



VALENCIA WASTE MANAGEMENT LTD

PILSWORTH LANDFILL MRF

PHASE 1 DESK STUDY

JUNE 2023

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DRAWINGS	TITLE	SCALE
GM12887-001	Site Location Plan	1 : 2,500 @ A3
GM12887-002	Walkover Photo Location Plan	1 : 500 @ A3

EXECUTIVE SUMMARY

This Phase 1 Desk Study report has been prepared to assist in the development of a Material Recovery Facility (MRF) at Pilsworth Landfill Site, Unsworth, Bury. A summary of the findings of the report is provided in Table 1.1.

Table 1.1 Executive Summary	
Site location	The site is located in Unsworth, Bury, with a central Ordnance Survey National Grid reference SD 82262 09026. The nearest postcode is BL9 8QZ.
Current Use and History	The site comprises undeveloped gravel hardstanding currently used for storage at Pilsworth landfill. This area was previously used for hardcore screening. Prior to the landfill, the site has remained undeveloped from earliest mapping (1848).
Adjacent land uses	The land immediately surrounding the site is an active landfill operated by Valencia Waste Management Ltd, with offices, car parking, and weighbridges to the south of the site, and landfill cells to the west. An access road off Pilsworth Road is east of the site. The surrounding area of the site was used as a sand quarry as seen on historical maps from 1992 to 2010.
Geology / Anticipated Ground Conditions	Made ground and infilled ground are recorded across the site from historic quarrying and present day land use as Pilsworth landfill. This is underlain by superficial hummocky glacial Diamicton till deposits and the Pennine Lower Coal Measures mudstones, siltstones, and sandstones. The Arley coal seam is conjectured to outcrop at the site, running northwest-southeast across the southwest corner of the site.
Asbestos	There is a potential for asbestos to be present on site associated within infilled ground and made ground on site.
Groundwater Vulnerability	The site is underlain by a Secondary A superficial and bedrock aquifer.
Mining	A Coal Mining Risk Assessment has been undertaken for the site, included within Appendix F, and should be read in conjunction with this report. In summary, The Coal authority notes the Pilsworth landfill MRF site is located in an area identified by The Coal Authority as having possible unrecorded shallow workings present beneath the site related to the Arley coal seam conjectured to outcrop at the site. The thickness of superficial deposits across the site is recorded to be between 24 – 28mbgl it is therefore possible that should workings exist beneath the site, collapse may result in voids at the ground surface (crown holes) resulting in a moderate risk to the site of ground instability and damage to infrastructure. We therefore recommend a suitably designed borehole investigation to investigate the mining situation at the site, and on completion interpret the data and review the risk assessment. If zones of potential ground instability are identified a programme of mine hazard remediation may be required over parts of the site prior to development. The potential presence of mine gas representing a source of ground gas is considered unlikely but cannot be discounted due to the probable past surface workings at the site. Mine gas should therefore be considered in the land contamination risk assessment.
Unexploded Ordnance (UXO)	The risk of UXO is considered Low.
Contamination Issues	The potential for significant contamination issues from the previous and current land use is considered moderate, due to the presence of made ground and infilled ground on site of unknown composition, and the current adjacent land use at Pilsworth landfill.
Radon Requirements	UKHSA Radon maps show the highest risk of radon across the site is a 10-30% chance of buildings in the area being above the action level, indicating full Radon Protection Measures are required.
Preliminary Conceptual Model and Risk Assessment	The overall risk classification is low to moderate and necessary actions have been provided for each contaminant source.
Geotechnical Issues	There is a moderate risk of compressible deposits on site related to the presence of made ground and infilled ground. Given the anticipated ground conditions there is a potential for excessive total and differential settlement of the proposed development, and this should be considered at the detailed design stage. Potential risk of shallow unrecorded mine workings in areas of the site present a potential risk including localised subsidence, instability, and settlement.
Recommendations	Undertake a detailed Phase 2 Ground Investigation to determine the environmental, geotechnical and coal mining conditions on site.

1 INTRODUCTION

1.1 Instruction

1.1.1 Wardell Armstrong LLP (WA) have been commissioned to prepare this Phase 1 Desk Study by INNOV8 Planning Ltd on behalf of Valencia Waste Management Ltd. The commission follows the proposal prepared by WA entitled 'Pilsworth Landfill Site, Bury – Proposal for a Phase 1 Desk Study Report' (Ref: FL.NT.GM12887.001) dated April 2023.

1.2 Site Location

1.2.1 The site is approximately 0.35 hectares (ha) in size and is located within Pilsworth Landfill Site, Unsworth circa. 2.5km southeast of the Bury, with a central Ordnance Survey National Grid reference of SD 82262 09026. The nearest postcode to the site is BL9 8QZ.

1.2.2 The location of the site is detailed on Drawing No. GM12887-001.

1.3 Proposed Development

1.3.1 It is understood that the proposed development will be for a new Material Recovery Facility with associated infrastructure.

1.4 Scope and Objectives

1.4.1 The purpose of this report is to support the proposed development of the site by identifying and examining readily available documentary sources of information relating to the following:

- Past and current uses of the site and surrounding area and the nature of any hazards and physical constraints;
- Environmental setting including geology, geochemistry, mining, hydrogeology and hydrology;
- Potential contamination sources, pathways and receptors as part of a preliminary conceptual site model; and
- Provide information on the preliminary risk assessment.

1.4.2 The results of the Phase 1 Desk Study research are presented in this report and conclusions are drawn regarding the geological, geotechnical, mining, and environmental hazards that could potentially affect the development on the site.

- 1.4.3 This report has been prepared in general accordance with BS5930:2015+A1:2020, BS10175:2011+A2:2017 and the Environment Agency (EA) Land Contamination Risk Management (LCRM) guidance.

1.5 Limitations of Report

- 1.5.1 The report does not constitute or contain a valuation nor is it a full rigorous environmental audit.
- 1.5.2 The opinions and findings of the report are given without the benefit of any physical site investigation, sampling or testing.
- 1.5.3 The findings and recommendations are considered to be valid and appropriate at the time of preparation and for the specific purpose or purposes intended. WA will not be liable if any findings are used by third parties, without the written agreement of the company, or if an interpretation is made and action taken without further consultation.
- 1.5.4 The possibility of significant variation in ground conditions existing on site in comparison to those described within this report cannot be discounted.

1.6 Data Sources

- 1.6.1 The following sources of information have been reviewed:
- A Groundsure report, dated 09 May 2023 (Ref: GS-DRR-L2Y-U6N-9JK), attached at Appendix A;
 - Site walkover notes and photographs attached at Appendix B;
 - The British Geological Survey (BGS) - GeoIndex [online] geological mapping interactive mapping database. Available at: <https://mapapps2.bgs.ac.uk/geoindex/home.html> (accessed 09 May 2023);
 - Borehole Log attached at Appendix C;
 - Geological Survey of England and Wales (Solid), Sheet 85 Manchester (1 Inch to the mile), published 1930;
 - GOV.uk [online] Check the long-term flood risk for an area in England. Available at <https://www.gov.uk/check-long-term-flood-risk> (accessed 09 May 2023);
 - GOV.uk [online] Flood map for planning. Available at <https://flood-map-for-planning.service.gov.uk/> (accessed 10 May 2023);
 - The Coal Authority Interactive Map Viewer [online]. Available at <https://mapapps2.bgs.ac.uk/coalauthority/home.html> (accessed 09 May 2023);

- Consultants Coal Authority Mining Report, dated 09 May 2023 (Ref: 51003353833001), attached at Appendix D;
- Zetica Unexploded Bomb Risk Map attached at Appendix F; and
- Published and unpublished information and records held by WA.

2 SITE SETTING

2.1 Site Description / Use

2.1.1 The site consists of undeveloped gravel hardstanding and is located within Pilsworth landfill, operated by Valencia Waste Management Ltd. The site is surrounded by a sorting area and concrete car park to the north, landfill cells and a pond to the east, landfill offices and weighbridges to the south, and an access road and undeveloped grassland to the west. Access into the site is through an access road off Pilsworth Road, to the west of the site.

Site Walkover

2.1.2 A site walkover was carried out for the proposed MRF site on 22 May 2023 by a WA Engineer. Photographs taken during the site walkover are attached at Appendix B.

2.1.3 The following observations were made during the site walkover:

- The site is generally flat, however there are areas of slight undulation;
- The site currently consists of gravel hardstanding and is used to store old tyre stockpiles, concrete debris, metal debris, plastic pipes, landfill liners, hardcore from previous screening, and machinery;
- Littering was shown across the site, possibly relating to landfill activities;
- A sorting area with gravel and hardcore stockpiles, a concrete car parking area and an old filled septic tank are located north of the site;
- It was confirmed by Valencia staff during the walkover that the site has never been used for storage of landfill waste and has largely been used for screening of hardcore and storage;
- Some surface water was noted across the site and anecdotal information suggests potential drainage issue; and
- There are three access points into the site and wider area off the landfill access road off Pilsworth Road.

2.2 Site History

2.2.1 Published OS County Grid series topographical maps dating from 1848 to 2023 have been reviewed. A summarised chronological site history identifying the features that may be relevant to the development is presented in Table 2.1. Copies of the historical maps are included with the Groundsure Report attached at Appendix A.

Table 2.1: Summary of historical mapping.		
Date of mapping	On Site Land Use	Surrounding Areas Land Use
1848-1851 1: 10,560	Site comprises undeveloped agricultural land. A track runs northeast-southwest across the southwest corner of the site.	<u>North</u> : c.750m Sand pit. <u>East</u> : c.150m Farm Building, c.400m Jackson's Green. <u>South</u> : c.400m Sand pit, c.550m Sand pit. <u>West</u> : c.300m Frog Hall, c.500m Farm Building, c.750m Hollins Vale Point Works. <u>South</u> : c.600m Hollin's Brook.
1891 1: 10,560	No change from previous mapping.	<u>North</u> : c.100m Pilsworth Road. <u>East</u> : c.750m Farm building. <u>West</u> : c.500m Reservoir. <u>South</u> : c.600m Reservoir, c.750m Pilsworth Bleach Works. Sand Pit no longer shown.
1908 1:10,560	No change from previous mapping.	<u>East</u> : c.150m Tank. <u>South</u> : c.600m Filter beds and Tanks.
1928-1932 1:10,560	No change from previous mapping.	<u>East</u> : c.70m Tank, c.300m Sewage Tank, c.400m Tank. <u>West</u> : Frog Hall no longer shown.
1939 1:2,500	No change from previous mapping.	<u>East</u> : c.70m Windpump.
1938 1: 10,560	No change from previous mapping.	<u>East</u> : c. 400m Tank.
1955-1956 1:10,560	No change from previous mapping..	<u>West</u> : c.200m Industrial works, c.300m Marsh. <u>East</u> : c.300m Jackson Fold. <u>South</u> : c.100m Pond.
1965-1967 1:10,560	No change from previous mapping.	<u>East</u> : c.200m Depot, c.250m Refuse Tip.
1974 1:10,560	No change from previous mapping	<u>South</u> : c.600m Pilsworth Cottages.
1981-1983 1: 10,000	No change from previous mapping.	<u>North</u> : c. 400m Pumping station. <u>East</u> : c.100m Motorway, Depot expanded.
2001 1: 10,000	No change from previous mapping.	<u>North</u> : c.750m Sand Quarry. <u>West</u> : c. 400m Superstore now labelled instead of Works.
2010 1: 10,000	No change from previous mapping.	<u>West</u> : c. 400m Works area has expanded. <u>East</u> : c 100m Waterbody and Pilsworth South Quarry. <u>South</u> : c.250m Waterbody.
2023 1: 10,000	No change from previous mapping.	<u>West</u> : c.25m Access road has lengthened, C.100M Pilsworth South Quarry no longer shown, c. 400m Works area has expanded, <u>South</u> : c. 100m Waterbody.
Present day	Site is located within Pilsworth landfill and is used for storage.	<u>West</u> : c.750m Industrial developments.

2.3 Asbestos

2.3.1 Asbestos was not observed across the site during the site walkover but cannot be ruled

out due to the presence of historic quarry backfill at the site, and a capped asbestos landfill cells to the east of the site.

- 2.3.2 The Health and Safety at Work Act, Control of Asbestos Regulations and Construction (Design and Management) Regulations impose duties upon employers, site owners, their agents and contractors in respect of hazardous materials including asbestos. Other health and safety and welfare regulations place duties on employers to undertake appropriate risk assessments. This could include the commissioning of surveys, identification and management of hazardous materials including any proposals for remedial work. Any works undertaken in areas, where asbestos is known or suspected to be present, such as within suspected made ground deposits across the site, should be done in accordance with the Control of Asbestos Regulations (2012).

3 GEOLOGICAL AND HYDROGEOLOGICAL INFORMATION

3.1 Geology

3.1.1 The assessment of the geology of the site is based on the published geological mapping (Geological Survey of England and Wales (Solid), Sheet 85 Manchester (1 Inch to the mile), published 1930) supplemented by the geological memoir, BGS GeoIndex, the BGS Lexicon of Named Rock Units and published and unpublished information held by WA. A summary of relevant geological information is provided in Table 3.1. This information has been supplemented by information contained within the Groundsure Report.

Table 3.1: Summary of relevant geological data.	
Strata	Description
Made Ground	Made ground is recorded at the site in the form of Infilled ground likely related to historic quarry backfill and current site use as a landfill site. Made ground across the site may present a compressible deposit risk.
Superficial Deposits	Published geological mapping states that superficial deposits of Hummocky Glacial Diamicton Till deposits are recorded on site. Historic boreholes across the wider area of the site were obtained by WA for previous projects at the Pilsworth landfill site. One borehole conducted on the proposed MRF site by Terry Adams Ltd in 1989, recorded fine to medium silty sand to 2m bgl, coarse sand with occasional pebbles and coal fragments to 4m bgl and gravelly sand, medium to coarse sand with pebbles, and sand and gravel were observed to >10m bgl. A borehole carried out c.40m southeast of the site in 1994 by Geo Research Limited observed brown slightly clayey slightly silty coarse sand with occasional rounded gravel to 1.7m bgl, brown slightly clayey slightly silty coarse sand with lignite fragments to 3.6m bgl, and grey and brown slightly silty sandy fine to coarse gravel to 4.8m bgl.
Solid Geology	The site is underlain by Pennine Lower Coal Measures mudstone, siltstone and sandstone. Historic WA boreholes on site record the solid geology to comprise of mudstone between 24 – 28m bgl.
Geological Structures	The Arley coal seam runs northwest-southeast across the southwest corner of the site.

3.1.2 Historic WA borehole logs and BGS Borehole logs within the area of the site are attached as Appendix C.

3.2 Hydrogeology

3.2.1 Hydrogeological information provided in the Groundsure report indicates the site is underlain by a Secondary A superficial aquifer of low to high permeability, and a Secondary A bedrock aquifer of low to moderate permeability with well-connected fractures.

3.2.2 Secondary A aquifers are generally regarded as containing permeable layers capable of supporting local water supplies.

3.2.3 There are two groundwater abstraction licenses within 500m of the site, both of which are located at the Pilsworth Landfill Site related to dewatering from sumps A and B.

- 3.2.4 There are no surface water, potable water abstraction licences or Source Protection Zones within 500m of the site. It is stated within the Groundsure report that the site lies within an area that is considered to be at a low risk of groundwater flooding.

3.3 Hydrology

Watercourses

- 3.3.1 The nearest water course to the site is an unnamed river located 239m northwest of the site, described in the Groundsure report as an inland river not influenced by normal tidal action. There are three reservoirs within 100m of the site utilised by Pilsworth Landfill Site.
- 3.3.2 The site is located within the 'Whittle Brook (Irwell)' Surface water body catchment (Ref: GB112069061250) which has been assigned a 'fail' chemical rating and ecological rating of moderate by the EA.

Groundwater bodies

- 3.3.3 The 'Northern Manchester Carboniferous Aquifers' (GB41202G101800) Aquifer is recorded as being present on site and has been assigned a 'poor' chemical rating and a 'good' quantitative rating by the EA.

Flooding

- 3.3.4 The Ambient Risk analytics FloodMap contained within the Groundsure report identifies a negligible risk of surface water flooding across the site. The maximum flood risk across the site is a 0.3-1.0m flood event occurring during a 1 in 100 year rainfall event.
- 3.3.5 The site lies within an EA Flood Zone 1 with a low probability of flooding.
- 3.3.6 The Groundsure report states that there are no records of historical flood events, flood defences, or flood storage areas within 250m of the site.

4 MINING AND QUARRYING

4.1 Coal Mining

4.1.1 The site is located within a Coal Mining Reporting Area and a Coal Authority Development High Risk Area as defined by The Coal Authority. A Consultants Mining Report (Ref: 51003353833001) has been obtained for the site and is attached within Appendix D.

4.1.2 Information relating to the mining setting beneath the site is contained within the Coal Mining Risk Assessment (CMRA) attached at Appendix B, which should be read in conjunction with this report.

4.1.3 Correspondence with the Coal Authority (email 'FW: AMC SEARCH REF 71009590765001' – Appendix F) confirmed that the no records are held which show the presence of recorded working within the site.

Summary taken from Coal Mining Risk Assessment contained in Appendix F

4.1.4 The Pilsworth landfill MRF site is located in an area identified by The Coal Authority as having possible unrecorded shallow workings present beneath the site related to the Arley coal seam conjectured to outcrop at the site. However, following consultation with The Coal Authority, they confirmed that no works are present in the Arley seam beneath the site.

4.1.5 The thickness of superficial deposits across the site is currently recorded to be between 24 – 28m bgl; it is possible that should workings exist beneath the site, collapse may result in voids at the ground surface (crown holes) resulting in a moderate risk to the site of ground instability and damage to infrastructure. We therefore recommend a suitably designed borehole investigation to investigate the mining situation at the site, and on completion interpret the data and review the risk assessment. If zones of potential ground instability are identified a programme of mine hazard remediation may be required over parts of the site prior to development. This is “normal” practice in many areas of former exposed coalfield and may include: detailed investigation and stabilisation of shallow workings by drilling and pressure grouting. All invasive works to be designed to ensure no risk to members of the public or the environment. If required, such works would be carried out in accordance with current Coal Authority requirements and the appropriate Permit and current industry guidance contained in CIRIA C758D Abandoned Mine Workings Manual (2019).

4.1.6 The potential presence of mine gas representing a source of ground gas is considered

unlikely but cannot be discounted due to the probable past surface workings at the site. Mine gas should therefore be considered in the land contamination risk assessment.

4.2 Non-Coal Mining

4.2.1 The Groundsure report highlights that no non-coal mining activities are recorded on site.

5 ENVIRONMENTAL SETTING AND CONSULTATIONS

5.1 Introduction

5.1.1 Information from various statutory sources has been summarised from the Groundsure report (Appendix A).

5.2 Contaminated Land Register Entries and Notices

5.2.1 The site or an area within 500m of the site has not been identified as potentially contaminated by the Local Authority under the Part IIA of the Environmental Protection Act 1990.

5.3 Waste Management

5.3.1 The wider site is currently used as an active landfill operated by Valencia Waste Management Ltd containing both non-hazardous and hazardous waste types. The landfill has been operational from c. 2003 with an annual tonnage of >25,000 tonnes. Pilsworth Landfill is also shown in the Groundsure report as a Local Authority historic waste site, and EA/NRW licensed waste site for waste recycling, waste transfer stations, and co-disposal landfill activities.

5.3.2 The Groundsure report LA/mapping records show a historical landfill (LA/mapping records) located 217m northwest of the site as shown on 1966 mapping. EA/NRW records show a historic landfill located 93m north of the site at Pilsworth Sand Pit, which accepted industrial waste from 1987 to 1989.

5.3.3 There are 12 No. waste exemptions within 500m of the site, the closest of which is located 286m north at Pilsworth landfill for the screening and blending of waste, the recovery of scrap metal, and the spreading of waste on non-agricultural land to confer benefit. Full details of waste exemptions surrounding the site are included within the Groundsure report attached as Appendix A.

5.4 Radon

5.4.1 The site is located in an area where less than 1% of homes are above the action level.

5.5 Environmental Issues

5.5.1 The Groundsure report identifies 17 No. Licensed industrial activities (Part A(1)) regulated under the Environmental Permitting Regulations within 500m of the site, 13 No. of which are for Pilsworth Landfill and include superseded entries. The remaining

four entries are located 409m southwest of the site at Pilsworth Surfactants Facility, operated by Holchem Laboratories Ltd.

- 5.5.2 A Control of Major Accident Hazards (COMAH) site has been identified 307m southwest of the site at Holchem Laboratories Ltd, which falls under a COMAH Upper Tier Operator. The Groundsure report also identifies a hazardous substance storage/usage consent under the Planning (Hazardous Substances) Regulations 2015 related to Holchem Laboratories Ltd.
- 5.5.3 There is a licensed pollutant release (Part A(2)/B) located 332m west of the site at an Asda petrol station for the unloading of petrol into storage.
- 5.5.4 There are three Licensed Discharges to controlled waters within 500m of the site related to Pilsworth Landfill, however all of these are shown as being revoked.
- 5.5.5 There is a licence to discharge pH substances, identified as List 2 Dangerous substances on European Directive E 2006/11/EC, located 375m southeast related to Pilsworth landfill activities.
- 5.5.6 There have been 11 No. EA/NRW Pollution Incidents within 500m of the site. Incidents with an impact rating of Category 1 (major) and Category 2 (significant) are summarised in Table 5.1.

Table 5.1: EA/NRW pollution incidents summary.			
Location from site	Incident Date	Pollutant Description	Impact
287m northeast	23/02/2020	Construction and demolition materials and wastes	Category 2 (Significant) impact to land
292m west	12/04/2013	Oils and Fuel - Diesel	Category 2 (Significant) impact to land and water
375m north	23/03/2004	Contaminated water – Suspended solids	Category 2 (Significant) impact to water
440m south	23/05/2001	Rocks and gravel	Category 2 (Significant) impact to water

- 5.5.7 There are six Pollution Inventory Substances recorded within 500m on the site all relating to Pilsworth Landfill. Full details on substances and quantities is included within the Groundsure report attached as Appendix A.
- 5.5.8 There is a Pollution Inventory Waste Transfer on site related to the Pilsworth landfill activities. Full details on routes and EWC descriptions is included within the Groundsure report attached as Appendix A.

5.5.9 The Groundsure report does not highlight any further environmental issues within a 500m radius of the site relating to the following:

- Regulated explosive sites and radioactive substance authorisations;
- Historical licenced industrial activities (IPC);
- Pollutant release to public sewer, and licensed pollutant release to surface waters (red list);
- List 1 Dangerous Substances, Radioactive Substance Authorisations; and
- Pollution inventory radioactive waste.

5.6 Unexploded Ordnance

5.6.1 A Zetica Unexploded Bomb (UXB) risk map for the site has been reviewed. The area is indicated as having been exposed to 15 bombs per 1000 acres or less and therefore designated as a low risk area. The map is attached at Appendix F.

6 PRELIMINARY CONCEPTUAL SITE MODEL

6.1 Background

6.1.1 Following a review of the information presented in this report a preliminary conceptual site model has been prepared to show the characteristics of the site and show the relationships between possible contaminants, pathways and receptors. The Preliminary Conceptual Site model is based upon a future industrial development. It is also assumed that the future site users will be involved only in the maintenance and operation of the site. This should be refined as more detail becomes available on the proposed end use and on the ground conditions present.

6.1.2 Potential Sources of Contamination:

- Made Ground – associated with historic quarrying and present-day landfill activities;
- Pilsworth Landfill non-hazardous and hazardous waste cells;
- Historic pollution incidents within 250m of the site;
- List 2 Dangerous substance discharge consent 375m southeast of the site;
- Ground gas – associated with made ground and potential unrecorded shallow mine workings; and
- Landfill gas – associated with adjacent landfilling activities.

6.1.3 Potential Pathways:

- Human health - inhalation, ingestion, dermal contact;
- Controlled waters - leaching, migration, over ground (ditches) and underground flow (Secondary A superficial and bedrock aquifer);
- Buildings/infrastructure - gas migration, direct contact;
- Flora and Fauna - ingestion, root uptake;
- Potentially poorly engineered quarry backfill.

6.1.4 Potential Receptors:

- Human health – construction workers and future site users (it is assumed that future site users will be involved in the maintenance and operation of the site);
- Controlled water – groundwater (Secondary A superficial and bedrock aquifer), surface water (reservoirs surrounding site); and
- Proposed buildings.

6.2 Preliminary Conceptual Site Model

6.2.1 Table 6.1 summaries the conceptual site model and potential pollution linkages.

Table 6.1: Conceptual Site Model & Potential Pollutant Linkages.		
Source (Contaminant)	Pathway	Receptor
Made Ground – associated with historic quarrying and present day landfill activities (Common metals, Sulphate, Asbestos, PAHs, Chlorinated Hydrocarbons, PCBs, Vanadium, etc.)	1. Inhalation 2. Dermal contact 3. Ingestion 4. Surface runoff/overland flow 5. Groundwater migration 6. Direct contact (aggressive attack) 7. Gas migration 8. Quarry backfill	1. Future occupiers (assumed to be maintenance workers) 2. Construction workers 3. Groundwater 4. Surface water 5. Building materials (substructure) 6. Water supply pipes 7. Flora and fauna
Pilsworth Landfill non-hazardous and hazardous waste cells (Common metals, Asbestos, Arsenic, Nitrate, Sulphate, Asbestos, pH, Hydrocarbons, PAHs, Chlorinated Hydrocarbons, PCBs, Dioxins);	1. Inhalation 2. Dermal contact 3. Ingestion 4. Surface runoff/overland flow 5. Groundwater migration 6. Direct contact (aggressive attack) 7. Gas migration 8. Quarry backfill	1. Future occupiers (assumed to be maintenance workers) 2. Construction workers 3. Groundwater 4. Surface water 5. Building materials 6. Water supply pipes 7. Flora and fauna
Historic pollution incidents within 250m of the site;	1. Inhalation 2. Dermal contact 3. Ingestion 4. Surface runoff/overland flow 5. Groundwater migration 6. Direct contact (aggressive attack) 7. Gas migration 8. Quarry backfill	1. Future occupiers (assumed to be maintenance workers) 2. Construction workers 3. Groundwater 4. Surface water 5. Building materials (substructure) 6. Water supply pipes 7. Flora and fauna
List 2 Dangerous substance discharge consent 375m southeast of the site (pH)	1. Inhalation 2. Ingestion 3. Surface runoff/overland flow 4. Groundwater migration 5. Direct contact (aggressive attack) 6. Quarry backfill	1. Future occupiers (assumed to be maintenance workers) 2. Construction workers 3. Groundwater 4. Surface water 5. Building materials (substructure) 6. Water supply pipes 7. Flora and fauna
Ground gas - associated with existing landfill cells and infrastructure, potential on site made ground and potential presence of mine gas (Carbon dioxide, Carbon monoxide, Methane, Hydrogen Sulphide)	1. Inhalation 2. Gas migration 3. Quarry backfill	1. Future occupiers (assumed to be maintenance workers) 2. Construction workers
Landfill gas – associated with adjacent landfilling activities (Carbon dioxide, Carbon monoxide, Methane, Hydrogen Sulphide)	1. Inhalation 2. Gas migration 3. Quarry backfill	1. Future occupiers (assumed to be maintenance workers) 2. Construction workers

7 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

7.1 Introduction

7.1.1 In line with EA Land Contamination Risk Management (LCRM) guidance the information gathered throughout this report can be used to carry out a Preliminary Risk Assessment. The Risk Assessment is provided for each identified source, pathway, receptor linkage in Table 7.5.

7.1.2 The CIRIA document Contaminated Land Risk Assessment – a guide to good practice C552, 2001 defines the Consequence of Risk, Probability of Risk Being Realised and Risk Classification Definition. These definitions are provided in Tables 7.1, 7.2 and 7.3, and the Risk Classification Matrix (Table 7.4) is used to provide a qualitative Risk Assessment for each identified source, pathway, receptor linkage.

Table 7.1: Consequence of risk being realised (based on CIRIA C552 2001).			
Classification	Category	Definition	Examples (Not necessarily specific to this site)
Severe short-term (acute) risks only	Humans	Short-term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part 2A.	High concentrations of cyanide on the surface of an informal recreation area.
	Controlled Waters	Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource.	Major spillage of contaminants from site into controlled water.
	Property	Catastrophic damage to buildings/property.	Explosion causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
	Ecological System	A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.	
Medium chronic (long term) risks; “significant harm”	Humans	Chronic damage to Human Health (“significant harm” as defined in Defra 2006).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria
	Controlled Waters	Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution).	Leaching of contaminants from a site into a major or minor aquifer.
	Ecological System	A significant change in a particular ecosystem	Death of a species within a designated nature reserve.
Mild chronic (long term) risks; less sensitive receptors	Controlled Waters	Pollution of non-sensitive water resources.	Pollution of non-classified groundwater
	Property	Significant damage to buildings, structures and services (“significant harm” as defined in Circular on Contaminated Land, Defra, 2006). Damage to sensitive buildings/structures/services	Damage to building rendering it unsafe to occupy (e.g., foundation damage resulting in instability)
	Ecological System	Significant damage to crops. Damage to the environment.	

Table 7.1: Consequence of risk being realised (based on CIRIA C552 2001).			
Classification	Category	Definition	Examples (Not necessarily specific to this site)
Minor chronic (long term) risks; mild	Financial / project	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve.	
	Humans	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc).	The presence of contaminants at such concentrations that protective equipment is required during site works.
	Property	Easily repairable effects of damage to buildings, structures and services	The loss of plants in a landscaping scheme. Discolouration of concrete.

Table 7.2: Probability of risk being realised (C552 CIRIA, 2001).	
Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long term.

Table 7.3: Risk classification definitions (C552 CIRIA, 2001).	
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Table 7.4: Risk classification matrix (C552 CIRIA, 2001).					
		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

Table 7.5: Preliminary qualitative risk assessment.

Source / Contaminant	Pathway(s)	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Necessary Actions / Commentary
Made Ground – associated with historic quarrying and present-day landfill activities (Common metals, Sulphate, Asbestos, PAHs, Chlorinated Hydrocarbons, PCBs, Vanadium etc.)	Inhalation, Dermal Contact, Ingestion, Migration via water pipes	Future occupiers (assumed to be maintenance workers), construction workers.	Medium	Likely	Moderate	Made ground is recorded as being present across the site from historic quarrying and present day landfill activities within the area of the site. The composition and nature of these deposits is currently unknown and therefore, there is potential for it to present a risk to human health and the surrounding environment. It is recommended that an intrusive investigation is undertaken in order to determine the nature and composition of the near surface deposits and determine the presence or absence of contamination.
	Surface water runoff, migration via field drains and groundwater migration	Surface water, Secondary A Aquifers beneath the Site	Medium	Likely	Moderate	
	Direct contact (aggressive attack)	Future buildings and water pipes, Flora and fauna	Medium	Low likelihood	Moderate/Low	
Pilsworth landfill non-hazardous and hazardous waste cells (Common metals, Asbestos, Arsenic, Nitrate, Sulphate, Asbestos, pH, Hydrocarbons, PAHs, Chlorinated Hydrocarbons, PCBs, Dioxins);	Inhalation, Dermal Contact, Ingestion, Migration via water pipes	Future occupiers (assumed to be maintenance workers) and construction workers.	Medium	Low likelihood	Moderate/Low	Given areas on site have had a long-term industrial use, the potential for contamination from landfill activities across the site cannot be discounted. It is recommended that an intrusive investigation is undertaken in order to determine the nature and composition of the near surface deposits and determine the presence or absence of contamination.
	Surface water runoff, migration via field drains and groundwater migration	Surface water, Secondary A Aquifers beneath the site	Medium	Low likelihood	Moderate/Low	
	Direct contact (aggressive attack)	Future buildings and water pipes, Flora and fauna	Medium	Low likelihood	Moderate/Low	
Historic pollution incidents within 250m of the site;	Inhalation, Dermal Contact, Ingestion, Migration via water pipes	Future occupiers (assumed to be maintenance workers), construction workers.	Mild	Low likelihood	Low	Historic pollution incidents within 250m of the site including wastes and materials may have resulted in contamination across the site which may present a risk to human health and the surrounding environment.

Table 7.5: Preliminary qualitative risk assessment.

Source / Contaminant	Pathway(s)	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Necessary Actions / Commentary
	Surface water runoff, migration via field drains and groundwater migration	Surface water, Secondary A Aquifer beneath the Site	Mild	Low likelihood	Low	It is recommended that an intrusive investigation is undertaken in order to determine the nature and composition of the near surface deposits and determine the presence or absence of contamination.
	Direct contact (aggressive attack)	Future buildings and water pipes, Flora and fauna	Mild	Low likelihood	Low	
List 2 Dangerous substance discharge consent 375m southeast of the site (pH)	Inhalation, Dermal Contact, Ingestion, Migration via water pipes	Future occupiers (assumed to be maintenance workers), construction workers.	Mild	Low likelihood	Low	Discharge consent of a List 2 Dangerous substance associated with Pilsworth landfill may result in contamination across the site which may present a risk to human health and the surrounding environment. It is recommended that an intrusive investigation is undertaken to determine the nature and composition of the near surface deposits and determine the presence or absence of contamination.
	Surface water runoff, migration via field drains and groundwater migration	Surface water, Secondary A Aquifer beneath the Site	Medium	Low likelihood	Moderate/Low	
	Direct contact (aggressive attack)	Future buildings and water pipes, Flora and fauna	Mild	Low likelihood	Low	
Ground gas – associated with potential on site made ground and potential presence of mine gas (Carbon dioxide, Carbon monoxide, Methane, Hydrogen Sulphide)	Inhalation, Dermal Contact, Ingestion, Migration via water pipes	Future occupiers (assumed to be maintenance workers), construction workers.	Medium	Likely	Moderate	Any made ground, organic natural soils and former coal mine workings are a potential source of ground gas on the site. It is recommended that an intrusive investigation is undertaken, and a ground gas assessment carried out to support any future design.
Landfill gas – associated with adjacent landfilling activities (Carbon dioxide, Carbon monoxide,	Inhalation, Dermal Contact, Ingestion, Migration via water pipes	Future occupiers (assumed to be maintenance workers), construction workers.	Medium	Likely	Moderate	Any landfill can be a potential source of landfill gas on the site. It is recommended that an intrusive investigation is undertaken, and a ground gas assessment following a period of

Table 7.5: Preliminary qualitative risk assessment.						
Source / Contaminant	Pathway(s)	Receptor	Consequence of Risk Being Realised	Probability of Risk Being Realised	Risk Classification	Necessary Actions / Commentary
Methane, Hydrogen Sulphide)						monitoring is carried out to support any future design.

8 PRELIMINARY GEOTECHNICAL RISK ASSESSMENT

- 8.1.1 The desk study researches suggest a moderate geotechnical risk to the proposed development.
- 8.1.2 The site is thought to contain infilled ground and made ground deposits associated with the historic sand quarrying on site, as well as present day land use as a landfill. The nature and extent of these made ground deposits is unknown and the depth to bedrock on site is also unknown. Any compaction or engineering undertaken on opencast backfill deposits across the site is unknown. The made ground deposits are underlain by superficial hummocky glacial Diamicton Till deposits, which are in turn further underlain by Pennine Middle Coal Measures.
- 8.1.3 Moderate ground compressibility is identified in the Groundsure report which corresponds with the recorded presence of made ground and infilled ground of unknown composition and strength. Made ground can present variable strengths under loading and therefore it should not be relied upon for any structural support associated with the proposed development.
- 8.1.4 The Coal Authority reports the Arley coal seam as being conjectured to outcrop at the site, as a result there is a possibility of unrecorded shallow workings to be present beneath the site. The presence of unrecorded shallow mine workings presents a potential risk including localised subsidence, instability and potential settlement as well as being a potential source of mine gas.
- 8.1.5 Given the anticipated ground conditions, the potential for excessive total and differential settlement of the proposed development (including roads, drainage, external areas) should be considered at the detailed design stage.
- 8.1.6 It is recommended that a detailed ground investigation comprising of trial pits and cable percussive boreholes (should poor ground be encountered then there may be a requirement for rotary boreholes) is undertaken to support the geotechnical and foundation design of the project.
- 8.1.7 Further to this, some remedial measures may be necessary depending on the nature and extent of made ground and the geotechnical nature of the mining setting beneath the site.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

9.1.1 Based on available information summarised in this report, the ground conditions beneath the site are considered to present an overall moderate/low risk to the future development. There are number of potential environmental and geotechnical constraints that need to be fully investigated and assessed once the final development proposals and layout are known. It is considered that some mitigation measures will be necessary given the subsurface geology at the site.

9.1.2 At this stage there is no fixed development layout or proposals and therefore the scope of any protection measures in relation to ground contamination cannot be determined.

9.2 Recommendations

9.2.1 It is recommended that a detailed investigation of the geological conditions will be required prior to the intended development of the site. Further to this, some remedial measures may be necessary depending on the possible presence of unrecorded shallow mine workings, the nature and extent of the made ground and the geotechnical nature of the subsurface materials.

9.2.2 It is recommended that a Phase 2 Ground Investigation is carried out to determine the geological conditions on site, geotechnical parameters and the potential for contamination. Table 9.1 outlines the preliminary objectives that the ground investigation would be anticipated to target. The list presented in Table 9.1 is not exhaustive and general investigation, sampling and testing across the site will be required to better understand the overall risk posed by the site.

Table 9.1: Preliminary ground investigation objectives.	
Geo-environmental Objectives	Geotechnical Objectives
- To reduce uncertainty in knowledge of the site, enabling the initial conceptual model to be refined and a reassessment of risk; - Target sampling and chemical testing across the Site; - Undertake groundwater and gas monitoring.	- To reduce uncertainty in knowledge of the site, enabling review of the Geotechnical Risk Assessment; - To identify the nature and parameters of the made ground, ground strata, and groundwater; - Identify the ground conditions associated with the coal seam outcrop and probable unrecorded shallow coal mining; - Establish parameters prior to design of foundations, temporary and permanent works; - Provide sufficient information to target further ground investigation or design a suitable remediation approach if required; - Locate, map and investigate and identify potential construction difficulties.

9.2.3 Based on the available information, it is considered likely that an investigation of contamination issues at the site will be required. This is likely to include an intrusive investigation comprising:

- Drilling and testing of made ground, groundwater, and ground gas to target potential sources of contamination within and outside of the current site;
- A quantitative risk assessment to determine if significant contamination is present; and
- If significant contamination is identified, calculation of site-specific remedial targets, liaison with the regulators and remediation.

9.2.4 A geotechnical assessment should be undertaken to:

- Determine the type, strength and bearing characteristics of the made ground and underlying geology;
- Determine the risk from shallow mining and the potential requirement for stabilisation works;
- Provide recommendations for a suitable and economic foundation solution for the development; and
- Provide recommendations regarding any other geotechnical aspects pertaining to the development.

9.2.5 A programme of gas and groundwater monitoring is recommended following an intrusive Phase II investigation to assess the risk from ground gas and landfill gas at the site.

9.2.6 The conclusions and recommendations presented are based on the information currently available (as referenced within this report) on the proposed development of a MRF and associated infrastructure, with the assumption that the MRF is not permanently inhabited. Should this is not the case, the report and its conclusions should be reviewed.

APPENDICES

Appendix A

Appendix B

Appendix C

Appendix D

Appendix E

Appendix F

DRAWINGS

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