



Verification Report

Land Adjacent 59-61

Broadway
Crowland
Lincolnshire
PE6 0BH

Prepared for:

Mr Ian Ladds

Church Farm
Church Street
Northborough
Peterborough
PE6 9BN

EPS Reference Number:	UK14.1470
Date Issued:	8 th August 2017
Report Status:	Issue 1



BROADWAY, CROWLAND

NON TECHNICAL CLIENT SUMMARY

This report presents a summary of activities undertaken to demonstrate the satisfactory implementation of control measures recommended necessary to address risks from contaminated land to ensure the site is safe and suitable for its proposed enduse (residential) and all regulatory requirements are met. Pertinent findings and conclusions are summarised as follows:

- Previous investigation at this site encountered contaminants associated with the sites former use as a petrol station and an apparent lack of remediation during / following its decommission several years ago. After EPS assessed the risks, it recommended a number of measures to make sure proposed residential development at the property would not be put at by the residual contaminant.
- The control measures recommended comprised the installation of clean soil within all communal garden and landscaped areas along with the installation of the appropriate types of water supply pipe and gas membranes within new houses.
- EPS visited the site to check that these measures were carried out and collected copies of installation certificates, material specifications, samples of topsoil and various photographic evidence. Our engineers also spoke with the client / builder about any unexpected contamination found during the build.
- Evidence collected during the verification work confirmed no unexpected contamination was observed during the build, certification showed that an appropriate vapour membrane was installed, the topsoil was from a suitable source and the specification of the water barrier pipe was appropriate.
- From the evidence collected it is concluded that the requirements of the remedial method statements have been satisfied.

By their very nature, the above bullet points represent a simplified summary of our work and should not be relied upon to form the basis for key decisions. A full picture is provided in the following report, alternatively give us a call and we'll talk you through it.

Project Reference:	UK14.1470	
Title:	Verification Report Land Adjacent 59-61 Broadway, Crowland	
Client:	Mr Ian Ladds	
Date:	8 th August 2017	
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Status:	Issue 1	

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Consultant	Director	Director

This report has been prepared for the client(s) listed on the report title page. EPS accepts no liability or responsibility for use of, or reliance upon, this report and / or the information contained within it by third parties.

No part of this report, or references to it, may be included in published documents of any kind without approval from EPS.

This report and its contents, together with any supporting correspondence or other documentation, remain the property of Environmental Protection Strategies Ltd until paid for in full.

Where ground investigations have been conducted, these have been limited to the level of detail required for the site in order to achieve the objectives of the investigation.

The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

The National Planning Policy Framework requires a competent person to prepare site investigation information, which is defined as a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation. EPS considers that it fulfils these criteria and would welcome any request for staff CVs or case studies to demonstrate it.

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1 INTRODUCTION

In April 2017, Environmental Protection Strategies Ltd (EPS) was commissioned by Mr Ian Ladds to produce a Verification Report following installation of a soil cover system, gas membranes and water barriers at Land Adjacent 59-61, Broadway, Crowland, Lincolnshire, PE6 0BH ('the site'), see Figure 1.

The development proposal includes the erection of five residential dwellings in connection with the current development proposals related to South Holland District Council planning application number: H02-0147-15 and Environment Agency reference number: AN/2015/121235/01/-L01.

1.1 Previous Reports

A number of environmental assessments have been undertaken at the site by a variety of different companies since the original petrol filling station was decommissioned. For background information, it is recommended that the reader review the following reports:

- Contamination Report for Former Broadway Garage, Crowland – (JP Chick & Partners Ref.: NGEN8340/JS/tb – 30th June 2003)
- Proposal for Remedial Measures at the Site – (JP Chick & Partners Letter Report – Ref.: NG8340/JS/AC – 13th August 2008)
- Site Investigation Report – Former Broadway PFS, Crowland, Lincolnshire, PE6 0BH (Applied Geology, Ref.: AG1031-08 – November 2008)
- Supplementary Sampling Report – Former Broadway PFS, Crowland, Lincolnshire, PE6 0BH (EPS Ltd, Ref.: UK14.1470 – 14th January 2014)
- Quantitative Risk Assessment – Former Broadway PFS, Crowland, Lincolnshire, PE6 0BH (EPS Ltd, Ref: UK14.1470 – 23rd October 2014).
- Phase I and II Geo-Environmental Assessment - Former Broadway PFS, Crowland, Lincolnshire, PE6 0BH (EPS Ltd, Ref: UK14.1470 – 12th June 2015).
- Groundwater Monitoring Report - Former Broadway PFS, Crowland, Lincolnshire, PE6 0BH (Letter Report sent 14th April 2016)
- Remedial Method Statement Verification Plan_ Former Broadway PFS, Crowland, Lincolnshire, PE6 0BH (UK14.1470 20th April 2016)

It is important to note that three other previous reports were referred to by JP Chick which have not been made available. These include:

- Investigation 1 – P Robson – 18th December 2000
- Investigation 2 – Ground Engineering Ltd – 9th November 2001
- Investigation 3 – JP Chick & Partners – 20th September 2002

To summarise these reports, the site's historic use was a petrol filling station with a number of underground storage tanks that remained in situ until 2003. Investigations determined localised hydrocarbons in the subsurface and groundwater due to one or more of these tanks leaking. Reports indicate that in 2008, the underground tanks were removed and boreholes were drilled on site in order to assess the condition of the subsurface and inform on further work that may be needed to ensure it was left in a satisfactory condition.

In 2014, EPS was instructed to carry out investigations in order to determine if there was any residual source of hydrocarbons ahead of proposed site redevelopment for residential use. These investigations found that contaminants were still present in the groundwater beneath the site which posed potential risks to the intended development but not to receptors in adjacent properties.

As a result of EPS findings, a Remedial Method Statement (RMS) was produced which provided recommendations for the installation of various controls during site redevelopment in order to reduce the residual risks found and to protect future site users.

1.2 Objectives

The objective of this is to verify the requirements of the remediation statement, which are as follows:

- To provide independent verification that imported topsoil is of appropriate composition and is present in sufficient thickness within proposed communal garden/landscaped areas.
- To provide independent verification of the installation and use of a gas membrane and water barriers for the proposed properties.
- Confirm that there are no risks to groundwater or domestic water supplies both onsite and to neighbouring houses.
- Confirm if any unexpected contamination was encountered during the construction process and whether it was dealt with in accordance with the method provided by EPS RMS.

1.3 Limitations and Constraints

The purpose of this report is to present the findings of a verification exercise conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, Environmental Protection Strategies Ltd (EPS) makes the following statements:

No investigation method is capable of completely identifying all ground conditions that might be present in the soil under a site. Where outlined in our report, we have inspected the ground beneath a site by constructing a number of boreholes and / or trial pits. The locations of these excavations are considered to be representative of the condition of the whole site subsurface however, ground conditions are naturally variable and it may be possible that the ground conditions encountered may differ to those encountered during the investigation.

Where third party data has been consulted during compilation of this report, the validity of any data that has been supplied, and which are included in the report, have been assessed as far as possible by EPS, however EPS cannot guarantee the validity of these data.

EPS Ltd cannot confirm that Japanese Knotweed rhizomes do not exist at the site, this is due to the difficulty of identifying the plant, especially in the early stages of growth. It is recommended that if Japanese Knotweed, (or any other similarly invasive plants,) is suspected to be present, a specialist contractor should be commissioned to make a detailed assessment.

2 SUMMARY OF VERIFICATION WORKS

EPS attended the site on the 12th July 2017 after the completion of the developments and the partial installation of the cover system, gas membrane and water barriers.

2.1 Groundwater and Domestic Water Verification

Due to the risk of contamination being present to controlled waters and their possible migration to off-site receptors, it was agreed with regulators to gather groundwater samples from site and the surrounding area along with water samples from neighbouring taps in order to determine if there are any risk to future site and neighbouring users.

In order to demonstrate this, EPS collected samples from two boreholes in the surrounding area located approximately 50m west labelled BH1 & BH2 and from domestic water supplies at the neighbouring homes of 55 & 57 Broadway.

2.2 Vapour Membrane Installation

In order to prevent any potential ingress of hydrocarbon vapours into the proposed residential buildings from groundwater, a proprietary gas and vapour resistant membrane was recommended by the remedial method statement for the ground floor footprint of Plots 1-4 in order to resist the passage of volatile vapours into the living space above.

EPS was not present during the installation of the gas membrane however, certification of the installation along with appropriate images were asked for from both the client and the company Reeve Tec who supplied and installed the membrane.

2.3 Water Barrier Installation

In order to remove any potential risk of impact to future site users through contaminants affecting domestic water supply pipes, it was recommended that aluminium barrier pipework meeting Water Industry Standard 4-32-19 and associated fittings should be used subject to agreement with the local water company.

To ensure that the correct water barrier pipe was used, EPS ask the client for the proposed water barriers specification and made a physical inspection of the pipe during the site walkover. Photographic evidence of its installation and was also collected.

2.4 Topsoil Verification

The remedial method statement specified that clean imported topsoil should be used in landscaped and garden area for Plot 4 (supported by appropriate chemical analysis), to ensure a suitable growing medium for any plants and to reduce potential risks from low concentrations of Benzo(a)pyrene. The client indicated that impermeable hardstanding would be provided in Plots 1-3 and no special provisions were required for gardens or landscaping in Plot 5 after previous investigations did not encounter any contaminants at levels with potential to pose risks to health in that area.

In order to verify that this work had been completed properly, the relevant plots were inspected and measurements were taken during the site walkover to ensure a suitable thickness of growing medium were present in accordance with the RMS.

2.5 Unexpected Contamination

The RMS also recommended that a watching brief be set up so that any unexpected contamination encountered during the redevelopment work could be dealt with appropriately. It also stated that photographs of open excavations would be collected. A method statement for assessing unexpected contamination was issued to the client which required him to notify EPS of any evidence of contamination found during the excavation phase of the redevelopment work so that appropriate action could be taken. A copy of the method statement supplied to the client can be observed as Appendix A.

In order to determine that this aspect of the work had been followed properly, the EPS engineer asked the client to confirm if any evidence of unexpected or severe contamination has been found during the construction phase and requested copies of any photographs taken during the construction phase.

3 FINDINGS OF VERIFICATION WORKS

3.1 Groundwater and Domestic Water Verification

The concentrations of contaminant in groundwater were measured in off-site groundwater wells and in adjacent property domestic water supplies prior to development and were found to be below the minimum laboratory detection limits for hydrocarbon contaminants. These results were provided under planning in EPS letter report dated 14th April 2016.

A copy of the laboratory results for the samples collected is included in Appendix B for reference.

3.2 Validation of Vapour Membrane Installation

A RTEC 4 reinforced LDPE gas membrane including aluminium foil was installed by the third party company Reeve Tec for all desired plots on the 14th July 2016 and 28th March 2017. Photographic evidence was taken by the installation engineers during these visits and a certificate of handover was supplied. Both of these can be located within Appendix C of this report.

3.3 Validation of Water Barrier Installation

During the investigation walkover and talks with the client it was determined that WIS 4-32-19 'Type A' water barrier pipe was installed across the site. Photographic evidence along with the water pipe specification can be observed as Appendix D.

3.4 Topsoil Verification

3.4.1 Physical Verification of Topsoil Thickness

Plot 1 - This plot had not been surfaced with hardstanding but it had been excavated to a depth of approximately 0.7m below surrounding grade and lined with a concrete skim to create a hardstanding cover over the underlying soils. The client reported that the concrete lined hole was to be filled with clean topsoil.

Plot 2 – This plot had not been surfaced with hardstanding nor had any soil been excavated at the time of the site walkover but the client advised that he would excavate to the same depth as Plot 1 in due course and line it with concrete to create the hardstanding cover required by the RMS. This plot would also then be filled with clean topsoil.

Plot 3 – This plot had been partially infilled with new topsoil at the time of the site walkover. The client advised that he was awaiting more soil to level that area. Measurements taken across this plot indicated that approximately 0.6m of topsoil had been imported and a 0.7m deep concrete lined hole remained to be infilled.

Plot 4 – This plot had been infilled with new topsoil at the time of the inspection and hand augured boreholes were dug to confirm the topsoil layer was at least 0.5m thickness, which was a suitable depth for a growing medium.

Selected site photographs of each plot and a photograph location plan for all plots can be observed as Appendix E.

3.4.2 Soil Quality and Chemical Analysis

Soil used to provide a clean growing medium consisted of both imported soil from a third party and soil moved from Plot 5, which had been investigated previously by EPS and shown not to have contaminants at levels that could pose risks to human health. Both soil types comprised dark brown silty, clayey, loam. The topsoil was provided by the third party company Bardo Midlands Ltd and photographs of the soil delivery notes provided by Mr Ladds are included in Appendix F.

Chemical analysis for the imported topsoil to be lain within Plots 1, 2 and 3 communal garden/landscaped areas was provided by Chemtest Ltd. EPS was not informed of the delivery or testing date of topsoil delivered before its site visit however, the chemical analysis is also included in Appendix F. It was confirmed by that client that the remaining topsoil needed will come from the same source as the one tested by Chemtest Ltd.

3.5 Unexpected Contamination

After being asked by the EPS engineer, the client stated that physical evidence of contamination, such as odour or soil staining was not observed during the construction work and therefore EPS was not contacted during the excavations of the footings across the site.

Photographs of open excavations made during the installation of the footings for the buildings were provided by the client and are included in Appendix G.

4 VERIFICATION STATEMENT

Based on the information obtained by EPS and the information provided by the client described in this report it is concluded that most of the requirements of the RMS have been met, including the installation of gas membranes, provision of suitable barrier pipe for potable water supply and evidence that there were no risks to adjacent properties from contaminated groundwater or domestic water supplies during the development.

However, whilst a form of concrete hardstanding has been installed at Plots 1-3, these areas are intended to be covered by new topsoil and EPS could not confirm the thickness or nature of topsoil at the time of its visit. Provided the topsoil is sourced from the same material tested by Chemtest Ltd, this should be acceptable however it is not clear if this change to the intended controls for these plots would be acceptable to regulators therefore confirmation of this should be sought before further verification is considered.

It is recommended that a copy of this report is provided to the Environmental Health Department of South Holland District Council so that it may be incorporated into their land quality records and to facilitate discharge of associated planning conditions.

FIGURES



Approximate Site Location

Crown Copyright. All rights reserved.
Licence Number: 100054115



Title: Site Location Plan

Project: Former Broadway PFS, Crowland,
PE6 0BH

Fig No: 1

Scale: Not to Scale

Drawn By: FC Approved By: GL

Job No: UK14.1470

Dwg No: Ladds/Broadway/0717/01

Date: July 2017

APPENDIX A

Method Statement for Unexpected Contamination



METHOD STATEMENT FOR FORMER BROADWAY PFS

WATCHING BRIEF AND ACTIONS TO BE TAKEN IN THE EVENT OF DISCOVERING UNEXPECTED CONTAMINATION DURING INTRUSIVE GROUNDWORKS

A watching brief should be maintained throughout any excavation work. This should comprise supervision of all excavations by a nominated engineer who should look for the following:

- 1) Evidence of buried fuel infrastructure such as pipes and tanks.
- 2) Evidence of significant hydrocarbon contamination such as very odorous soil and/or groundwater.
- 3) Evidence of liquid hydrocarbons

If at any point during intrusive groundworks at a site, evidence of this nature or of a different / unforeseen source of contamination is encountered the following actions will be taken:

- Intrusive works in the immediate area of the impacted ground will be suspended and the continuation of work in other areas of the site will be considered within the context of the site specific health & safety plan.
- Environmental Protection Strategies Ltd (EPS) will be contacted and appraised of the situation so that arrangements can be made to characterise the impact and determine what action may be necessary in addition to the scheduled site works. Where possible / health & safety plan permits, digital photographs of the impacted ground will be taken and emailed to EPS at the address below to assist in the initial assessment.
- It may well be necessary for EPS to attend site to undertake visual inspection and obtain samples for field and/or laboratory analysis, although the actions taken will be dependent on the nature of what is encountered.
- In cases where EPS consider the unforeseen contamination is potentially capable of posing an unacceptable risk to adjacent site users or local environmental receptors, the local authority and the Environment Agency will be informed of the situation and the actions being taken.
- Once appropriate action has been agreed and undertaken, a written summary will be produced by EPS for submission to the Local Authority, (and where relevant, the Environment Agency) in accordance with planning requirements. The submission will include details of work undertaken, analytical results of investigative and verification samples obtained and conclusions and recommendations for any further actions considered necessary.
- Where regulatory bodies have been involved, site works should only recommence following their agreement and in all cases should only recommence when the site manager considers it safe to do so within the context of the site specific health & safety plan.

EPS Contact Details:

Giles Lock	Director	Tel: 0781 253 9656
Will Evans	Director	Tel: 0781 253 9655
Steve Bullock	Director	Tel: 0786 694 9221

Email: info@epstrategies.co.uk (Automatically forwarded to the above and office based personnel.)

APPENDIX B

Laboratory Results of Neighbouring Domestic Water Supplies



Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA, UK

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Attention : Rory Griggs
Date : 15th February, 2016
Your reference : UK14.1470
Our reference : Test Report 16/4669
Location : Crowlands
Date samples received : 9th February, 2016
Status : Final report
Issue : 1

Five samples were received for analysis on 9th February, 2016 of which five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Bruce Leslie
Project Co-ordinator

Client Name: EPS Ltd
 Reference: UK14.1470
 Location: Crowlands
 Contact: Rory Griggs
 JE Job No.: 16/4669

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
 H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HNO₃

J E Sample No.	1-3	4-6	7-9	10-12	13-15						Please see attached notes for all abbreviations and acronyms		
Sample ID	BH1	BH1a	BH2	House 55 Mains	House 57 Mains								
Depth													
COC No / misc													
Containers	V G	V G	V G	V G	V G								
Sample Date	05/02/2016	05/02/2016	05/02/2016	05/02/2016	05/02/2016								
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water								
Batch Number	1	1	1	1	1								
Date of Receipt	09/02/2016	09/02/2016	09/02/2016	09/02/2016	09/02/2016						LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
>C6-C8 #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
>C8-C10 #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
>C10-C12 #	<5	<5	<5	<5	<5						<5	ug/l	TM5/PM30
>C12-C16 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
>C16-C21 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
>C21-C35 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
Total aliphatics C5-35 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/TM36/PM30
Aromatics													
>C5-EC7 #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
>EC7-EC8 #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
>EC8-EC10 #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
>EC10-EC12 #	<5	<5	<5	<5	<5						<5	ug/l	TM5/PM30
>EC12-EC16 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
>EC16-EC21 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
>EC21-EC35 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
Total aromatics C5-35 #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
Total aliphatics and aromatics(C5-35) #	<10	<10	<10	<10	<10						<10	ug/l	TM5/TM36/PM30
MTBE #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
Benzene #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
Toluene #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
Ethylbenzene #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
m/p-Xylene #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12
o-Xylene #	<5	<5	<5	<5	<5						<5	ug/l	TM36/PM12

Matrix : Liquid

[illegible]

Client Name: EPS Ltd
Reference: UK14.1470
Location: Crowlands
Contact: Rory Griggs

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/4669

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (UKAS) accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/4669

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes			

APPENDIX C

Certification and Images of Gas Membrane Installation

CERTIFICATE OF HANDOVER

PROJECT: Broadway

CUSTOMER: J.L.A.

DATES/DURATION OF VISIT:

DATE: 14.7.2016 VISIT No: 1

AREA/PLOT COMPLETED:
(State if work was perimeter, infill or gridlines)

+ Completed full perimeter + internal wall detail
using polythene vapour membrane

+ Sealed all cracks using mastic

+ All sealed + heated using heater

PENETRATIONS QUANTITIES

Pipes less than 130mm..... <u>8</u>	Lift pits wrapped.....
Pipes more than 130mm.....	Manhole lids.....
Ducts (state size).....	Piles.....
Steel columns.....	Thresholds.....
Periscope vents.....	Drainage hangers (self adhesive).....
Starter bars.....	Self adhesive to concrete etc.....
Battening m.....	P.S.Hooks.....
Wall ties.....	Corners..... <u>8</u>

We confirm that we have inspected the works carried out by Reeve-Tec Membranes Ltd and are satisfied that the condition and scope of works ordered has been executed in accordance with the Sub-Contract order and Specification.

REEVE-TEC SITE FOREMAN (PRINT NAME): C. Stanton

SIGNATURE: C. Stanton

CUSTOMER'S SITE MANAGER (PRINT NAME):

SIGNATURE:

CERTIFICATE OF HANDOVER

PROJECT: Convent

CUSTOMER: ICA

DATES/DURATION OF VISIT:

DATE: 28.3.2017 VISIT No:

AREA/PLOT COMPLETED: 1-3
(State if work was perimeter, infill or gridlines)

* Completed All linear to plots using Voc membrane

* Spaced on access only over tank

* All tanks using laser welder

PENETRATIONS QUANTITIES

Pipes less than 130mm.....	Lift pits wrapped.....
Pipes more than 130mm.....	Manhole lids.....
Ducts (state size).....	Piles.....
Steel columns.....	Thresholds.....
Periscope vents.....	Drainage hangers (self adhesive).....
Starter bars.....	Self adhesive to concrete etc.....
Battening m.....	P.S.Hooks.....
Wall ties.....	Corners.....

We confirm that we have inspected the works carried out by Reeve-Tec Membranes Ltd and are satisfied that the condition and scope of works ordered has been executed in accordance with the Sub-Contract order and Specification.

REEVE-TEC SITE FOREMAN (PRINT NAME): C. Storker

SIGNATURE: C. Storker

CUSTOMER'S SITE MANAGER (PRINT NAME): Mr. Ladd

SIGNATURE: [Signature]

Photo 1: Image of gas membrane being installed within plot 3	Photo 2: Image of gas membrane being installed within plot 3
	
Photo 3: Image of gas membrane being installed within unknown plot	Photo 4: Image of gas membrane being installed within unknown plot
	

Photo 5: Image of gas membrane being installed within unknown plot	Photo 6: Image of gas membrane being installed within unknown plot
	
Photo 7: Image of gas membrane being installed within unknown plot	Photo 8: Image of gas membrane being installed within unknown plot
	

APPENDIX D

Water Barrier Specification and Images



RADIUS
Systems

Puriton® barrier pipe and fittings system

Protecting drinking water through contaminated land



March 2017



Puriton®

Barrier pipe & fittings system

The barrier pipe system of choice for your new or replacement drinking water supply, Puriton® is a cutting edge solution for the safe distribution of drinking water through contaminated land.

Designed to provide a high level of protection against soil contaminants commonly found in brownfield sites, Puriton® is a multi-layer composite structure pipe, which combines the unique characteristics of polyethylene (PE) with the exceptional barrier properties of aluminium (Al).

Lightweight, flexible and corrosion resistant, the Puriton® system is easy to install, without the need to post-wrap the finished joints. The pipe can be joined using most industry standard installation techniques with our comprehensive range of electrofusion and mechanical fittings, which have been specifically developed to give you assurance of a safe and durable solution which provides protection to your drinking water through contaminated land.

Benefits of the Puriton® system

- Multi-layer pipe construction PE-Al-PE
- Brown stripes denote a multi-layer pipe
- Full barrier pipe system
- Combines the flexibility of polyethylene with the barrier properties of aluminium
- Safeguards drinking water quality
- Easy to handle, flexible and lightweight
- End load resistant system
- Installation cost savings - no requirement for thrust blocks
- No requirement to post-wrap the joints
- Suitable for most common installation techniques
- Suitable for new and replacement drinking water supply systems

Approvals

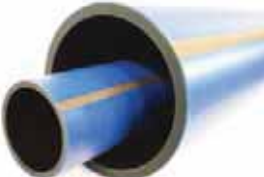
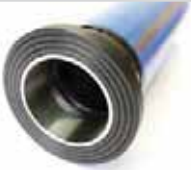
- Polyethylene pipe material approved for use in drinking water supply
- WIS 4-32-19 (KM 592372)
 - 25 to 63 mm PE80 pipe
 - 90 to 180 mm PE100 pipe
- BS EN 12201-3 (KM 597648)
 - Electrofusion fittings 90 to 180 mm
- WRAS
 - PE material for 25 to 63 mm pipe



WIS 4-32-19 (KM 592372) Puriton® jointing methods

- Puriton® electrofusion fittings
- Butt-fusion in accordance with WIS 4-32-08 and Radius Systems' installation guide
- Puriton® plastic mechanical fittings
- Puriton® gun metal tapping tees
- Redman™ fittings

Puriton® range at a glance

Description	Diameter	Maximum pressure	Material(s)	Joining
Service pipe				
	• 25, 32, 63 mm	• 12.5 bar - SDR11	• PE80 • Aluminium	• Puriton® mechanical fittings • Redman™ fittings (63 mm) • Tapping tee (63 mm) • Spigot fitting (63 mm)
Mains pipe				
	• 90, 110, 125, 160, 180 mm	• 10 bar - SDR17 • 16 bar - SDR11	• PE100 • Aluminium	• Electrofusion fittings • Redman™ fittings • Spigot fittings • Tapping tee
Mechanical fittings				
	• 25, 32, 63 mm	• 12.5 bar	• Polypropylene	• Puriton® service pipe
Electrofusion fittings				
	• 90, 110, 125, 160, 180 mm	• 16 bar	• Polyethylene	• Puriton® mains pipe
Redman™ fittings				
	• 63 mm • 90, 110, 125, 160, 180 mm	• 12.5 bar • 16 bar	• Steel insert • Steel and copper outer shell	• Puriton® service pipe (63 mm) • Puriton® mains pipe
Tapping tees				
	• 63 - 180 mm x 25 mm • 63 - 180 mm x 32 mm	• 12.5 bar • 12.5 bar	• Gun metal body • Polypropylene outlet	• Puriton® service pipe (63 mm) • Puriton® mains pipe
Spigot fittings				
	• 63 mm PE80 - SDR11 • 90 mm PE100 - SDR11 • 90 - 180 mm PE100 - SDR17	• 12.5 bar • 16 bar • 10 bar	• Polyethylene with stainless steel insert	• Puriton® service pipe (63 mm) • Puriton® mains pipe

Puriton® service pipe

WIS 4-32-19 'Type A' pipe

Available in diameters 25 to 63 mm, our Puriton® service pipe is manufactured from a black PE80 core, protected by an aluminium barrier layer and a light blue PE80 external skin with brown stripes.

Available in coils and in straight lengths for the 63 mm pipe, our Puriton® service pipe is quick and easy to join without surface preparation, using our range of cutting edge mechanical fittings and Redman™ fittings for our 63 mm pipe.



Pipe dimensions

Nominal diameter mm	Materials	SDR	Pressure rating bar	Core pipe external diameter mm	Core pipe wall thickness mm	Internal diameter mm	External diameter (including skin) mm	Pipe weight kg/m	Pipe length m	Product code
25	PE80/Al	11	12.5	25.0 - 25.3	2.3 - 2.7	19.6 - 20.7	27.0 - 27.6	0.3	50	XQ2528
32	PE80/Al	11	12.5	32.0 - 32.3	3.0 - 3.4	25.2 - 26.3	34.0 - 34.6	0.5	50	XQ2535
63	PE80/Al	11	12.5	63.0 - 63.4	5.8 - 6.5	50.0 - 51.8	64.8 - 65.8	1.3	6	XQ2568
									50	XQ2571
									100	XQ2572



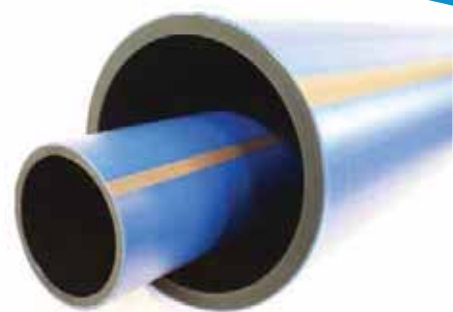
Pipe coil dimensions

Nominal diameter mm	SDR	Pressure rating bar	Coil inner diameter mm	Coil outer diameter mm	Coil width mm	Coil length m	Coil weight kg
25	11	12.5	785	965	175	50	14.2
32	11	12.5	785	1015	175	50	23.4
63	11	12.5	1275	1815	208	50	67.1
			1275	1815	310	100	134.1

Puriton® mains pipe

WIS 4-32-19 'Type A' pipe

Available in diameters 90 to 180 mm, our Puriton® mains pipe is manufactured from a black PE100 core, protected by an aluminium barrier layer and a dark blue PE100 external skin with brown stripes. Our Puriton® mains pipes are joined using our range of approved state of the art Redman™ fittings and electrofusion fittings detailed within this brochure.



Pipe dimensions

Nominal diameter mm	Materials	SDR	Pressure rating bar	Core pipe external diameter mm	Core pipe wall thickness mm	Internal diameter mm	External diameter (including skin) mm	Pipe weight kg/m	Pipe length m	Product code
90	PE100/Al	11	16	90.0 - 90.6	8.2 - 9.2	71.6 - 74.2	92.0 - 93.6	2.6	6	XQ0125
									12	XQ0126
									50	XQ0128
									100	XQ0129
90	PE100/Al	17	10	90.0 - 90.6	5.4 - 6.1	77.8 - 79.8	92.0 - 93.6	1.9	6	XQ0143
									12	XQ0145
									50	XQ0146
									100	XQ0147
110	PE100/Al	17	10	110 - 110.7	6.6 - 7.4	95.2 - 97.5	112.0 - 113.7	2.7	6	XQ0251
									12	XQ0253
									50	XQ0254
									100	XQ0255
125	PE100/Al	17	10	125.0 - 125.8	7.4 - 8.3	108.4 - 111.0	127.0 - 128.8	3.4	6	XQ0305
									12	XQ0307
									50	XQ0308
									100	XQ0309
160	PE100/Al	17	10	160.0 - 161.0	9.5 - 10.6	138.8 - 142.0	162.0 - 164.0	5.3	6	XQ0476
									12	XQ0478
									50	XQ0479
									100	XQ0480
180	PE100/Al	17	10	180.0 - 181.1	10.7 - 11.9	156.2 - 159.7	182.0 - 184.1	6.6	6	XQ0550
									12	XQ0552
									50	XQ0554
									100	XQ0555

Pipe coil dimensions

Nominal diameter mm	SDR	Pressure rating bar	Coil inner diameter mm	Coil outer diameter mm	Coil width mm	Coil length m	Coil weight kg
90	11	16	1800	2220	320	50	130.0
	11	16	1800	2440	410	100	260.0
90	17	10	2500	2930	320	50	95.0
	17	10	2500	3000	410	100	190.0
110	17	10	2500	3000	400	50	136.0
	17	10	2500	3200	500	100	272.0
125	17	10	2500	3000	450	50	169.0
	17	10	2500	3200	600	100	338.0
160	17	10	3000	3590	530	50	266.0
	17	10	3000	3850	700	100	532.0
180	17	10	3000	3800	630	50	330.5
	17	10	3000	4000	800	100	661.0

To ensure that the barrier properties of the Puriton® system are maintained, Puriton® fittings must be used with Puriton® pipe. The use of non Puriton® fittings may compromise the barrier properties of the system.

Puriton® fittings

Mechanical fittings

Quick and easy to install, our range of Puriton® mechanical fittings for service pipes are manufactured from polypropylene and supplied with integral inserts, grip rings and O-ring seals for maximum contamination protection. The system is easy to construct with no requirement for pipe surface preparation and no need to post-wrap the joint after installation.

Fitting diameter	25 mm	32 mm	63 mm
Grip ring colour	Blue	Blue	Grey
Insert colour	Black	Black	White



Couplers



Diameter mm	Pack quantity	Product code
25	1	XR5244
32	1	XR5245
63	1	XR5251

Equal tees



Diameter mm	Pack quantity	Product code
25	1	XR5247
32	1	XR5248
63	1	XR5253

90° elbows



Diameter mm	Pack quantity	Product code
25	1	XR5249
32	1	XR5250
63	1	XR5252

Reducers



Diameter mm	Pack quantity	Product code
32 x 25	1	XR5246
63 x 25	1	XR5257
63 x 32	1	XR5254

Female adaptors



Diameter mm	Pack quantity	Product code
25 x ¾"	1	XR5240
32 x ¾"	1	XR5241
32 x 1"	1	XR5242
63 x 2"	1	XR5260

Male adaptors



Diameter mm	Pack quantity	Product code
25 x ¾"	1	XR5235
32 x ¾"	1	XR5236
32 x 1"	1	XR5237
63 x 1½"	1	XR5258
63 x 2"	1	XR5259

C ring wrenches



Pipe diameter	Pack quantity	Product code
25-32 mm	1	XR4998
63 mm	1	XR4999

Redman™ fittings

Simple and quick to install with little pipe preparation, the Redman™ joint is made by pressurising the outer shell of the fitting using a dedicated hydraulic pump. Once made, our Redman™ fitting provides a 'fit and forget' end-load-bearing joint. Available in diameters 63 mm to 180 mm, the fittings are colour coded black for Puriton® pipe*. They are supplied ready to install with the appropriate number of outer shells and inserts, offering full corrosion resistance and barrier protection against contamination to your potable water.



Couplers



Diameter mm	Pipe SDR	Pack quantity	Product code
63	11	1	RE0001
90	11	1	RE0002
90	17	1	RE0009
110	17	1	RE0010
125	17	1	RE0005
160	17	1	RE0007
180	17	1	RE0047

Repair couplers



Diameter mm	Pipe SDR	Pack quantity	Product code
63	11	1	RE0065
90	11	1	RE0064
90	17	1	RE0067
110	17	1	RE0069
125	17	1	RE0071
160	17	1	RE0078
180	17	1	RE0080

45° elbows



Diameter mm	Pipe SDR	Pack quantity	Product code
63	11	1	RE0032
90	11	1	RE0033
90	17	1	RE0034
110	17	1	RE0036
125	17	1	RE0038
160	17	1	RE0040
180	17	1	RE0045

90° elbows



Diameter mm	Pipe SDR	Pack quantity	Product code
63	11	1	RE0011
90	11	1	RE0012
90	17	1	RE0013
110	17	1	RE0015
125	17	1	RE0017
160	17	1	RE0019
180	17	1	RE0021

* Outer shells are coloured blue for 63 mm fittings

Redman™ fittings

Flange adaptors



Diameter mm	Pipe SDR	Pack quantity	Product code
63 x DN50	11	1	RE0073
63 x DN80	11	1	RE0083
90 x DN80	11	1	RE0074
90 x DN80	17	1	RE0075
110 x DN100	17	1	RE0077
125 x DN100	17	1	RE0079
160 x DN150	17	1	RE0081
180 x DN150	17	1	RE0089

Flange drilling BS 4504 NP16. Supplied with galvanised iron backing ring. Nuts, bolts, washers and gaskets not supplied.

* Outer shells are coloured blue for 63 mm Redman fittings

Adaptors



Diameter mm	Pipe SDR	Pack quantity	Product code
63 x 1½" BSPF/2" BSPM	11	1	RE0123

Tooling

Hydraulic pump



Description	Pack quantity	Product code
Redman hydraulic pump	1	XR0211

Hydraulic oil



Description	Pack quantity	Product code
Biodegradable hydraulic oil for Redman pump - 5 litres	1	XR0212

For calibration and servicing of the Redman™ hydraulic pump, contact Fluidlink:
t: +44(0)1249 818555
w: www.fluidlink.co.uk.

Electrofusion Fittings

Available in diameters 90mm to 180mm, our range of Puriton® electrofusion fittings are manufactured from high strength black PE100. The fittings are welded in a single fusion operation using a 40V electrofusion control unit and when correctly installed in accordance with Radius Systems' guidance, there is no requirement to post-wrap the joint.

For guidance on the correct preparation of Puriton® pipe for electrofusion jointing, please visit our website:
www.radius-systems.com



Couplers



Diameter mm	Pack quantity	Product code 4.7 mm pin	Product code 4.0 mm pin
90	1	WA0010	WA0210
110	1	WA0011	WA0211
125	1	WA0012	WA0212
160	1	WA0014	WA0214
180	1	WA0015	WA0215

Equal tees



Diameter mm	Pack quantity	Product code 4.7 mm pin	Product code 4.0 mm pin
90	1	WA2010	WA2210
110	1	WA2011	WA2211
125	1	WA2012	WA2212
160	1	WA2014	WA2214
180	1	WA2015	WA2215

45° elbows



Diameter mm	Pack quantity	Product code 4.7 mm pin	Product code 4.0 mm pin
90	1	WA3068	WA3318
110	1	WA3069	WA3319
125	1	WA3070	WA3320
160	1	WA3072	WA3322
180	1	WA3073	WA3323

90° elbows



Diameter mm	Pack quantity	Product code 4.7 mm pin	Product code 4.0 mm pin
90	1	WA3097	WA3347
110	1	WA3098	WA3348
125	1	WA3099	WA3349
160	1	WA3101	WA3351
180	1	WA3102	WA3352

Reducers



Diameter mm	Pack quantity	Product code 4.7 mm pin	Product code 4.0 mm pin
110 x 90	1	WA4036	WA4286
125 x 90	1	WA4039	WA4289
125 x 110	1	WA4041	WA4291
160 x 110	1	WA4044	WA4294
180 x 125	1	WA4047	WA4297

Service pipe off-take connections

Radius Systems offer a dedicated range of gunmetal tapping tee service off-takes, which incorporates a unique stainless steel sleeve. As part of the tapping operation, the sleeve is swaged into the pipe wall, sealing the aluminium barrier layer from contact with the water supply. A 25 or 32mm mechanical outlet is fitted to enable the service pipe to be connected.



Tapping tees

Diameter mm	Pack quantity	Product code
63 x 25	1	XR5111
90 x 25	1	XR5112
110 x 25	1	XR5113
125 x 25	1	XR5114
160 x 25	1	XR5115
180 x 25	1	XR5116
63 x 32	1	XR5117
90 x 32	1	XR5118
110 x 32	1	XR5119
125 x 32	1	XR5120
160 x 32	1	XR5121
180 x 32	1	XR5122



Ferrule adaptors

Diameter mm	Pack quantity	Product code
25 x 3/4"	1	XR5055

Spigot fittings

Our Puriton® flange adaptors have been specifically designed with an internal stainless steel insert, which provides barrier properties to the polyethylene stub flange. The insert is fitted during the manufacturing process.



Flange adaptors

Diameter mm	SDR	Pack quantity	Product code
63 x DN80	11	1	XR0290
90 x DN80	11	1	XR0291
90 x DN80	17	1	XR0300
110 x DN100	17	1	XR0303
125 x DN100	17	1	XR0301
160 x DN150	17	1	XR0304
180 x DN150	17	1	XR0302

Flange drilling BS 4504 NP16. Supplied with Rilsan coated backing ring. Nuts, bolts and gaskets are not supplied.

Tooling

Tapping tee T key

Description	Pack quantity	Product code
3/8" T key	1	XR0215



To ensure that the barrier properties of the Puriton® system are maintained, only Puriton® fittings must be used with Puriton® pipe. The use of non Puriton® fittings may compromise the barrier properties of the system.

Joining guidance

The Puriton® pipe system has been developed for ease of joining with a range of fittings specifically designed to suit the pipe type. Minimal pipe surface preparation is required when using our mechanical or Redman™ fittings. However, pipe surface preparation is mandatory when joining Puriton® pipe using electrofusion or butt-fusion techniques.

To ensure that the barrier properties of the Puriton® system are maintained, only Puriton® fittings must be used with Puriton® pipe. The use of non Puriton® fittings may compromise the barrier properties of the system.

Pipe joining methods and pipe surface preparation requirements

Pipe diameter (mm)	25	32	63	90	110	125	160	180
Mechanical compression fittings	●	●	●					
Redman™ hydraulic fittings			●	●	●	●	●	●
Electrofusion				●	●	●	●	●
Butt-fusion				●	●	●	●	●
Gun metal tapping tee			●	●	●	●	●	●

- No pipe surface preparation required. Ensure the pipe outer surface is clean and free from damage
- Pipe surface preparation mandatory

When joining Puriton® pipe in diameters 90 to 180 mm using electrofusion or butt-fusion joining techniques, pipe surface preparation is mandatory. Dedicated equipment has been designed to locally remove the outer polyethylene and aluminium barrier layers. This equipment is available for sale or hire from the suppliers below:

- Caldervale Technology www.caldertech.co.uk
- PSS Hire www.psshire.com
- Hy-Ram www.hynam.com
- MCA-Fusion Hire www.mcafusionhire.co.uk



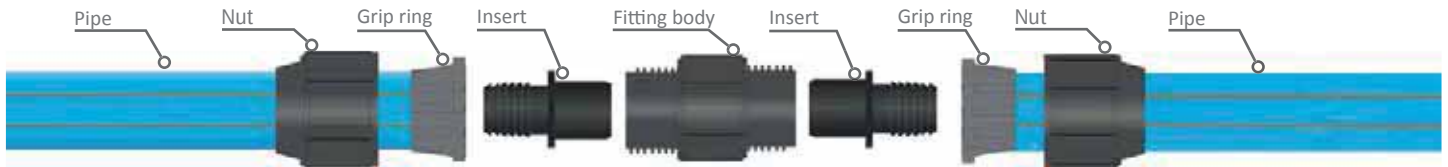
Rotary pipe surface preparation tools

Joining overview

Mechanical fitting - coupler joining overview



Please follow full joining procedures before making a joint.
Visit our website:
www.radius-systems.com.



Ensure the pipe is cut square and damage free. Re-round if necessary. Slide the nut and grip ring on the pipe



Using a rubber mallet, gently tap the insert fully into the pipe end



Push the pipe fully into the body of the fitting



Slide the grip ring so it is flush with the pipe end



Hand tighten the nut onto the body of the fitting



Repeat steps 1 to 4 for the second pipe to be joined



Using C ring wrenches fully tighten the nuts onto the body of the fitting



The joint is complete. Carry out a water industry approved joint pressure test to check for leak-tightness.

Redman™ fittings - coupler joining overview



Ensure the pipe is cut square and damage free. Re-round if necessary. Slide the outer shell over the pipe and push the insert into the pipe end



Fit the second pipe onto the insert. Ensure that both pipes are pushed up to the insert stop



Slide the outer shell over both pipes, ensuring it is centralised over the two pipes



Using the Redman™ pump, pressurise the fitting following Radius Systems' pressurisation procedure on our website:
www.radius-systems.com.

Operate the pump at a safe distance away from the joint, using the full length of the hose. Do not touch the fitting or the pipe during the pressurisation & de-pressurisation processes.

Electrofusion fittings - coupler jointing overview

Pipe preparation is mandatory before carrying out an electrofusion joint. A 2-pass pipe surface preparation process is required for electrofusion jointing of Puriton® pipes. Please follow full jointing procedure before making a joint. Visit our website www.radius-systems.com for more details.

			
Ensure the pipe is cut square and damage free. Measure and mark the fitting insertion depth on the pipe	Select the correct size tooling for the pipe diameter and cutting blade and carry out the first pass of the pipe surface preparation	Rotate the tool anti-clockwise, to remove the outer PE and aluminium layers up to the fitting insertion depth mark	Select the standard pipe preparation blade to carry out the second pass of the pipe surface preparation
			
Rotate the tool continuously in an anti-clockwise direction. This will remove a continuous layer of polyethylene swarf	Place the fitting on the pipe end	Repeat the pipe surface preparation for the second pipe to be joined and fully insert into the fitting	Fit alignment clamps and follow industry best practice to fuse the joint.

Butt-fusion jointing overview

Pipe preparation is mandatory before carrying out a butt-fusion joint. A 2-pass pipe surface preparation process is required for butt-fusion jointing of Puriton® pipes. Please follow full jointing procedure before making a joint. Visit our website www.radius-systems.com for more details.

			
Mark the minimum pipe preparation distance using the Puriton® butt-fusion gauge	Select the correct size tooling for the pipe diameter and cutting blade and carry out the first pass of the pipe surface preparation	Rotate the tool anti-clockwise, to remove the outer PE and aluminium layers up to the fitting insertion depth mark	Select the standard pipe preparation blade to carry out the second pass of the pipe surface preparation

(Cont...)

Butt-fusion jointing overview (Cont...)



Rotate the tool continuously in an anti-clockwise direction. This will remove a continuous layer of polyethylene swarf



Check the correct pipe surface distance using the Puriton butt-fusion gauge. Prepare the second pipe following steps 1 to 5



Follow water industry standard butt-fusion procedure. Program the butt-fusion unit with the correct pipe parameters



Finished joint. Remove the external bead and perform a bend back test to assess the joint quality.

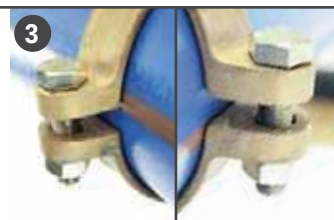
Tapping tee jointing overview



Place the O-ring into the recess of the tapping tee base and place the fitting onto the main



Equally tighten the nuts on both sides of the tapping tee



Ensure the distances between the 'lugs' are identical and parallel on both sides



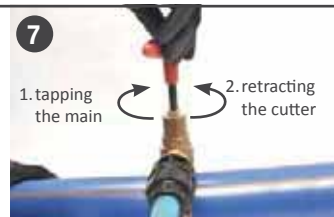
Carry out the service pipe connection to the tapping tee outlet following the jointing overview on page 11



Using C ring wrenches fully tighten the nuts onto the tapping tee outlet



Using a 3/8" T key, remove the tapping tee dust cap and seal



1. Tapping the main
Use a hexagonal 3/8" T key and turn in a clockwise direction. The cutter must come to a definite stop.
2. Retracting the cutter
Turn the T key in an anti-clockwise direction. The cutter will come to a definite stop at the top of the system



Replace the dust cap and tighten. The connection is complete.

Carry out a water industry approved joint pressure test to check for leak-tightness.



? Why are there 2 different polyethylene pipe materials used within the range of Puriton® pipes?

To maintain the current industry convention that PE80 materials are used for small diameter service pipes and PE100 materials are used for mains pipes:

- Puriton® pipes in diameters 25, 32 and 63 mm are manufactured from a PE80 black inner core and a light blue PE80 outer
- Puriton® pipes in diameters 90 to 180 mm are manufactured from a PE100 black inner core and a dark blue PE100 outer.

? When referring to barrier pipe systems, what does the term 'Type A' refer to?

The term 'Type A' is defined within Water Industry Specification 4-32-19, and refers to pipes 'where one or more of the polymer layers form a core pipe which is designed to bear the stress associated with the hydrostatic pressure', the outer aluminium and protective polyethylene layers do not add to the pipe's internal pressure resistance.

? Are the dimensions of Puriton® pipes the same as those of conventional SDR11 and SDR17 pipes?

Puriton® pipe being 'Type A', its overall wall thickness exceeds the requirements of BS EN 12201 for SDR11 and SDR17 pipes.

The dimensions of the black core pipe meet the requirements of BS EN 12201-2, to which the aluminium and outer protective polyethylene layers are added, which increases the wall thickness and the outer diameter over conventional polyethylene pipes to BS EN 12201.

? What are the pressure ratings of Puriton® pipes?

Puriton® pipe maximum operating pressures:

- PE80 SDR11 service pipe 25 to 63 mm: 12.5 bar
- PE100 SDR11 mains pipe 90 mm: 16 bar
- PE100 SDR17 mains pipe 90 to 180 mm: 10 bar

? What are the recommended jointing techniques for Puriton® service pipes?

For ease of installation, Radius Systems offer a range of mechanical fittings in diameters 25, 32 and 63 mm. In addition, for 63 mm diameter pipe our Redman™ hydraulic compression fittings range can be used.

? What are the recommended jointing techniques for Puriton® mains pipes?

For Puriton® pipes in diameters 90, 110, 125, 160 and 180 mm the following jointing techniques are recommended:

- Redman™ hydraulic compression fittings.
- Butt-fusion jointing
To maintain the barrier properties of the system this method of jointing must be undertaken in accordance with the Radius Systems' jointing procedure.
- Electrofusion jointing
To maintain the barrier properties of the system only the Radius Systems' electrofusion fittings identified within the Puriton® product range are recommended. The jointing method must be undertaken in accordance with the Radius Systems' jointing procedure.
- When making either a butt-fusion or an electrofusion joint onto Puriton® pipe, both the outer polyethylene and aluminium layers must be locally removed using the tooling recommended by Radius Systems. Care must be taken to ensure that additional external material is not removed.

? Where can I find detailed jointing instructions for the system?

Jointing instructions in PDF format and videos are available to download from the Radius Systems' website: www.radius-systems.com. The jointing instructions for the mechanical fittings, Redman™ fittings and the tapping tees are also included in the fittings' packaging.

? How do I connect 90 mm Puriton® pipe to 63 mm Puriton® pipe?

63 mm and 90 mm Puriton pipes are joined together using a 63 mm and a 90 mm Redman™ flange adaptor.

? When I have made a joint or connection onto Puriton® pipe using Puriton® fittings and following Radius Systems' Puriton® jointing guidance, do I need to wrap the joint with an additional aluminium or protective barrier tape?

There is no requirement to wrap the Puriton® joints with additional aluminium or protective barrier tape, when the joints have been made using Puriton® fittings and when following Radius Systems' Puriton® jointing guidance. Radius Systems have evaluated and approved their Puriton® jointing systems without the use of additional aluminium and protective barrier tape.

? Can I use fittings from other manufacturers with Puriton pipe

Radius Systems only recommend the use of Puriton® fittings with Puriton® pipe, to ensure that the barrier properties of the Puriton® system are maintained. The use of non Puriton® fittings may compromise the barrier properties of the system.

? What are the recommended installation techniques for Puriton® pipe?

Puriton® pipe is typically installed using the open-cut technique. However, alternative techniques like 'slip lining' and 'horizontal directional drilling' can be used. Particular care must be taken to ensure that the outer polyethylene layer is not damaged to an extent that the aluminium barrier is exposed. This will compromise the barrier properties of the pipe.

? When installing a Puriton® pipe, what should I do if the outer polyethylene layer becomes damaged and the aluminium layer is exposed?

To maintain the integrity of the aluminium layer and the barrier properties of the system, we recommend that the damaged pipe is removed and replaced with undamaged pipe.

? Do I need to use a PTFE thread tape for the male threaded connection when using mechanical fittings and the Redman™ 63 x 1½" BSPF/2" BSPM fitting?

To ensure that the system is leak-tight, only WRAS approved PTFE thread tape should be used.

? Who can I contact if I have additional product or technical queries on the Puriton® system?

If you have additional questions relating to our Puriton® pipe, please contact Radius Systems' Sales or Technical Support teams:

Sales:
t: +44 (0)1773 811112
e: sales@radius-systems.com

Technical support:
t: +44 (0)1773 811112
e: techsupport@radius-systems.com

Radius Systems

Radius Systems are a market leader in the innovation and manufacture of plastic pipe systems for the utilities and construction industries. With extensive research and development at the heart of our products and systems, we take care of the entire pipe life cycle - from design and manufacture through to installation, repair and rehabilitation. We strive to improve industry practices, with good health and safety policies at the forefront of our philosophy of 'getting it right first time'. Our continuous customer inspired research and development, combined with successful customer partnerships represent our total dedication to the plastic piping industry.

○ Manufacturing facilities

With 2 production sites in the UK, we have complete control over quality and the ability to meet the expectations of our customers

○ Innovative approach

We are leaders in our field with a history of research and new product development. Practicality, durability and adaptability are all high on our agenda to meet our clients' needs

○ Flexible product and service provision

Our comprehensive range of services is designed to fit the variable demands of our clients' developments in pipes, fittings, training and support services

○ Reliability and safety

With over 40 years experience of design and manufacture, our clients know that they can count on us to meet not just their product and service needs, but also their delivery and safety requirements

○ Outstanding customer service

We have a dedicated Customer Services team to answer queries from our customers in the UK and overseas. Our service is not just about the delivery of products - contact our team if you have a product or installation enquiry or a post-delivery query



For more information please visit our website:
www.radius-systems.com or contact us:

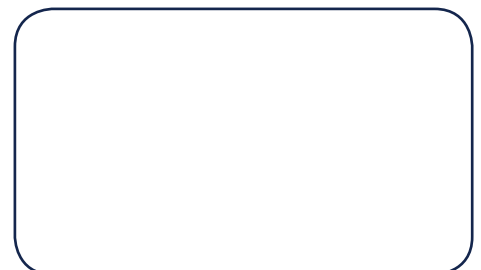
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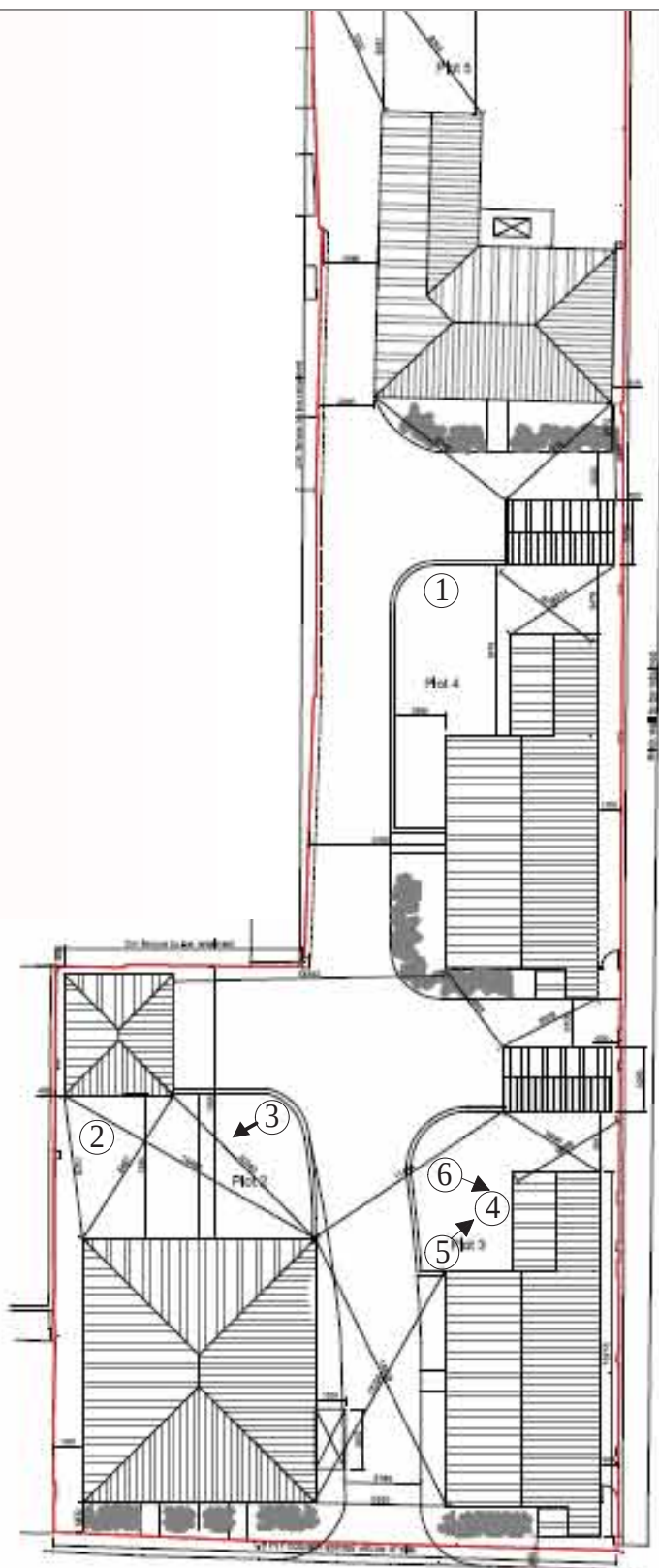
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Photo 1:Image displaying the water barrier pipe has been installed below ground level	Photo 2:Image of the water barrier pipe
	
Photo 3:Image of water barrier pipe outside the front of Plot 2	Photo 4: Image of water barrier pipe along the front of plot 1 & plot 2
	

APPENDIX E

Selected Site Photographs Obtained During and Following Completion of Topsoil Installation



Key



Approximate Photograph
Locations & Directions



Approximate Site Boundary



Title: Photograph Location Plan

Project: Former Broadway PFS, Crowland
PE6 0BH

Appendix: D

Scale: Not to Scale

Drawn By: FC Approved By: GL

Job No: UK14.1470

Dwg No: Ladds/Broadway/0717/D

Date: July 2017

Photo 1: Image of the measured thickness of topsoil imported to Plot 4



Photo 2: Image of concrete lined hole prepared to receive soil for Plot 1



Photo 3: Image of plot one in the background and Plot 2 in the foreground



Photo 4: Image indicating the depth of concrete lined hold ready to receive imported topsoil in Plot 3



Photo 5:Image of plot 3



Photo 6:Image of plot 3 from the southern boundary



APPENDIX F

Delivery Notes & Chemical Analysis for Imported Material

Chemtest Job No.: 17-01445
Chemtest Sample ID.: 401755

Client Sample Ref.: SWS1

Client Sample ID.: Screened

Top Depth (m): 0.1

Bottom Depth (m): 0.5

Date Sampled:

Time Sampled:

Parameter	Units	Multipurpose Range	Result	Compliant with Multipurpose Range? (Y/N)	Compliant with Specific Purpose Range? (Y/N)		
Texture					Acid	Low F	Calc.
Clay content	%		8.1				
Silt content	%		15				
Sand content	%		77				
Soil texture class		See Attached Chart	Sandy Loam	YES			
Mass Loss on Ignition							
Clay 5-20%		3.0-20	4.9	YES	YES	YES	YES
Clay 20-35%		5.0-20					
Stone Content	% m/m						
>2mm		0-30	43	NO			
>20mm		0-10	< 0.020	YES			
>50mm		0	< 0.020	YES			
Soil pH value		5.5-8.5	[A] 6.1	YES	NO	YES	NO
Carbonate (Calcareous only)	%		< 0.10				NO
Electrical Conductivity	µS/cm	If >3300 do ESP	[A] 2300	YES			
Available Nutrient Content							
Nitrogen %		>0.15	0.96	YES	YES		YES
Extractable phosphorus	mg/l	16-140	5.2	NO	NO	YES	NO
Extractable potassium	mg/l	121-1500	360	YES	YES		YES
Extractable magnesium	mg/l	51-600	210	YES	YES		YES
Carbon : Nitrogen Ratio		<20:1	3.0/1	YES	YES	YES	YES
Exchangeable sodium	%	<15	0.58				
Available Calcium	mg/l		12000				
Available Sodium	mg/l		85				
Phytotoxic Contaminants (by soil pH)		< 6.0	6.0-7.0	> 7.0			
Zinc (Nitric Acid extract)	mg/kg	<200	<200	<300	55	YES	
Copper (Nitric Acid extract)	mg/kg	<100	<135	<200	28	YES	
Nickel (Nitric Acid extract)	mg/kg	<60	<75	<110	35	YES	
Visible Contaminants	% mm						
>2mm		<0.5	0.000	YES			
..... of which plastics		<0.25	0.000	YES			
..... man-made sharps		zero in 1kg	0.000	YES			

Client: P J Thory Ltd		Chemtest Job No.: 17-01445			
Quotation No.:		Chemtest Sample ID.: 401755			
Order No.:		Client Sample Ref.: SWS1		Screened	
		Client Sample ID.:		SOIL	
		Sample Type:		Top Depth (m): 0.1	
		Bottom Depth (m):		0.5	
Determinand	Accred.	SOP	Units	LOD	
Moisture	N	2030	%	0.020	39
Stones	N	2030	%	0.020	< 0.020
pH	U	2010		N/A	[A] 6.1
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	2.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	1.2
Cyanide (Free)	U	2300	mg/kg	0.50	[A] < 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	[A] 0.50
Thiocyanate	U	2300	mg/kg	5.0	[A] 11
Sulphide (Easily Liberatable)	U	2325	mg/kg	0.50	[A] 2.5
Sulphate (Total)	U	2430	%	0.010	[A] 2.1
Arsenic	U	2450	mg/kg	1.0	27
Cadmium	U	2450	mg/kg	0.10	0.32
Chromium	U	2450	mg/kg	1.0	49
Copper	U	2450	mg/kg	0.50	31
Mercury	U	2450	mg/kg	0.10	0.15
Nickel	U	2450	mg/kg	0.50	42
Lead	U	2450	mg/kg	0.50	22
Selenium	U	2450	mg/kg	0.20	2.1
Zinc	U	2450	mg/kg	0.50	80
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Organic Matter	U	2625	%	0.40	[A] 19
Naphthalene	U	2700	mg/kg	0.10	[A] < 0.10
Acenaphthylene	U	2700	mg/kg	0.10	[A] < 0.10
Acenaphthene	U	2700	mg/kg	0.10	[A] < 0.10
Fluorene	U	2700	mg/kg	0.10	[A] < 0.10
Phenanthrene	U	2700	mg/kg	0.10	[A] < 0.10
Anthracene	U	2700	mg/kg	0.10	[A] < 0.10
Fluoranthene	U	2700	mg/kg	0.10	[A] < 0.10
Pyrene	U	2700	mg/kg	0.10	[A] < 0.10
Benzof[a]anthracene	U	2700	mg/kg	0.10	[A] < 0.10
Chrysene	U	2700	mg/kg	0.10	[A] < 0.10
Benzof[b]fluoranthene	U	2700	mg/kg	0.10	[A] < 0.10
Benzok[j]fluoranthene	U	2700	mg/kg	0.10	[A] < 0.10
Benzof[a]pyrene	U	2700	mg/kg	0.10	[A] < 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	[A] < 0.10
Dibenz[a,h]Anthracene	U	2700	mg/kg	0.10	[A] < 0.10
Benzof[g,h,i]perylene	U	2700	mg/kg	0.10	[A] < 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	[A] < 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30



Photo 1: Image of the topsoil delivery receipt

OFFICE USE ONLY
Collection Point Code

DELIVERY NOTE/WASTE TRANSFER NOTE
764191/G

P. J. THORY LTD
Waste Carrier Licence No. 130404734

Vehicle Registration: **PS 1200**
Driver Signature: **[Signature]**
Date and Time of Loading: **11/10/17**

Customer: **LAIRDSON**
Delivery Address: **LAIRDSON**
Waste: **Topsoil**

Received By: **LAIRDSON**
Weighed By: **[Signature]**

Photo 2: Image of the topsoil delivery receipt

OFFICE USE ONLY
Collection Point Code

DELIVERY NOTE
678732/G

P. J. THORY LTD
Waste Carrier Licence No. 130404734

Vehicle Registration: **PS 1200**
Driver Signature: **[Signature]**
Date and Time of Loading: **11/10/17**

Customer: **LAIRDSON**
Delivery Address: **LAIRDSON**
Waste: **Topsoil**

Received By: **LAIRDSON**
Weighed By: **[Signature]**

Photo 3: Image of the topsoil delivery receipt

OFFICE USE ONLY
Collection Point Code

DELIVERY NOTE/WASTE TRANSFER NOTE
767011/G

P. J. THORY LTD
Waste Carrier Licence No. 130404734

Vehicle Registration: **PS 1200**
Driver Signature: **[Signature]**
Date and Time of Loading: **11/10/17**

Customer: **LAIRDSON**
Delivery Address: **LAIRDSON**
Waste: **Topsoil**

Received By: **LAIRDSON**
Weighed By: **[Signature]**

APPENDIX G

Photographs of Open Excavation

Photo 1: Image of the site taken from the adjacent road during installation of concrete footings	Photo 2: Image of the ground encountered during the footing excavation in plots 1,2 & 3
	
Photo 3: Image of the ground encountered during the footing excavation in plots 1,2 & 3	Photo 4: Image of the ground encountered during the footing excavation in plots 1,2 & 3
	

Photo 5: Image of the ground encountered during the footing excavation in plots 1, 2 & 3



Photo 6: Image of the ground encountered during the footing excavation in plots 1, 2 & 3

