

Memo

Subject Wellington Road Landfill – Technical Review of Existing Information **From** Peter Kenny

To Matthew Nicholson & Sally Shaw (Bury Council) **Date** 20 June 2025

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WELLINGTON ROAD LANDFILL SITE, BURY

1.0 INTRODUCTION

- 1.1.1** The purpose of this review is to summarise findings from previous ground investigations to support an understanding of the likely ground conditions across the site. The focus is on characterising the physical ground conditions encountered and does not extend to broader regulatory considerations, such as the Waste Framework Directive or Environmental Permitting Regulations. Given the proposed redevelopment of a historical landfill, regulatory approvals will be necessary, and a permitting strategy will need to be agreed. Consultation with the Environment Agency is ongoing.
- 1.1.2** This review will inform subsequent work, including a desk study and the development of a conceptual site model. Further ground investigation may also be required to support development proposals, identify potential constraints, and inform design decisions.
- 1.1.3** The following reports have been made available for review:

Table 1.1: Information Reviewed

Reference Details	Author	Reference
Report on Soil Investigation at Site of A Day Care Centre for the Elderly and Handicapped at Wellington Road, Bury. Ref: 70/133, dated Jan 1971	Sub Soil Surveys Limited	[1]
Landfill Gas Site Investigation, Wellington Road, Bury. Dated 1993	Greater Manchester Geological Unit	[2]
Assessment of Data and Remedial Design Recommendations. Former Landfill Site off Wellington Road Bury. Ref: 15156, dated 1994	Robinson Fletcher Consultants Limited	[3]
Site Investigation Wellington Road, Bury Factual and Interpretative Report. Ref: 3604, dated Nov 2002	Greater Manchester Geological Unit	[4]
Wellington Road Landfill Site, Site Investigation and Risk Assessment. Ref: ES/EM/BUR/W/01, dated Nov 2004	Cleanaway	[5]
Bury MBC Landfill Audit, Wellington Road Landfill Site. Ref: C085, dated Aug 2007	Bury MBC	[6]
Wellington Road Landfill, Bury – Interpretative Report. Ref: 3511179A-ZEV, dated Sept 2011	Parsons Brinckerhoff	[7]

2.0 REVIEW

2.1 A review of the reports details in Table 1.1 is presented below.

Soil Investigation at Wellington Road, Bury - Sub Soil Survey 1971 [1]

2.2 The works were undertaken to inform ground conditions beneath a proposed day centre (location of existing building) within the eastern section of the site (currently the Grundy Day Centre).

2.3 Sub Soil Survey (SubS) noted that the Arley Coal Mine Seam outcrops beneath the site and that it may have been worked, particularly towards the western edge of the site (note, this refers to the eastern section of the undeveloped field). It was recommended that a detailed mining report was obtained.

2.4 The works were stated to have comprised 7 No. cable percussion boreholes drilled to depths ranging from 21 ft (6.4m) and 51ft 11 in (15.8m). Ground conditions encountered were summarised as topsoil and fill over peat and both granular and cohesive glacial deposits. The Made Ground was described as very loose and loose ashes, cinders, brick fragments etc "fill material" and was encountered in all but two of the exploratory holes (located in the south) to a maximum depth of approximately 14 ft (4.25m). It was stated that the fill was between 12 ft (3.65m) and 14 ft (4.25m) in the north and west of the site, 5.5 ft thick in the east and absent from the south of the site.

2.5 With regards to the presence of peat, the report states that the peat deposit lies in a shallow valley or depression formed by the underlying Glacial Sand deposits running in an approximately northeast to southwest direction.

2.6 Where encountered, bedrock was recorded between approximately 30.75 ft (9.4m) and 45.25 ft (13.8m) depth. In BH2 and BH4 (note, from review of the logs, the report incorrectly refers to BH2 and BH5 in Section 3. g)), coal was recorded at the top of the bedrock and SubS noted that this may be associated with the Arley Coal Seam.

2.7 Although the exploratory hole locations from the SubS investigation cannot be accurately confirmed, the suggested locations of BH2 and BH4 from the included plan do generally correspond with the inferred location of the coal seam shown on the Mining Remediation Authority's interactive mapping, see insert below:



Figure 2.1 Mining Remediation Authority – Coal Seams

2.8 Groundwater was recorded in some areas perched within the base of the fill materials and within the natural granular strata ranging from 12 ft (3.65m) and 17 ft (5.2m) depth.

2.9 Testing of samples focused on physical properties of the soil with no testing of common contaminants reported.

Landfill Gas Site Investigation, Wellington Road, Bury – Greater Manchester Geological Unit 1993 [2]

2.10 The stated purpose of this report by Greater Manchester Geological Unit (GMGU) was to assess the risk to existing and proposed development from gas migration from the former landfill site located on Wellington Road and Market Street. Previous gas monitoring had reportedly been undertaken by searcher bar survey and concern existed that Made Ground may be acting as a potential migration pathway for gas.

2.11 The report initially provides a summary of the site history based on review of historical plans. This indicates that excavations on site took place as early as the 1927 edition plan which is stated to show that the site is at a lower level than the surrounding ground with adjacent roads shown as embankments.

2.12 The report also states that a planning permission (Bury Corporation Cleansing Department, dated 1954) was obtained to infill the site to the level of the surrounding roads, however, the filling didn't take place until after around 1961 based on GMGU's review of available aerial photography. It stated that the permission related to the eastern part of the site only and that no information was available regarding the material tipped. GMGU confirmed that further infilling was undertaken by Bury Engineering Department in early 1970s, with the exact extent of the filling unknown but assumed to be around 3-5m deep and consisting mainly domestic refuse.

2.13 The ground investigation works undertaken by GMGU comprised 11 No. cable percussion boreholes to depths of between 10m and 10.5m. Material described as 'fill' was recorded in all exploratory holes, with the exception of two (BH3 and BH4, which were located centrally on the southern edge of the site). The fill was described as 1m of clay, brick and stones over 'tip refuse' (not encountered in BH1 in north of site and BH2 located on southern section) with ash in places and was recorded to depths of between 2.7m and 6.5m.

2.14 Peat was encountered in several of the exploratory holes directly beneath the fill, with silty sandy gravel and sandy silty clay present beneath the peat horizon. Bedrock was recorded in BH3, BH4 and BH7 (the log for BH7 is missing from the report) described as weathered marl. Groundwater was noted to be generally at a depth of 4.5m to 5.0m with shallow perched groundwater also recorded in several locations (notes groundwater depths are likely to relate to that encountered during the intrusive works rather than monitored depths).

2.15 It should be noted that as the purpose of the investigation was to consider the potential for gas migration off site, the boreholes were constructed towards the eastern, southern and western site boundaries and no investigation was undertaken towards the central area of the site. Therefore, the depth of fill material was only confirmed on the site boundaries and not in the central area where it may potentially be present to a greater depth.

2.16 From monitoring of ground gas, maximum concentrations of methane and carbon dioxide were recorded as 50.5% v/v and 15.5% v/v, respectively. Gas pressures (kPa), rather than flow rates, were recorded during monitoring, with GMGU stating that no positive pressures were recorded. GMGU concluded that carbon dioxide was predominant in the eastern area of the site, likely due to the greater age of the fill and the greater proportion of "inert" material, while methane in the western section was likely due to the greater proportion of putrescible waste.

- 2.17 High concentrations of gas were recorded BH3, where fill was not encountered, and GMGU concluded that this suggested gas migration was occurring, likely due to the presence of sand horizons present at this location.
- 2.18 From review of the exploratory hole logs, the construction details of monitoring installations fitted into the boreholes is not clear. It is stated that these were generally fitted to the full depth of the borehole, however, no specific detail is provided on response zones. A general figure arrangement is provided, showing full depth response zones with the upper meter finished with plain pipe.
- 2.19 GMGU recommended the installation of a “standard” landfill gas venting trench, lined with an impermeable membrane on the development side i.e. along the western boundary of the proposed Hurdles Centre (Note, Grundy Centre is already present at this time) with the trench extending to 6.5m to 7.0m depth. Gas “exclusion” measures were also recommended for the proposed buildings, or consideration should be given to raising the building above ground level to allow “free movement” of air.
- 2.20 A “venting trench of similar design” was also recommended for the southern and western boundaries of the site. In terms of the western boundary, GMGU also recommended the installation of monitoring wells in the gardens of properties along Market Street to confirm the need for installation of a bentonite / cement barrier if monitoring indicates that greater control measures (beyond the installation of the trench) is required.
- Assessment of Data and Remedial Design Recommendations at Fromer Landfill Site off Wellington Road, Bury – Robinson Fletcher (1994)*
- 2.21 The report by Robinson Fletcher (RF) provided a review of factual data from the GMGU report from 1993. RF also noted that additional landfill gas monitoring data from Bury Council was also reviewed. It appears the purpose of this report, although it is not clearly stated, was to peer review the proposed remedial recommendations made by GMGU and to appraise likely costs associated with implementing the proposed measures.
- 2.22 No further intrusive investigations appear to have been undertaken by RF in preparation of this report. However, it does refer to further investigation by dynamic probing undertaken in 1991 at the site of Hurdles Nursery (assumed to be part of present day Grundy Centre), where the “fill and peat” extended to a depth of 8.0m, which is deeper than encountered in other investigations, although no factual data from this report was available for review as part of this exercise.
- 2.23 From review of landfill gas monitoring, RF noted that “*elevated levels of methane and carbon dioxide have been found in all boreholes*”; in the west of the site, “*carbon dioxide levels occur in the range of 8 – 17% volume, and the methane levels are on occasion between 40 and 75% volume*”. In the northeast of the site (BH01), methane was recorded at 23% volume and carbon dioxide at 16% volume. In the east of the site (BH10 and BH11) typical levels of methane and carbon dioxide were in the range of 10 to 14% volume and 10 to 17% volume, respectively. Flow rates do not appear to have been recorded, by RF note that “*landfill gas pressures within the ground*” were monitored and “*only negligible positive pressures were recorded*”.
- 2.24 Having undertaken a review of the GMGU remediation proposals, RF stated that these “*were considered to be comprehensive and will provide the landfill gas control required*”.

- 2.25 Following review of the factual information, RF concluded that significant landfill gas production is occurring at the site and remedial works were required. RF agreed with the findings of GMGU and indicated that the Grundy Centre, Hurdles Nursery and housing along the northern end of Shortlands Avenue and the houses along Market Street are at risk. RF highlighted the potential for landfill gas migration through natural sands and gravels and that the presence of substantial thickness of peat was considered by RF to exacerbate the problem in terms of it also potentially generating hazardous ground gas as it degrades.
- 2.26 RF did go on to state that there is no monitoring data presented in the existing reports showing that landfill gas is in fact causing either a hazard or nuisance off site. RF stated that in terms of risk, the landfill has now matured to an age where the maximum gas production rates and driving pressures will have passed with gas emissions escaping into the environment, indicating "*the period of maximum risk has therefore also passed*".
- Site Investigation Wellington Road, Bury Factual and Interpretative Report – GMGU (2002)*
- 2.27 The investigation works undertaken by GMGU in 2002 was to identify and evaluate whether further remediation or maintenance measures were required. The works undertaken by are indicated to have comprised a series of six new boreholes and the repair of three existing along with monitoring of the waste mass, venting trench and boreholes outside the venting trench.
- 2.28 GMGU stated that in 1995, a gas ventilation system with associated stacks was installed on the site. A total of 88 "chimney vents" were installed, all to depths of 6.5m, located along the eastern, southern and western site boundaries. GMGU also stated that contrary to previous recommendations, no impermeable membrane was installed on the development side of the trench. No reference to the origin of this information was provided by GMGU, although a chimney vent design drawing is appended to the report.
- 2.29 GMGU reported that two boreholes, noted as BH10A and BH11A, were believed to have been installed to replace the corresponding boreholes from previous investigation (GMGU, 1993) following construction of the car park for the Grundy Centre. GMGU stated that logs for these boreholes or installation dates were not available and that they could not locate BH11A.
- 2.30 Ground conditions encountered were described to include two distinct types of Made Ground, comprising the following:
- Clay ash and brock extending to a maximum depth of 4.6m bgl
 - Clay, ash, brick, concrete, wood and other general refuse, recorded to a maximum depth of 7.6m bgl
- 2.31 Peat and Glaciofluvial sand and gravel deposits were encountered beneath the Made Ground, which were in turn underlain by Glacial Clays.
- 2.32 As with previous investigations, monitoring identified that significant concentrations of methane and carbon dioxide were recorded from borehole installations present within the landfill. No flow rates were presented as part of the data. Outside of the landfill area and outside of the venting trench, GMGU reported that monitoring and sampling indicated reduced concentrations of both methane and carbon dioxide, indicative of the organic peat horizons encountered in these boreholes (rather than attributing the gas concentrations to landfill source).
- 2.33 GMGU concluded that the current gas venting measures were considered adequate as although "dangerous" concentrations of landfill gases are still accumulating in the landfill, much reduced levels are present outside the perimeter of the landfill which can be attributed to naturally occurring peat horizons.

- 2.34 However, GMGU did state that due to the sensitivity of the adjoining properties, a gas risk assessment has identified that the level of landfill gas at this site is unacceptable.
- 2.35 It was recommended that the integrity of the venting trench should be assessed periodically by monitoring of boreholes on site. A survey of the floor void air bricks of properties on Market Street was also recommended to confirm they were functional and providing adequate ventilation.
- 2.36 GMGU also stated that based on the source-pathway-receptor scenario associated with landfill gas generation and migration to neighbouring residential properties, the site would meet the definition of Contaminated Land in accordance with Part IIA of the EPA (1990).
- Wellington Road Landfill Site, Site Investigation and Risk Assessment – Cleanaway (2004)*
- 2.37 Cleanaway undertook a comprehensive review of existing factual information supplemented by additional monitoring, sampling and laboratory analysis (both groundwater and gas). This informed the development of a landfill gas risk assessment, undertaken using GasSim, with the model developed to assess lateral subsurface migration only (noting that exposure through surface emissions would need to be considered as part of a more comprehensive risk assessment). GasSim is a probabilistic model and is highly dependent on the model input parameters. A detailed evaluation of the model and input parameters assumed by Cleanaway has not been completed as part of this review.
- 2.38 In conclusion of the GasSim risk assessment model, it was noted that based on estimated emission rates the model shows landfill gas (methane) may migrate up to 55m from the site boundaries. Cleanaway discussed the limitations of the model based on the source data input parameters but stated that (whether the model was accurate or not) the model indicated that the current gas venting system may be inadequate to prevent lateral gas migration off site. Cleanaway noted that there were no suitable gas migration monitoring boreholes installed around the site to quantify the risk of lateral migration.
- 2.39 It was suggested that further research and data was required to calibrate the model and in the absence of essential details, it was considered by Cleanaway that it was more beneficial to quantify the risks of landfill gas migration using available monitoring data.
- 2.40 From review of the monitoring data, Cleanaway concluded that there was a marked decrease in the landfill gas concentration post control system installation in boreholes located outside of the infrastructure. A detailed series of recommendations was presented, including the installation of additional perimeter boreholes at 20m centres in virgin ground (assumed to mean outside the deposited waste) to allow representative monitoring results for landfill gas migration to be obtained. Further risk assessment was also recommended once the monitoring dataset was increased from the proposed new boreholes.
- 2.41 Other recommendations included monthly monitoring of installations, setting “trigger” levels for borehole gas concentrations, monthly FID survey around site perimeter and monthly monitoring of the venting system to confirm its performance.
- Bury MBC Landfill Audit, Wellington Road Landfill Site – Bury MBC (2007)*
- 2.42 The purpose of this report was stated to assess the site conditions and identify existing boreholes and their condition.
- 2.43 A summary of the site history was provided, indicating that filling took place between 1960 and 1972, prior to waste licencing act. It was noted that the fill primarily comprised domestic waste with some underlying peat. A gas trench and venting system was installed in 1995 to a depth of 6.5m at 3m intervals.

- 2.44 The Audit identified “*most of the boreholes, with several needing new headworks*”. Some however, were reported as lost. The audit also included a visual inspection of the vent stacks and cowls, all of which were reported to be in “OK” condition, however several were potentially impacted by trees.
- 2.45 Bury reported that monitoring of landfill gas recorded methane at a maximum of 33.5% v/v in BH6 (located in southwest corner, possibly outside the venting trench) and carbon dioxide at 18.2% v/v in BH8 (located towards the northern section of the western site boundary fronting Market Street).
- Wellington Road Landfill, Bury – Interpretative Report – Parsons Brinkerhoff (2011)*
- 2.46 The objectives of the report by Parsons Brinkerhoff (PB) included determining the extent of any ground gas and leachate at the site and assessing the impact on the gas and leachate regime at the site if a hardstanding cover was placed to allow use of the site as a car park.
- 2.47 PB undertook ground investigation works comprising two cable percussion boreholes to depths of 6.5m and shallow hand pits. Materials encountered in the boreholes comprised gravelly clay/silt and sandy gravel with inclusions of brick, concrete, plyboard, glass, plastic bags, shredded plastic, wire, ceramics and textiles, with observations of partial combustion. No suspected asbestos was encountered. Organic and solvent odours were noted throughout the drilling works.
- 2.48 Ground gas monitoring was conducted on one occasion, including on previous exploratory locations where they could be located. Concentrations of methane and carbon dioxide were recorded at maximum concentrations of 43% v/v and 25.8% v/v, respectively. A maximum recorded flow rate of 0.5 l/hr was recorded in BH1702, which is located towards the southwestern boundary of the site. Notes provided from the monitoring indicate that headworks / gas tap bungs were missing from several installations. Also, solvent” odours were noted during monitoring of BHA and BHB with PID readings of up to 162ppm recorded.
- 2.49 A PID meter was used to screen for volatile organic compounds within samples, however, the PID readings remained relatively low, with a maximum recorded concentration of 14.2ppm at the base of the waste material in BHA where a slight solvent / tar odour was noted. Methane monitoring was also undertaken by PB down each borehole as they were progressed to depth. Only low concentrations of methane were recorded, with a maximum concentration of 0.7% v/v from 0.4 to 5.6m bgl in BHB, which corresponds to the landfill material strata.
- 2.50 Monitoring indicated groundwater levels in the range 3.98m to 4.88m bgl. During groundwater sampling, no free product was noted within any of the sample locations, but a sheen was observed on the interface probe when it was removed from BH14/02.
- 2.51 PB undertook an assessment of risks to human health, based on a proposed end use of the site as a car park. No contaminant exceedances were reported by PB based on the assumed commercial end use. The assessment also considered the site for its existing site use, i.e. public open space. This identified that several PAH compounds were recorded at concentrations above associated generic assessment criteria, however, PB considered these to be minimal exceedances and would not be indicative of the site meeting the statutory definition of Contaminated Land. Overall, PB concluded that with respect to human health, there would be negligible impact for a proposed commercial end use development (car park).

2.52 In terms of ground gas risk assessment, PB considered that development of the site surface with a carpark would potentially seal the surface and prevent gas migrating to atmosphere. PB considered that although this could potentially increase the risk of lateral gas migration, the risk would still be very low, and the vent system would most likely prevent off site migration. PB concluded that the gas volume being generated on site was small and would continue to reduce and that there was no evidence to suggest significant gas outside of the site has occurred. PB stated that further site investigation, ongoing gas monitoring or remediation work were not required in relation to ground gas risk.

2.53 Based on a Controlled Waters Detailed Quantitative Risk Assessment, PB concluded that the recorded concentrations of several contaminants, including BTEX compounds, TPH fractions and ammoniacal nitrogen, do not pose a risk to the River Roch, down gradient of the site. Due to the low sensitivity of the Coal Measures bedrock beneath the site, PB did not consider risks to this aquifer. It was noted that site development may impact leachate generation within the unsaturated zone, however, the model indicated that any potential increases are unlikely to lead to exceedances of remedial target concentrations derived.

2.54 PB also recommended that vent stacks on site should be repaired.

3.0 SUMMARY

3.1 From available information, several phases of intrusive ground investigation works have been undertaken across the site, initially focused on development of the eastern section of the site (SSS in 1971 [1]) followed by consideration of the potential for landfill gas migration (GMGU in 1993 [2]; GMGU in 2002; and PB in 2011[7]). The report by Cleanaway in 2004 [5] appears to have been based on available factual information at that time.

3.2 The main method of intrusive investigation has been via the drilling of boreholes, which are relatively small in size (diameter) and only allow inspection of a small quantity of material as it is recovered during the drilling process. This is likely due to the works having taken place to assess landfill gas risk and boreholes obviously allow the installation of monitoring standpipes for this purpose.

3.3 Trial pitting, although unlikely to penetrate to the full depth of fill in all areas of the site, would have provided the opportunity to allow more accurate characterisation of the waste materials deposited in the landfill site, noting that there are several references to the uncertainty around the exact nature and composition of the materials deposited within the landfill. Trial pitting would have proven useful in this regard for refining landfill gas risk assessment using probabilistic tools (GasSim).

3.4 It is also evident that much of the intrusive investigation work has occurred around the perimeter of the site, mainly the eastern, southern and western boundaries. Again, this is likely due to the primary aims and objectives of the previous reports were to consider the potential for off site migration of ground gas towards sensitive receptors identified to be potentially at risk.

3.5 It should be noted that from review of the landfill gas risk assessment completed to date, there appears to remain concern over the potential for uncontrolled gas migration towards nearby properties. Further, detailed recommendations have been made in several reports for the completion of monthly monitoring of installations and the gas venting system, however, it is not clear if this has taken place and no further monitoring records have been presented for review at this time.

- 3.6 Notwithstanding the above, there are no available records indicating that landfill gas migration has impacted properties. Given the time elapsed since waste deposition and the installation of the gas venting trench, this is considered unlikely to change under current site conditions. Previous reports have indicated that the gas venting system is functioning to reduce lateral migration of landfill gas off site. However, any future development proposals must carefully consider the potential for altering the existing ground gas regime and ensure that appropriate assessment and mitigation measures are incorporated as necessary.
- 3.7 In terms of construction of the landfill, fill material is likely to have been loose tipped and informally compacted. It is evident from ground investigation information that there is no basal liner or formal / engineered capping to the landfill and the thickness of cover materials across the site is not uniform.
- 3.8 This review has been undertaken to establish a baseline understanding of the site in the context of potential redevelopment. Sufficient historical and factual information is available to support the development of a conceptual ground model at desk study stage. However, any future development will require targeted ground investigation works to confirm subsurface conditions, assess the potential risks associated with the landfill, and obtain preliminary geotechnical information to inform design.