_2 /g substance

Sulfuric acid, mono-C8-10 (even numbered)-alkyl esters, sodium salts (85338-42-7)	
Persistence and degradability	Rapidly degradable

Sodium laureth sulphate (68891-38-3)	
Persistence and degradability	Readily biodegradable in water.

12.3. Bioaccumulative potential

Respondol ATF 3/3	
Bioaccumulative potential	The product is not expected to bioaccumulate.

1-dodecanol (112-53-8)	
Partition coefficient n-octanol/water (Log Pow)	5.4 (Experimental value, OECD 117: Partition Coefficient (n-octanol/water), HPLC method, 23 °C)
Bioaccumulative potential	High potential for bioaccumulation (Log Kow > 5).

1-tetradecanol (112-72-1)	
BCF - Fish [1]	26 (BCFBAF v3.01, Pisces, QSAR)
Partition coefficient n-octanol/water (Log Pow)	5.5 (Experimental value, ASTM E1147, 25 °C)
Bioaccumulative potential	High potential for bioaccumulation (Log Kow > 5).

1-butoxy-2-propanol (5131-66-8)	
Partition coefficient n-octanol/water (Log Pow)	1.2 (Experimental value, OECD 117: Partition Coefficient (n-octanol/water), HPLC method, 20 °C)
Bioaccumulative potential	Low potential for bioaccumulation (Log Kow < 4).

1,2-propanediol (57-55-6)	
Partition coefficient n-octanol/water (Log Pow)	-1.07 (Experimental value, EU Method A.8: Partition Coefficient, 20.5 °C)
Bioaccumulative potential	Not bioaccumulative.

Sodium laureth sulphate (68891-38-3)	
Partition coefficient n-octanol/water (Log Pow)	0.3 (Experimental value, OECD 123: Partition Coefficient (1-Octanol/Water): Slow-Stirring Method, 23 °C)
Bioaccumulative potential	Low potential for bioaccumulation (Log Kow < 4).

12.4. Mobility in soil

1-dodecanol (112-53-8)	
Surface tension	31.8 mN/m (23 °C, 6.4 mg/l)
Organic Carbon Normalized Adsorption Coefficient (Log Koc)	3.71 (log Koc, OECD 121: Estimation of the Adsorption Coefficient (Koc) on Soil and on Sewage Sludge using High Performance Liquid Chromatography (HPLC), Experimental value)
Ecology - soil	Low potential for mobility in soil.

1-tetradecanol (112-72-1)	
Surface tension	24 mN/m
Organic Carbon Normalized Adsorption Coefficient (Log Koc)	4.53 (log Koc, OECD 121: Estimation of the Adsorption Coefficient (Koc) on Soil and on Sewage Sludge using High Performance Liquid Chromatography (HPLC), Experimental value)
Ecology - soil	Low potential for mobility in soil.

1-butoxy-2-propanol (5131-66-8)	
Surface tension	57600 mN/m (20 °C, 100 vol %)
Ecology - soil	No straightforward conclusion can be drawn based upon the available numerical values.

1,2-propanediol (57-55-6)	
Surface tension	71.6 mN/m (21.5 °C, 1.01 g/l, EU Method A.5: Surface tension)
Organic Carbon Normalized Adsorption Coefficient (Log Koc)	0.46 (log Koc, Calculated value)
Ecology - soil	Highly mobile in soil.

Sodium laureth sulphate (68891-38-3)	
Surface tension	33 mN/m (25 °C, 0.07 %, BS EN 14370:2004: Surface tension)
Organic Carbon Normalized Adsorption Coefficient (Log Koc)	0.34 (log Koc, QSAR)
Ecology - soil	Highly mobile in soil.

12.5. Results of PBT and vPvB assessment

Respondol ATF 3/3
PBT: not relevant – no registration required
vPvB: not relevant – no registration required

Component	
Substance(s) not meeting the PBT criteria of REACH regulation, in accordance with Annex XIII	1-dodecanol (112-53-8), 1-tetradecanol (112-72-1), 1-butoxy-2-propanol (5131-66-8), 1,2-propanediol (57-55-6), Sodium laureth sulphate (68891-38-3)
Substance(s) not meeting the vPvB criteria of REACH regulation, in accordance with Annex XIII	1-dodecanol (112-53-8), 1-tetradecanol (112-72-1), 1-butoxy-2-propanol (5131-66-8), 1,2-propanediol (57-55-6), Sodium laureth sulphate (68891-38-3)

12.6. Endocrine disrupting properties

No additional information available

12.7. Other adverse effects

Other adverse effects : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Concentrate

Prevent foam concentrate from entering ground water, surface water or storm drains. Small quantities of foam concentrate may be collected on absorbents which can then be disposed of. Disposal should be made in accordance with local, state and federal regulations.

Foam/Foam Solution

Prevent foam/foam solution from entering ground water, surface water or storm drains. Small quantities of foam solution may be collected on absorbents which can then be disposed of. Disposal should be made in accordance with local, state and federal regulations.

NOTE: Please consult Angus Fire for additional information regarding the disposal of foam concentrates and foam solutions or visit https://angusfire.co.uk/use-discharge-and-disposal-of-firefighting-foam-products/.

Product/Packaging disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.
Ecological information : Avoid release to the environment.
European List of Waste (LoW, EC 2000/532) : 16 03 05* - organic wastes containing dangerous substances

SECTION 14: Transport information

In accordance with ADR / IMDG / IATA / ADN / RID

ADR	IMDG	IATA	ADN	RID
14.1. UN number or ID number				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.2. UN proper shipping name				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.3. Transport hazard class(es)				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.4. Packing group				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.5. Environmental hazards				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
No supplementary information available				

14.6. Special precautions for user

Overland transport
Not applicable

Transport by sea
Not applicable

Air transport
Not applicable

Inland waterway transport
Not applicable

Rail transport
Not applicable

14.7. Maritime transport in bulk according to IMO instruments

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

REACH Annex XVII (Restriction List)

EU restriction list (REACH Annex XVII)		
Reference code	**Applicable on**	**Entry title or description**
3(b)	Respondol ATF 3/3 ; 1-butoxy-2-propanol	Substances or mixtures fulfilling the criteria for any of the following hazard classes or categories set out in Annex I to Regulation (EC) No 1272/2008: Hazard classes 3.1 to 3.6, 3.7 adverse effects on sexual function and fertility or on development, 3.8 effects other than narcotic effects, 3.9 and 3.10

REACH Annex XIV (Authorisation List)

Contains no substance(s) listed on REACH Annex XIV (Authorisation List)

REACH Candidate List (SVHC)

Contains no substance(s) listed on the REACH Candidate List

PIC Regulation (Prior Informed Consent)

Contains no substance(s) listed on the PIC list (Regulation EU 649/2012 concerning the export and import of hazardous chemicals)

POP Regulation (Persistent Organic Pollutants)

Contains no substance(s) listed on the POP list (Regulation EU 2019/1021 on persistent organic pollutants)

Ozone Regulation (1005/2009)

Contains no substance(s) listed on the Ozone Depletion list (Regulation EU 1005/2009 on substances that deplete the ozone layer)

Dual-Use Regulation (428/2009)

Contains no substance subject to the COUNCIL REGULATION (EC) No 428/2009 of 5 May 2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items.

Explosives Precursors Regulation (2019/1148)

Contains no substance(s) listed on the Explosives Precursors list (Regulation EU 2019/1148 on the marketing and use of explosives precursors)

Drug Precursors Regulation (273/2004)

Contains no substance(s) listed on the Drug Precursors list (Regulation EC 273/2004 on the manufacture and the placing on market of certain substances used in the illicit manufacture of narcotic drugs and psychotropic substances)

15.1.2. National regulations

Not listed on the United States TSCA (Toxic Substances Control Act) inventory

France

Occupational diseases	
Code	Description
RG 66	Occupational rhinitis and asthma
RG 84	Conditions caused by liquid organic solvents for professional use: saturated or unsaturated aliphatic or cyclic liquid hydrocarbons and mixtures thereof; liquid halogenated hydrocarbons; nitrated derivatives of aliphatic hydrocarbons; alcohols; glycols, glycol ethers; ketones; aldehydes; aliphatic and cyclic ethers, including tetrahydrofuran; esters; dimethylformamide and dimethylacetamine; acetonitrile and propionitrile; pyridine; dimethylsulfone and dimethylsulfoxide

Germany

Water hazard class (WGK) : WGK 1, Slightly hazardous to water (Classification according to AwSV, Annex 1).

Hazardous Incident Ordinance (12. BImSchV) : Is not subject to the Hazardous Incident Ordinance (12. BImSchV)

Netherlands

SZW-lijst van kankerverwekkende stoffen	:	None of the components are listed
SZW-lijst van mutagene stoffen	:	None of the components are listed
SZW-lijst van reprotoxische stoffen – Borstvoeding	:	None of the components are listed
SZW-lijst van reprotoxische stoffen – Vruchtbaarheid	:	None of the components are listed
SZW-lijst van reprotoxische stoffen – Ontwikkeling	:	None of the components are listed

Denmark

Danish National Regulations	:	Pregnant/breastfeeding women working with the product must not be in direct contact with the product

15.2. Chemical safety assessment

No additional information available

SECTION 16: Other information

Data sources	:	REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Full text of H- and EUH-statements:	
Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Acute 1	Hazardous to the aquatic environment – Acute Hazard, Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment – Chronic Hazard, Category 1
Aquatic Chronic 2	Hazardous to the aquatic environment – Chronic Hazard, Category 2
Aquatic Chronic 3	Hazardous to the aquatic environment – Chronic Hazard, Category 3
Eye Dam. 1	Serious eye damage/eye irritation, Category 1
Eye Irrit. 2	Serious eye damage/eye irritation, Category 2
H302	Harmful if swallowed.
H315	Causes skin irritation.
H318	Causes serious eye damage.
H319	Causes serious eye irritation.
H373	May cause damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
H411	Toxic to aquatic life with long lasting effects.
H412	Harmful to aquatic life with long lasting effects.
Skin Irrit. 2	Skin corrosion/irritation, Category 2
STOT RE 2	Specific target organ toxicity – Repeated exposure, Category 2

SDS EU (REACH Annex II) - Angus Fire

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

FREEFOR SF2

SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME	**FREEFOR SF2**
Recommended use	Fire Fighting Foam Concentrate
MANUFACTURER	**3FFF LIMITED**
Address	Unit B, 18 Brunel Road, Earlstree Industrial Estate, Corby, Northants, NN17 4JW, UNITED KINGDOM
Phone n°	+44(0)1536 202919 or EMERGENCY N°+44 (0)7801 850011
Fax n°	+44(0)1536 263641
E-mail	sales@3fff.co.uk

2. HAZARDS IDENTIFICATION

CLASSIFICATION / REGULATION	EC 1272/2008 (CLP/GHS)
Physical Hazards	/
Health Hazards	Eye damage 1 - H318 Skin Irritation 2 – H315
Environment Hazards	/
LABEL ELEMENTS	
Symbols	GHS05 DANGER 
Danger	H318 Causes serious eye damage H315 Causes skin irritation
Precaution	P264 Wash your hands thoroughly after handling P280: Wear safety clothes, gloves and goggles P305+PP351+P338 IF ON EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to remove. Continue rinsing P302+P352 IF ON SKIN: Wash with plenty of soap and water P310 Immediately call a POISON CENTER or doctor P332+P313 If skin irritation occurs, get medical attention

3. COMPOSITION AND INFORMATION ON INGREDIENTS

Characteristics	Mixture: Aqueous solution of surfactants
Hazardous components	AlkylSulfate.....[10 – 15%] Skin Irritant 2; Eye Damage 1 H315. H318 P280. P302+P352. P305+P351+P338. P310. P332+P313 AlkylBetain.....[1 –5%] Eye Damage 2 H319 P264. P280

4. FIRST AID MEASURES

Skin contact	Wash off with water. Remove contaminated soaked clothing and rinse with water
Eye contact	Flush eye with plenty of water for at least 10 minutes maintaining open eyelids
Swallowing	Wash mouth with water. Seek medical advice
Inhalation	If there are any signs of nausea or sickness, seek medical advice



5. FIRE FIGHTING MEASURES

Extinguishing media	Fire fighting foam concentrate: not flammable
Specific risks	Aqueous solution: does not present specific risk in the case of fire

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Wear impervious clothes, gloves, goggles and safety shoes 
Environmental protection	Absorb onto sand or other absorbent material and shovel into container for disposal
CLEANING MEASURES	
• Collecting	Pump into clearly identified unbreakable containers
• Cleaning	Wash thoroughly with water
• Disposal	Incineration according to local regulations

7. HANDLING AND STORAGE

HANDLING	Require protective equipment (see section 8)
STORAGE	
• Technical measures	Storage area should contain accidental spill
• Storage conditions	Sealed containers in normal cool warehouse
• Storage recommendations	Product in bulk: stainless steel, polyester or mild steel protected with epoxy or polyurethane coating. Tanks in PE, PP
PACKAGING MATERIALS	
• Recommended	Polyethylene, Polypropylene, stainless steel
• Not advised	Mild steel, iron
• Recommended sealing	Viton, Kevlar, Teflon

8. EXPOSURE CONTROL AND PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT	
• Hand protection	Impermeable gloves (PVC) if continual handling 
• Eye protection	Goggles
• Body protection	Working clothes, safety shoes
HYGIENIC MEASURES	 Eye washing solution and washer eye cup 
	DO NOT eat, drink or smoke while handling the product
	Clean hands after working with any chemical products

9. PHYSICAL AND CHEMICAL PROPERTIES

• Physical form	Liquid
• Colour / Odour	Yellow / Synthetic smell
• pH at 20°C	7.0 +/- 1.0
• Freezing point	-8^0C
• Boiling point	$+100^0$C
• Flammability / oxidising / explosive properties	None
• Specific gravity at 20°C	1030 +/- 20 Kg/m^3
• Solubility	Completely soluble in water

10. STABILITY AND REACTIVITY

Thermal decomposition	Stable under normal conditions of use and storage
Hazardous reactions	None expected in standard use

11. TOXICOLOGICAL DATA

Acute toxicity Local effects on the eye and skin	Not classified as toxic if swallowed Eye Damage 1 May cause serious eye damage (pure) Skin Irritation 2 Causes skin irritation (pure) Not irritating to eyes and skin at recommended concentration of use of 1%

12. ECOLOGICAL DATA

ENVIRONMENTAL BEHAVIOUR		
• Biodegradation data	COD = 397 g O_2 / l BOD_5 = 239 g O_2 / l	
• Biodegradation rate	BOD/COD after 28 Days > 90% (OECD 301c); FREEFOR SF2 is readily biodegradable	
• Persistency	FREEFOR SF2 is free of persistent components.	
• Bio accumulative	FREEFOR SF2 is free of bio accumulative components.	
• PBT and vPvB assessment	Not classified PBT or vPvB	
ECOTOXICITY		
• Aquatic life toxicity	LC_{50} (*fish egg*) 96 hr : 240 mg/l EC_{50} (*Daphnia Magna*) 48 hr : 534 mg/l E_rC_{50} (*Selenastrum capricornutum*) 48 hr : 313 mg/l	OECD 236 OECD 202 OECD 201
• WGK Classification	WGK2 (pure); WGK1 (diluted at 3%)	

13. DISPOSAL CONDITIONS

PRODUCT	
• Prohibition	Do not discharge in the environment
• Disposal	Small amounts of product do not interfere with water treatment facilities If released in sewage system accidentally, it is recommended to control a slow flow rate in order to avoid any excess foaming
PACKAGING	
• Prohibition	Do not discharge in the environment
• Cleaning	Rinse with plenty of water
• Disposal	Incineration or an agreed method for package recycling

14. TRANSPORT INFORMATION

INTERNATIONAL REGULATIONS	
• Road - RID/ADR	Non hazardous
• Sea - OMI/MDG	Non hazardous
• Air - ICAO/IATA	Non hazardous

15. REGULATORY INFORMATION

Safety, human health and environmental regulations related to the product	Regulation EC 440/2008 on chemicals Directive 2008/98/EC on waste management Government Regulation 361/2007 for health protection at work Regulation EC 1907/2006 on REACH registration Regulation EC 1272/2008 on classification and labelling of chemicals

16. OTHER INFORMATION

Rules of drafting	This Safety Data Sheet complies with European Regulation EC 1272/2008 (CLP/GHS)
Relevant Symbols	GHS05 DANGER
Relevant H Statements	H315. H318
Relevant P statements	P264. P280. P302+P352. P305+P351+P338. P310. P332+P313

APPENDIX B

WINDOWLESS SAMPLING BOREHOLE LOGS

Intégral Géotechnique
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Castlegate Business Park
Caerphilly CF83 2AX
Tel. 029 20807991
Fax. 029 20862176
mail@integralgeotec.com

Project Name: **Earlswood Training Facility**		Project No.: **14050**	Borehole No.: **WS201** Sheet 1 of 1
Location: Jersey Marine, Neath	Client: Mid & West Wales Fire Service	Coordinates:	Hole Type: WLS
Equipment: DART 554	Diameter of Casing: 101mm	Level: 6.60mAOD	Scale 1:25
Diameter of Boring: 101mm	Depth of Casing: 3.00m	Dates 24/04/2025 -	Logged By: EH

Well	Water Strikes	Samples & In situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								Light grey reinforced CONCRETE.
					0.40	6.20		Black SAND and GRAVEL with low cobble content and increments of wood fragments. Gravel is fine to coarse angular ro subangular of limestone, slag, brick, clinker and concrete. (MADE GROUND).
		0.90	ES		0.80	5.80		Black sandy GRAVEL with high cobble content of angular brick. Gravel is fine to coarse angular to subangular or limestone, brick and slag. (MADE GROUND). ... Limited recovery below 2m.
	1.20 ▼							
		1.40	ES					
		3.00	ES		3.00	3.60		Greyish brown gravelly SAND. Gravel is fine to coarse subangular to subrounded of sandstone.
	3.40 ▼							
		3.70	ES		3.60	3.00		Greyish brown fine to coarse SAND.
					4.00	2.60		End of Borehole at 4.00 m

Remarks:
1. Borehole terminated at 4.0mbgl.

Key:
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

AGS

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Project Name: **Earlswood Training Facility**		Project No.: **14050**	Borehole No.: **WS202** Sheet 1 of 1
Location: Jersey Marine, Neath	Client: Mid & West Wales Fire Service	Coordinates:	Hole Type: WLS
Equipment: DART554	Diameter of Casing: 101mm	Level: 6.70mAOD	Scale 1:25
Diameter of Boring: 101mm	Depth of Casing: 1.00m	Dates 24/04/2025 -	Logged By: EH

Well	Water Strikes	Samples & In situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20	6.50		Light grey reinforced CONCRETE.
		0.50	ES					Brown very gravelly SAND. Gravel is fine to coarse angular to subangular of limestone, brick and slag. (MADE GROUND).
					0.70	6.00		Black gravelly SAND. Gravel is fine to coarse angular to subangular of limestone, brick and slag. (MADE GROUND).
					1.10	5.60		Greyish brown fine to coarse SAND.
		1.50	ES					
	2.00 ▼							
		2.30	ES					
					3.90	2.80		Soft grey slightly sandy CLAY.
					4.00	2.70		End of Borehole at 4.00 m

1 2 3 4 5

Remarks:

1. Borehole terminated at 4.0mbgl.

Key:

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

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Project Name: **Earlswood Training Facility**		Project No.: **14050**	Borehole No.: **WS203** Sheet 1 of 1
Location: Jersey Marine, Neath	Client: Mid & West Wales Fire Service	Coordinates:	Hole Type: WLS
Equipment: DART 554	Diameter of Casing:	Level: 6.50mAOD	Scale 1:25
Diameter of Boring: 101mm	Depth of Casing:	Dates 23/04/2025 -	Logged By: EH

Well	Water Strikes	Samples & In situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.15	6.35		Light grey reinforced CONCRETE.
					0.30	6.20		Greyish brown gravelly SAND. Gravel is fine to coarse angular to subangular of limestone. (MADE GROUND).
		0.40	ES		0.35	6.15		Black silty gravelly SAND. Gravel is fine to coarse angular to subangular of limestone, ash, slag and clinker. (MADE GROUND)
								Black slightly silty sandy GRAVEL. Gravel is fine to coarse angular to subangular of limestone, ash, slag and clinker.
					1.30	5.20		Black silty fine to coarse SAND. (MADE GROUND).
					1.60	4.90		Dark grey clayey sandy fine to coarse angular to subangular GRAVEL of limestone. (MADE GROUND).
		2.00	ES		1.80	4.70		Grey slightly sandy clayey GRAVEL with low cobble content. Gravel and cobbles are fine to coarse angular to subangular of limestone.
	2.40				2.20	4.30		Brownish grey fine to coarse SAND.
		3.00	ES					
					4.00	2.50		End of Borehole at 4.00 m

Remarks:

1. Borehole terminated at 4.0mbgl.
2. Water monitoring well installed.

Key:

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

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Project Name: **Earlswood Training Facility**		Project No.: **14050**	Borehole No.: **WS204** Sheet 1 of 1
Location: Jersey Marine, Neath	Client: Mid & West Wales Fire Service	Coordinates:	Hole Type: WLS
Equipment: DART554	Diameter of Casing:	Level: 6.70mAOD	Scale 1:25
Diameter of Boring: 101mm	Depth of Casing:	Dates 24/04/2025 -	Logged By: EH

Well	Water Strikes	Samples & In situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.15	6.55		Light grey reinforced CONCRETE.
					0.35	6.35		Grey gravelly SAND. Gravel is fine to coarse angular to subangular of limestone and slag. (MADE GROUND).
					0.45	6.25		Black ashy gravelly SAND. Gravel is fine to coarse angular to subangular of limestone and slag. (MADE GROUND).
		0.60	ES		0.50	6.20		Reddish brown slightly gravelly SAND, Gravel is fine to coarse subangular to subrounded of limestone and brick, (MADE GROUND).
		0.80	ES					Orangish greyish brown fine to coarse SAND.
	1.20 ▼							
		1.40	ES					
					2.85	3.85		Firm grey slightly silty CLAY.
					3.00	3.70		End of Borehole at 3.00 m

Remarks:

1. Borehole terminated at 3.0mbgl.

Key:

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

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Project Name: **Earlswood Training Facility**		Project No.: **14050**	Borehole No.: **WS205** Sheet 1 of 1
Location: Jersey Marine, Neath	Client: Mid & West Wales Fire Service	Coordinates:	Hole Type: WLS
Equipment: DART554	Diameter of Casing:	Level: 6.50mAOD	Scale 1:25
Diameter of Boring: 101mm	Depth of Casing:	Dates 23/04/2025 -	Logged By: EH

Well	Water Strikes	Samples & In situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.28	6.22		Light grey reinforced CONCRETE.
					0.50	6.00		Greyish brown gravelly SAND. Gravel is fine to coarse angular to subangular of limestone and slag. (MADE GROUND)
					0.75	5.75		Brown and orange sandy slightly silty GRAVEL. Gravel is fine to coarse angular to subangular of limestone, slag, ash and clinker. (MADE GROUND).
					1.10	5.40		Black sandy clayey fine to coarse angular to subangular GRAVEL of limestone, slag, ash and clinker. (MADE GROUND).
					1.45	5.05		Stiff dark grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subangular of limestone, slag and clinker. (MADE GROUND).
					1.65	4.85		Soft brownish black spongy fibrous PEAT.
		2.00	ES					Greyish brown fine to coarse SAND.
	2.50							
		2.80	ES					
					3.00	3.50		End of Borehole at 3.00 m

Remarks:

1. Borehole terminated at 3.0mbgl.
2. Water monitoring well installed.

Key:

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

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Project Name: **Earlswood Training Facility**		Project No.: **14050**	Borehole No.: **WS206** Sheet 1 of 1
Location: Jersey Marine, Neath	Client: Mid & West Wales Fire Service	Coordinates:	Hole Type: WLS
Equipment: DART554	Diameter of Casing:	Level: 6.80mAOD	Scale 1:25
Diameter of Boring: 101mm	Depth of Casing:	Dates 23/04/2025 -	Logged By: EH

Well	Water Strikes	Samples & In situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.30	6.50		Reddish grey sandy fine to coarse angular to subangular GRAVEL of limestone. (MADE GROUND).
		0.50	ES					Orangish brown slightly clayey fine to coarse SAND.
		0.80	ES					
	1.50 ▼							
		1.80	ES					
					2.90	3.90		Firm grey slightly sandy CLAY.
					3.00	3.80		End of Borehole at 3.00 m

Remarks:

1. Borehole terminated at 3.0m bgl.
2. Water monitoring well installed.

Key:

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

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APPENDIX C

RISING HEAD TEST CALCULATION SHEETS

Integral Géotechnique

Rising Head Test Calculation Sheet

Project Name: Earlswood Training Centre

Project Number: 14050

Date: 13/08/2025

Borehole No. WS205

Test No: 1

Elapsed Time, t (min)	Elapsed Time, t (sec)	Head, h (m)	h/h_0
0	0	2.87	1
0.5	30	2.48	0.86
1	60	2.09	0.73
1.5	90	1.88	0.66
2	120	1.81	0.63
2.5	150	1.73	0.60
3	180	1.65	0.57
3.5	210	1.6	0.56
4	240	1.56	0.54
4.5	270	1.51	0.53
5	300	1.47	0.51
6	360	1.42	0.49
7	420	1.37	0.48
8	480	1.33	0.46
9	540	1.3	0.45
10	600	1.28	0.45
15	900	1.26	0.44
20	1200	1.23	0.43
25	1500	1.2	0.42
30	1800	1.18	0.41
35	2100	1.16	0.40
40	2400	1.14	0.40
45	2700	1.11	0.39
50	3000	1.06	0.37
55	3300	1.04	0.36
60	3600	1.01	0.35

Well Radius (m): 0.05

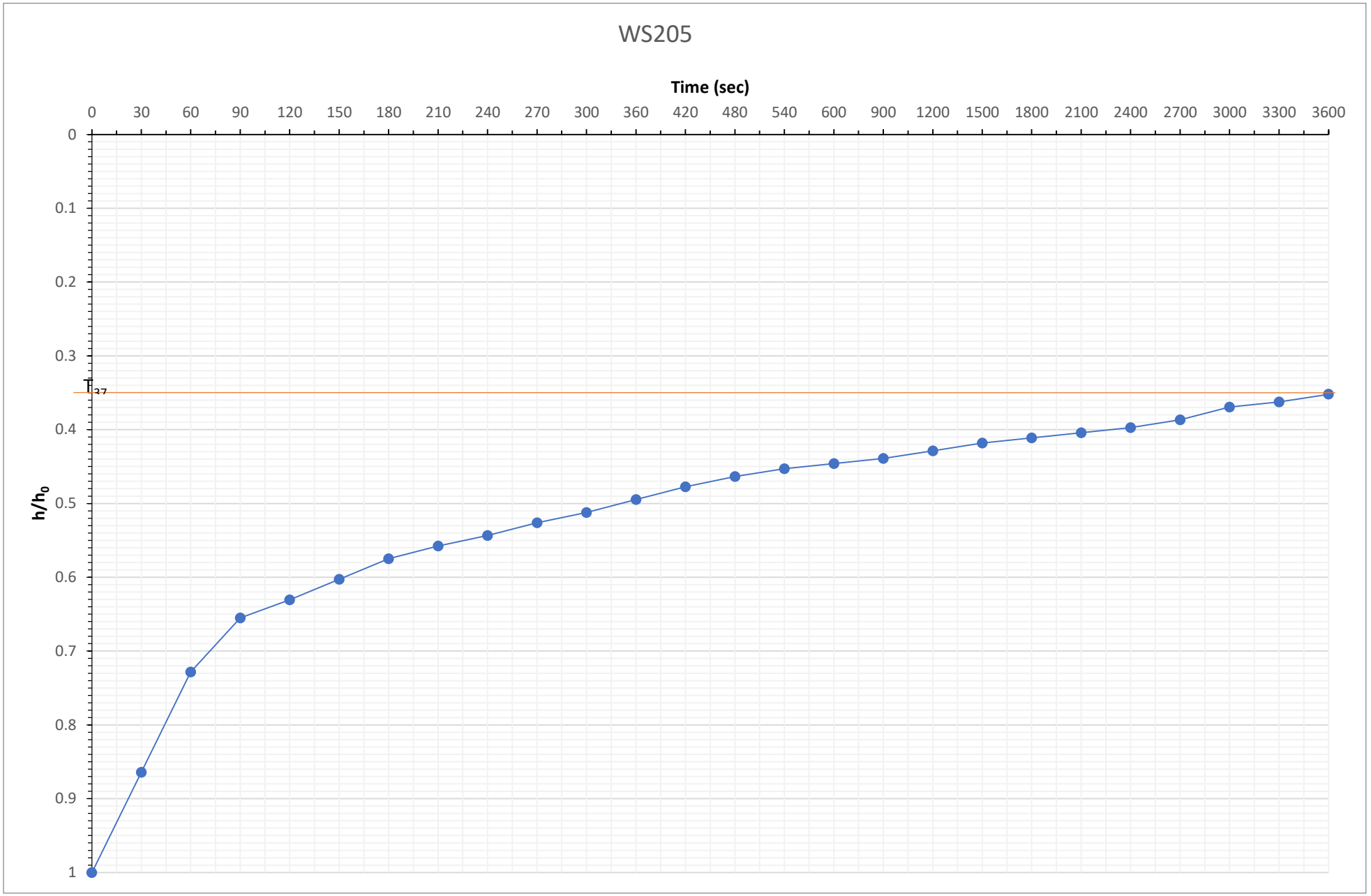
Screen Length, L (m): 1

Initial Head Change, h (m): 2.87

T_{37} (s): 3000

K (m/s): 4.16667E-07

K (m/day): 0.04


WS205
Time (sec)
0
30
60
90
120
150
180
210
240
270
300
360
420
480
540
600
900
1200
1500
1800
2100
2400
2700
3000
3300
3600
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
h/h0
T37

APPENDIX D

LABORATORY CHEMICAL TEST RESULTS - SOILS

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e: Lowri@integralgeotec.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 25-021164

Project / Site name:	Earlswood Training Centre	**Samples received on:**	28/04/2025
Your job number:	14050	**Samples instructed on/ Analysis started on:**	28/04/2025
Your order number:	14381 AF	**Analysis completed by:**	07/05/2025
Report Issue Number:	1	**Report issued on:**	08/05/2025
Samples Analysed:	4 soil samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-021164
Project / Site name: Earlswood Training Centre
Your Order No: 14381 AF

Lab Sample Number				525469	525470	525471	525472
Sample Reference				WS203	WS201	WS202	WS204
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				0.40	0.90	0.50	0.60
Date Sampled				23/04/2025	24/04/2025	24/04/2025	24/04/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
Stone Content	%	0.1	NONE	70.3	47.1	33.9	< 0.1
Moisture Content	%	0.01	NONE	5.7	19	29	19
Total mass of sample received	kg	0.1	NONE	1.4	1.8	1.4	1.2
Asbestos							
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JWU	JWU	JWU	JWU
Analysis completed	N/A	N/A	N/A	05/05/2025	05/05/2025	05/05/2025	05/05/2025
General Inorganics							
pH (L099)	pH Units	N/A	MCERTS	11.2	7.9	8.4	9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO_4	mg/kg	50	MCERTS	3700	1400	21000	140
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	630	250	200	57
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.315	0.126	0.102	0.0284
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	315	126	102	28.4
Sulphide	mg/kg	1	MCERTS	14	33	2.8	< 1.0
Total Sulphur	mg/kg	50	MCERTS	2700	2000	10000	71
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.9	3.8	4.4	0.2
Loss on Ignition @ 450°C	%	0.2	MCERTS	6.5	13	16	0.5
Total Phenols							
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs							
Naphthalene	mg/kg	0.05	MCERTS	0.23	0.92	1.2	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.1	0.26	0.06	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.07	0.22	0.24	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.08	0.76	0.22	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.61	7.5	2.6	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.15	0.81	0.33	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.91	11	3.5	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.85	8	2.9	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.44	3.9	1.8	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.75	5.3	2.2	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.2	4.8	2	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.3	2.4	0.82	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.84	3.6	1.3	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.78	1.6	0.66	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.21	0.44	0.24	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.88	1.6	0.73	< 0.05
Total PAH							
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	8.36	52.5	20.6	< 0.80

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Analytical Report Number: 25-021164
Project / Site name: Earlswood Training Centre
Your Order No: 14381 AF

Lab Sample Number				525469	525470	525471	525472
Sample Reference				WS203	WS201	WS202	WS204
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				0.40	0.90	0.50	0.60
Date Sampled				23/04/2025	24/04/2025	24/04/2025	24/04/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
Heavy Metals / Metalloids							
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	150	130	500	15
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.79	1.7	2	0.16
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1	1.1	1	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	460	21	23	4.3
Copper (aqua regia extractable)	mg/kg	1	MCERTS	190	710	1000	37
Lead (aqua regia extractable)	mg/kg	1	MCERTS	1200	3000	5200	40
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	7.3	12	15	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	90	55	6.3
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	28	43	60	14
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	730	46	63	12
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	180	630	230	66
Petroleum Hydrocarbons							
TPHCWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	< 1.0	2.5	1	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	11	8.6	< 8.0	< 8.0
TPHCWG - Aliphatic >EC16 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	10	MCERTS	51	84	14	< 10
TPHCWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	41	75	14	< 8.0
TPHCWG - Aliphatic >EC35 - EC44 $_{EH\_CU\_1D\_AL}$	mg/kg	8.4	NONE	40	13	< 8.4	< 8.4
TPHCWG - Aliphatic >EC5 - EC35 $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	51	86	15	< 10
TPHCWG - Aliphatic >EC5 - EC44 $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	91	99	15	< 10
TPHCWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	< 1.0	< 1.0	1.7	< 1.0
TPHCWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	3.2	4.1	2.5	< 2.0
TPHCWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	< 10	28	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	43	54	< 10	< 10
TPHCWG - Aromatic >EC35 - EC40 $_{EH\_CU\_1D\_AR}$	mg/kg	10	NONE	45	15	< 10	< 10
TPHCWG - Aromatic >EC35 - EC44 $_{EH\_CU\_1D\_AR}$	mg/kg	8.4	NONE	100	58	< 8.4	< 8.4
TPHCWG - Aromatic >EC5 - EC35 $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	46	86	< 10	< 10
TPHCWG - Aromatic >EC5 - EC44 $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	150	140	< 10	< 10
TPH Total >EC5 - EC44 $_{EH\_CU+HS\_1D\_TOTAL}$	mg/kg	10	NONE	240	240	15	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 25-021164
Project / Site name: Earlswood Training Centre

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
525469	WS203	None Supplied	0.4	Brown sand with gravel and stones
525470	WS201	None Supplied	0.9	Brown sand with stones
525471	WS202	None Supplied	0.5	Brown clay and sand with gravel and stones
525472	WS204	None Supplied	0.6	Brown sand

Analytical Report Number : 25-021164
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	In-house method	L010-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES	In-house method	L038B	D	MCERTS
Loss on ignition of soil @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	In-house method	L047-PL	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088-PL	D/W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS

Analytical Report Number : 25-021164
Project / Site name: Earlswood Training Centre

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Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

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Analytical Report Number : 25-021153

Project / Site name:	Earlswood Training Centre	**Samples received on:**	28/04/2025
Your job number:	14050	**Samples instructed on/ Analysis started on:**	28/04/2025
Your order number:	14384 AF	**Analysis completed by:**	02/05/2025
Report Issue Number:	1	**Report issued on:**	02/05/2025
Samples Analysed:	15 soil samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

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soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Analytical Report Number: 25-021153
Project / Site name: Earlswood Training Centre
Your Order No: 14384 AF

Lab Sample Number				525387	525388	525389	525390	525391
Sample Reference				WS203	WS203	WS206	WS206	WS206
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				2.00	3.00	0.50	0.80	1.80
Date Sampled				23/04/2025	23/04/2025	23/04/2025	23/04/2025	23/04/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	26	19	20	22	18
Total mass of sample received	kg	0.1	NONE	0.5	0.5	0.5	0.5	0.5
PFAS								
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTCA (8:2 Fluorotelomer acid) - Semiquantitative - CAS	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSAA (methyl perfluorooctanesulfonamidoacetic acid)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number: 25-021153
Project / Site name: Earlswood Training Centre
Your Order No: 14384 AF

Lab Sample Number				525392	525393	525394	525395	525396
Sample Reference				WS225	WS205	WS201	WS201	WS201
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				2.00	2.80	0.90	1.40	3.00
Date Sampled				23/04/2025	23/04/2025	24/04/2025	24/04/2025	24/04/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	47.1	68.7	< 0.1
Moisture Content	%	0.01	NONE	18	19	19	11	22
Total mass of sample received	kg	0.1	NONE	0.4	0.5	1.8	0.5	0.5
PFAS								
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTCA (8:2 Fluorotelomer acid) - Semiquantitative - CAS	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/kg	0.1	NONE	< 0.1	< 0.1	5	< 0.1	< 0.1
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/kg	0.1	NONE	< 0.1	< 0.1	2.9	0.2	0.2
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSAA (methyl perfluorooctanesulfonamidoacetic acid)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/kg	0.1	NONE	< 0.1	< 0.1	0.3	< 0.1	< 0.1
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/kg	0.1	NONE	< 0.1	< 0.1	12	1.9	0.5
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 25-021153
Project / Site name: Earlswood Training Centre
Your Order No: 14384 AF

Lab Sample Number				525397	525398	525399	525400	525401
Sample Reference				WS201	WS202	WS202	WS204	WS204
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				3.70	1.50	2.30	0.80	1.40
Date Sampled				24/04/2025	24/04/2025	24/04/2025	24/04/2025	24/04/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	24	18	20	18	18
Total mass of sample received	kg	0.1	NONE	0.4	0.5	0.5	0.5	0.5
PFAS								
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTCA (8:2 Fluorotelomer acid) - Semiquantitative - CAS	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSAA (methyl perfluorooctanesulfonamidoacetic acid)	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

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Analytical Report Number : 25-021153
Project / Site name: Earlswood Training Centre

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
525387	WS203	None Supplied	2	Brown sand
525388	WS203	None Supplied	3	Brown clay and sand
525389	WS206	None Supplied	0.5	Brown sand
525390	WS206	None Supplied	0.8	Brown sand
525391	WS206	None Supplied	1.8	Brown sand
525392	WS225	None Supplied	2	Brown sand
525393	WS205	None Supplied	2.8	Brown sand
525394	WS201	None Supplied	0.9	Brown sand with stones
525395	WS201	None Supplied	1.4	Brown sand with stones
525396	WS201	None Supplied	3	Brown clay and sand with gravel
525397	WS201	None Supplied	3.7	Brown clay and sand with gravel
525398	WS202	None Supplied	1.5	Brown sand with gravel
525399	WS202	None Supplied	2.3	Brown sand
525400	WS204	None Supplied	0.8	Brown sand
525401	WS204	None Supplied	1.4	Brown sand

Analytical Report Number : 25-021153
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
PFAS in soil by LC-MS/MS	Determination of PFAS in soil by LC-MS/MS	In-house method	L117B	W	NONE
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

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Analytical Report Number : 25-021198

Project / Site name:	Earlswood Training Centre	**Samples received on:**	28/04/2025
Your job number:	14050	**Samples instructed on/ Analysis started on:**	28/04/2025
Your order number:	14381 AF	**Analysis completed by:**	02/05/2025
Report Issue Number:	1	**Report issued on:**	02/05/2025
Samples Analysed:	2 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-021198
Project / Site name: Earlswood Training Centre

Your Order No: 14381 AF

Lab Sample Number				525606	525607
Sample Reference				SWD 1	SWD 2
Sample Number				None Supplied	None Supplied
Water Matrix				Other water	Other water
Depth (m)				None Supplied	None Supplied
Date Sampled				24/04/2025	24/04/2025
Time Taken				1000	1030
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
PFAS					
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - C	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 25-021198
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

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Analytical Report Number : 25-021174

Project / Site name:	Earlswood Training Centre	**Samples received on:**	28/04/2025
Your job number:	14050	**Samples instructed on/ Analysis started on:**	28/04/2025
Your order number:	14381 AF	**Analysis completed by:**	02/05/2025
Report Issue Number:	1	**Report issued on:**	02/05/2025
Samples Analysed:	1 soil sample		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-021174
Project / Site name: Earlswood Training Centre
Your Order No: 14381 AF

Lab Sample Number				525529
Sample Reference				QC 3
Sample Number				None Supplied
Water Matrix				N/A
Depth (m)				None Supplied
Date Sampled				24/04/2025
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	21
Total mass of sample received	kg	0.1	NONE	0.5
PFAS				
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/kg	0.1	NONE	< 0.1
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/kg	0.1	NONE	< 0.1
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/kg	0.1	NONE	< 0.1
8:2FTCA (8:2 Fluorotelomer acid) - Semiquantitative - CAS	µg/kg	0.1	NONE	< 0.1
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/kg	0.1	NONE	< 0.1
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/kg	0.1	NONE	< 0.1
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/kg	0.1	NONE	< 0.1
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/kg	0.1	NONE	< 0.1
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/kg	0.1	NONE	< 0.1
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/kg	0.1	NONE	< 0.1
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/kg	0.1	NONE	< 0.1
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/kg	0.1	NONE	< 0.1
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - C	µg/kg	0.1	NONE	< 0.1
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/kg	0.1	NONE	< 0.1
NMeFOSAA (methyl perfluorooctanesulfonamidoacetic acid)	µg/kg	0.1	NONE	< 0.1
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/kg	0.1	NONE	< 0.1
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/kg	0.1	NONE	< 0.1
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/kg	0.1	NONE	< 0.1
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/kg	0.1	NONE	< 0.1
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/kg	0.1	NONE	< 0.1
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/kg	0.1	NONE	< 0.1
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/kg	0.1	NONE	< 0.1
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/kg	0.1	NONE	< 0.1
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/kg	0.1	NONE	< 0.1
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/kg	0.1	NONE	< 0.1
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/kg	0.1	NONE	< 0.1
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/kg	0.1	NONE	< 0.1
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/kg	0.1	NONE	< 0.1
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/kg	0.1	NONE	< 0.1
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/kg	0.1	NONE	< 0.1
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/kg	0.1	NONE	< 0.1
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/kg	0.1	NONE	< 0.1
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/kg	0.1	NONE	< 0.1
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/kg	0.1	NONE	< 0.1
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/kg	0.1	NONE	< 0.1

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 25-021174
Project / Site name: Earlswood Training Centre

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
525529	QC 3	None Supplied	None Supplied	Brown sand with gravel

Analytical Report Number : 25-021174
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
PFAS in soil by LC-MS/MS	Determination of PFAS in soil by LC-MS/MS	In-house method	L117B	W	NONE
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

APPENDIX E

LABORATORY CHEMICAL TEST RESULTS - DRAINAGE

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Analytical Report Number : 25-021198

Project / Site name:	Earlswood Training Centre	**Samples received on:**	28/04/2025
Your job number:	14050	**Samples instructed on/ Analysis started on:**	28/04/2025
Your order number:	14381 AF	**Analysis completed by:**	02/05/2025
Report Issue Number:	1	**Report issued on:**	02/05/2025
Samples Analysed:	2 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-021198
Project / Site name: Earlswood Training Centre

Your Order No: 14381 AF

Lab Sample Number				525606	525607
Sample Reference				SWD 1	SWD 2
Sample Number				None Supplied	None Supplied
Water Matrix				Other water	Other water
Depth (m)				None Supplied	None Supplied
Date Sampled				24/04/2025	24/04/2025
Time Taken				1000	1030
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
PFAS					
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - C	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 25-021198
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

APPENDIX F

LABORATORY CHEMICAL TEST RESULTS - GROUNDWATER

UKAS TESTING
4041

Environmental Science

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Analytical Report Number : 25-025222

Project / Site name:	Earlswood Training Centre	**Samples received on:**	16/05/2025
Your job number:	14050 RJH	**Samples instructed on/ Analysis started on:**	16/05/2025
Your order number:		**Analysis completed by:**	02/06/2025
Report Issue Number:	1	**Report issued on:**	02/06/2025
Samples Analysed:	5 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Some records may be kept for longer according to other legal/best practice requirements.

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Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-025222
Project / Site name: Earlswood Training Centre

Lab Sample Number				547797	547798	547799	547800
Sample Reference				WS 203	WS 205	WS 206	WS 205A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025	14/05/2025	14/05/2025
Time Taken				1035	1115	1245	1315
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
General Inorganics							
pH (L099)	pH Units	N/A	ISO 17025	7.5	7.8	7.7	-
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	-
Sulphate as SO_4	µg/l	45	ISO 17025	14300	16300	16700	-
Total Sulphur	µg/l	15	NONE	4800	5400	5600	-
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	-
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	7.16	9.99	2.14	-
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	7.33	11	2.52	-
Hardness - Total	mgCaCO3/l	1	ISO 17025	91.8	175	216	-
Total Phenols							
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	-
Speciated PAHs							
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Total PAH							
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	-

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Analytical Report Number: 25-025222
Project / Site name: Earlswood Training Centre

Lab Sample Number				547797	547798	547799	547800
Sample Reference				WS 203	WS 205	WS 206	WS 205A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025	14/05/2025	14/05/2025
Time Taken				1035	1115	1245	1315
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
Heavy Metals / Metalloids							
Arsenic (dissolved)	µg/l	0.15	ISO 17025	4.32	51.5	13.5	-
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	-
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.03	< 0.02	< 0.02	-
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.3	< 0.2	< 0.2	-
Copper (dissolved)	µg/l	0.5	ISO 17025	3.2	0.8	1.4	-
Lead (dissolved)	µg/l	0.2	ISO 17025	1.6	15	< 0.2	-
Mercury (dissolved)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	-
Nickel (dissolved)	µg/l	0.5	ISO 17025	3.6	2.1	1.5	-
Selenium (dissolved)	µg/l	0.6	ISO 17025	0.7	< 0.6	4.7	-
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.9	1.8	0.8	-
Zinc (dissolved)	µg/l	0.5	ISO 17025	28	3.4	1.9	-
Boron (dissolved)	µg/l	10	ISO 17025	19	110	22	-
Calcium (dissolved)	mg/l	0.012	ISO 17025	32	61	80	-
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	-
Petroleum Hydrocarbons							
TPH - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aliphatic >EC10 - EC12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aliphatic >EC12 - EC16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aliphatic >EC16 - EC21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aliphatic >EC21 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aliphatic >EC5 - EC35 $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aliphatic >EC16 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aliphatic >EC35 - EC44 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	6.1	< 1.0	-
TPH - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aromatic >EC10 - EC12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC12 - EC16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC16 - EC21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC21 - EC35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC5 - EC35 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC35 - EC40 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC35 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC40 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC5 - EC44 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH (>EC5 - EC10) $_{HS\_1D\_TOTAL}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH (>EC10 - EC20) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH (>EC20 - EC44) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH Total >EC5 - EC44 $_{HS+EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-

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Analytical Report Number: 25-025222
Project / Site name: Earlswood Training Centre

Lab Sample Number				547797	547798	547799	547800
Sample Reference				WS 203	WS 205	WS 206	WS 205A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025	14/05/2025	14/05/2025
Time Taken				1035	1115	1245	1315
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
VOCs							
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
Toluene	µg/l	1	ISO 17025	< 1.0	6	< 1.0	-
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
PFAS							
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05	0.38	< 0.05	0.28
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - C	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	0.13	< 0.05	0.07
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05

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Analytical Report Number: 25-025222
Project / Site name: Earlswood Training Centre

Lab Sample Number				547797	547798	547799	547800
Sample Reference				WS 203	WS 205	WS 206	WS 205A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025	14/05/2025	14/05/2025
Time Taken				1035	1115	1245	1315
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
Subcontracted Analysis							
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached	See Attached	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached	See Attached	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number: 25-025222
Project / Site name: Earlswood Training Centre

Lab Sample Number	547801
Sample Reference	SPF 01
Sample Number	None Supplied
Water Matrix	Potable water (non regulatory)
Depth (m)	None Supplied
Date Sampled	14/05/2025
Time Taken	1335

Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**	
PFAS				
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - C	µg/l	0.05	NONE	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05
Subcontracted Analysis				
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 25-025222
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW,GW, Hg - SW,PW, Al - SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode	In-house method	L029-PL	W	NONE
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Total Organic Carbon in water	Determination of total organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Sulphur in water	Determination of total sulphur in water by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE
Total Hardness of water	Determination of total hardness of water by calculation from calcium and magnesium. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	ISO 17025
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total Petroleum Hydrocarbons in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS. Accredited matrices (TPH C12 - C35): SW, PW, GW	In-house method	L070B	W	NONE
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5-diphenylcarbazide, followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method by continuous flow analyser	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide in water by distillation followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total Petroleum Hydrocarbons in water by HS-GC-MS	Determination of total petroleum hydrocarbons in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	ISO 17025

Analytical Report Number : 25-025222
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE
Subcontracted analysis (water)	Subcontracted analysis - see attached subcon report.	Subcontracted analysis - see attached subcon report.			NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

TEST REPORT

Report Number: 2025-1320

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7743
Additional Reference:	25-025222
Issue :	0
Date of Receipt :	20/05/2025
Date of Analysis :	23/05/2025
Date of Report :	30/05/2025
Sample Type :	Groundwater
Customer Sample Identifier :	547799 WS 206 14/05/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1320
Customer Sample Identifier : 547799 WS 206 14/05/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	1.39
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	1.39
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	1.02
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	0.95
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	1.98

ND - not detected

TEST REPORT

Report Number: 2025-1319

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7743
Additional Reference:	25-025222
Issue :	0
Date of Receipt :	20/05/2025
Date of Analysis :	23/05/2025
Date of Report :	30/05/2025
Sample Type :	Groundwater
Customer Sample Identifier :	547798 WS 205 14/05/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1319
Customer Sample Identifier : 547798 WS 205 14/05/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	24.6
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	24.6
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	26.1
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	10.2
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	36.3

ND - not detected

TEST REPORT

Report Number: 2025-1318

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7743
Additional Reference:	25-025222
Issue :	0
Date of Receipt :	20/05/2025
Date of Analysis :	23/05/2025
Date of Report :	30/05/2025
Sample Type :	Groundwater
Customer Sample Identifier :	547797 WS 203 14/05/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1318
Customer Sample Identifier : 547797 WS 203 14/05/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	8.7
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	8.7
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	2.96
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	2.35
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	5.3

ND - not detected

TEST REPORT

Report Number: 2025-1322

Customer Name : i2 Analytical UK
Customer Address : 7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 SYS
Order Number : PO_S_C7743
Additional Reference: 25-025222
Issue : 0
Date of Receipt : 20/05/2025
Date of Analysis : 23/05/2025
Date of Report : 30/05/2025
Sample Type : Water
Customer Sample Identifier : 547801 SPF 01 14/05/2025 Portable Water
Sample Condition : Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Water
Test Report Number : 2025-1322
Customer Sample Identifier : 547801 SPF 01 14/05/2025 Portable Water
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

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e: reception@i2analytical.com

Analytical Report Number : 25-029817

Project / Site name:	Earlswood Training Centre	**Samples received on:**	09/06/2025
Your job number:	14050 RJH	**Samples instructed on/ Analysis started on:**	09/06/2025
Your order number:		**Analysis completed by:**	20/06/2025
Report Issue Number:	1	**Report issued on:**	20/06/2025
Samples Analysed:	5 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-029817
Project / Site name: Earlswood Training Centre

Lab Sample Number				573568	573569	573570	573571
Sample Reference				WS 203	WS 205	WS 206	WS 203A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				04/06/2025	04/06/2025	04/06/2025	04/06/2025
Time Taken				1035	1115	1245	1315
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
General Inorganics							
pH (L099)	pH Units	N/A	ISO 17025	7.1	7.5	7.7	-
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	-
Sulphate as SO_4	µg/l	45	ISO 17025	1620	12000	16200	-
Total Sulphur	µg/l	15	NONE	540	4000	5400	-
Sulphide	µg/l	5	NONE	< 5.0	15	< 5.0	-
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	4.13	5.2	1.51	-
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	4.35	5.42	1.62	-
Hardness - Total	mgCaCO3/l	1	ISO 17025	302	274	199	-
Total Phenols							
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	-
Speciated PAHs							
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	1.4	< 0.01	-
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	0.21	< 0.01	-
Fluorene	µg/l	0.01	ISO 17025	0.06	0.08	< 0.01	-
Phenanthrene	µg/l	0.01	ISO 17025	0.2	0.21	0.03	-
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Fluoranthene	µg/l	0.01	ISO 17025	0.11	0.21	< 0.01	-
Pyrene	µg/l	0.01	ISO 17025	0.09	0.22	0.02	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	0.07	< 0.01	< 0.01	-
Chrysene	µg/l	0.01	ISO 17025	0.08	< 0.01	< 0.01	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	0.07	< 0.01	-
Total PAH							
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	0.61	2.35	< 0.16	-
Heavy Metals / Metalloids							
Arsenic (dissolved)	µg/l	0.15	ISO 17025	18.4	62.1	5.29	-
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	-
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02	< 0.02	< 0.02	-
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	-
Copper (dissolved)	µg/l	0.5	ISO 17025	1.8	1.8	1.6	-
Lead (dissolved)	µg/l	0.2	ISO 17025	0.3	6.4	< 0.2	-
Mercury (dissolved)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	-
Nickel (dissolved)	µg/l	0.5	ISO 17025	1.4	1.5	1.4	-
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6	< 0.6	2.3	-
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.2	1.1	0.6	-
Zinc (dissolved)	µg/l	0.5	ISO 17025	1.4	2.4	2.6	-

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Analytical Report Number: 25-029817
Project / Site name: Earlswood Training Centre

Lab Sample Number				573568	573569	573570	573571
Sample Reference				WS 203	WS 205	WS 206	WS 203A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				04/06/2025	04/06/2025	04/06/2025	04/06/2025
Time Taken				1035	1115	1245	1315
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
Boron (dissolved)	µg/l	10	ISO 17025	99	120	23	-
Calcium (dissolved)	mg/l	0.012	ISO 17025	100	97	74	-
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	-
Petroleum Hydrocarbons							
TPH - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aliphatic >EC10 - EC12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	43	< 10	-
TPH - Aliphatic >EC12 - EC16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	160	< 10	-
TPH - Aliphatic >EC16 - EC21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	32	170	< 10	-
TPH - Aliphatic >EC21 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	330	130	< 10	-
TPH - Aliphatic >EC5 - EC35 $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	370	500	< 10	-
TPH - Aliphatic >EC16 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	370	300	< 10	-
TPH - Aliphatic >EC35 - EC44 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
TPH - Aromatic >EC10 - EC12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC12 - EC16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC16 - EC21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC21 - EC35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC5 - EC35 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC35 - EC40 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC35 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC40 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH - Aromatic >EC5 - EC44 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH (>EC5 - EC10) $_{HS\_1D\_TOTAL}$	µg/l	10	NONE	< 10	< 10	< 10	-
TPH (>EC10 - EC20) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	340	< 10	-
TPH (>EC20 - EC44) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	370	160	< 10	-
TPH Total >EC5 - EC44 $_{HS+EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	370	500	< 10	-
VOCs							
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-

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Analytical Report Number: 25-029817
Project / Site name: Earlswood Training Centre

Lab Sample Number				573568	573569	573570	573571
Sample Reference				WS 203	WS 205	WS 206	WS 203A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				04/06/2025	04/06/2025	04/06/2025	04/06/2025
Time Taken				1035	1115	1245	1315
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
PFAS							
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-3	µg/l	0.05	NONE	< 0.05	0.11	< 0.05	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-9	µg/l	0.05	NONE	< 0.05	0.75	< 0.05	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	0.05	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Subcontracted Analysis							
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached	See Attached	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached	See Attached	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 25-029817
Project / Site name: Earlswood Training Centre

Lab Sample Number				573572
Sample Reference				SPF 01
Sample Number				None Supplied
Water Matrix				Potable water (non regulatory)
Depth (m)				None Supplied
Date Sampled				04/06/2025
Time Taken				1335
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**	
PFAS				
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/l	0.05	NONE	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05
Subcontracted Analysis				
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 25-029817
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW,GW, Hg - SW,PW, Al - SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode	In-house method	L029-PL	W	NONE
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Total Organic Carbon in water	Determination of total organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Sulphur in water	Determination of total sulphur in water by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE
Total Hardness of water	Determination of total hardness of water by calculation from calcium and magnesium. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	ISO 17025
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total Petroleum Hydrocarbons in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS. Accredited matrices (TPH C12 - C35): SW, PW, GW	In-house method	L070B	W	NONE
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5-diphenylcarbazide, followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method by continuous flow analyser	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide in water by distillation followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total Petroleum Hydrocarbons in water by HS-GC-MS	Determination of total petroleum hydrocarbons in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	ISO 17025
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025

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Analytical Report Number : 25-029817
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE
Subcontracted analysis (water)	Subcontracted analysis - see attached subcon report.	Subcontracted analysis - see attached subcon report.			NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

Sample Deviation Report

Analytical Report Number : 25-029817
Project / Site name: Earlswood Training Centre

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container/Insufficient material provided c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS 203	N/A	W	573568	c	BTEX and/or Volatile Organic Compounds in water	L073B	c
WS 203	N/A	W	573568	c	Hexavalent chromium in water	L080-PL	c
WS 203	N/A	W	573568	c	Total Petroleum Hydrocarbons in water by HS-GC-MS	L088-PL	c
WS 203	N/A	W	573568	c	Total cyanide in water	L080-PL	c
WS 203	N/A	W	573568	c	pH of water at 20°C (automated)	L099-PL	c
WS 205	N/A	W	573569	c	BTEX and/or Volatile Organic Compounds in water	L073B	c
WS 205	N/A	W	573569	c	Hexavalent chromium in water	L080-PL	c
WS 205	N/A	W	573569	c	Total Petroleum Hydrocarbons in water by HS-GC-MS	L088-PL	c
WS 205	N/A	W	573569	c	Total cyanide in water	L080-PL	c
WS 205	N/A	W	573569	c	pH of water at 20°C (automated)	L099-PL	c
WS 206	N/A	W	573570	c	BTEX and/or Volatile Organic Compounds in water	L073B	c
WS 206	N/A	W	573570	c	Hexavalent chromium in water	L080-PL	c
WS 206	N/A	W	573570	c	Total Petroleum Hydrocarbons in water by HS-GC-MS	L088-PL	c
WS 206	N/A	W	573570	c	Total cyanide in water	L080-PL	c
WS 206	N/A	W	573570	c	pH of water at 20°C (automated)	L099-PL	c

TEST REPORT

Report Number: 2025-1608

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7804
Additional Reference:	25-029817
Issue :	0
Date of Receipt :	12/06/2025
Date of Analysis :	16/06/2025
Date of Report :	19/06/2025
Sample Type :	Groundwater
Customer Sample Identifier :	573570 WS 206 04/06/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1608
Customer Sample Identifier : 573570 WS 206 04/06/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

TEST REPORT

Report Number: 2025-1607

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7804
Additional Reference:	25-029817
Issue :	0
Date of Receipt :	12/06/2025
Date of Analysis :	16/06/2025
Date of Report :	19/06/2025
Sample Type :	Groundwater
Customer Sample Identifier :	573569 WS 205 04/06/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1607
Customer Sample Identifier : 573569 WS 205 04/06/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	24.7
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	24.7
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	16.6
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	6.62
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	23.2

ND - not detected

TEST REPORT

Report Number: 2025-1606

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7804
Additional Reference:	25-029817
Issue :	0
Date of Receipt :	12/06/2025
Date of Analysis :	16/06/2025
Date of Report :	19/06/2025
Sample Type :	Groundwater
Customer Sample Identifier :	573568 WS 203 04/06/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1606
Customer Sample Identifier : 573568 WS 203 04/06/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	2.37
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	2.37
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	2.67
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	1.41
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	4.08

ND - not detected

TEST REPORT

Report Number: 2025-1610

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7804
Additional Reference:	25-029817
Issue :	0
Date of Receipt :	12/06/2025
Date of Analysis :	16/06/2025
Date of Report :	19/06/2025
Sample Type :	Water
Customer Sample Identifier :	573572 SPF 01 Portable Water 04/06/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Water
Test Report Number : 2025-1610
Customer Sample Identifier : 573572 SPF 01 Portable Water 04/06/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

TEST REPORT

Report Number: 2025-1609

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7804
Additional Reference:	25-029817
Issue :	0
Date of Receipt :	12/06/2025
Date of Analysis :	16/06/2025
Date of Report :	19/06/2025
Sample Type :	Groundwater
Customer Sample Identifier :	573571 WS 203A 04/06/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1609
Customer Sample Identifier : 573571 WS 203A 04/06/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	2.92
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	2.92
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	3.3
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	0.85
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	4.14

ND - not detected

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Analytical Report Number : 25-031166

Project / Site name:	Earlswood Training Centre	**Samples received on:**	13/06/2025
Your job number:	14050 RJH	**Samples instructed on/ Analysis started on:**	13/06/2025
Your order number:		**Analysis completed by:**	30/06/2025
Report Issue Number:	1	**Report issued on:**	30/06/2025
Samples Analysed:	3 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

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Analytical Report Number: 25-031166
Project / Site name: Earlswood Training Centre

Lab Sample Number				581150	581151	581152
Sample Reference				WS 203	WS 205	WS 206
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied
Date Sampled				11/06/2025	11/06/2025	11/06/2025
Time Taken				1035	1115	1245
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
General Inorganics						
pH (L099)	pH Units	N/A	ISO 17025	7.3	7.6	7.5
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10
Sulphate as SO_4	µg/l	45	ISO 17025	7700	18200	19100
Total Sulphur	µg/l	15	NONE	2600	6100	6400
Sulphide	µg/l	5	NONE	< 5.0	19	< 5.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	3.51	4.65	1.41
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	3.53	4.66	1.45
Hardness - Total	mgCaCO3/l	1	ISO 17025	136	179	253
Total Phenols						
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10
Speciated PAHs						
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	0.11	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Total PAH						
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16
Heavy Metals / Metalloids						
Arsenic (dissolved)	µg/l	0.15	ISO 17025	12.3	35.2	5.76
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.04	< 0.02	< 0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.8	0.4	0.7
Copper (dissolved)	µg/l	0.5	ISO 17025	6	1.5	3.4
Lead (dissolved)	µg/l	0.2	ISO 17025	3.8	1.6	< 0.2
Mercury (dissolved)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	2.7	1.5	2.1
Selenium (dissolved)	µg/l	0.6	ISO 17025	0.9	0.6	3.2
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.5	1.2	1.1
Zinc (dissolved)	µg/l	0.5	ISO 17025	3.6	8.6	23

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Analytical Report Number: 25-031166
Project / Site name: Earlswood Training Centre

Lab Sample Number				581150	581151	581152
Sample Reference				WS 203	WS 205	WS 206
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied
Date Sampled				11/06/2025	11/06/2025	11/06/2025
Time Taken				1035	1115	1245
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
Boron (dissolved)	µg/l	10	ISO 17025	53	110	25
Calcium (dissolved)	mg/l	0.012	ISO 17025	46	63	94
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0
Petroleum Hydrocarbons						
TPH - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC10 - EC12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	16	23	18
TPH - Aliphatic >EC12 - EC16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	65	150	55
TPH - Aliphatic >EC16 - EC21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	48	380	20
TPH - Aliphatic >EC21 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	490	1200	< 10
TPH - Aliphatic >EC5 - EC35 $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	620	1700	93
TPH - Aliphatic >EC16 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	540	1600	20
TPH - Aliphatic >EC35 - EC44 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	30	40	< 10
TPH - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC12 - EC16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC16 - EC21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC21 - EC35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC5 - EC35 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC35 - EC40 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC35 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC40 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH - Aromatic >EC5 - EC44 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH (>EC5 - EC10) $_{HS\_1D\_TOTAL}$	µg/l	10	NONE	< 10	< 10	< 10
TPH (>EC10 - EC20) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	91	190	78
TPH (>EC20 - EC44) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	530	2000	25
TPH Total >EC5 - EC44 $_{HS+EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	620	2200	100
VOCs						
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0

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Analytical Report Number: 25-031166
Project / Site name: Earlswood Training Centre

Lab Sample Number				581150	581151	581152
Sample Reference				WS 203	WS 205	WS 206
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water
Depth (m)				None Supplied	None Supplied	None Supplied
Date Sampled				11/06/2025	11/06/2025	11/06/2025
Time Taken				1035	1115	1245
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
PFAS						
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-3	µg/l	0.05	NONE	< 0.05	0.09	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-9	µg/l	0.05	NONE	< 0.05	1.3	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acic	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05
Subcontracted Analysis						
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 25-031166
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW,GW, Hg - SW,PW, Al - SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode	In-house method	L029-PL	W	NONE
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Total Organic Carbon in water	Determination of total organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Sulphur in water	Determination of total sulphur in water by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE
Total Hardness of water	Determination of total hardness of water by calculation from calcium and magnesium. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	ISO 17025
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total Petroleum Hydrocarbons in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS. Accredited matrices (TPH C12 - C35): SW, PW, GW	In-house method	L070B	W	NONE
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5-diphenylcarbazide, followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method by continuous flow analyser	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide in water by distillation followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total Petroleum Hydrocarbons in water by HS-GC-MS	Determination of total petroleum hydrocarbons in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	ISO 17025
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025

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Analytical Report Number : 25-031166
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE
Subcontracted analysis (water)	Subcontracted analysis - see attached subcon report.	Subcontracted analysis - see attached subcon report.			NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

TEST REPORT

Report Number: 2025-1808

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7836
Additional Reference:	25-031166
Issue :	0
Date of Receipt :	18/06/2025
Date of Analysis :	19/06/2025
Date of Report :	25/06/2025
Sample Type :	Groundwater
Customer Sample Identifier :	581152 WS 206 11/06/2025
Sample Condition :	Non-Conforming*

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS. ***Sample's temperature outside of acceptable range.**

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1808
Customer Sample Identifier : 581152 WS 206 11/06/2025
Sample Condition : Non-Conforming*
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

TEST REPORT

Report Number: 2025-1807

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7836
Additional Reference:	25-031166
Issue :	0
Date of Receipt :	18/06/2025
Date of Analysis :	19/06/2025
Date of Report :	25/06/2025
Sample Type :	Groundwater
Customer Sample Identifier :	581151 WS 205 11/06/2025
Sample Condition :	Non-Conforming*

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS. ***Sample's temperature outside of acceptable range.**

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1807
Customer Sample Identifier : 581151 WS 205 11/06/2025
Sample Condition : Non-Conforming*
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	32.4
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	32.4
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	19.1
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	8.9
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	28

ND - not detected

TEST REPORT

Report Number: 2025-1806

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7836
Additional Reference:	25-031166
Issue :	0
Date of Receipt :	18/06/2025
Date of Analysis :	19/06/2025
Date of Report :	25/06/2025
Sample Type :	Groundwater
Customer Sample Identifier :	581150 WS 203 11/06/2025
Sample Condition :	Non-Conforming*

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS. ***Sample's temperature outside of acceptable range.**

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Groundwater
Test Report Number : 2025-1806
Customer Sample Identifier : 581150 WS 203 11/06/2025
Sample Condition : Non-Conforming*
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	5.51
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	5.51
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	3.82
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	1.94
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	5.75

ND - not detected

APPENDIX G

LABORATORY CHEMICAL TEST RESULTS – SURFACE WATER

4041

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Analytical Report Number : 25-025223

Project / Site name:	Earlswood Training Centre	**Samples received on:**	16/05/2025
Your job number:	14050 RJH	**Samples instructed on/ Analysis started on:**	16/05/2025
Your order number:		**Analysis completed by:**	02/06/2025
Report Issue Number:	1	**Report issued on:**	02/06/2025
Samples Analysed:	2 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-025223
Project / Site name: Earlswood Training Centre

Lab Sample Number				547802	547803
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
General Inorganics					
pH (L099)	pH Units	N/A	ISO 17025	8.1	8.1
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10
Sulphate as SO_4	µg/l	45	ISO 17025	2470000	2050000 $^{\$\$}$
Total Sulphur	µg/l	15	NONE	820000	680000
Sulphide	µg/l	5	NONE	< 5.0	< 5.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	0.78	0.75
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	0.85	0.84
Hardness - Total	mgCaCO3/l	1	ISO 17025	5680	5780
Total Phenols					
Total Phenols (monohydric)	µg/l	10	ISO 17025	230	69
Speciated PAHs					
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Total PAH					
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16

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Environmental Science

Analytical Report Number: 25-025223
Project / Site name: Earlswood Training Centre

Lab Sample Number				547802	547803
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
Heavy Metals / Metalloids					
Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.86	1.73
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	<0.1 [&]	<0.1 [&]
Chromium (dissolved)	µg/l	0.2	ISO 17025	2.5	<1 [&]
Copper (dissolved)	µg/l	0.5	ISO 17025	8.4	9.2
Lead (dissolved)	µg/l	0.2	ISO 17025	<1 [&]	<1 [&]
Mercury (dissolved)	µg/l	0.05	ISO 17025	<0.25 [&]	<0.25 [&]
Nickel (dissolved)	µg/l	0.5	ISO 17025	3.2	<2.5 [&]
Selenium (dissolved)	µg/l	0.6	ISO 17025	<3 [&]	<3 [&]
Vanadium (dissolved)	µg/l	0.2	ISO 17025	1.4	1.2
Zinc (dissolved)	µg/l	0.5	ISO 17025	9	8.6
Boron (dissolved)	µg/l	10	ISO 17025	3700	3300
Calcium (dissolved)	mg/l	0.012	ISO 17025	370	370
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0
Petroleum Hydrocarbons					
TPH - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC10 - EC12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC12 - EC16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC16 - EC21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC21 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC5 - EC35 $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC16 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC35 - EC44 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC12 - EC16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC16 - EC21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC21 - EC35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC35 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC35 - EC40 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC35 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC40 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC44 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH (>EC5 - EC10) $_{HS\_1D\_TOTAL}$	µg/l	10	NONE	< 10	< 10
TPH (>EC10 - EC20) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH (>EC20 - EC44) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH Total >EC5 - EC44 $_{HS+EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10

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Analytical Report Number: 25-025223
Project / Site name: Earlswood Training Centre

Lab Sample Number				547802	547803
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
VOCs					
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
PFAS					
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - C	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05

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Analytical Report Number: 25-025223
Project / Site name: Earlswood Training Centre

Lab Sample Number				547802	547803
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				14/05/2025	14/05/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
Subcontracted Analysis					
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 25-025223
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW,GW, Hg - SW,PW, Al - SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode	In-house method	L029-PL	W	NONE
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Total Organic Carbon in water	Determination of total organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Sulphur in water	Determination of total sulphur in water by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE
Total Hardness of water	Determination of total hardness of water by calculation from calcium and magnesium. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	ISO 17025
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total Petroleum Hydrocarbons in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS. Accredited matrices (TPH C12 - C35): SW, PW, GW	In-house method	L070B	W	NONE
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5-diphenylcarbazide, followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method by continuous flow analyser	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide in water by distillation followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total Petroleum Hydrocarbons in water by HS-GC-MS	Determination of total petroleum hydrocarbons in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	ISO 17025

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Analytical Report Number : 25-025223
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE
Subcontracted analysis (water)	Subcontracted analysis - see attached subcon report.	Subcontracted analysis - see attached subcon report.			NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

&- Sample required dilution above the concentration range for the procedure due to matrix effect/ analyte concentration. The method limit of detection has been raised in line with the dilution. The result should be considered deviating and should be interpreted with caution. The result is not accredited.

$$- Result was reported from high dilution. The result should be interpreted with caution.

TEST REPORT

Report Number: 2025-1317

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7744
Additional Reference:	25-025223
Issue :	0
Date of Receipt :	20/05/2025
Date of Analysis :	23/05/2025
Date of Report :	30/05/2025
Sample Type :	Surface water
Customer Sample Identifier :	25-025223 547803 RMD 01
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Surface water
Test Report Number : 2025-1317
Customer Sample Identifier : 25-025223 547803 RMD 01
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

TEST REPORT

Report Number: 2025-1316

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7744
Additional Reference:	25-025223
Issue :	0
Date of Receipt :	20/05/2025
Date of Analysis :	23/05/2025
Date of Report :	30/05/2025
Sample Type :	Surface water
Customer Sample Identifier :	25-025223 547802 RSC 01
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Surface water
Test Report Number : 2025-1316
Customer Sample Identifier : 25-025223 547802 RSC 01
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

UKAS TESTING
4041

Environmental Science

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Analytical Report Number : 25-029793

Project / Site name:	Eastswood Training Centre	**Samples received on:**	09/06/2025
Your job number:	14050 RJH	**Samples instructed on/ Analysis started on:**	09/06/2025
Your order number:		**Analysis completed by:**	20/06/2025
Report Issue Number:	1	**Report issued on:**	20/06/2025
Samples Analysed:	2 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-029793
Project / Site name: Eastswood Training Centre

Lab Sample Number				573345	573346
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				04/06/2025	04/06/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
General Inorganics					
pH (L099)	pH Units	N/A	ISO 17025	8	8
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10
Sulphate as SO_4	µg/l	45	ISO 17025	1380000	1390000
Total Sulphur	µg/l	15	NONE	460000	460000
Sulphide	µg/l	5	NONE	< 5.0	< 5.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	2.25	1.79
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	2.44	1.91
Hardness - Total	mgCaCO3/l	1	ISO 17025	3370	3550
Total Phenols					
Total Phenols (monohydric)	µg/l	10	ISO 17025	72	62
Speciated PAHs					
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Total PAH					
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16
Heavy Metals / Metalloids					
Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.5	1.51
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.03	0.03
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.4	0.2
Copper (dissolved)	µg/l	0.5	ISO 17025	9.9	9.5
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	0.11	0.06
Nickel (dissolved)	µg/l	0.5	ISO 17025	1.2	1.1
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6	< 0.6
Vanadium (dissolved)	µg/l	0.2	ISO 17025	1	0.9
Zinc (dissolved)	µg/l	0.5	ISO 17025	9.2	7.7

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Analytical Report Number: 25-029793
Project / Site name: Eastswood Training Centre

Lab Sample Number				573345	573346
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				04/06/2025	04/06/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
Boron (dissolved)	µg/l	10	ISO 17025	1700	1700
Calcium (dissolved)	mg/l	0.012	ISO 17025	210	220
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0
Petroleum Hydrocarbons					
TPH - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC10 - EC12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC12 - EC16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC16 - EC21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC21 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC5 - EC35 $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC16 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC35 - EC44 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC12 - EC16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC16 - EC21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC21 - EC35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC35 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC35 - EC40 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC35 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC40 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC44 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH (>EC5 - EC10) $_{HS\_1D\_TOTAL}$	µg/l	10	NONE	< 10	< 10
TPH (>EC10 - EC20) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH (>EC20 - EC44) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH Total >EC5 - EC44 $_{HS+EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	< 10
VOCs					
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0

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Analytical Report Number: 25-029793
Project / Site name: Eastswood Training Centre

Lab Sample Number				573345	573346
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				04/06/2025	04/06/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
PFAS					
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acid	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05
Subcontracted Analysis					
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 25-029793
Project / Site name: Eastswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW,GW, Hg - SW,PW, Al - SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode	In-house method	L029-PL	W	NONE
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Total Organic Carbon in water	Determination of total organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Sulphur in water	Determination of total sulphur in water by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE
Total Hardness of water	Determination of total hardness of water by calculation from calcium and magnesium. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	ISO 17025
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total Petroleum Hydrocarbons in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS. Accredited matrices (TPH C12 - C35): SW, PW, GW	In-house method	L070B	W	NONE
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5-diphenylcarbazide, followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method by continuous flow analyser	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide in water by distillation followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total Petroleum Hydrocarbons in water by HS-GC-MS	Determination of total petroleum hydrocarbons in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	ISO 17025
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025

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Analytical Report Number : 25-029793
Project / Site name: Eastswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE
Subcontracted analysis (water)	Subcontracted analysis - see attached subcon report.	Subcontracted analysis - see attached subcon report.			NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

Sample Deviation Report

Analytical Report Number : 25-029793
Project / Site name: Eastswood Training Centre

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container/Insufficient material provided c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
RMD 01	N/A	W	573346	c	pH of water at 20°C (automated)	L099-PL	c
RSC 01	N/A	W	573345	c	pH of water at 20°C (automated)	L099-PL	c

TEST REPORT

Report Number: 2025-1612

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7805
Additional Reference:	25-029793
Issue :	0
Date of Receipt :	12/06/2025
Date of Analysis :	16/06/2025
Date of Report :	19/06/2025
Sample Type :	Surface water
Customer Sample Identifier :	573346 RMD 01 04/06/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Surface water
Test Report Number : 2025-1612
Customer Sample Identifier : 573346 RMD 01 04/06/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	0.79
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	0.79

ND - not detected

TEST REPORT

Report Number: 2025-1611

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7805
Additional Reference:	25-029793
Issue :	0
Date of Receipt :	12/06/2025
Date of Analysis :	16/06/2025
Date of Report :	19/06/2025
Sample Type :	Surface water
Customer Sample Identifier :	573345 RSC 01 04/06/2025
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Surface water
Test Report Number : 2025-1611
Customer Sample Identifier : 573345 RSC 01 04/06/2025
Sample Condition : Conforming
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

UKAS TESTING
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Analytical i2 Environmental Science

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Analytical Report Number : 25-031162

Project / Site name:	Earlswood Training Centre	**Samples received on:**	13/06/2025
Your job number:	14050 RJH	**Samples instructed on/ Analysis started on:**	13/06/2025
Your order number:		**Analysis completed by:**	01/07/2025
Report Issue Number:	1	**Report issued on:**	01/07/2025
Samples Analysed:	2 water samples		



Signed:

Elaine Guy
Customer Services Advisor
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

UKAS TESTING
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Analytical i2 Environmental Science

Analytical Report Number: 25-031162
Project / Site name: Earlswood Training Centre

Lab Sample Number				581126	581127
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				11/06/2025	11/06/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
General Inorganics					
pH (L099)	pH Units	N/A	ISO 17025	8.1	8.1
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10
Sulphate as SO_4	µg/l	45	ISO 17025	2300000	2290000
Total Sulphur	µg/l	15	NONE	770000	760000
Sulphide	µg/l	5	NONE	< 5.0	< 5.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	0.94	0.81
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	1.02	0.82
Hardness - Total	mgCaCO3/l	1	ISO 17025	5420	5380
Total Phenols					
Total Phenols (monohydric)	µg/l	10	ISO 17025	35	18
Speciated PAHs					
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Total PAH					
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16
Heavy Metals / Metalloids					
Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.48	1.55
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.03	0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	12	20
Copper (dissolved)	µg/l	0.5	ISO 17025	18	15
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2 #	< 0.2 #
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05 #	< 0.05 #
Nickel (dissolved)	µg/l	0.5	ISO 17025	4.6	7.1
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.5	1.8
Vanadium (dissolved)	µg/l	0.2	ISO 17025	1.1	1.1
Zinc (dissolved)	µg/l	0.5	ISO 17025	26	38

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Analytical Report Number: 25-031162
Project / Site name: Earlswood Training Centre

Lab Sample Number				581126	581127
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				11/06/2025	11/06/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
Boron (dissolved)	µg/l	10	ISO 17025	3300	3400
Calcium (dissolved)	mg/l	0.012	ISO 17025	350	350
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0
Petroleum Hydrocarbons					
TPH - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aliphatic >EC10 - EC12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	12
TPH - Aliphatic >EC12 - EC16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	48
TPH - Aliphatic >EC16 - EC21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	25
TPH - Aliphatic >EC21 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	50
TPH - Aliphatic >EC5 - EC35 $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	140
TPH - Aliphatic >EC16 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	75
TPH - Aliphatic >EC35 - EC44 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC12 - EC16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC16 - EC21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC21 - EC35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC35 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC35 - EC40 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC35 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC40 - EC44 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC5 - EC44 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10
TPH (>EC5 - EC10) $_{HS\_1D\_TOTAL}$	µg/l	10	NONE	< 10	< 10
TPH (>EC10 - EC20) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	65
TPH (>EC20 - EC44) $_{EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	55
TPH Total >EC5 - EC44 $_{HS+EH\_1D\_TOTAL\_MS}$	µg/l	10	NONE	< 10	120
VOCs					
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0

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Analytical Report Number: 25-031162
Project / Site name: Earlswood Training Centre

Lab Sample Number				581126	581127
Sample Reference				RSC 01	RMD 01
Sample Number				None Supplied	None Supplied
Water Matrix				Surface water	Surface water
Depth (m)				None Supplied	None Supplied
Date Sampled				11/06/2025	11/06/2025
Time Taken				930	1005
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**		
PFAS					
NEtFOSA (ethyl perfluorooctanesulfonamide) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
FOSA (Perfluorooctanesulfonamide) - Semiquantitative - CA	µg/l	0.05	NONE	< 0.05	< 0.05
FOSAA (Perfluorooctanesulfonamidoacetic acid) - CAS No 2	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTCA (8:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTCA (10:2 Fluorotelomer carboxylic acid) - Semiquant	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTCA (6:2 Fluorotelomer carboxylic acid) - Semiquantita	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTOH (8:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTOH (10:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTOH (4:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTOH (6:2 Fluorotelomer alcohol)	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTS (8:2 Fluorotelomer sulfonic acid) - CAS No 39108-34	µg/l	0.05	NONE	< 0.05	< 0.05
4:2FTS (4:2 Fluorotelomer sulfonic acid) - CAS No 757124-7	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTS (6:2 Fluorotelomer sulfonic acid) - CAS No 27619-97	µg/l	0.05	NONE	< 0.05	< 0.05
8:2FTUCA (8:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
10:2FTUCA (10:2 Fluorotelomer unsaturated carboxylic acic	µg/l	0.05	NONE	< 0.05	< 0.05
6:2FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid) -	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSAA (ethyl perfluorooctanesulfonamidoacetic acid) - (	µg/l	0.05	NONE	< 0.05	< 0.05
NEtFOSE (ethyl perfluorooctanesulfonamido ethanol) - CAS	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSAA (methyl perfluorooctanesulfonamido acetic acid	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSA (methyl perfluorooctanesulfonamide) - CAS No 3	µg/l	0.05	NONE	< 0.05	< 0.05
NMeFOSE (methyl perfluorooctanesulfonamido ethanol) - C	µg/l	0.05	NONE	< 0.05	< 0.05
PFBA (Perfluorobutanoic acid) - CAS No 375-22-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFBS (Perfluorobutanesulfonic acid) - CAS No 375-73-5	µg/l	0.05	NONE	< 0.05	< 0.05
PFDA (Perfluorodecanoic acid) - CAS No 335-76-2	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoS (Perfluorododecanesulfonic acid) - CAS No 79780-39	µg/l	0.05	NONE	< 0.05	< 0.05
PFDoA (Perfluorododecanoic acid) - CAS No 307-55-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFDS (Perfluorodecanesulfonic acid) - CAS No 335-77-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpA (Perfluoroheptanoic acid) - CAS No 375-85-9	µg/l	0.05	NONE	< 0.05	< 0.05
PFHpS (Perfluoroheptanesulphonic acid) - CAS No 375-92-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxA (Perfluorohexanoic acid) - CAS No 307-24-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFHxS (Perfluorohexanesulfonic acid) - CAS No 355-46-4	µg/l	0.05	NONE	< 0.05	< 0.05
PFNA (Perfluorononanoic acid) - CAS No 375-95-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFNS (Perfluorononanesulfonic acid) - CAS No 68259-12-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOA (Perfluorooctanoic acid) - CAS No 335-67-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFOS (Perfluorooctanesulfonic acid) - CAS No 1763-23-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeA (Perfluoropentonic acid) - CAS No 2706-90-3	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdA (Perfluoroundecanoic acid) - CAS No 2058-94-8	µg/l	0.05	NONE	< 0.05	< 0.05
PFUdS (Perfluoroundecanesulfonic acid) - CAS No 749786-1	µg/l	0.05	NONE	< 0.05	< 0.05
PFPeS (Perfluoropentanesulfonic acid) - CAS No 2706-91-4	µg/l	0.05	NONE	< 0.05	< 0.05
Subcontracted Analysis					
Low Level PFOA (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached
Low Level PFOS (Subcontracted)	N/A	N/A	NONE	See Attached	See Attached

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 25-031162
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW,GW, Hg - SW,PW, Al - SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode	In-house method	L029-PL	W	NONE
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Total Organic Carbon in water	Determination of total organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Sulphur in water	Determination of total sulphur in water by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE
Total Hardness of water	Determination of total hardness of water by calculation from calcium and magnesium. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	ISO 17025
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total Petroleum Hydrocarbons in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS. Accredited matrices (TPH C12 - C35): SW, PW, GW	In-house method	L070B	W	NONE
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5-diphenylcarbazide, followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method by continuous flow analyser	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide in water by distillation followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total Petroleum Hydrocarbons in water by HS-GC-MS	Determination of total petroleum hydrocarbons in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	ISO 17025
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025

4041

Analytical Report Number : 25-031162
Project / Site name: Earlswood Training Centre

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
PFAS in water	Determination of PFAS in water by LC-MS/MS	In-house method	L117B	W	NONE
Subcontracted analysis (water)	Subcontracted analysis - see attached subcon report.	Subcontracted analysis - see attached subcon report.			NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

#- Quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as deviating and should be interpreted with caution. The result is not accredited.

TEST REPORT

Report Number: 2025-1810

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7837
Additional Reference:	25-031162
Issue :	0
Date of Receipt :	18/06/2025
Date of Analysis :	19/06/2025
Date of Report :	25/06/2025
Sample Type :	Surface water
Customer Sample Identifier :	581127 RMD01 11/06/2025
Sample Condition :	Non-Conforming*

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS. ***Sample's temperature outside of acceptable range.**

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Surface water
Test Report Number : 2025-1810
Customer Sample Identifier : 581127 RMD01 11/06/2025
Sample Condition : Non-Conforming*
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

TEST REPORT

Report Number: 2025-1809

Customer Name :	i2 Analytical UK
Customer Address :	7 Woodshots Meadow Croxley Green Business Park Watford, WD18 SYS
Order Number :	PO_S_C7837
Additional Reference:	25-031162
Issue :	0
Date of Receipt :	18/06/2025
Date of Analysis :	19/06/2025
Date of Report :	25/06/2025
Sample Type :	Surface water
Customer Sample Identifier :	581126 RSC01 11/06/2025
Sample Condition :	Non-Conforming*

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS. ***Sample's temperature outside of acceptable range.**

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

Results PFAS

Sample Type : Surface water
Test Report Number : 2025-1809
Customer Sample Identifier : 581126 RSC01 11/06/2025
Sample Condition : Non-Conforming*
Test Method : VLS SOP 021

Target Analyte Name	Abbreviation	CAS Reg No	MDLs	Units	Conc.
Linear Perfluorooctanoic acid	PFOA Linear	335-67-1	0.65	ng/l	ND
Branched Perfluorooctanoic acid	PFOA Branched	-	0.65	ng/l	ND
Perfluorooctanoic acid Total	PFOA Total	-	0.65	ng/l	ND
Linear Perfluorooctanesulfonic acid	PFOS Linear	1763-23-1	0.65	ng/l	ND
Branched Perfluorooctanesulfonic acid	PFOS Branched	-	0.65	ng/l	ND
Perfluorooctanesulfonic acid Total	PFOS Total	-	0.65	ng/l	ND

ND - not detected

APPENDIX H

GROUNDWATER MONITORING RESULTS

Groundwater Quality Monitoring Results

Site: Earlswood Training Centre
Job No: 14050
Date: 14.05.25
Weather: Sunny
Name of Engineer: RH

Sample No.	Water level (mbgl)	Well Base Level (mbgl)	pH (pH Units)	Temperature (C)	Conductivity (uS/cm)	Total disolved solids (ppm)	Salinity (PSU)	Oxygen Reduction Potential (mV)	Disolved Oxygen (%)	Comments
WS 203	0.83	2.72	7.91	12.80	741	341	0.41			Slow Recharge
WS 205	0.84	3.02	7.88	13.09	659	312	0.39			Medium Recharge
WS 206	0.75	3.11	8.02	12.00	612	311	0.42			Medium Recharge

Notes:

1. Instrument Used: HI Multiparameter
2. Typical Accuracy: Water

Temperature	+/- 0.15 ˚C	DO	+/- 1%	PSU	+/- 2% or '+/- 0.01 PSU
pH	+/- 0.01 pH	Conductivity	+/- 1% or '+/- 1uS/cm	Resistivity	+/- 1% or '+/- 1mg/L
ORP	+/- 1mV				

3. N/R = No Reading Taken

Intégral Géotechnique

Groundwater Quality Monitoring Results

Site: Earlswood Training Centre
Job No: 14050
Date: 04.06.25
Weather: Sunny
Name of Engineer: RH

Sample No.	Water level (mbgl)	Well Base Level (mbgl)	pH (pH Units)	Temperature (C)	Conductivity (uS/cm)	Total disolved solids (ppm)	Salinity (PSU)	Oxygen Reduction Potential (mV)	Disolved Oxygen (%)	Comments
WS 203	0.86	2.72	8.02	12.45	658	311	0.39			Slow Recharge
WS 205	0.85	3.02	7.69	12.59	596	287	0.38			Medium Recharge
WS 206	0.79	3.11	8.23	11.79	784	365	0.41			Medium Recharge

Notes:

1. Instrument Used: HI Multiparameter
2. Typical Accuracy: Water

Temperature	+/- 0.15 ˚C	DO	+/- 1%	PSU	+/- 2% or '+/- 0.01 PSU
pH	+/- 0.01 pH	Conductivity	+/- 1% or '+/- 1uS/cm	Resistivity	+/- 1% or '+/- 1mg/L
ORP	+/- 1mV				

3. N/R = No Reading Taken

Intégral Géotechnique

Groundwater Quality Monitoring Results

Site: Earlswood Training Centre
Job No: 14050
Date: 11.06.25
Weather: Cloudy
Name of Engineer: RH

Sample No.	Water level (mbgl)	Well Base Level (mbgl)	pH (pH Units)	Temperature (C)	Conductivity (uS/cm)	Total disolved solids (ppm)	Salinity (PSU)	Oxygen Reduction Potential (mV)	Disolved Oxygen (%)	Comments
WS 203	0.84	2.72	7.63	12.11	712	335	0.40			Slow Recharge
WS 205	0.87	3.02	8.09	12.26	627	291	0.38			Medium Recharge
WS 206	0.81	3.11	7.93	11.85	711	315	0.40			Medium Recharge

Notes:

1. Instrument Used: HI Multiparameter
2. Typical Accuracy: Water

Temperature	+/- 0.15 ˚C	DO	+/- 1%	PSU	+/- 2% or '+/- 0.01 PSU
pH	+/- 0.01 pH	Conductivity	+/- 1% or '+/- 1uS/cm	Resistivity	+/- 1% or '+/- 1mg/L
ORP	+/- 1mV				

3. N/R = No Reading Taken

Intégral Géotechnique

APPENDIX I

SUMMARY OF CHEMICAL RESULTS – SOILS

SUMMARY OF LABORATORY SOIL TEST RESULTS

Job No.: 14050

Site: Earlswood Training Facility

Soil Type: Made Ground

Soil Organic Matter: 1%

METALS AND SEMI-METALS

No.	Location	Depth (m)	Arsenic (mg/kg)	Boron (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Chromium (VI) (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (Elemental) (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
1	**WS203**	**0.40**	150	1.1	0.79	< 0.2	460	< 1.8	190	**1200**	7.3	25	28	730	180
2	**WS201**	**0.90**	130	1.1	1.7	< 0.2	21	< 1.8	710	**3000**	12	90	43	46	630
3	**WS202**	**0.50**	500	1	2	< 0.2	23	< 1.8	1000	**5200**	15	55	60	63	230
4	**WS204**	**0.60**	15	0.3	0.16	< 0.2	4.3	< 1.8	37	40	< 0.3	6.3	14	12	66
		Screening Criteria Value	**640.0**	**240000.0**	**12.0**	**190.0**	**-**	**33.0**	**68000.0**	**200.0**	**58.0**	**980.0**	**12000.0**	**9000.0**	**730000.0**
		Source of Screening Criteria Value	S4UL	S4UL	S4UL	S4UL	-	S4UL	S4UL	C4SL	S4UL	S4UL	S4UL	S4UL	S4UL

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Intégral Géotechnique

SUMMARY OF LABORATORY SOIL TEST RESULTS

INORGANIC CHEMICALS & OTHERS

Job No.: 14050
Site: Earlswood Training Facility
Soil Type: Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Cyanide (mg/kg)	Loss on ignition, dried solids (%)	Moisture content at 30 C (%)	Phenol (mg/kg)	pH (pH units)	Water Soluble Sulphate (g/l)	Sulphate Total as SO4 (mg/kg)	Sulphide (mg/kg)	Total Sulphur (mg/kg)	TOC by Ignition in O2 (%)	Equivalent SOM (%)	Asbestos in Soil	Asbestos Quantification (%)
1	WS203	0.40	< 1.0	6.5	5.7	< 1.0	11.2	0.315	3700	14	2700	2.9	4.99	Not-detected	#N/A
2	WS201	0.90	< 1.0	13	19	< 1.0	7.9	0.126	1400	33	2000	3.8	6.54	Not-detected	#N/A
3	WS202	0.50	< 1.0	16	29	< 1.0	8.4	0.102	21000	2.8	10000	4.4	7.57	Not-detected	#N/A
4	WS204	0.60	< 1.0	0.5	19	< 1.0	9	0.0284	140	< 1.0	71	0.2	0.34	Not-detected	#N/A
	Screening Criteria Value		**34.0**	-	-	**440.0**	-	-	-	-	-	-	-	-	**0.001**
	Source of Screening Criteria Value		ATRISK	-	-	S4UL	-	-	-	-	-	-	-	-	IOM

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Intégral Géotechnique

SUMMARY OF LABORATORY SOIL TEST RESULTS

Job No.: 14050
Site: Earlswood Training Facility
Soil Type: Made Ground
Soil Organic Matter: 1%

POLYAROMATIC HYDROCARBONS (PAH)

No.	Location	Depth (m)	Acenaphthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzo(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(ghi)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Chrysene (mg/kg)	Dibenzo(ah)anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(123cd)pyrene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
1	WS203	0.40	0.07	0.1	0.15	0.44	0.84	1.2	0.88	0.3	0.75	0.21	0.91	0.08	0.78	0.23	0.61	0.85
2	WS201	0.90	0.22	0.26	0.81	3.9	3.6	4.8	1.6	2.4	5.3	0.44	11	0.76	1.6	0.92	7.5	8
3	WS202	0.50	0.24	0.06	0.33	1.8	1.3	2	0.73	0.82	2.2	0.24	3.5	0.22	0.66	1.2	2.6	2.9
4	WS204	0.60	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Screening Criteria Value		84000.0	83000.0	520000.0	170.0	35.0	44.0	3900.0	1200.0	350.0	3.50	23000.0	63000.0	500.0	190.0	22000.0	54000.0
	Source of Screening Criteria Value		S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL

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Intégral Géotechnique

SUMMARY OF LABORATORY SOIL TEST RESULTS

Job No.: 14050

Site: Earlswood Training Facility

Soil Type: Made Ground

Soil Organic Matter: 1%

PETROLEUM HYDROCARBONS

No.	Location	Depth (m)	Aliphatic C5-C6 (mg/kg)	Aliphatic C6-C8 (mg/kg)	Aliphatic C8-C10 (mg/kg)	Aliphatic C10-C12 EPH (mg/kg)	Aliphatic C12-C16 EPH (mg/kg)	Aliphatic C16-C35 EPH (mg/kg)	Aliphatic C35-C44 EPH (mg/kg)	Aromatic C5-C7 (mg/kg)	Aromatic C7-C8 (mg/kg)	Aromatic C8-C10 (mg/kg)	Aromatic C10-C12 EPH (mg/kg)	Aromatic C12-C16 EPH (mg/kg)	Aromatic C16-C21 EPH (mg/kg)	Aromatic C21-C35 EPH (mg/kg)	Aromatic C35-C40 EPH (mg/kg)
1	WS203	0.40	< 0.010	< 0.010	< 0.010	< 1.0	< 2.0	51	40	< 0.010	< 0.010	< 0.020	< 1.0	3.2	< 10	43	45
2	WS201	0.90	< 0.010	< 0.010	< 0.010	2.5	< 2.0	84	13	< 0.010	< 0.010	< 0.020	< 1.0	4.1	28	54	15
3	WS202	0.50	< 0.010	< 0.010	< 0.010	1	< 2.0	14	< 8.4	< 0.010	< 0.010	< 0.020	1.7	2.5	< 10	< 10	< 10
4	WS204	0.60	< 0.010	< 0.010	< 0.010	< 1.0	< 2.0	< 10	< 8.4	< 0.010	< 0.010	< 0.020	< 1.0	< 2.0	< 10	< 10	< 10
	Screening Criteria Value		3200.0	7800.0	2000.0	9700.0	59000.0	1600000.0	1600000.0	27.0	56000.0	3500.0	16000.0	36000.0	28000.0	28000.0	28000.0
	Source of Screening Criteria Value		S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL

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APPENDIX J

SUMMARY OF GROUNDWATER TEST RESULTS

Groundwater Results (Round 1)

Determinand	Unit	Borehole			Generic Assessment Criteria		
		WS203	WS205	WS206	MAC-EQS (Inland Surface Waters >200mg/l CaCo3)	AA-EQS (Freshwater >250mg/l CaCO3)	UK DWS (or best equivalent)
Inorganic Determinands							
pH	pH Units	7.5	7.8	7.7	-	6.0 - 8.5	-
Total Cyanide	µg/l	< 10	< 10	< 10	5.00	1.00	50.00
Sulphate as SO4	µg/l	14300	16300	16700	-	400000.00	250000.00
Total Sulphur	µg/l	4800	5400	5600	-	-	-
Sulphide	µg/l	< 5.0	< 5.0	< 5.0	-	-	-
Dissolved Organic Carbon (DOC)	mg/l	7.16	9.99	2.14			
Total Organic Carbon (TOC)	mg/l	7.33	11	2.52			
Hardness	mgCaCO3/l	91.8	175	216	-	-	-
Total Phenols							
Total Phenols	µg/l	< 10	< 10	< 10	46.00	7.70	0.50
Metals / Metalloids							
Boron (dissolved)	µg/l	19	110	22	-	2000.00	1000.00
Calcium (dissolved)	mg/l	32	61	80	-	-	-
Arsenic (dissolved)	µg/l	4.32	**51.5**	13.5	-	50.00	10.00
Beryllium (dissolved)	µg/l	< 0.1	< 0.1	< 0.1	-	-	-
Cadmium (dissolved)	µg/l	0.03	< 0.02	< 0.02	1.50	0.25	5.00
Chromium (dissolved)	µg/l	0.3	< 0.2	< 0.2	-	-	50.00
Copper (dissolved)	µg/l	**3.2**	0.8	**1.4**	-	1.00	2000.00
Lead (dissolved)	µg/l	**1.6**	**15**	< 0.2	14.00	1.20	10.00
Mercury (dissolved)	µg/l	< 0.05	< 0.05	< 0.05	0.07	-	1.00
Nickel (dissolved)	µg/l	3.6	2.1	1.5	34.00	4.00	20.00
Selenium (dissolved)	µg/l	0.7	< 0.6	4.7	-	-	10.00
Vanadium (dissolved)	µg/l	0.9	1.8	0.8	-	60.00	-
Zinc (dissolved)	µg/l	**28**	3.4	1.9	-	10.00	5000.00
Polyaromatic Hydrocarbons							
Naphthalene	µg/l	< 0.01	< 0.01	< 0.01	130.00	2.00	-
Acenaphthylene	µg/l	< 0.01	< 0.01	< 0.01	-	10.00	-
Acenaphthene	µg/l	< 0.01	< 0.01	< 0.01	-	10.00	-
Fluorene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Phenanthrene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Anthracene	µg/l	< 0.01	< 0.01	< 0.01	0.10	0.10	-
Fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.12	0.01	-
Pyrene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Benzo(a)anthracene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Chrysene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Benzo(b)fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.02	-	-
Benzo(k)fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.02	-	-
Benzo(a)pyrene	µg/l	< 0.01	< 0.01	< 0.01	0.27	0.00	0.01
Indeno(1,2,3-cd)pyrene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Dibenzo(ah)anthracene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Benzo(ghi)perylene	µg/l	< 0.01	< 0.01	< 0.01	0.01	-	-
Petroleum Hydrocarbons							
Aliphatic VPH >C5 - C6	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C6 - C8	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C8 - 10	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic EPH >C10 - C12	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C12 - C16	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C16 - C21	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C21 - C35	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C35 - C44	µg/l	< 10	< 10	< 10	-	-	-
Aliphatic EPH (C5 - C35)	µg/l	< 10	< 10	< 10	-	-	-
Aromatic VPH >C5 - C7	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C7 - C8	µg/l	< 1.0	6.1	< 1.0	10.00	10.00	10.00
Aromatic VPH >C8 - C10	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic EPH >C10 - C12	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C12 - C16	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C16 - C21	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C21 - C35	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C35 - C44	µg/l	< 10	< 10	< 10	-	-	-
Aromatic EPH (C5 - C44)	µg/l	< 10	< 10	< 10	-	-	-
TPH C5 - C44	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
PFAS							
PFOS	ng/l	**5.3**	**36.3**	**1.98**	36.00	0.65000	

Results exceeding the AA-EQS value, or the most conservative EQS/UKDWS guideline value where AA-EQS values are unavailable are highlighted in red bold type

Results exceeding the EQS threshold but below site specific PNEC highlighted blue bold type

Sources:
MAC-EQS and AA-EQS values sourced from the Environment Agency/Water Framework Directive
Drinking Water Standards sourced from The Water Supply (Water Quality) Regulations 2018 Water, England and Wales: 2018 No.647 (W.121)

Groundwater Results (Round 2)

Determinand	Unit	Borehole			Generic Assessment Criteria		
		WS203	WS205	WS206	MAC-EQS (Inland Surface Waters >200mg/l CaCo3)	AA-EQS (Freshwater >250mg/l CaCO3)	UK DWS (or best equivalent)
Inorganic Determinands							
pH	pH Units	7.1	7.5	7.7	-	6.0 - 8.5	-
Total Cyanide	µg/l	< 10	< 10	< 10	5.00	1.00	50.00
Sulphate as SO4	µg/l	1620	12000	16200	-	400000.00	250000.00
Total Sulphur	µg/l	540	4000	5400	-	-	-
Sulphide	µg/l	< 5.0	15	< 5.0	-	-	-
Dissolved Organic Carbon (DOC)	mg/l	4.13	5.2	1.51			
Total Organic Carbon (TOC)	mg/l	4.35	5.42	1.62			
Hardness	mgCaCO3/l	302	274	199	-	-	-
Total Phenols							
Total Phenols	µg/l	< 10	< 10	< 10	46.00	7.70	0.50
Metals / Metalloids							
Boron (dissolved)	µg/l	99	120	23	-	2000.00	1000.00
Calcium (dissolved)	mg/l	100	97	74	-	-	-
Arsenic (dissolved)	µg/l	18.4	**62.1**	5.29	-	50.00	10.00
Beryllium (dissolved)	µg/l	< 0.1	< 0.1	< 0.1	-	-	-
Cadmium (dissolved)	µg/l	< 0.02	< 0.02	< 0.02	1.50	0.25	5.00
Chromium (dissolved)	µg/l	< 0.2	< 0.2	< 0.2	-	-	50.00
Copper (dissolved)	µg/l	**1.8**	**1.8**	**1.6**	-	1.00	2000.00
Lead (dissolved)	µg/l	0.3	**6.4**	< 0.2	14.00	1.20	10.00
Mercury (dissolved)	µg/l	< 0.05	< 0.05	< 0.05	0.07	-	1.00
Nickel (dissolved)	µg/l	1.4	1.5	1.4	34.00	4.00	20.00
Selenium (dissolved)	µg/l	< 0.6	< 0.6	2.3	-	-	10.00
Vanadium (dissolved)	µg/l	0.2	1.1	0.6	-	60.00	-
Zinc (dissolved)	µg/l	1.4	2.4	2.6	-	10.00	5000.00
Polyaromatic Hydrocarbons							
Naphthalene	µg/l	< 0.01	1.4	< 0.01	130.00	2.00	-
Acenaphthylene	µg/l	< 0.01	< 0.01	< 0.01	-	10.00	-
Acenaphthene	µg/l	< 0.01	0.21	< 0.01	-	10.00	-
Fluorene	µg/l	0.06	0.08	< 0.01	-	-	-
Phenanthrene	µg/l	0.2	0.21	0.03	-	-	-
Anthracene	µg/l	< 0.01	< 0.01	< 0.01	0.10	0.10	-
Fluoranthene	µg/l	**0.11**	**0.21**	< 0.01	0.12	0.01	-
Pyrene	µg/l	0.09	0.22	0.02	-	-	-
Benzo(a)anthracene	µg/l	0.07	< 0.01	< 0.01	-	-	-
Chrysene	µg/l	0.08	< 0.01	< 0.01	-	-	-
Benzo(b)fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.017	-	-
Benzo(k)fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.017	-	-
Benzo(a)pyrene	µg/l	< 0.01	< 0.01	< 0.01	0.27	0.00017	0.01000
Indeno(1,2,3-cd)pyrene	µg/l	< 0.01	< 0.01	< 0.01	-	0.0008	-
Dibenzo(ah)anthracene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Benzo(ghi)perylene	µg/l	< 0.01	0.07	< 0.01	0.01	-	-
Petroleum Hydrocarbons							
Aliphatic VPH >C5 - C6	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C6 - C8	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C8 - 10	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic EPH >C10 - C12	µg/l	< 10	**43**	< 10	10.00	10.00	10.00
Aliphatic EPH >C12 - C16	µg/l	< 10	**160**	< 10	10.00	10.00	10.00
Aliphatic EPH >C16 - C21	µg/l	**32**	**170**	< 10	10.00	10.00	10.00
Aliphatic EPH >C21 - C35	µg/l	**330**	**130**	< 10	10.00	10.00	10.00
Aliphatic EPH >C35 - C44	µg/l	< 10	< 10	< 10	-	-	-
Aliphatic EPH (C5 - C35)	µg/l	370	500	< 10	-	-	-
Aromatic VPH >C5 - C7	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C7 - C8	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C8 - C10	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic EPH >C10 - C12	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C12 - C16	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C16 - C21	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C21 - C35	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C35 - C44	µg/l	< 10	< 10	< 10	-	-	-
Aromatic EPH (C5 - C44)	µg/l	< 10	< 10	< 10	-	-	-
TPH C5 - C44	µg/l	**370**	**500**	< 10	10.00	10.00	10.00
PFAS							
PFOS	ng/l	**4.08**	**23.2**	ND	36.00	0.65000	

Results exceeding the AA-EQS value, or the most conservative EQS/UKDWS guideline value where AA-EQS values are unavailable are highlighted in red bold type

Results exceeding the EQS threshold but below site specific PNEC highlighted blue bold type

Sources:
MAC-EQS and AA-EQS values sourced from the Environment Agency/Water Framework Directive
Drinking Water Standards sourced from The Water Supply (Water Quality) Regulations 2018 Water, England and Wales: 2018 No.647 (W.121)

Groundwater Results (Round 3)

Determinand	Unit	Borehole			Generic Assessment Criteria		
		WS203	WS205	WS206	MAC-EQS (Inland Surface Waters >200mg/l CaCo3)	AA-EQS (Freshwater >250mg/l CaCO3)	UK DWS (or best equivalent)
Inorganic Determinands							
pH	pH Units	7.3	7.6	7.5	-	6.0 - 8.5	-
Total Cyanide	µg/l	< 10	< 10	< 10	5.00	1.00	50.00
Sulphate as SO4	µg/l	7700	18200	19100	-	400000.00	250000.00
Total Sulphur	µg/l	2600	6100	6400	-	-	-
Sulphide	µg/l	< 5.0	19	< 5.0	-	-	-
Dissolved Organic Carbon (DOC)	mg/l	3.51	4.65	1.41			
Total Organic Carbon (TOC)	mg/l	3.53	4.66	1.45			
Hardness	mgCaCO3/l	136	179	253	-	-	-
Total Phenols							
Total Phenols	µg/l	< 10	< 10	< 10	46.00	7.70	0.50
Metals / Metalloids							
Boron (dissolved)	µg/l	53	110	25.00	-	2000.00	1000.00
Calcium (dissolved)	mg/l	46	63	94.00	-	-	-
Arsenic (dissolved)	µg/l	12.3	35.2	5.76	-	50.00	10.00
Beryllium (dissolved)	µg/l	< 0.1	< 0.1	< 0.1	-	-	-
Cadmium (dissolved)	µg/l	0.04	< 0.02	< 0.02	1.50	0.25	5.00
Chromium (dissolved)	µg/l	0.8	0.4	0.70	-	-	50.00
Copper (dissolved)	µg/l	**6**	**1.5**	**3.40**	-	1.00	2000.00
Lead (dissolved)	µg/l	**3.8**	**1.6**	< 0.2	14.00	1.20	10.00
Mercury (dissolved)	µg/l	< 0.05	< 0.05	< 0.05	0.07	-	1.00
Nickel (dissolved)	µg/l	2.7	1.5	2.10	34.00	4.00	20.00
Selenium (dissolved)	µg/l	0.9	0.6	3.20	-	-	10.00
Vanadium (dissolved)	µg/l	0.5	1.2	1.10	-	60.00	-
Zinc (dissolved)	µg/l	3.6	8.6	**23.00**	-	10.00	5000.00
Polyaromatic Hydrocarbons							
Naphthalene	µg/l	< 0.01	< 0.01	< 0.01	130.00	2.00	-
Acenaphthylene	µg/l	< 0.01	< 0.01	< 0.01	-	10.00	-
Acenaphthene	µg/l	< 0.01	0.11	< 0.01	-	10.00	-
Fluorene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Phenanthrene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Anthracene	µg/l	< 0.01	< 0.01	< 0.01	0.10	0.10	-
Fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.12	0.01	-
Pyrene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Benzo(a)anthracene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Chrysene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Benzo(b)fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.017	-	-
Benzo(k)fluoranthene	µg/l	< 0.01	< 0.01	< 0.01	0.017	-	-
Benzo(a)pyrene	µg/l	< 0.01	< 0.01	< 0.01	0.27	0.00017	0.01
Indeno(1,2,3-cd)pyrene	µg/l	< 0.01	< 0.01	< 0.01	0.0008	-	-
Dibenzo(ah)anthracene	µg/l	< 0.01	< 0.01	< 0.01	-	-	-
Benzo(ghi)perylene	µg/l	< 0.01	< 0.01	< 0.01	0.01	-	-
Petroleum Hydrocarbons							
Aliphatic VPH >C5 - C6	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C6 - C8	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C8 - 10	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic EPH >C10 - C12	µg/l	**16**	**23**	**18.00**	10.00	10.00	10.00
Aliphatic EPH >C12 - C16	µg/l	**65**	**150**	**55.00**	10.00	10.00	10.00
Aliphatic EPH >C16 - C21	µg/l	**48**	**380**	**20.00**	10.00	10.00	10.00
Aliphatic EPH >C21 - C35	µg/l	**490**	**1200**	< 10	10.00	10.00	10.00
Aliphatic EPH >C35 - C44	µg/l	30	40	< 10	-	-	-
Aliphatic EPH (C5 - C35)	µg/l	620	1700	93.00	-	-	-
Aromatic VPH >C5 - C7	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C7 - C8	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C8 - C10	µg/l	< 1.0	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic EPH >C10 - C12	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C12 - C16	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C16 - C21	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C21 - C35	µg/l	< 10	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C35 - C44	µg/l	< 10	< 10	< 10	-	-	-
Aromatic EPH (C5 - C35)	µg/l	< 10	< 10	< 10	-	-	-
TPH C5 - C44	µg/l	**620**	**2200**	**100.00**	10.00	10.00	10.00
PFAS							
PFOS	ng/l	**5.75**	**28**	ND	36.00	0.65000	

Results exceeding the AA-EQS value, or the most conservative EQS/UKDWS guideline value where AA-EQS values are unavailable are highlighted in red bold type

Results exceeding the EQS threshold but below site specific PNEC highlighted blue bold type

Sources:
MAC-EQS and AA-EQS values sourced from the Environment Agency/Water Framework Directive
Drinking Water Standards sourced from The Water Supply (Water Quality) Regulations 2018 Water, England and Wales: 2018 No.647 (W.121)

Metal Bioavailability Assessment Tool

Back

Calculate

Clear Data

INPUT DATA											RESULTS (Copper)				RESULTS (Zinc)			
ID	Location	Waterbody	Date	Measured Cu Concentration (dissolved) (µg l^{-1})	Measured Zn Concentration (dissolved) (µg l^{-1})	Measured Mn Concentration (dissolved) (µg l^{-1})	Measured Ni Concentration (dissolved) (µg l^{-1})	pH	DOC	Ca	Site-specific PNEC Dissolved Copper (µg l^{-1})	BioF	Bioavailable Copper Concentration (µg l^{-1})	Risk Characterisation Ratio	Site-specific PNEC Dissolved Zinc (µg l^{-1})	BioF	Bioavailable Zinc Concentration (µg l^{-1})	Risk Characterisation Ratio
1	WS203 R1	Shallow GW		3.2	28			7.5	7.16	32	31.87	0.03	0.10	0.10	33.27	0.33	9.17	0.84
2	WS205 R1	Shallow GW		0.8	3.4			7.8	9.99	61	37.73	0.03	0.02	0.02	45.53	0.24	0.81	0.07
3	WS206 R1	Shallow GW		1.4	1.9			7.7	2.14	80	7.48	0.13	0.19	0.19	19.24	0.57	1.08	0.10
4	WS203 R2	Shallow GW		1.8	1.4			7.1	4.13	100	17.74	0.06	0.10	0.10	23.69	0.46	0.64	0.06
5	WS205 R2	Shallow GW		1.8	2.4			7.5	5.2	97	23.16	0.04	0.08	0.08	27.60	0.39	0.95	0.09
6	WS206 R2	Shallow GW		1.6	2.6			7.7	1.51	74	5.08	0.20	0.31	0.31	17.21	0.63	1.65	0.15
7	WS203 R3	Shallow GW		6	3.6			7.3	3.51	46	14.95	0.07	0.40	0.40	21.55	0.51	1.82	0.17
8	WS205 R3	Shallow GW		1.5	8.6			7.6	4.65	63	19.45	0.05	0.08	0.08	26.11	0.42	3.59	0.33
9	WS206 R3	Shallow GW		3.4	23			7.5	1.41	94	5.37	0.19	0.63	0.63	17.85	0.61	14.04	1.29

Pb Screening Tool 1.0

Back

Calculate

Clear Data

INPUT DATA						RESULTS (Pb)			
ID	Location	Waterbody	Date	Measured Pb Concentration (dissolved) (µg l^{-1})	DOC	Site Specific PNEC Dissolved Pb (µg l^{-1})	BioF	Available Pb (µg l^{-1})	Risk Characterisation Ratio
1	WS203 R1	Shallow		1.60	7.16	8.59	0.14	0.22	0.19
2	WS205 R1	Shallow		15.00	9.99	11.99	0.10	1.50	1.25
3	WS205 R2	Shallow		6.40	5.20	6.24	0.19	1.23	1.03
4	WS203 R3	Shallow		3.80	3.51	4.21	0.28	1.08	0.90
5	WS205 R3	Shallow		1.60	4.65	5.58	0.22	0.34	0.29

APPENDIX K

SUMMARY OF SURFACE WATER TEST RESULTS

Surface Water Results (Round 1)

Determinand	Unit	Location		Generic Assessment Criteria		
		RSC 01	RMD 01	MAC-EQS (Inland Surface Waters >200mg/l CaCo3)	AA-EQS (Freshwater >250mg/l CaCO3)	UK DWS (or best equivalent)
Inorganic Determinands						
pH	pH Units	8.1	8.1	-	6.0 - 8.5	-
Total Cyanide	µg/l	< 10	< 10	5.00	1.00	50.00
Sulphate as SO4	µg/l	2470000	2050000	-	400000.00	250000.00
Total Sulphur	µg/l	820000	680000	-	-	-
Sulphide	µg/l	< 5.0	< 5.0	-	-	-
Dissolved Organic Carbon (DOC)	mg/l	0.78	0.75			
Total Organic Carbon (TOC)	mg/l	0.85	0.84			
Hardness	mgCaCO3/l	5680	5780	-	-	-
Total Phenols						
Total Phenols	µg/l	**230**	**69**	46.00	7.70	0.50
Metals / Metalloids						
Boron (dissolved)	µg/l	**3700**	**3300**	-	2000.00	1000.00
Calcium (dissolved)	mg/l	370	370	-	-	-
Arsenic (dissolved)	µg/l	1.86	1.73	-	50.00	10.00
Beryllium (dissolved)	µg/l	< 0.1	< 0.1	-	-	-
Cadmium (dissolved)	µg/l	<0.1	<0.1	1.50	0.25	5.00
Chromium (dissolved)	µg/l	2.5	<1	-	-	50.00
Copper (dissolved)	µg/l	**8.4**	**9.2**	-	1.00	2000.00
Lead (dissolved)	µg/l	<1	<1	14.00	1.20	10.00
Mercury (dissolved)	µg/l	<0.25	<0.25	0.07	-	1.00
Nickel (dissolved)	µg/l	3.2	<2.5	34.00	4.00	20.00
Selenium (dissolved)	µg/l	<3	<3	-	-	10.00
Vanadium (dissolved)	µg/l	1.4	1.2	-	60.00	-
Zinc (dissolved)	µg/l	9	8.6	-	10.00	5000.00
Polyaromatic Hydrocarbons						
Naphthalene	µg/l	< 0.01	< 0.01	130.00	2.00	-
Acenaphthylene	µg/l	< 0.01	< 0.01	-	10.00	-
Acenaphthene	µg/l	< 0.01	< 0.01	-	10.00	-
Fluorene	µg/l	< 0.01	< 0.01	-	-	-
Phenanthrene	µg/l	< 0.01	< 0.01	-	-	-
Anthracene	µg/l	< 0.01	< 0.01	0.10	0.10	-
Fluoranthene	µg/l	< 0.01	< 0.01	0.12	0.01	-
Pyrene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(a)anthracene	µg/l	< 0.01	< 0.01	-	-	-
Chrysene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(b)fluoranthene	µg/l	< 0.01	< 0.01	0.02	-	-
Benzo(k)fluoranthene	µg/l	< 0.01	< 0.01	0.02	-	-
Benzo(a)pyrene	µg/l	< 0.01	< 0.01	0.27	0.00	0.01
Indeno(1,2,3-cd)pyrene	µg/l	< 0.01	< 0.01	-	-	-
Dibenzo(ah)anthracene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(ghi)perylene	µg/l	< 0.01	< 0.01	0.01	-	-
Total PAH	µg/l	< 0.16	< 0.16	-	1.00	0.10
Petroleum Hydrocarbons						
Aliphatic VPH >C5 - C6	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C6 - C8	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C8 - 10	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic EPH >C10 - C12	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C12 - C16	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C16 - C21	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C21 - C35	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C35 - C44	µg/l	< 10	< 10	-	-	-
Aliphatic EPH (C5 - C35)	µg/l	< 10	< 10	-	-	-
Aromatic VPH >C5 - C7	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C7 - C8	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C8 - C10	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic EPH >C10 - C12	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C12 - C16	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C16 - C21	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C21 - C35	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C35 - C44	µg/l	< 10	< 10	-	-	-
Aromatic EPH (C5 - C44)	µg/l	< 10	< 10	-	-	-
TPH C5 - C44	µg/l	< 10	< 10	10.00	10.00	10.00
PFAS						
PFOS	ng/l	<0.65	<0.65	36.00	0.65000	

Results exceeding the AA-EQS value, or the most conservative EQS/UKDWS guideline value where AA-EQS values are unavailable are highlighted in red bold type

Results exceeding the EQS threshold but below site specific PNEC highlighted blue bold type

Sources:
MAC-EQS and AA-EQS values sourced from the Environment Agency/Water Framework Directive
Drinking Water Standards sourced from The Water Supply (Water Quality) Regulations 2018 Water, England and Wales: 2018 No.647 (W.121)

Surface Water Results (Round 2)

Determinand	Unit	Borehole		Generic Assessment Criteria		
		RSC 01	RMD 01	MAC-EQS (Inland Surface Waters >200mg/l CaCo3)	AA-EQS (Freshwater >250mg/l CaCO3)	UK DWS (or best equivalent)
Inorganic Determinands						
pH	pH Units	8	8	-	6.0 - 8.5	-
Total Cyanide	µg/l	< 10	< 10	5.00	1.00	50.00
Sulphate as SO4	µg/l	1380000	1390000	-	400000.00	250000.00
Total Sulphur	µg/l	460000	460000	-	-	-
Sulphide	µg/l	< 5.0	< 5.0	-	-	-
Dissolved Organic Carbon (DOC)	mg/l	2.25	1.79			
Total Organic Carbon (TOC)	mg/l	2.44	1.91			
Hardness	mgCaCO3/l	3370	3550	-	-	-
Total Phenols						
Total Phenols	µg/l	**72**	**62**	46.00	7.70	0.50
Metals / Metalloids						
Boron (dissolved)	µg/l	1700	1700	-	2000.00	1000.00
Calcium (dissolved)	mg/l	210	220	-	-	-
Arsenic (dissolved)	µg/l	1.5	1.51	-	50.00	10.00
Beryllium (dissolved)	µg/l	< 0.1	< 0.1	-	-	-
Cadmium (dissolved)	µg/l	0.03	0.03	1.50	0.25	5.00
Chromium (dissolved)	µg/l	0.4	0.2	-	-	50.00
Copper (dissolved)	µg/l	**9.9**	**9.5**	-	1.00	2000.00
Lead (dissolved)	µg/l	< 0.2	< 0.2	14.00	1.20	10.00
Mercury (dissolved)	µg/l	0.11	0.06	0.07	-	1.00
Nickel (dissolved)	µg/l	1.2	1.1	34.00	4.00	20.00
Selenium (dissolved)	µg/l	< 0.6	< 0.6	-	-	10.00
Vanadium (dissolved)	µg/l	1	0.9	-	60.00	-
Zinc (dissolved)	µg/l	9.2	7.7	-	10.00	5000.00
Polyaromatic Hydrocarbons						
Naphthalene	µg/l	< 0.01	< 0.01	130.00	2.00	-
Acenaphthylene	µg/l	< 0.01	< 0.01	-	10.00	-
Acenaphthene	µg/l	< 0.01	< 0.01	-	10.00	-
Fluorene	µg/l	< 0.01	< 0.01	-	-	-
Phenanthrene	µg/l	< 0.01	< 0.01	-	-	-
Anthracene	µg/l	< 0.01	< 0.01	0.10	0.10	-
Fluoranthene	µg/l	< 0.01	< 0.01	0.12	0.01	-
Pyrene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(a)anthracene	µg/l	< 0.01	< 0.01	-	-	-
Chrysene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(b)fluoranthene	µg/l	< 0.01	< 0.01	0.017	-	-
Benzo(k)fluoranthene	µg/l	< 0.01	< 0.01	0.017	-	-
Benzo(a)pyrene	µg/l	< 0.01	< 0.01	0.27	0.00017	0.01000
Indeno(1,2,3-cd)pyrene	µg/l	< 0.01	< 0.01	-	0.0008	-
Dibenzo(ah)anthracene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(ghi)perylene	µg/l	< 0.01	< 0.01	0.01	-	-
Total PAH	µg/l	< 0.16	< 0.16	-	1.00000	0.10
Petroleum Hydrocarbons						
Aliphatic VPH >C5 - C6	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C6 - C8	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C8 - 10	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic EPH >C10 - C12	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C12 - C16	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C16 - C21	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C21 - C35	µg/l	< 10	< 10	10.00	10.00	10.00
Aliphatic EPH >C35 - C44	µg/l	< 10	< 10	-	-	-
Aliphatic EPH (C5 - C35)	µg/l	< 10	< 10	-	-	-
Aromatic VPH >C5 - C7	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C7 - C8	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C8 - C10	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic EPH >C10 - C12	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C12 - C16	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C16 - C21	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C21 - C35	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C35 - C44	µg/l	< 10	< 10	-	-	-
Aromatic EPH (C5 - C44)	µg/l	< 10	< 10	-	-	-
TPH C5 - C44	µg/l	< 10	< 10	10.00	10.00	10.00
PFAS						
PFOS	ng/l	<0.65	**0.79**	36.00	0.65000	ND

Results exceeding the AA-EQS value, or the most conservative EQS/UKDWS guideline value where AA-EQS values are unavailable are highlighted in red bold type

Results exceeding the EQS threshold but below site specific PNEC highlighted blue bold type

Sources:
MAC-EQS and AA-EQS values sourced from the Environment Agency/Water Framework Directive
Drinking Water Standards sourced from The Water Supply (Water Quality) Regulations 2018 Water, England and Wales: 2018 No.647 (W.121)

Surface Water Results (Round 3)

Determinand	Unit	Location		Generic Assessment Criteria		
		RSC 01	RMD 01	MAC-EQS (Inland Surface Waters >200mg/l CaCo3)	AA-EQS (Freshwater >250mg/l CaCO3)	UK DWS (or best equivalent)
Inorganic Determinands						
pH	pH Units	8.1	8.1	-	6.0 - 8.5	-
Total Cyanide	µg/l	< 10	< 10	5.00	1.00	50.00
Sulphate as SO4	µg/l	2300000	2290000	-	400000.00	250000.00
Total Sulphur	µg/l	770000	760000	-	-	-
Sulphide	µg/l	< 5.0	< 5.0	-	-	-
Dissolved Organic Carbon (DOC)	mg/l	0.94	0.81			
Total Organic Carbon (TOC)	mg/l	1.02	0.82			
Hardness	mgCaCO3/l	5420	5380	-	-	-
Total Phenols						
Total Phenols	µg/l	**35**	**18**	46.00	7.70	0.50
Metals / Metalloids						
Boron (dissolved)	µg/l	**3300**	**3400**	-	2000.00	1000.00
Calcium (dissolved)	mg/l	350	350	-	-	-
Arsenic (dissolved)	µg/l	1.48	1.55	-	50.00	10.00
Beryllium (dissolved)	µg/l	< 0.1	< 0.1	-	-	-
Cadmium (dissolved)	µg/l	0.03	0.02	1.50	0.25	5.00
Chromium (dissolved)	µg/l	12	20	-	-	50.00
Copper (dissolved)	µg/l	**18**	**15**	-	1.00	2000.00
Lead (dissolved)	µg/l	< 0.2	< 0.2	14.00	1.20	10.00
Mercury (dissolved)	µg/l	< 0.05	< 0.05	0.07	-	1.00
Nickel (dissolved)	µg/l	**4.6**	**7.1**	34.00	4.00	20.00
Selenium (dissolved)	µg/l	1.5	1.8	-	-	10.00
Vanadium (dissolved)	µg/l	1.1	1.1	-	60.00	-
Zinc (dissolved)	µg/l	**26**	**38**	-	10.00	5000.00
Polyaromatic Hydrocarbons						
Naphthalene	µg/l	< 0.01	< 0.01	130.00	2.00	-
Acenaphthylene	µg/l	< 0.01	< 0.01	-	10.00	-
Acenaphthene	µg/l	< 0.01	< 0.01	-	10.00	-
Fluorene	µg/l	< 0.01	< 0.01	-	-	-
Phenanthrene	µg/l	< 0.01	< 0.01	-	-	-
Anthracene	µg/l	< 0.01	< 0.01	0.10	0.10	-
Fluoranthene	µg/l	< 0.01	< 0.01	0.12	0.01	-
Pyrene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(a)anthracene	µg/l	< 0.01	< 0.01	-	-	-
Chrysene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(b)fluoranthene	µg/l	< 0.01	< 0.01	0.017	-	-
Benzo(k)fluoranthene	µg/l	< 0.01	< 0.01	0.017	-	-
Benzo(a)pyrene	µg/l	< 0.01	< 0.01	0.27	0.00017	0.01
Indeno(1,2,3-cd)pyrene	µg/l	< 0.01	< 0.01	0.0008	-	-
Dibenzo(ah)anthracene	µg/l	< 0.01	< 0.01	-	-	-
Benzo(ghi)perylene	µg/l	< 0.01	< 0.01	0.01	-	-
Total PAH	µg/l	< 0.16	< 0.16	-	1.00000	0.10
Petroleum Hydrocarbons						
Aliphatic VPH >C5 - C6	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C6 - C8	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic VPH >C8 - 10	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aliphatic EPH >C10 - C12	µg/l	< 10	**12**	10.00	10.00	10.00
Aliphatic EPH >C12 - C16	µg/l	< 10	**48**	10.00	10.00	10.00
Aliphatic EPH >C16 - C21	µg/l	< 10	**25**	10.00	10.00	10.00
Aliphatic EPH >C21 - C35	µg/l	< 10	**50**	10.00	10.00	10.00
Aliphatic EPH >C35 - C44	µg/l	< 10	< 10	-	-	-
Aliphatic EPH (C5 - C35)	µg/l	< 10	140	-	-	-
Aromatic VPH >C5 - C7	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C7 - C8	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic VPH >C8 - C10	µg/l	< 1.0	< 1.0	10.00	10.00	10.00
Aromatic EPH >C10 - C12	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C12 - C16	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C16 - C21	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C21 - C35	µg/l	< 10	< 10	10.00	10.00	10.00
Aromatic EPH >C35 - C44	µg/l	< 10	< 10	-	-	-
Aromatic EPH (C5 - C44)	µg/l	< 10	< 10	-	-	-
TPH C5 - C44	µg/l	< 10	**120**	10.00	10.00	10.00
PFAS						
PFOS	ng/l	<0.65	<0.65	36.00	0.65000	

Results exceeding the AA-EQS value, or the most conservative EQS/UKDWS guideline value where AA-EQS values are unavailable are highlighted in red bold type

Results exceeding the EQS threshold but below site specific PNEC highlighted blue bold type

Sources:
MAC-EQS and AA-EQS values sourced from the Environment Agency/Water Framework Directive
Drinking Water Standards sourced from The Water Supply (Water Quality) Regulations 2018 Water, England and Wales: 2018 No.647 (W.121)

APPENDIX L

ENVIRONMENT AGENCY RTM WORKSHEETS

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Arsenic		from Level 1
Target Concentration	C_T	5.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.21E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	5.00E+03	fraction
Decay rate used	λ	1.39E-104	d^{-1}
Rate of contaminant flow due to retardation	u	1.00E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	2.13E-02	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**2.91E+00**	

Remedial Targets

Remedial Target		**1.45E-01**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**2.13E-02**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 5.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 5.00E+02 — l/kg

Define dispersivity (click brown cell and use pull down list)

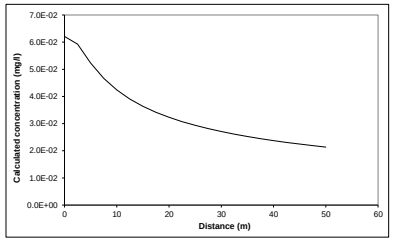
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	6.2E-02
2.5	5.93E-02
5.0	5.23E-02
7.5	4.67E-02
10.0	4.24E-02
12.5	3.91E-02
15.0	3.64E-02
17.5	3.42E-02
20.0	3.23E-02
22.5	3.07E-02
25.0	2.94E-02
27.5	2.82E-02
30.0	2.71E-02
32.5	2.61E-02
35.0	2.53E-02
37.5	2.45E-02
40.0	2.37E-02
42.5	2.31E-02
45.0	2.25E-02
47.5	2.19E-02
50.0	2.13E-02

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Zinc		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	2.30E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	3.81E+02	fraction
Decay rate used	λ	1.82E-103	d^{-1}
Rate of contaminant flow due to retardation	u	1.31E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	7.90E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**2.91E+00**	

Remedial Targets

Remedial Target		**2.91E-02**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**7.90E-03**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	3.80E+01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.80E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

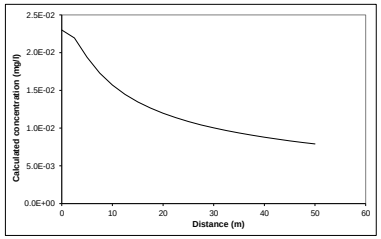
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	2.3E-02
2.5	2.20E-02
5.0	1.94E-02
7.5	1.73E-02
10.0	1.57E-02
12.5	1.45E-02
15.0	1.35E-02
17.5	1.27E-02
20.0	1.20E-02
22.5	1.14E-02
25.0	1.09E-02
27.5	1.04E-02
30.0	1.00E-02
32.5	9.68E-03
35.0	9.35E-03
37.5	9.06E-03
40.0	8.79E-03
42.5	8.55E-03
45.0	8.32E-03
47.5	8.10E-03
50.0	7.90E-03

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Lead		from Level 1
Target Concentration	C_T	1.20E-03	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.50E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.80E+02	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	5.80E+03	fraction
Decay rate used	λ	1.19E-104	d^{-1}
Rate of contaminant flow due to retardation	u	8.62E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	5.15E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**2.91E+00**	

Remedial Targets

Remedial Target		**3.49E-03**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**5.15E-03**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.80E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.80E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

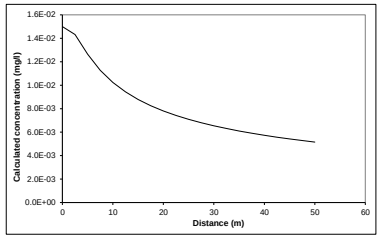
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.5E-02
2.5	1.43E-02
5.0	1.26E-02
7.5	1.13E-02
10.0	1.02E-02
12.5	9.43E-03
15.0	8.79E-03
17.5	8.25E-03
20.0	7.81E-03
22.5	7.43E-03
25.0	7.09E-03
27.5	6.80E-03
30.0	6.54E-03
32.5	6.31E-03
35.0	6.10E-03
37.5	5.91E-03
40.0	5.73E-03
42.5	5.57E-03
45.0	5.42E-03
47.5	5.28E-03
50.0	5.15E-03

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Aliphatic C10-C12		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	4.30E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	2.10E+01	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	3.30E-02	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.77E+03	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	3.77E+04	fraction
Decay rate used	λ	8.76E-07	d^{-1}
Rate of contaminant flow due to retardation	u	1.33E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.97E-25	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**2.18E+23**	

Remedial Targets

Remedial Target		**2.18E+21**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**1.97E-25**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	2.51E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.77E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

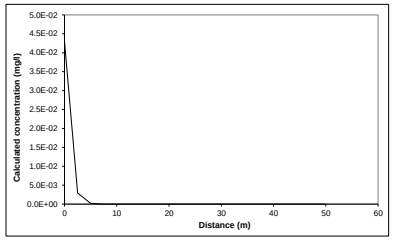
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	4.3E-02
2.5	2.95E-03
5.0	1.87E-04
7.5	1.20E-05
10.0	7.81E-07
12.5	5.17E-08
15.0	3.46E-09
17.5	2.33E-10
20.0	1.59E-11
22.5	1.08E-12
25.0	7.43E-14
27.5	5.12E-15
30.0	3.54E-16
32.5	2.45E-17
35.0	1.70E-18
37.5	1.18E-19
40.0	8.25E-21
42.5	5.76E-22
45.0	4.03E-23
47.5	2.82E-24
50.0	1.97E-25

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		Aliphatic C12-C16		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.60E-01	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	5.00E+01	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	1.39E-02	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	7.52E+04	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	5.01E+06	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	7.52E+04	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

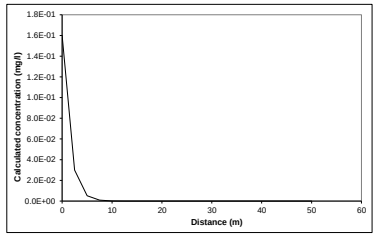
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Calculated Parameters	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	7.52E+05	fraction
Decay rate used	λ	1.84E-08	d^{-1}
Rate of contaminant flow due to retardation	u	6.65E-09	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	3.95E-16	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**4.05E+14**	

Remedial Targets

Remedial Target		**4.05E+12**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**3.95E-16**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.6E-01
2.5	3.00E-02
5.0	5.19E-03
7.5	9.09E-04
10.0	1.62E-04
12.5	2.93E-05
15.0	5.35E-06
17.5	9.87E-07
20.0	1.83E-07
22.5	3.42E-08
25.0	6.41E-09
27.5	1.21E-09
30.0	2.28E-10
32.5	4.31E-11
35.0	8.18E-12
37.5	1.55E-12
40.0	2.96E-13
42.5	5.65E-14
45.0	1.08E-14
47.5	2.06E-15
50.0	3.95E-16

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Aliphatic C16-C21		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	3.80E-01	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+03	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.46E+06	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	9.46E+07	fraction
Decay rate used	λ	7.32E-12	d^{-1}
Rate of contaminant flow due to retardation	u	5.28E-11	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.17E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**3.24E+02**	

Remedial Targets

Remedial Target		**3.24E+00**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**1.17E-03**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	6.31E+08	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.46E+06	l/kg

Define dispersivity (click brown cell and use pull down list)

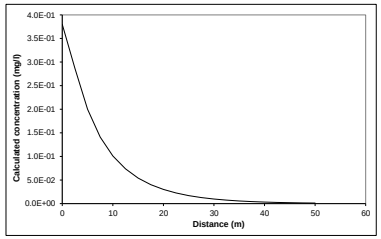
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	3.8E-01
2.5	2.87E-01
5.0	2.00E-01
7.5	1.41E-01
10.0	1.01E-01
12.5	7.36E-02
15.0	5.42E-02
17.5	4.02E-02
20.0	3.00E-02
22.5	2.26E-02
25.0	1.70E-02
27.5	1.29E-02
30.0	9.81E-03
32.5	7.48E-03
35.0	5.71E-03
37.5	4.37E-03
40.0	3.35E-03
42.5	2.57E-03
45.0	1.98E-03
47.5	1.52E-03
50.0	1.17E-03

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Aliphatic C21-C35		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.20E+00	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.25E+02	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.49E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.46E+06	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	9.46E+07	fraction
Decay rate used	λ	7.92E-12	d^{-1}
Rate of contaminant flow due to retardation	u	5.28E-11	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	2.79E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**4.31E+02**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	6.31E+08	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.46E+06	l/kg

Define dispersivity (click brown cell and use pull down list)

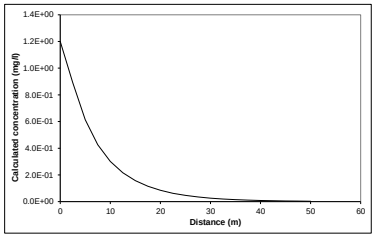
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.2E+00
2.5	8.92E-01
5.0	6.14E-01
7.5	4.26E-01
10.0	3.02E-01
12.5	2.16E-01
15.0	1.57E-01
17.5	1.15E-01
20.0	8.46E-02
22.5	6.27E-02
25.0	4.67E-02
27.5	3.48E-02
30.0	2.61E-02
32.5	1.96E-02
35.0	1.48E-02
37.5	1.11E-02
40.0	8.42E-03
42.5	6.38E-03
45.0	4.83E-03
47.5	3.67E-03
50.0	2.79E-03

Site being assessed: Earlswood Training Facility
Completed by: Lowri Williams
Date: #######
Version: 1

Remedial Targets

Remedial Target		**4.31E+00**	**mg/l**
Ogata Banks			
Distance to compliance point		**50**	**m**
Concentration of contaminant at compliance point	C_{ED}/C_0	**2.79E-03**	**mg/l**
after		**1.0E+100**	**days**

For comparison with measured groundwater concentration.

Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Fluoranthene		from Level 1
Target Concentration	C_T	1.00E-05	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	2.10E-04	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+03	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	7.74E-02	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	1.77E+00	fraction
Decay rate used	λ	3.91E-04	d^{-1}
Rate of contaminant flow due to retardation	u	2.82E-03	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	6.49E-07	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**3.24E+02**	

Remedial Targets

Remedial Target		**3.24E-03**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**6.49E-07**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	5.16E+00	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	7.74E-02	l/kg

Define dispersivity (click brown cell and use pull down list)

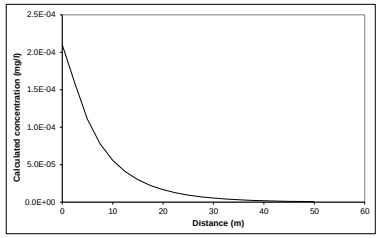
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	2.1E-04
2.5	1.58E-04
5.0	1.10E-04
7.5	7.79E-05
10.0	5.59E-05
12.5	4.07E-05
15.0	2.99E-05
17.5	2.22E-05
20.0	1.66E-05
22.5	1.25E-05
25.0	9.42E-06
27.5	7.13E-06
30.0	5.42E-06
32.5	4.13E-06
35.0	3.16E-06
37.5	2.42E-06
40.0	1.85E-06
42.5	1.42E-06
45.0	1.09E-06
47.5	8.42E-07
50.0	6.49E-07

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		PFOS		from Level 1
Target Concentration	C_T	3.00E-06	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	3.60E-05	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.90E+99	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.00E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+01	m	*Site width based on potential onsite source*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.46E+03	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for ionic organic chemicals (acids)

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	1.46E+03	l/kg
pH value	pH	8.50E+00	
acid dissociation constant	pKa	3.00E-01	
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Soil water partition coefficient	Kd	1.46E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

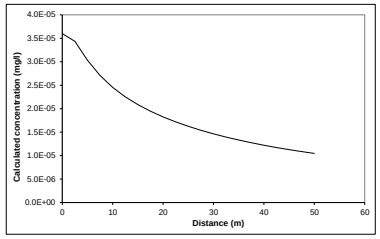
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Calculated Parameters	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	1.46E+04	fraction
Decay rate used	λ	4.80E-105	d^{-1}
Rate of contaminant flow due to retardation	u	3.42E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.05E-05	mg/l
Attenuation factor (one way vertical dispersion, C0/CED)	**AF**	**3.44E+00**	

Remedial Targets

Remedial Target		**1.03E-05**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**1.05E-05**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	3.6E-05
2.5	3.44E-05
5.0	3.03E-05
7.5	2.71E-05
10.0	2.45E-05
12.5	2.25E-05
15.0	2.09E-05
17.5	1.95E-05
20.0	1.83E-05
22.5	1.72E-05
25.0	1.63E-05
27.5	1.54E-05
30.0	1.46E-05
32.5	1.39E-05
35.0	1.33E-05
37.5	1.27E-05
40.0	1.22E-05
42.5	1.17E-05
45.0	1.13E-05
47.5	1.09E-05
50.0	1.05E-05

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		6:2FTS		from Level 1
Target Concentration	C_T	1.00E-04	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.20E-03	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.90E+99	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.00E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+01	m	*Site width based on potetnial onsite source*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.47E+02	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	9.47E+03	fraction
Decay rate used	λ	7.39E-105	d^{-1}
Rate of contaminant flow due to retardation	u	5.28E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	3.49E-04	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**3.44E+00**	

Remedial Targets

Remedial Target		**3.44E-04**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**3.49E-04**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for ionic organic chemicals (acids)

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	9.47E+02	l/kg
pH value	pH	8.50E+00	
acid dissociation constant	pKa	1.31E+00	
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Soil water partition coefficient	Kd	9.47E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

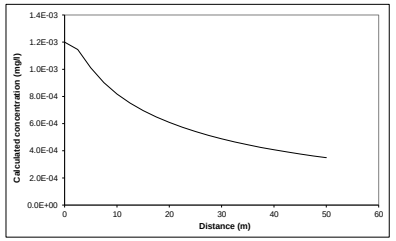
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.2E-03
2.5	1.15E-03
5.0	1.01E-03
7.5	9.02E-04
10.0	8.18E-04
12.5	7.51E-04
15.0	6.96E-04
17.5	6.49E-04
20.0	6.09E-04
22.5	5.73E-04
25.0	5.42E-04
27.5	5.13E-04
30.0	4.88E-04
32.5	4.65E-04
35.0	4.44E-04
37.5	4.25E-04
40.0	4.07E-04
42.5	3.91E-04
45.0	3.76E-04
47.5	3.62E-04
50.0	3.49E-04

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		6:2FTS		from Level 1
Target Concentration	C_T	1.00E-04	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.20E-03	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.90E+99	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.00E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+01	m	*Site width based on potetnial onsite source*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.47E+02	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	9.47E+03	fraction
Decay rate used	λ	7.39E-105	d^{-1}
Rate of contaminant flow due to retardation	u	5.28E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	3.49E-04	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**3.44E+00**	

Remedial Targets

Remedial Target		**3.44E-04**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**3.49E-04**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for ionic organic chemicals (acids)

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	9.47E+02	l/kg
pH value	pH	8.50E+00	
acid dissociation constant	pKa	1.31E+00	
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Soil water partition coefficient	Kd	9.47E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

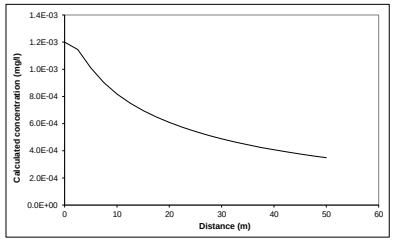
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.2E-03
2.5	1.15E-03
5.0	1.01E-03
7.5	9.02E-04
10.0	8.18E-04
12.5	7.51E-04
15.0	6.96E-04
17.5	6.49E-04
20.0	6.09E-04
22.5	5.73E-04
25.0	5.42E-04
27.5	5.13E-04
30.0	4.88E-04
32.5	4.65E-04
35.0	4.44E-04
37.5	4.25E-04
40.0	4.07E-04
42.5	3.91E-04
45.0	3.76E-04
47.5	3.62E-04
50.0	3.49E-04

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		8:2FTS		from Level 1
Target Concentration	C_T	1.00E-04	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.10E-04	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.90E+99	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.00E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+01	m	*Site width based on potential onsite source*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	5.00E+01	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E-02	l/kg	*see options*
Longitudinal dispersivity	ax	5.00E+00	m	*see options*
Transverse dispersivity	az	5.00E-01	m	*see options*
Vertical dispersivity	ay	5.00E-02	m	*see options*

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for ionic organic chemicals (acids)

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	1.00E-02	l/kg
pH value	pH	8.50E+00	
acid dissociation constant	pKa	1.32E+00	
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Soil water partition coefficient	Kd	1.00E-02	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	**az**	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	**ay**	0.00E+00	5.00E-02	2.98E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

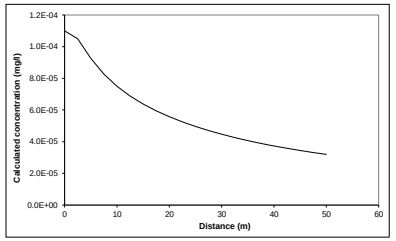
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Calculated Parameters	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	1.10E+00	fraction
Decay rate used	λ	6.37E-101	d^{-1}
Rate of contaminant flow due to retardation	u	4.55E-03	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	3.20E-05	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**3.44E+00**	

Remedial Targets

Remedial Target		**3.44E-04**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**50**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**3.20E-05**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.1E-04
2.5	1.05E-04
5.0	9.27E-05
7.5	8.27E-05
10.0	7.50E-05
12.5	6.89E-05
15.0	6.38E-05
17.5	5.95E-05
20.0	5.58E-05
22.5	5.25E-05
25.0	4.97E-05
27.5	4.71E-05
30.0	4.47E-05
32.5	4.26E-05
35.0	4.07E-05
37.5	3.89E-05
40.0	3.73E-05
42.5	3.58E-05
45.0	3.45E-05
47.5	3.32E-05
50.0	3.20E-05

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu) | Variable | Value | Unit | Source

Contaminant		Arsenic		from Level 1
Target Concentration	C_T	5.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.21E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters | Variable

Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	5.00E+03	fraction
Decay rate used	λ	1.39E-104	d^{-1}
Rate of contaminant flow due to retardation	u	1.00E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	2.88E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**2.16E+01**	

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 5.00E+02 — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 5.00E+02 — l/kg

Define dispersivity (click brown cell and use pull down list)

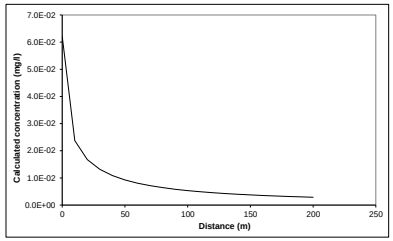
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	6.2E-02
10.0	2.37E-02
20.0	1.67E-02
30.0	1.31E-02
40.0	1.09E-02
50.0	9.26E-03
60.0	8.07E-03
70.0	7.15E-03
80.0	6.42E-03
90.0	5.82E-03
100.0	5.33E-03
110.0	4.91E-03
120.0	4.55E-03
130.0	4.24E-03
140.0	3.97E-03
150.0	3.74E-03
160.0	3.53E-03
170.0	3.34E-03
180.0	3.17E-03
190.0	3.02E-03
200.0	2.88E-03

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Remedial Targets

Remedial Target		**1.08E+00**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**2.88E-03**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Zinc		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	2.30E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	3.81E+02	fraction
Decay rate used	λ	1.82E-103	d^{-1}
Rate of contaminant flow due to retardation	u	1.31E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.07E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**2.16E+01**	

Remedial Targets

Remedial Target		**2.16E-01**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**1.07E-03**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	3.80E+01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.80E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

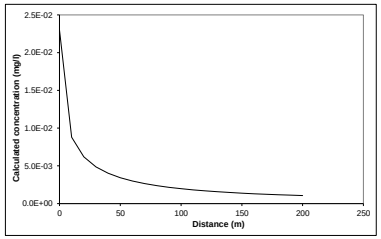
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	2.3E-02
10.0	8.79E-03
20.0	6.19E-03
30.0	4.87E-03
40.0	4.02E-03
50.0	3.43E-03
60.0	2.99E-03
70.0	2.65E-03
80.0	2.38E-03
90.0	2.16E-03
100.0	1.97E-03
110.0	1.82E-03
120.0	1.69E-03
130.0	1.57E-03
140.0	1.47E-03
150.0	1.38E-03
160.0	1.31E-03
170.0	1.24E-03
180.0	1.17E-03
190.0	1.12E-03
200.0	1.07E-03

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Lead		from Level 1
Target Concentration	C_T	1.20E-03	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.50E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.80E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	5.80E+03	fraction
Decay rate used	λ	1.19E-104	d^{-1}
Rate of contaminant flow due to retardation	u	8.62E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	6.95E-04	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**2.16E+01**	

Remedial Targets

Remedial Target		**2.59E-02**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**6.95E-04**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.80E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc.n}$		l/kg
Sorption coefficient for ionised species	$K_{oc.i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.80E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

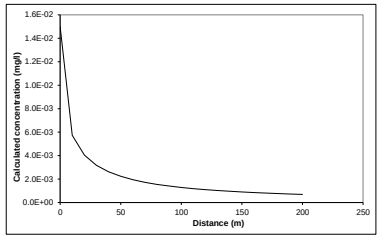
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.5E-02
10.0	5.73E-03
20.0	4.04E-03
30.0	3.18E-03
40.0	2.62E-03
50.0	2.24E-03
60.0	1.95E-03
70.0	1.73E-03
80.0	1.55E-03
90.0	1.41E-03
100.0	1.29E-03
110.0	1.19E-03
120.0	1.10E-03
130.0	1.02E-03
140.0	9.60E-04
150.0	9.03E-04
160.0	8.52E-04
170.0	8.06E-04
180.0	7.65E-04
190.0	7.29E-04
200.0	6.95E-04

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		Aliphatic C10-C12		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	4.30E-02	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	2.10E+01	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	3.30E-02	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.77E+03	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	2.51E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.77E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

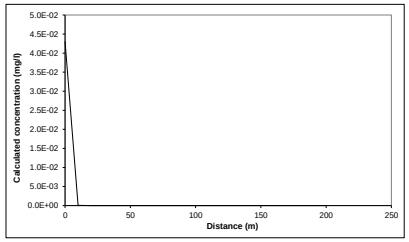
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Calculated Parameters	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	3.77E+04	fraction
Decay rate used	λ	8.76E-07	d^{-1}
Rate of contaminant flow due to retardation	u	1.33E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	3.32E-51	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**1.30E+49**	

Remedial Targets

Remedial Target		**1.30E+47**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**3.32E-51**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	4.3E-02
10.0	6.71E-05
20.0	1.93E-07
30.0	6.20E-10
40.0	2.09E-12
50.0	7.28E-15
60.0	2.59E-17
70.0	9.38E-20
80.0	3.44E-22
90.0	1.27E-24
100.0	4.76E-27
110.0	1.79E-29
120.0	6.78E-32
130.0	2.58E-34
140.0	9.88E-37
150.0	3.79E-39
160.0	1.46E-41
170.0	5.65E-44
180.0	2.19E-46
190.0	8.51E-49
200.0	3.32E-51

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Aliphatic C12-C16		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.60E-01	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	5.00E+01	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	1.39E-02	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	7.52E+04	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	7.52E+05	fraction
Decay rate used	λ	1.84E-08	d^{-1}
Rate of contaminant flow due to retardation	u	6.65E-09	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	4.25E-33	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**3.77E+31**	

Remedial Targets

Remedial Target		**3.77E+29**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**4.25E-33**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	5.01E+06	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	7.52E+04	l/kg

Define dispersivity (click brown cell and use pull down list)

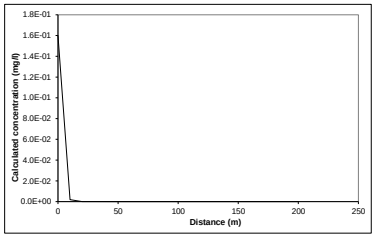
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.6E-01
10.0	1.88E-03
20.0	4.08E-05
30.0	9.85E-07
40.0	2.50E-08
50.0	6.56E-10
60.0	1.76E-11
70.0	4.79E-13
80.0	1.32E-14
90.0	3.69E-16
100.0	1.04E-17
110.0	2.94E-19
120.0	8.39E-21
130.0	2.41E-22
140.0	6.93E-24
150.0	2.00E-25
160.0	5.82E-27
170.0	1.69E-28
180.0	4.94E-30
190.0	1.45E-31
200.0	4.25E-33

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Aliphatic C16-C21		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	3.80E-01	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+03	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.46E+06	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	9.46E+07	fraction
Decay rate used	λ	7.32E-12	d^{-1}
Rate of contaminant flow due to retardation	u	5.28E-11	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	7.35E-08	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**5.17E+06**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	6.31E+08	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.46E+06	l/kg

Define dispersivity (click brown cell and use pull down list)

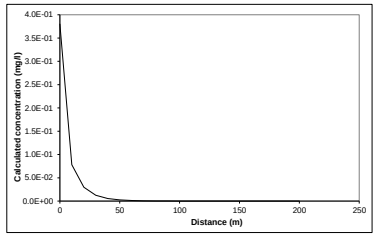
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	3.8E-01
10.0	7.82E-02
20.0	2.97E-02
30.0	1.26E-02
40.0	5.58E-03
50.0	2.56E-03
60.0	1.20E-03
70.0	5.73E-04
80.0	2.77E-04
90.0	1.35E-04
100.0	6.66E-05
110.0	3.30E-05
120.0	1.65E-05
130.0	8.28E-06
140.0	4.17E-06
150.0	2.11E-06
160.0	1.07E-06
170.0	5.47E-07
180.0	2.80E-07
190.0	1.43E-07
200.0	7.35E-08

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Remedial Targets

Remedial Target		**5.17E+04**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**7.35E-08**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		Aliphatic C21-C35		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.20E+00	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.25E+02	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.49E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.46E+06	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	6.31E+08	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.46E+06	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

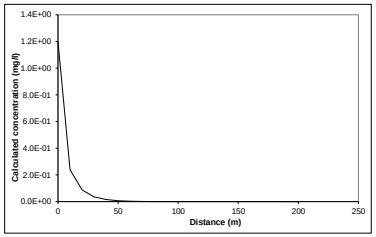
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Calculated Parameters	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	9.46E+07	fraction
Decay rate used	λ	7.92E-12	d^{-1}
Rate of contaminant flow due to retardation	u	5.28E-11	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.23E-07	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**9.75E+06**	

Remedial Targets

Remedial Target		**9.75E+04**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**1.23E-07**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.2E+00
10.0	2.39E-01
20.0	8.79E-02
30.0	3.60E-02
40.0	1.55E-02
50.0	6.90E-03
60.0	3.14E-03
70.0	1.45E-03
80.0	6.78E-04
90.0	3.21E-04
100.0	1.53E-04
110.0	7.36E-05
120.0	3.56E-05
130.0	1.73E-05
140.0	8.45E-06
150.0	4.14E-06
160.0	2.04E-06
170.0	1.01E-06
180.0	4.98E-07
190.0	2.47E-07
200.0	1.23E-07

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu) | Variable | Value | Unit | Source

Contaminant		Fluoranthene		from Level 1
Target Concentration	C_T	1.00E-05	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	2.10E-04	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+03	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	6.93E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	4.00E+01	m	*Site width*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.70E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	7.74E-02	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters | Variable

Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	1.82E+00	fraction
Decay rate used	λ	3.80E-04	d^{-1}
Rate of contaminant flow due to retardation	u	2.74E-03	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	4.06E-11	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**5.17E+06**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Organic carbon partition coefficient	Koc	5.16E+00	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	7.74E-02	l/kg

Define dispersivity (click brown cell and use pull down list)

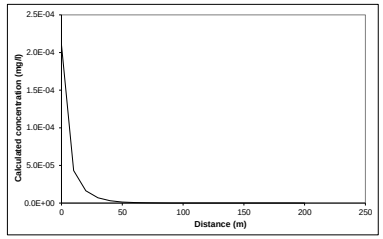
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	2.1E-04
10.0	4.32E-05
20.0	1.64E-05
30.0	6.94E-06
40.0	3.09E-06
50.0	1.42E-06
60.0	6.64E-07
70.0	3.17E-07
80.0	1.53E-07
90.0	7.47E-08
100.0	3.68E-08
110.0	1.83E-08
120.0	9.12E-09
130.0	4.58E-09
140.0	2.31E-09
150.0	1.17E-09
160.0	5.93E-10
170.0	3.02E-10
180.0	1.54E-10
190.0	7.91E-11
200.0	4.06E-11

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Remedial Targets

Remedial Target		**5.17E+01**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**4.06E-11**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		PFOS		from Level 1
Target Concentration	C_T	3.00E-06	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	3.60E-05	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.90E+99	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.00E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+01	m	*Site width based on potential onsite source*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.46E+03	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	1.46E+04	fraction
Decay rate used	λ	4.80E-105	d^{-1}
Rate of contaminant flow due to retardation	u	3.42E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	8.86E-07	mg/l
Attenuation factor (one way vertical dispersion, C0/CED)	**AF**	**4.07E+01**	

Remedial Targets

Remedial Target		**1.22E-04**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**8.86E-07**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for ionic organic chemicals (acids)

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	1.46E+03	l/kg
pH value	pH	8.50E+00	
acid dissociation constant	pKa	3.00E-01	
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Soil water partition coefficient	Kd	1.46E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

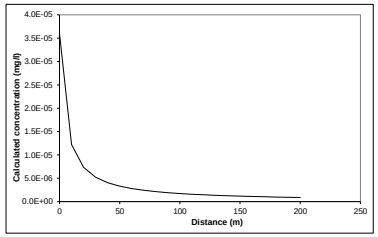
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	3.6E-05
10.0	1.22E-05
20.0	7.33E-06
30.0	5.22E-06
40.0	4.06E-06
50.0	3.32E-06
60.0	2.80E-06
70.0	2.43E-06
80.0	2.14E-06
90.0	1.91E-06
100.0	1.73E-06
110.0	1.58E-06
120.0	1.45E-06
130.0	1.35E-06
140.0	1.25E-06
150.0	1.17E-06
160.0	1.10E-06
170.0	1.04E-06
180.0	9.81E-07
190.0	9.31E-07
200.0	8.86E-07

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu) | Variable | Value | Unit | Source

Contaminant		6:2FTS		from Level 1
Target Concentration	C_T	1.00E-04	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.20E-03	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.90E+99	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.00E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+01	m	*Site width based on potetnial onsite source*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.47E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Calculated Parameters | Variable

Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	9.47E+03	fraction
Decay rate used	λ	7.39E-105	d^{-1}
Rate of contaminant flow due to retardation	u	5.28E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	2.95E-05	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**4.07E+01**	

Remedial Targets

Remedial Target		**4.07E-03**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	**C_{ED}/C_0**	**2.95E-05**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for ionic organic chemicals (acids)

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	9.47E+02	l/kg
pH value	pH	8.50E+00	
acid dissociation constant	pKa	1.31E+00	
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Soil water partition coefficient	Kd	9.47E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

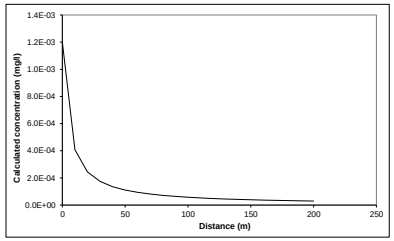
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.2E-03
10.0	4.07E-04
20.0	2.44E-04
30.0	1.74E-04
40.0	1.35E-04
50.0	1.11E-04
60.0	9.34E-05
70.0	8.09E-05
80.0	7.14E-05
90.0	6.38E-05
100.0	5.77E-05
110.0	5.27E-05
120.0	4.85E-05
130.0	4.49E-05
140.0	4.18E-05
150.0	3.91E-05
160.0	3.67E-05
170.0	3.46E-05
180.0	3.27E-05
190.0	3.10E-05
200.0	2.95E-05

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		8:2FTS		from Level 1
Target Concentration	C_T	1.00E-04	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: **Simulate vertical dispersion in 1 direction**

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.10E-04	mg/l	*Max measured on site*
Half life for degradation of contaminant in water	$t_{1/2}$	9.90E+99	days	*Physical & chemical properites datasheet*
Calculated decay rate	λ	7.00E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+01	m	*Site width based on potential onsite source*
Plume thickness at source	Sy	1.00E+00	m	*Based on laboratory testing of soils*
Saturated aquifer thickness	da	4.00E+00	m	*Max known thickness*
Bulk density of aquifer materials	ρ	1.60E+00	g/cm^3	*Assumed*
Effective porosity of aquifer	n	1.60E-01	fraction	*Worst case*
Hydraulic gradient	i	2.00E-02	fraction	*Measured from site data*
Hydraulic conductivity of aquifer	K	4.00E-02	m/d	*Measured from site data*
Distance to compliance point	x	2.00E+02	m	*Measure from site boundary*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*No offset*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*No offset*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E-02	l/kg	*see options*
Longitudinal dispersivity	ax	2.00E+01	m	*see options*
Transverse dispersivity	az	2.00E+00	m	*see options*
Vertical dispersivity	ay	2.00E-01	m	*see options*

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for ionic organic chemicals (acids)

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	1.00E-02	l/kg
pH value	pH	8.50E+00	
acid dissociation constant	pKa	1.32E+00	
Fraction of organic carbon in aquifer	foc	1.50E-02	fraction
Soil water partition coefficient	Kd	1.00E-02	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+01	6.21E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E+00	6.21E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-01	6.21E-02	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

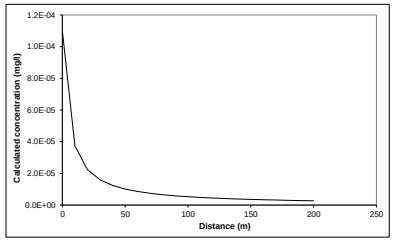
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Calculated Parameters	Variable		
Groundwater flow velocity	v	5.00E-03	m/d
Retardation factor	Rf	1.10E+00	fraction
Decay rate used	λ	6.37E-101	d^{-1}
Rate of contaminant flow due to retardation	u	4.55E-03	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	2.71E-06	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**4.07E+01**	

Remedial Targets

Remedial Target		**4.07E-03**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**200**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**2.71E-06**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Earlswood Training Facility
Completed by:	Lowri Williams
Date:	#######
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.1E-04
10.0	3.73E-05
20.0	2.24E-05
30.0	1.60E-05
40.0	1.24E-05
50.0	1.01E-05
60.0	8.56E-06
70.0	7.42E-06
80.0	6.54E-06
90.0	5.85E-06
100.0	5.29E-06
110.0	4.83E-06
120.0	4.44E-06
130.0	4.11E-06
140.0	3.83E-06
150.0	3.58E-06
160.0	3.36E-06
170.0	3.17E-06
180.0	3.00E-06
190.0	2.84E-06
200.0	2.71E-06

APPENDIX M

INPUT PARAMETERS SENSITIVITY ANALYSIS

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: Arsenic
Maximum Recorded Concentration: 0.0621mg/l

Existing Model Remedial Target (mg/l) - 200m: 1.08mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	1.08	1.8	1.08
Effective porosity of aquifer (fraction)	0.16	0.25	1.08	0.3	1.08
Hydraulic gradient (fraction)	0.02	0.03	1.08	0.04	1.08
Hydraulic conductivity (m/d)	0.04	0.05	1.08	0.06	1.08

Existing Model Remedial Target (mg/l) - 50m: 0.145mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.145	1.8	0.145
Effective porosity of aquifer (fraction)	0.16	0.25	0.145	0.3	0.145
Hydraulic gradient (fraction)	0.02	0.03	0.145	0.04	0.145
Hydraulic conductivity (m/d)	0.04	0.05	0.145	0.06	0.145

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: Lead
Maximum Recorded Concentration: 0.015mg/l

Existing Model Remedial Target (mg/l) - 200m: 0.0259mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.0259	1.8	0.0259
Effective porosity of aquifer (fraction)	0.16	0.25	0.0259	0.3	0.0259
Hydraulic gradient (fraction)	0.02	0.03	0.0259	0.04	0.0259
Hydraulic conductivity (m/d)	0.04	0.05	0.0259	0.06	0.0259

Existing Model Remedial Target (mg/l) - 50m: 0.00349mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.00349	1.8	0.00349
Effective porosity of aquifer (fraction)	0.16	0.25	0.00349	0.3	0.00349
Hydraulic gradient (fraction)	0.02	0.03	0.00349	0.04	0.00349
Hydraulic conductivity (m/d)	0.04	0.05	0.00349	0.06	0.00349

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: Zinc
Maximum Recorded Concentration: 0.023mg/l

Integral Géotechnique

Existing Model Remedial Target (mg/l) - 200m: 0.216mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.216	1.8	0.216
Effective porosity of aquifer (fraction)	0.16	0.25	0.216	0.3	0.216
Hydraulic gradient (fraction)	0.02	0.03	0.216	0.04	0.216
Hydraulic conductivity (m/d)	0.04	0.05	0.216	0.06	0.216

Existing Model Remedial Target (mg/l) - 50m: 0.029mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.029	1.8	0.029
Effective porosity of aquifer (fraction)	0.16	0.25	0.029	0.3	0.029
Hydraulic gradient (fraction)	0.02	0.03	0.029	0.04	0.029
Hydraulic conductivity (m/d)	0.04	0.05	0.029	0.06	0.029

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: C10-C12
Maximum Recorded Concentration: 0.043mg/l

Existing Model Remedial Target (mg/l) - 200m: $1.3x10^{+47}$mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	$1.3x10^{+47}$	1.8	$1.3x10^{+47}$
Effective porosity of aquifer (fraction)	0.16	0.25	$3.9x10^{+59}$	0.3	$3.38x10^{+65}$
Hydraulic gradient (fraction)	0.02	0.03	$9.25x10^{+37}$	0.04	$3.25x10^{+32}$
Hydraulic conductivity (m/d)	0.04	0.05	$7.08x10^{+41}$	0.06	$9.25x10^{+37}$

Existing Model Remedial Target (mg/l) - 50m: $2.18x10^{+21}$mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	$2.18x10^{+21}$	1.8	$2.18x10^{+21}$
Effective porosity of aquifer (fraction)	0.16	0.25	$3.61x10^{+29}$	0.3	$3.37x10^{+30}$
Hydraulic gradient (fraction)	0.02	0.03	$6.03x10^{+16}$	0.04	$1.17x10^{+14}$
Hydraulic conductivity (m/d)	0.04	0.05	$5.19x10^{+18}$	0.06	$6.03x10^{+18}$ 、

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: C12-C16
Maximum Recorded Concentration: 0.16mg/l

Existing Model Remedial Target (mg/l) - 200m: $3.77x10^{+29}$mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	$3.77x10^{+29}$	1.8	$3.77x10^{+29}$
Effective porosity of aquifer (fraction)	0.16	0.25	$4.43x10^{+37}$	0.3	$3.16x10^{+41}$
Hydraulic gradient (fraction)	0.02	0.03	$4.45x10^{+23}$	0.04	$1.36x10^{+20}$
Hydraulic conductivity (m/d)	0.04	0.05	$1.48x10^{+26}$	0.06	$4.55x10^{+23}$

Existing Model Remedial Target (mg/l) - 50m: $4.05x10^{+12}$mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	$4.05x10^{+12}$	1.8	$4.05x10^{+12}$
Effective porosity of aquifer (fraction)	0.16	0.25	$4.18x10^{+16}$	0.3	$3.47x10^{+18}$
Hydraulic gradient (fraction)	0.02	0.03	$4.71x10^{+09}$	0.04	$8.53x10^{+07}$
Hydraulic conductivity (m/d)	0.04	0.05	$8.27x10^{+10}$	0.06	$4.71x10^{+09}$

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: C16-C21
Maximum Recorded Concentration: 0.38mg/l

Existing Model Remedial Target (mg/l) - 200m: $5.17x10^{+04}$mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	$5.17x10^{+04}$	1.8	$5.17x10^{+04}$
Effective porosity of aquifer (fraction)	0.16	0.25	$2.88x10^{+06}$	0.3	$2.0x10^{+07}$
Hydraulic gradient (fraction)	0.02	0.03	$2.84x10^{+03}$	0.04	$5.23x10^{+02}$
Hydraulic conductivity (m/d)	0.04	0.05	$9.67x10^{+03}$	0.06	$2.84x10^{+03}$

Existing Model Remedial Target (mg/l) - 50m: 3.24mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	3.24	1.8	3.24
Effective porosity of aquifer (fraction)	0.16	0.25	20.3	0.3	50
Hydraulic gradient (fraction)	0.02	0.03	0.906	0.04	0.443
Hydraulic conductivity (m/d)	0.04	0.05	1.54	0.06	0.906

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: C21-C35
Maximum Recorded Concentration: 1.2mg/l

Existing Model Remedial Target (mg/l) - 200m: $9.75x10^{+04}$mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	$9.75x10^{+4}$	1.8	$9.75x10^{+4}$
Effective porosity of aquifer (fraction)	0.16	0.25	$6.44x10^{+6}$	0.3	$4.84x10^{+7}$
Hydraulic gradient (fraction)	0.02	0.03	$4.73x10^{+3}$	0.04	$8.05x10^{+2}$
Hydraulic conductivity (m/d)	0.04	0.05	$1.7x10^{+4}$	0.06	$4.73x10^{+3}$

Existing Model Remedial Target (mg/l) - 50m: 4.31mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	4.31	1.8	4.31
Effective porosity of aquifer (fraction)	0.16	0.25	29.5	0.3	75.8
Hydraulic gradient (fraction)	0.02	0.03	1.13	0.04	0.531
Hydraulic conductivity (m/d)	0.04	0.05	1.97	0.06	1.13

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: Fluoranthene
Maximum Recorded Concentration: 0.00021mg/l

Integral Géotechnique

Existing Model Remedial Target (mg/l) - 200m: 51.7mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	51.7	1.8	51.7
Effective porosity of aquifer (fraction)	0.16	0.25	$2.88x10^{+3}$	0.3	$2.0x10^{+4}$
Hydraulic gradient (fraction)	0.02	0.03	2.84	0.04	0.05
Hydraulic conductivity (m/d)	0.04	0.05	9.67	0.06	2.84

Existing Model Remedial Target (mg/l) - 50m: 0.00324mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.00324	1.8	0.00324
Effective porosity of aquifer (fraction)	0.16	0.25	0.0203	0.3	0.05
Hydraulic gradient (fraction)	0.02	0.03	0.000906	0.04	0.000434
Hydraulic conductivity (m/d)	0.04	0.05	0.00154	0.06	0.000906

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: PFOS
Maximum Recorded Concentration: 0.000036mg/l

Existing Model Remedial Target (mg/l) - 200m: 0.000122mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.000122	1.8	0.000122
Effective porosity of aquifer (fraction)	0.16	0.25	0.000122	0.3	0.000122
Hydraulic gradient (fraction)	0.02	0.03	0.000122	0.04	0.000122
Hydraulic conductivity (m/d)	0.04	0.05	0.000122	0.06	0.000122

Existing Model Remedial Target (mg/l) - 50m: 0.0000103mg/l

Input Parameter					
Bulk density of aquifer matertial (g/cm^3)	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Effective porosity of aquifer (fraction)	1.6	1.7	0.0000103	1.8	0.0000103
Hydraulic gradient (fraction)	0.16	0.25	0.0000103	0.3	0.0000103
Hydraulic conductivity (m/d)	0.02	0.03	0.0000103	0.04	0.0000103
	0.04	0.05	0.0000103	0.06	0.0000103

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: 6:2FTS
Maximum Recorded Concentration: 0.0012mg/l

Existing Model Remedial Target (mg/l) - 200m: 0.0041mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.0041	1.8	0.0041
Effective porosity of aquifer (fraction)	0.16	0.25	0.0041	0.3	0.0041
Hydraulic gradient (fraction)	0.02	0.03	0.0041	0.04	0.0041
Hydraulic conductivity (m/d)	0.04	0.05	0.0041	0.06	0.0041

Existing Model Remedial Target (mg/l) - 50m: 0.000344mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.000344	1.8	0.000344
Effective porosity of aquifer (fraction)	0.16	0.25	0.000344	0.3	0.000344
Hydraulic gradient (fraction)	0.02	0.03	0.000344	0.04	0.000344
Hydraulic conductivity (m/d)	0.04	0.05	0.000344	0.06	0.000344

Sensitivity Analysis

Project Name: Earlswood Training Centre
Project No. : 14050
Contaminant of Concern: 8:2FTS
Maximum Recorded Concentration: 0.00011mg/l

Existing Model Remedial Target (mg/l) - 200m: 0.0041mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.0041	1.8	0.0041
Effective porosity of aquifer (fraction)	0.16	0.25	0.0041	0.3	0.0041
Hydraulic gradient (fraction)	0.02	0.03	0.0041	0.04	0.0041
Hydraulic conductivity (m/d)	0.04	0.05	0.0041	0.06	0.0041

Existing Model Remedial Target (mg/l) - 50m: 0.000344mg/l

Input Parameter	Exisiting Model Value	Alternative Value	Revised Remedial Target (mg/l)	Alternative Value	Revised Remedial Target (mg/l)
Bulk density of aquifer matertial (g/cm^3)	1.6	1.7	0.000344	1.8	0.000344
Effective porosity of aquifer (fraction)	0.16	0.25	0.000344	0.3	0.000344
Hydraulic gradient (fraction)	0.02	0.03	0.000344	0.04	0.000344
Hydraulic conductivity (m/d)	0.04	0.05	0.000344	0.06	0.000344

FIGURES

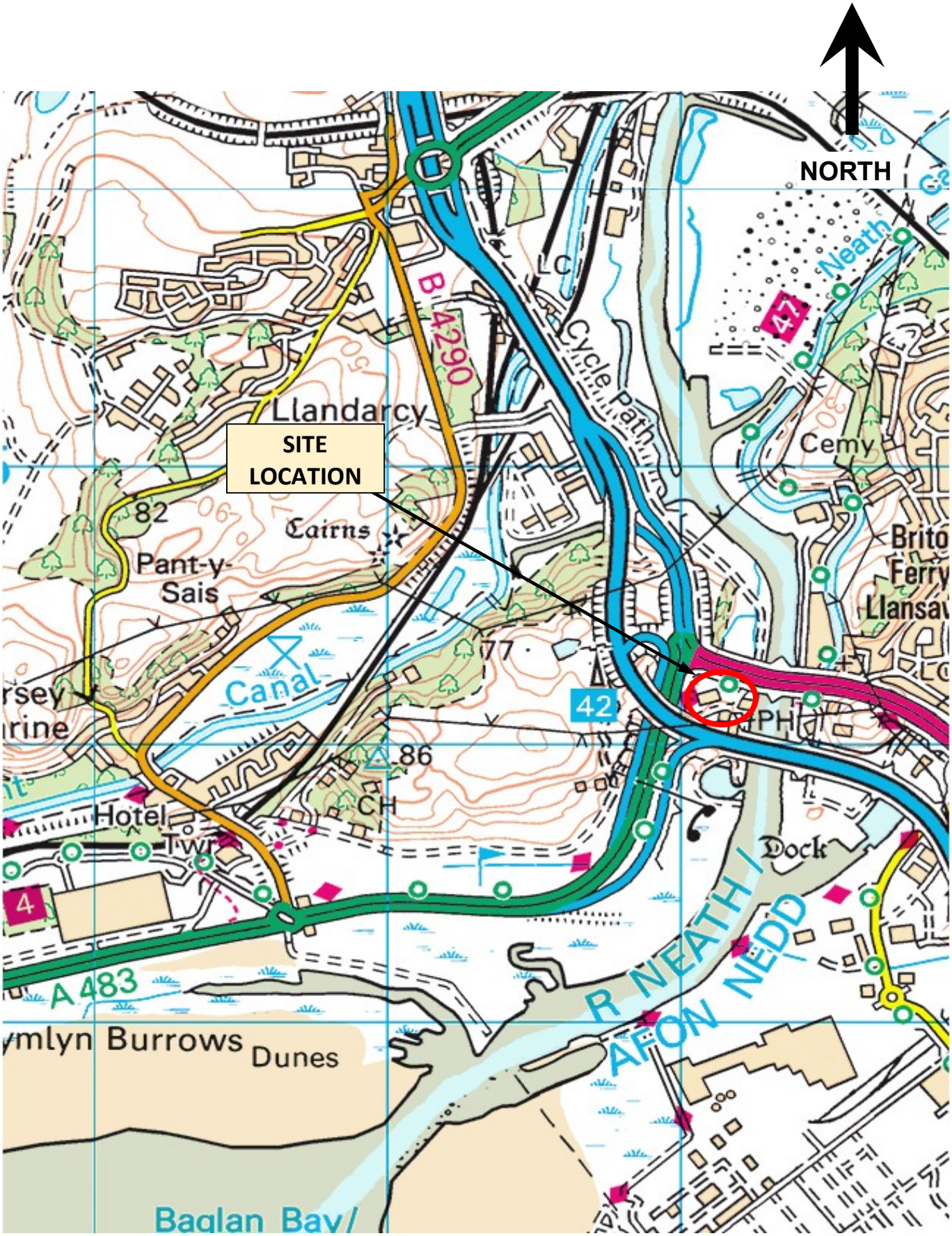


Figure 1: Site Location

Earlswood Training Centre, Jersey Marine, Neath

Intégral Géotechnique

Intégral House
7 Beddau Way
Castlegate Business Park
Caerphilly
CF83 2AX
Tel: 029 2080 7991
Fax: 029 2086 2176

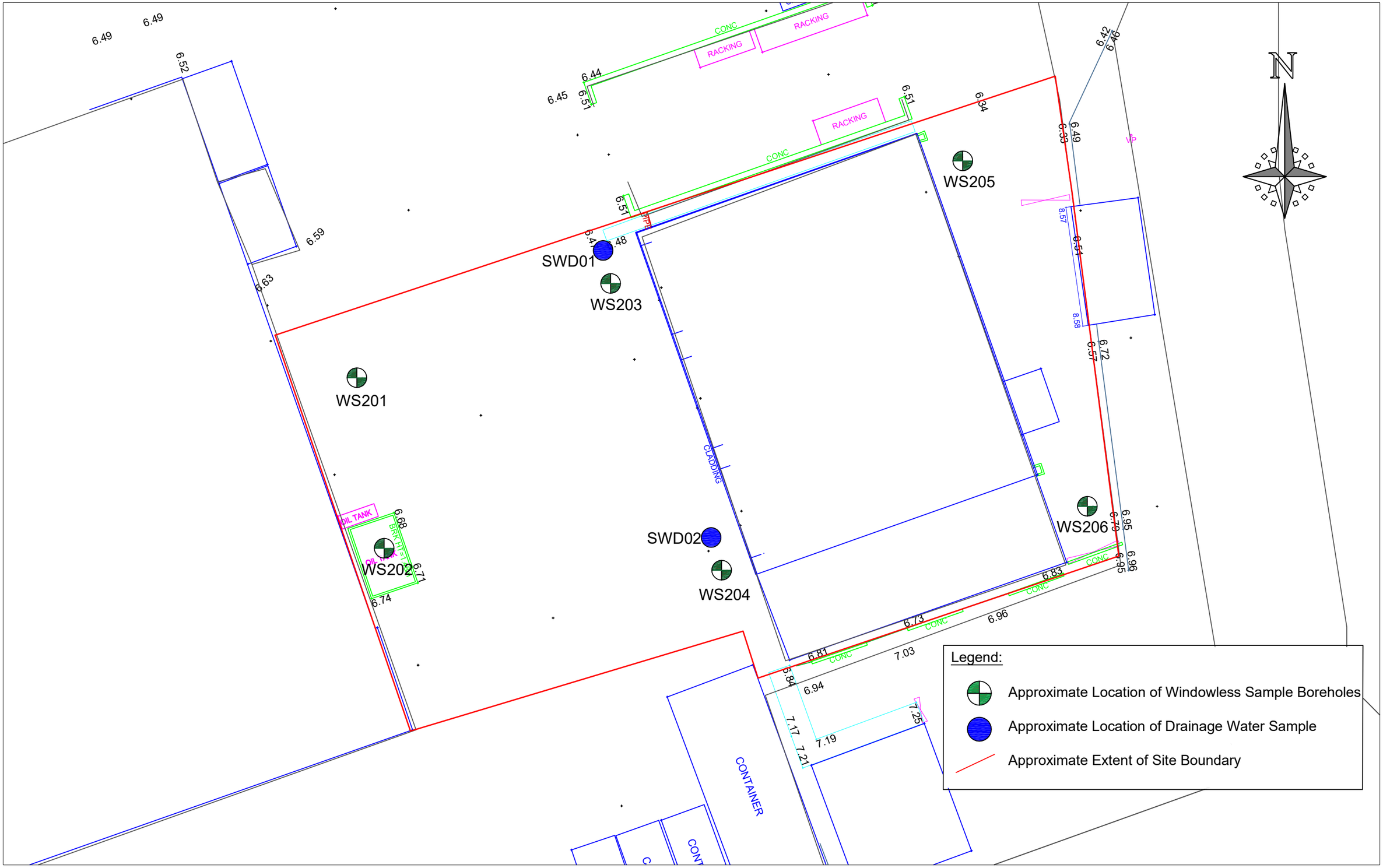


Figure 2: Site Plan

Project: Earlswood Training Centre, Jersey Marine, Neath	Job No.: 14050	Intégral Géotechnique	Integral House, 7 Beddau Way, Castlegate Business Park, Caerphilly, CF83 2AX. Tel: 029 2080 7991
Client: Mid & West Wales Fire Service	Scale: NTS		



Figure 2a: Surface Water Sample Locations

Project: Earlswood Training Centre, Jersey Marine, Neath	Job No.: 14050	Intégral Géotechnique
Client: Mid & West Wales Fire Service	Scale: NTS	

Integral House,
7 Beddau Way,
Castlegate Business Park,
Caerphilly,
CF83 2AX.
Tel: 029 2080 7991

Key

Made Ground

Superficial Soils

Groundwater

Contaminant Pathways

P1 - Dermal contact with made ground/dust

P2 - Ingestion of soil

P3 - Inhaltion of dust

P4 - Inhalation of vapours indoor/outdoor

P5 - Leaching from made ground

P6 - Transportation in groundwater

P7 - Construction materials durability

P8 - Migration and accumulation of gas in enclosed spaces

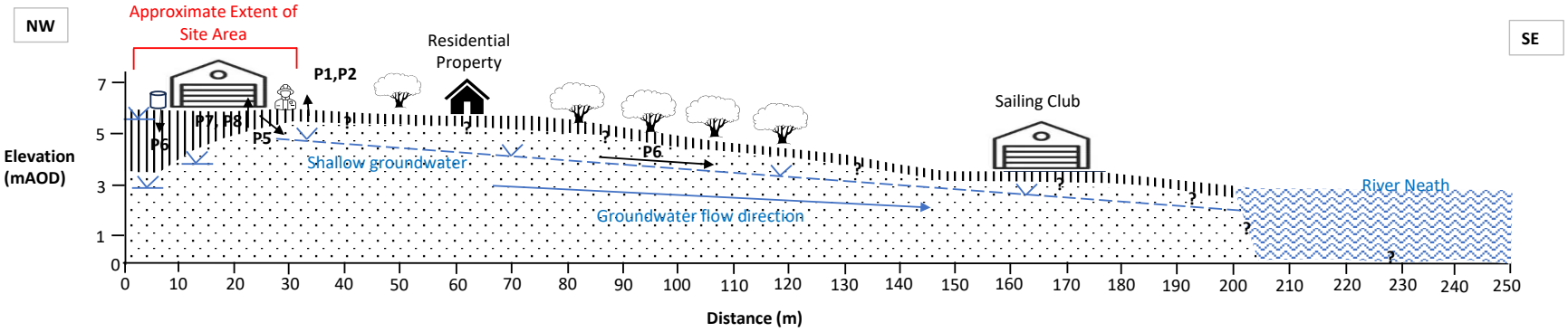


Figure 3: Conceptual Site Model

Earlswood Training Centre, Jersery Marine, Neath

Intégral Géotechnique

Intégral House
7 Beddau Way
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