Elemental GI Ltd

REPORT: REMEDIAL METHOD STATEMENT FOR SITE OFF CHAPELGATE, SUTTON ST. JAMES

CLIENTS: SHIELDS WILSON LTD AND SCENIC HOMES LTD

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REMEDIAL METHOD STATEMENT:
SITE OFF CHAPELGATE, SUTTON ST. JAMES

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Semi-Technical Summary

The reader is referred to the terms and conditions which accompany this report, and which are presented at the end of this document.

This semi-technical summary provides a brief overview of the main conditions which have been noted on site. These features / factors (alongside others) are explained fully in the following report and the following should therefore not be referred to in isolation. **No reliance should be placed on the summary until the whole report and related documents have been read in full.**

Contamination	Where asbestos-containing materials are present on site (e.g. building materials) they should be safely removed by licensed contractors for appropriate disposal before the start of any redevelopment works. The western half of the site has been recorded to contain made ground which has elevated concentrations of PAHs alongside pathogenic bacteria and asbestos. Remedial works including the removal and / or capping of these materials will be required to protect future end-users. Some other features, including slurry pits and their contents, will also require removal from the site.
Conceptual Site Model	Potential pollutant linkages exist which relate to the contamination and to the future residential end users. These need to be broken in order to ensure that risks to future site users are negated. It is considered that the remedial works presented in this RMS should also provide significant protection to controlled waters through various 'source removal' works (including the removal of slurry pits and their contents).
Remediation Specification	Please see Section 4.0 for details. In summary it is recommended that a combination of source removal and capping shall be required across the western half of the site. Validation works will be necessary to confirm that these works have been successfully completed.

1.0 INTRODUCTION

1.1 Report Status

Elemental GI Ltd were appointed by Shields Wilson Ltd and Scenic Homes Ltd (hereafter referred to as 'the Client') to prepare a Remedial Method Statement ("RMS") for the site off Chapelgate, Sutton St. James (hereafter referred to as 'the site').

This report has been prepared on the understanding that the site is to undergo redevelopment to support residential housing. We have reviewed a copy of the proposed layout (Ref. SD16-049/3), and extracts of this plan are presented in the Proposed Site Layout Plan (Drawing 001) in Appendix I.

This report has been prepared in accordance with our notes concerning the terms and conditions of these works and of our engagement, which are presented at the end of this report.

Should the development proposals alter, then the recommendations in this report may be subject to change. Whilst it may be utilised by others for reference purposes at the Client's discretion, it has not been prepared for any other purposes (e.g. waste classification etc.) and therefore additional works may be required by third parties dependent upon their own requirements / works.

All recommendations are subject to the approval of the relevant Regulatory Authorities.

1.2 Previous Reports

The following reports have been prepared for this site:

- Grange GeoConsulting Ltd – Piggery to the South of Chapelgate, Sutton St. James, Spalding, Lincolnshire: Phase 1 Desk Study (Dated July 2017 ref. R17053);
- Grange GeoConsulting Ltd – Piggery to the South of Chapelgate, Sutton St. James, Spalding, Lincolnshire: Phase 2 Intrusive Ground Works Factual Report (Dated July 2017 ref. R17053);
- Lincolnshire County Council – Ground Investigation Report for a Proposed Residential Development off Chapelgate, Sutton St. James (Dated 20th Nov. 2017 ref. G40654/HD/17/MT);
- Grange GeoConsulting Ltd – Piggery to the South of Chapelgate, Sutton St. James, Spalding, Lincolnshire: Phase 1 and 2 Intrusive Ground Investigation Report (Dated April 2018 ref. R17053); and
- Geo-Matters Ltd – Phase I and II Geo-Environmental Investigation (Dated June 2021 ref. GML21135/2/0).

It has been assumed that the Client has reliance on the 2021 report and related information. However, it is also noted that copies of the above listed reports are available on the South Holland District Council (SHDC) planning website, and have therefore can be used for general background information.

As part of our preparation to produce this RMS, Elemental GI Ltd have also reviewed comments made by the SHDC Environmental Health Officer (EHO), which have been incorporated within this document where relevant.

1.2.1 Summary of Geo-Matters Phase II Investigation Report

The 2021 Phase II Investigation by Geo-Matters incorporated information from the previous investigation reports, and it is therefore assumed that this represents the most current and comprehensive summary of the site's setting and related background information.

The 2021 report noted that previous works at the site (undertaken by others) had reported the following key findings (summarised from extracts within the 2021 Geo-Matters report):

- *"In 2017 the western part of site was recorded to have been a piggery, having been developed from fields in the 1970s;*
- *The piggery was noted to contain asbestos-containing building fabrics, with similar materials present in mounds on site. Bulk storage of fuels, animal wastes and fertilisers was also recorded;*
- *The 2017 Phase I also notes the probable burial of animal carcasses on site (adjacent to lagoon) prior to the mid 1980's. They also said that ground gas and pathogenic bacteria may be an issue;*
- *The 2017 investigation report indicated that the third party completed 10 No. trial pits across the site to depths of up to 2.3m, generally recording topsoil or made ground overlying Tidal Flat Deposits (generally soft to stiff clay with peat present in one location). Pig bones and other anthropogenic materials were recorded in 4 of the 10 pits;*
- *The 2017 investigation report indicated that the third party found a hotspot of asbestos and a hotspot of benzo(a)pyrene, but they also found 'extremely high concentrations' of pathogenic bacteria in several samples and they noted that the piggery activities '..have had a huge impact on the underlying soils..'. They also noted exceedances of some contaminants in water samples; and*
- *The 2018 investigation report indicated that the piggery was now recorded to have ceased operations. Their investigation included an additional 11 No. window sampler boreholes to depths of up to 4m, including the installation of monitoring wells for gas / groundwater;*

- *The 2018 investigation report indicated that they recorded 'significant additional contamination' including 4 No. asbestos detections, and 'high' concentrations of ammonia and nitrogen were also reported. They also recorded several exceedances of determinands in groundwater. However, they confirmed that soils had tested negative for salmonella and anthrax;*
- *The third party recommended the installation of a capping layer across all soft landscaping;*
- *The third party found no contamination issues associated with the eastern paddock / field area of the site; and*
- *Piled foundations were selected by the third party as the preferable likely foundation option."*

The Geo-Matters report in 2021 included the following summary of the site:

> *"According to the viewed historical mapping, the site was part of a field since the earliest viewed map of 1888 and was developed to support a piggery by 1975. This was extended up until the early 1990s prior to its recent closure and partial demolition. The site currently supports and open grassed field and a former piggery area which contains various disused barns and open ground. The land surrounding the site supports a mix of residential, agricultural and light industrial land uses.*
>
> *Previous investigations undertaken by the third party have encountered contamination across the former piggery area including pathogenic bacteria, heavy metals, PAHs and asbestos.*
>
> *Potential ground gas sources have been identified on site, although a ground gas investigation by the third party did not encounter any elevated concentrations of ground gas (6 No. visits from 2nd Feb. 2018 to 16th March 2018 from 6 No. monitoring standpipes).*
>
> *The site is in a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Therefore, Radon protective measures are not required, subject to approval of the regulatory authorities and NHBC."*

Their investigation reported the following in relation to made ground and soils at the site:

> *"Made ground was encountered in all positions which were completed across the former piggery area but was generally absent across the eastern part of the site. …The made ground which was encountered comprised either reworked topsoil (with fragments of brick) or reworked sandy silt / clay (with occasional bricks, brick fragments, plastic bags. During our recent investigation this was encountered to a*

maximum depth of 0.7m begl in trial pit TT04 although previous investigations encountered made ground to a maximum depth of 1.8m begl at their location TP8. In general it was noted that made ground only exceeded 1.0m thickness in 2 No. areas of the site, which are a single 'hotspot' around TP4 (in the south-east of the piggery area), and in a localised area around locations WS1, WS7 and WS8 (in the south-west of the former piggery area).

Natural topsoil was encountered across the eastern area of the site and in some parts of the former piggery area.

... The majority of exploratory holes appeared to be free from significant / obvious potential contamination, with the exception of animal remains / bones which were encountered in the centre of trial trench TT03 and the presence of black ashy made ground at shallow depths at location TT07.

The third party noted the presence of animal remains / bones at 4 No. locations (WS7, WS11, TP4 & TP8). It is noted that the animal remains / bones were not encountered uniformly across the southern part of the former piggery area, and were generally only located in isolated pockets towards the southern part of this area of the site. It is understood from the site owner that further animal remains are present at the site, but are in similar isolated pockets. These are understood to be mostly present in the southern part of the former piggery area, although a horse is understood to have been buried in the southern part of the eastern area."

The Geo-Matters report found elevated PAHs at location TP102 (0.3m begl), and they also found pathogenic bacteria in 4 No. samples. With regards to the pathogenic bacteria, they said:

"4 No. selected samples were also analysed for the pathogenic bacteria e. coli and for total presumptive colioforms. The results reported are similar to those obtained by the third party during their works, with high levels of total colioforms detected, but low levels of certain specific pathogenic bacteria (e.g. e. coli) recorded.

Similarly to the third party's findings, our own analyses also indicated a distribution of colioform concentration which was noted to be significantly higher in the southern and central areas of the former piggery.

At present there is a significant lack of guideline values or authoritative guidance / standards with regards to the significance of data concerning pathogenic bacteria contamination in soils. However, based upon our own professional experience it is noted that the levels of coliforms detected within the central and southern parts of

the former piggery area is significantly high, and is indicative of contamination of these areas with animal wastes / faeces. However, the concentrations detected within peripheral locations (e.g. TT105) are considered to be significantly lower and may be considered as almost 'background' levels which could be typical of sites which have not been impacted with animal wastes / faeces."

They also noted animal remains in trench TT03, alongside slurry pits and anecdotal evidence of animal burials in the eastern 'field'.

1.2.2 Summary of SHDC Discussions

The Geo-Matters report confirmed the following in relation to discussions with SHDC:

"Geo-Matters Ltd liaised with representatives of the Council as part of the works reported herein to ensure that they were aware of our investigation and to discuss the scope in the context of the updated development proposals and with reference to their previous comments. Notes and details on these discussions are presented herein where relevant, although in summary the following was discussed / concluded:

- *Application Ref. H20-0977-19 has a response letter from SHDC which is shown on their planning portal. This includes comments from the Council's Environmental Protection Officer, who said that they agreed that no remediation was necessary across the eastern paddock / field area, but that they disagreed with the third party's recommendations for the southern part of the western paddock (animal burial area), and that the recommended 600mm cap (with marker layer) was insufficiently protective of human health and controlled waters. Their recommendation was that the excavation and off-site disposal of some soils across the southern part of the site would be necessary.*

Discussions between Geo-Matters Ltd and the Council's Environmental Protection Officer on 4th May 2021 included the following key points:

- *The Council were surprised that ground gas levels were generally 'low';*
- *The Council required a more refined ground model to be produced as part of any investigation, including consideration of ground levels in the context of contamination and in the context of remedial recommendations (balanced against associated recommendations from other consultants e.g. FRA);*
- *The proposed investigation works which were presented by Geo-Matters Ltd appeared to be provisionally suitable to assess the main risks, and the completion of trenching and additional ground gas monitoring as part of the works was approved."*

It is recommended that representatives of SHDC are consulted and contacted with regards to the next stages of redevelopment and construction in advance of any such works including; but not limited to; the comments and recommendations made within this Remedial Method Statement.

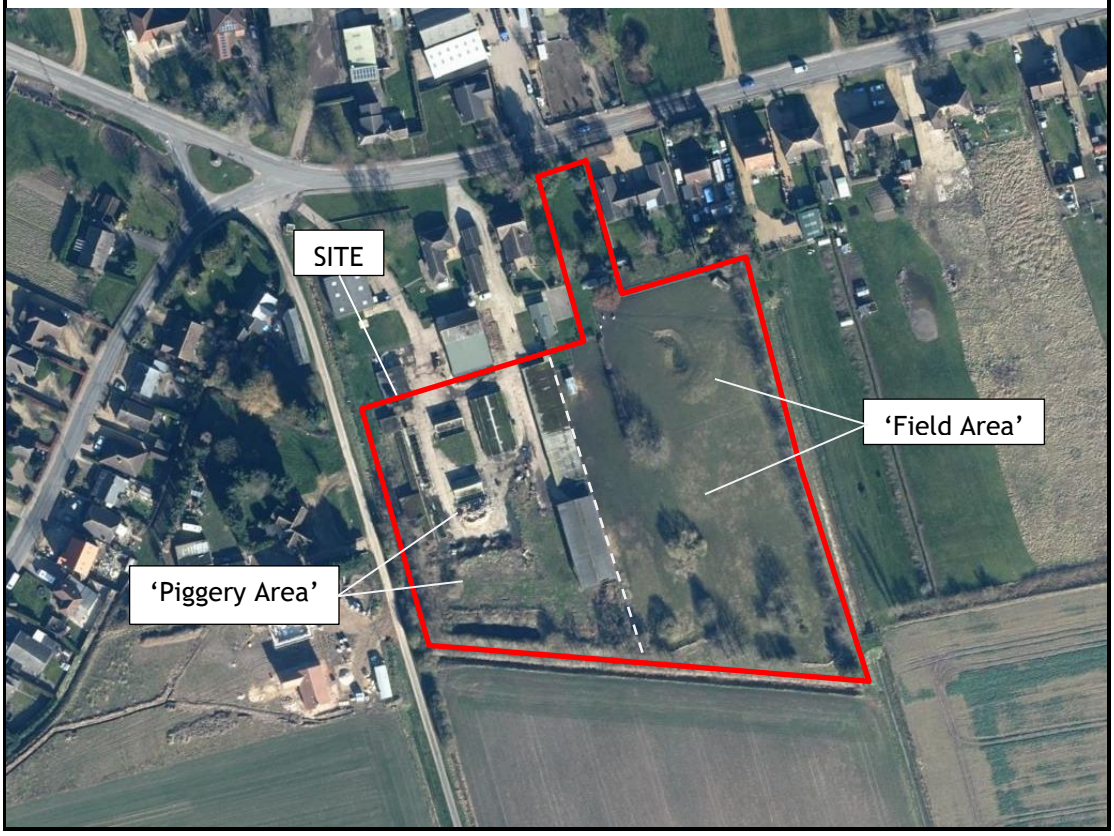
2.0 SITE SETTING

2.1 Location

The address and location of the subject site are shown in Table 2.0 below:

Table 2.0: Site Location and Dimensions

Site Address	Land South of Chapelgate, Sutton St. James
National Grid Ref.	539040, 318060
Area (Approx.)	1.64ha
Access	The site is currently accessed via 2 No. open entry points leading from Chapelgate



2.2 Geo-Environmental Setting

The site is recorded to be underlain by made ground and natural topsoil over Tidal Flat Deposits (clay / sand / silt). The West Walton Formation and Ampthill Clay Formation are recorded at greater depths. The aquifer status of these natural formations is 'Unproductive Strata'.

The Geo-Matters report indicated that there are no Source Protection Zones on / near the site, and no abstractions from either groundwater or surface waters are recorded within a 500m radius. However, surface watercourses are present along the site's southern and western boundaries.

2.2.1 Site:

- The site supported a disused piggery and an open grassed 'field' at the time of the most recent investigation. The field area broadly occupies the eastern half of the site, with the disused piggery occupying the remaining western half;
- The field supports open grassed areas with some small areas of trees / vegetation also present. A pond and accompanying mound / bund (possible arisings from the construction of the pond) are present in the norther part of the field. The site owner reported the possible burial of a horse near trees in the southern part of the field;
- The piggery supported an area of open / grassed ground across its southern part, with disused buildings and hardstanding across remaining areas. The Geo-Matters report noted the presence of possible asbestos containing materials within some of these structures; and
- Slurry pits were noted in some areas of the site in the vicinity of the piggery.

Please refer to the Geo-Matters report for a full / detailed site description.

2.3 Ground Conditions

Reference should be made to the report(s) referenced in section 1 of this RMS for a full description of the site's ground conditions, but in summary:

- The third party encountered made ground across the piggery area, but reported it to be absent across the eastern field area;
- The made ground was reported to generally comprise reworked topsoil or reworked sandy silt including some anthropogenic materials and rare animal remains;
- Natural soils were encountered as sandy clays which were underlain by softer sandy silt / silty sand soils;
- Groundwater was encountered during the most recent investigation in around half the exploratory holes from depths of between 1.00m and 2.00m below existing ground level (begl).

Extracts of the third party's Exploratory Hole Layout Plan (Drawing G-001) and a General Photographic Record (Drawing G-002) are included in Appendix I.

2.4 Contamination Summary

Geo-Matters noted the following with regards to contamination at the site, which was mainly assessed against screening criteria for a 'residential with plant uptake' end-use scenario:

- *TT101 at 0.2m begl (topsoil) – Exceedances of pathogenic bacteria;*
- *TT105 at 0.1m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP101 at 0.2m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP102 at 0.3m begl (made ground) – Exceedances of PAHs and pathogenic bacteria;*
- *TP4 at 0.8m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP6 at 0.6m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP7 at 0.2m begl (made ground) – Exceedances of asbestos;*
- *TP8 at 1.8m begl (made ground / clay interface) – Exceedances of benzo(a)pyrene and pathogenic bacteria;*
- *WS7 at 0.4m begl (made ground) – Exceedances of PAHs and asbestos;*
- *WS8 at 0.2m begl (made ground) – Exceedances of asbestos;*
- *WS9 at 0.3m begl (made ground) – Exceedances of pathogenic bacteria;*
- *WS10 at 0.4m begl (made ground) - Exceedances of pathogenic bacteria; and*
- *WS11 at 1.4m begl (made ground) – Exceedances of asbestos.*

They also summarised some observed trends with regards to ground / contamination as follows:

- *It is noted that all of the exceedances identified to date have been within samples of made ground. No contamination has been detected within samples of natural soils.*
- *Made ground across the former piggery area appears to be widely / generally impacted by pathogenic bacteria.*
- *Made ground across the central and northern part of the former piggery area appears to be impacted by asbestos.*
- *Made ground along the western boundary of the former piggery area appears to be generally impacted by PAHs (NB the third party used a higher T1SV for the screening of benzo(a)pyrene than Geo-Matters Ltd, which was at 3.0mg/kg).*

2.5 Ground Gas and Radon

The site is in a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Therefore, Radon protective measures are **not** required, subject to regulatory approval.

In relation to ground gas, the Geo-Matters report discussed previous gas monitoring (i.e. by other companies) and said that maximum steady-state flow rates of 2.6 l/hr were recorded,

and steady-state concentrations of methane and carbon dioxide of 0.3% v/v and 3.4% v/v respectively were recorded. Geo-Matters installed 2 No. gas wells at the site in 2021 and completed an additional 3 No. monitoring visits to provide an updated record of ground gas conditions. In summary they recorded generally negative flow rates, very low methane (maximum of 0.1 % v/v) and carbon dioxide ranging from 0.1 to 5.2% v/v (but typically being present below 5.0% v/v). The lowest concentration of oxygen recorded by them was 17.9% v/v.

Geo-Matters did not recommend a ground gas classification for the site. The following significant observations are noted by Elemental GI Ltd with respect to the combined gas monitoring data for the site to date:

- Total of 9 No. ground gas monitoring visits have been completed.
- Atmospheric pressures ranged from 987mb to 1026mb.
- Maximum flow rate of 2.6 l/hr has been recorded.
- Third party locations 'WS8' and 'WS9' generally have response zones which were 'flooded' or nearly flooded during monitoring visits. These may therefore be disregarded. This should change the highest reliable flow reading at the site to 1.6 l/hr, which should usually be used for volumetric flow rate calculations.
- Maximum carbon dioxide concentration of 5.2% has been recorded.
- Maximum methane concentration of 0.3% has been recorded.

At this stage it is noted that significantly and / or consistently elevated concentrations of methane or carbon dioxide have not been recorded. Significantly elevated gas flow rates also appear to be absent.

The third party provided an unclear recommendation in their 2018 report with regards to ground gas and its classification at the site, stating that:

> *"The site is classified as Green Amber 1 (*sic*) in accordance with the NHBC Traffic Light Classification ….no mitigation against ground gas is required."*

A review of the data from the site indicates that whilst the threshold for methane and carbon dioxide have not been significantly and / or consistently exceeded, the overall 'worst case' volumetric flow rate for carbon dioxide would exceed the CIRIA C665 threshold of 0.07 l/hr. However, a closer review of the gas screening value for each location indicates that the individual GSVs at each monitoring well do not exceed this threshold. On this basis the classification of '**CS1**' and '**Green**' is considered appropriate at this stage, subject to Local Authority and warranty provider approval.

3.0 CONCEPTUAL SITE MODEL

3.1 Sources

As summarised in Section 2.4 above, exceedances have been recorded at the site comprising the following:

- *TT101 at 0.2m begl (topsoil) – Exceedances of pathogenic bacteria;*
- *TT105 at 0.1m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP101 at 0.2m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP102 at 0.3m begl (made ground) – Exceedances of PAHs and pathogenic bacteria;*
- *TP4 at 0.8m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP6 at 0.6m begl (made ground) – Exceedances of pathogenic bacteria;*
- *TP7 at 0.2m begl (made ground) – Exceedances of asbestos;*
- *TP8 at 1.8m begl (made ground / clay interface) – Exceedances of benzo(a)pyrene and pathogenic bacteria;*
- *WS7 at 0.4m begl (made ground) – Exceedances of PAHs and asbestos;*
- *WS8 at 0.2m begl (made ground) – Exceedances of asbestos;*
- *WS9 at 0.3m begl (made ground) – Exceedances of pathogenic bacteria;*
- *WS10 at 0.4m begl (made ground) - Exceedances of pathogenic bacteria; and*
- *WS11 at 1.4m begl (made ground) – Exceedances of asbestos.*

These are considered to comprise 'sources' within the site's conceptual site model (CSM).

3.2 Pathways

The following main potential pathways have been identified at the site in relation to the above sources should they remain unchanged / *in situ*:

- Direct Contact with PAHs;
- Ingestion of Contaminated Soils;
- Ingestion of Home-Grown Fruit / Vegetables;
- Inhalation of Asbestos Fibres; and
- Inhalation of Contaminated Dust.

3.3 Receptors

The redevelopment proposals for the site comprise the construction of new residential plots, which will include private gardens and some soft external landscaped areas.

The main / primary receptors considered within this CSM comprise the future residential end-users. Workers involved in the redevelopment of the site have also been considered, but it is recommended that health and safety risks to such parties should be assessed and managed by them once the scope of their works is finalised and with due regard to this RMS.

3.4 Pollutant Linkages

Based on the above sections, sources, pathways and receptors have been identified at the site and therefore feasible pollutant linkages are considered to have been identified.

This RMS will present steps through which these pollutant linkages may be broken.

4.0 REMEDIATION SPECIFICATION

The 2021 Geo-Matters report included initial remediation suggestions, which had been discussed with representatives of SHDC. Extracts of their report are presented below:

> *"The Phase II Conceptual Model and the Qualitative Risk Assessment … indicate that made ground soils across the former piggery area should be treated as contaminated in the context of the proposed residential redevelopment. This is due to the generally widespread presence of pathogenic bacteria and the localised presence of asbestos and PAHs. Remedial works across this area are required to address and break the pollutant linkages in this area of the site.*
>
> *Based on the discussions undertaken with the Local Authority, it is considered that a combination of capping and source removal (i.e. complete removal of materials from site) will be required to address the risks to human health identified herein.*
>
> *Examination of the made ground profile and contaminant distribution (presented within drawings 005a to 005d within Appendix VII) shows that the thickness of made ground across the former piggery area is generally ≤0.5m, although it is locally deeper around the central and central-western parts of this area, extending to a maximum 1.8m begl at TP8. Contaminant distribution plans indicate that concentrations of determinands diminish rapidly on the boundary between the former piggery area and paddock area (e.g. TT05).*
>
> *The Client has informed Geo-Matters Ltd that the redevelopment proposals for the site include topographical modification (for flood risk purposes) incorporating the average raising of site levels by approx. 0.5m. Drawing 005d (presented within Appendix VII) shows that the former piggery area shall be modified with levels extending between +0.5m and +0.8m from current elevations. At this stage it is recommended that the complete removal of animal remains and slurry pits (including surrounding soils) shall be required by the Local Authority as part of redevelopment works. The localised removal of the soils exhibiting the highest concentrations of total coliforms should also be undertaken (third party locations TP4, TP6, TP8, WS9 and WS10) where they are to be present within 1.0m of final levels.*
>
> *This is considered to be a robust approach which would constitute 'source removal' of the main contaminant source. However, residual pathogenic bacteria and other contaminants are present within made ground across the former piggery area which would still present risks to future site users. It is therefore provisionally recommended that the following remedial proposals may be considered across the former piggery area:*

- *Where ≥ 1.0m of 'clean' materials are used to raise levels in gardens as part of final layouts, then no further remedial works would be required to protect human health;*
- *Where less than 1.0m of 'clean' materials are used to raise levels in gardens as part of final layouts, then a minimum 600mm 'clean' capping soils plus geotextile marker layer or 150mm 'hard-dig' layer should be installed across all proposed garden areas;*
- *For public open spaces and other soft landscaping, a minimum 300mm 'clean' capping layer should be installed.*

In addition to the above, it is also advised that consideration should be given to the protection of utility / service installers and maintenance works within areas where residual soil contamination is present."

Extracts of the drawings mentioned by Geo-Matters in the above text (referenced herein as G-005a to G-005d) are presented in Appendix I.

4.1 Excavation Works

The areas which shall be excavated from the ground (as recommended in the section above) and removed from site should be marked-out site prior to the start of site clearance / construction works.

There is a risk of cross-contamination from the made ground materials when they are disturbed / removed. If soils are dry, then there is a risk that free asbestos fibres and / or other contamination may be able to cross-contaminate other areas of the site through the migration of dust. Dust suppression should therefore be applied to the materials before and during their excavation. It is also recommended that the following are undertaken:

- **Either** materials should be excavated and loaded directly into wagons for off-site disposal;
- **Or** materials should be excavated and placed on an impermeable membrane on site awaiting removal. If materials are stored on site, they must be fully covered with an impermeable membrane until their removal to prevent the migration of dust etc.

Where fluids or slurries are present then these should be appropriately removed from the site by the Client before the start of any further excavations. All such materials should be removed by appropriately licensed contractors for suitable off-site disposal.

All documents relating to the importation / export of materials (e.g. tip tickets) should be retained by the Client.

Where excavations are re-filled then suitable site-won materials may be used for these works. This must be taken in accordance with all relevant permits / exemptions etc. (e.g. MMP) and should be fully recorded. We would also recommend that your appointed Structural Engineers (and other designers, as appropriate) should be made fully aware of these works.

4.2 Capping Works

Geo-Matters have recommended that:

- *"Where less than 1.0m of 'clean' materials are used to raise levels in gardens as part of final layouts, then a minimum 600mm 'clean' capping soils plus geotextile marker layer or 150mm 'hard-dig' layer should be installed across all proposed garden areas;*
- *For public open spaces and other soft landscaping, a minimum 300mm 'clean' capping layer should be installed."*

Topsoil is absent across the western half of the site but is generally present across the eastern area of the site, which may prove suitable for re-use within capping layers etc. It is also suggested that site won soils from road / sewer / foundation excavations may also be used in the construction of site capping layers. The re-use of all site won materials must be established in advance of the works and must be covered by the appropriate licence / exemption in advance (e.g. MMP).

Where there is a shortfall of suitable materials on site then there may also be a need to find additional soils. Where topsoil / soil is imported onto site then (as always) the movement, import / export and deposition of all soils must also be undertaken in accordance with all relevant permits / exemptions in advance (e.g. MMP).

Once suitable soils have been designated then it is recommended that they be identified to Elemental GI Ltd and to SHDC (and any warranty providers e.g. NHBC or similar) for approval prior to their importation / re-use.

It is recommended that the 'hard dig layer' should comprise granular materials (typically of around 100mm diameter). These could be imported or site-won materials (e.g. demolition arisings) although use of all such materials should be accompanied by appropriate testing (e.g. asbestos screening) and must also be used in accordance with all relevant permits / exemptions in advance (e.g. MMP).

5.0 VALIDATION REQUIREMENTS

5.1 General Procedures

When the remedial works have been completed (as summarised in section 4 above), it will be necessary to confirm that the full extent of the significant contamination has been removed from the ground / successfully capped etc.

The following validation steps are recommended. Where further contamination is encountered (or where insufficient capping thicknesses are recorded) then Elemental GI Ltd and SHDC must be notified immediately, and these steps should then be repeated in full until no further contamination is recorded (to be reviewed by Supervising Engineer).

- Excavations / Hotspots – Samples should be retrieved from the base and sides of excavations where they are within 1.0m of final levels, and samples should be submitted for appropriate analysis to confirm that contamination has been removed.
- Alternatively (e.g. for the slurry pits, removal of animal bones or deeper areas of made ground) then a visual inspection of the base and sides should be undertaken by an Engineer to confirm that sufficient materials have been removed.

In order to confirm that an appropriate thickness of capping soils has been placed, an inspection ratio of 1 No. validation point per 3 No. consecutive rear gardens is recommended, subject to approval by SHDC (and any warranty providers e.g. NHBC or similar). These inspections should be undertaken by an Engineer from Elemental GI Ltd, with the findings presented to the appropriate regulators for 'sign-off' on a plot-by-plot basis.

5.2 Screening Criteria

The following main screening criteria have been suggested for delineation / validation purposes at this stage:

Table 5.0: General Screening Values – Gardens and other Soft Landscaping

Analyte	Screening Values (mg/kg)
Benzo(a)pyrene	2.2[a]
Dibenzo(a,h)anthracene	0.24[a]
Asbestos	D[b]

[a] Third party UK screening values e.g. CIEH, CL:AIRE, Elemental GI Ltd and LQM 'S4UL' values for a ''residential with gardens' end-use (licence S4UL3849);
[b] 'D' = 'Detected', which is an Elemental GI Ltd general screening level. ***A threshold of >0.001% is applicable if / when asbestos is detected as an action level beyond which further remediation should be considered.***
Further Testing may be required depending upon the hotspot / source / regulatory requirements.
Testing in accordance with BS3882 may be required where topsoil requires formal verification.

6.0 RECOMMENDATIONS AND OTHER CONSIDERATIONS

6.1 General Considerations / Assumptions: The following assumptions have been made concerning the site and the remedial works described herein:

- It always remains possible that ground and groundwater conditions may change between each exploratory hole and therefore such variations cannot be discounted. Seasonal variations may also be expected in relation to groundwater observations etc.
- We have assumed that the Client and their appointed contractors will follow all relevant regulatory requirements including health and safety and demolition works (e.g. Construction (Design and Management) Regulations 2015).
- A suitable environmental advisor (i.e. Elemental GI Ltd) should be appointed to supervise and validate all works described herein. However, other advisors / contractors may be involved with the site (e.g. remedial contractors) and they would be wholly responsible for their own works as agreed with the Client.
- The importation and re-location of all soils (site-won or otherwise) must be undertaken in full accordance with the relevant permits / exemptions / regulations. The Client / developer should ensure that these are all in place in advance of relevant works. Where soils are re-used on site, or are imported onto site, it is assumed that they will be tested for suitable determinands prior to their re-use / importation. Please contact us for further advice in advance of all such works.
- Any previously unexpected / unidentified contamination should be reported to Elemental GI Ltd immediately, and works may need to stop until we can review and discuss the associated risks with you. The regulatory authorities should also be informed.
- The Client / developer should discuss utility construction requirements with the appropriate providers prior to the start of works.
- All soil samples must be retrieved by an Engineer from Elemental GI Ltd, and should be scheduled for analysis at a suitably accredited laboratory.
- The excavation, movement or any other disturbance of contaminated soils could result in the spreading of contamination to other areas of the site. Suitable management procedures should be put in place prior to all such works (e.g. dust suppression) to manage this at all times.

- Site staff are responsible for ensuring that all relevant environmental management procedures are in place throughout the works. This includes the safe an appropriate storage of contaminated soils (e.g. on suitable membranes) to ensure that cross-contamination and off-site contamination (e.g. through dust migration) are not possible.
- The Client is responsible for ensuring that their site staff are sufficiently protected from health and safety risks associated with the works outlined herein.

6.2 Local Regulatory Requirements:

SHDC may have their own local additional guidance / preferences relating to the importation of soils for capping purposes. This should be checked before soils are selected for importation so that they can be appropriately chosen, tested etc.

Terms and Conditions

We have obtained and reviewed information relating to the site, but this may not be complete, and liability cannot be accepted for information not available to Elemental GI Ltd at the time of writing this report. This report has been written in consideration of construction / development proposals (or similar) as described in Section 1.0 of this report. If any of these proposals change (e.g. layout), then this report may be subject to change.

This report has been prepared for the sole use and reliance of the Client. No other third party may rely upon or reproduce the content of this report without our prior written approval. If any unauthorised third party comes into possession of this report, they rely upon it entirely at their own risk and the authors do not owe them any warranty, duty of care or skill.

Our report, including the conclusions and recommendations, are considered reasonable based on the findings of the Phase I assessment. However, these cannot be guaranteed to gain regulatory approval and therefore the Client should submit it to them (as necessary) for their comments and approval prior to undertaking any irrecoverable works associated with the subject site.

The findings and recommendations made in this report are based on published information (as presented in the accompanying appendices). Elemental GI Ltd cannot accept responsibility for the reliability and authenticity of published information or reports prepared by third parties. There may be conditions prevailing on site which have not been revealed by this assessment and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by this investigation and assessment. It should be noted that groundwater levels etc. may vary due to seasonal and other effects. Whilst it may be utilised by others for reference purposes at the Client's discretion, it has not been prepared for any other purposes (e.g. waste classification, drainage excavations etc.) and therefore additional works may be required by third parties dependent upon their own requirements / works. Any works which are proposed at greater depths than reported herein may require confirmatory investigation works as necessary.

The conclusions and recommendations presented herein are considered reasonable based on the assessments of the site undertaken by Elemental GI Ltd. However, these cannot be guaranteed to gain regulatory approval and therefore copies of this report should be sent to the appropriate regulatory authorities and / or other organisations (as appropriate) by the Client for their comments and approval prior to undertaking any irrecoverable works associated with the site.

The possibility of significant variation in ground conditions existing between / beneath test locations / depths cannot be discounted and must be considered within the design proposals for the subject site. All soakaway designs should be approved by the relevant statutory authority prior to implementation and must adhere to the standard design and ground setting requirements, upon which your appointed drainage design engineers should advise you.

Where comments / recommendations have been made relating to specific depths it cannot be guaranteed that ground conditions shall be similar at surrounding / underlying depths, which should be taken into consideration as necessary by other.

Standard Risk Assessment – Considerations and Methodology

Elemental GI Ltd have based our standard risk assessment methodology upon current legislation and prevailing best practice and available guidance. This includes the following:

- DEFRA / EA document 'Contaminated Land Report 11 (CLR11) Model Procedures for the Management of Land Contamination' (2004) [*withdrawn but used for general reference purposes*];
- NHBC / EA / CIEH document 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (2008);
- DEFRA 'Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance (2012); and
- Environment Agency 'Collection: Land Contamination Technical Guidance (2014) held at:
  - https://www.gov.uk/government/collections/land-contamination-technical-guidance

Construction of Conceptual Site Model

Elemental GI Ltd have based our standard risk assessment methodology upon current legislation and prevailing best practice and available guidance. This includes the assessment of potentially contaminated land in terms of 'significant pollutants' and 'pollutant linkages', using SOURCE-PATHWAY-RECEPTOR' scenarios for the site. For a pollutant linkage to exist all three of these elements must be present. These have been clearly defined in the guidance as follows:

- …..potential source as 'a contaminant which is in, or under the land and which has the potential to cause significant harm or to cause pollution of controlled waters'.
- …..potential pathway as 'one or more routes or means by, or through, which a receptor is being exposed to, or affected by a contaminant, or could be so exposed or affected'.
- …..potential receptor as 'a living organism, a group of living organisms, an ecological system or a piece of property which is being or could be, harmed by a contaminant or controlled waters which are being, or could be, polluted by a contaminant'.

Within this report, pathways including the following have been considered:

- Ingestion of soil;
- Ingestion of site-grown vegetables;
- Ingestion of site-reared livestock / fish;
- Dermal contact with soils;
- Inhalation of vapours;
- Inhalation of soil-derived dust.

The receptors which we have considered are described in Section 1.0 of this report.

Risk Assessment Methodology

Our risk assessment methodology is based upon a phased approach, which takes the following steps:

1. Hazard Identification and Assessment:
    a. Establishing potential contaminant sources through the derivation of initial conceptual site model (CSM); and
    b. Analysing the potential for unacceptable risks (what pathways and receptors could be present, what pollutant linkages could result and what could the effects be).

2. Risk Estimation and Evaluation:
    a. Prediction of the magnitude and probability of the possible consequences;
    b. Investigation of the potential risks;
    c. Completion of Generic Quantitative Risk Assessment (GQRA); and
    d. Evaluation of risks / confirmation of pollutant linkages (leading onto step '3' if identified).

3. Remediation Design / Implementation / Verification:
    a. Completion of Detailed Quantitative Risk Assessment (DQRA) if necessary;
    b. Collation of remedial strategy;
    c. Implementation of remedial strategy / validation; and
    d. Final reporting.

Risk terminology and classification is defined through standard wording and descriptions, as contained in the documents referenced above. This includes the balance, comparison and assessment of risk as a dynamic categorisation / classification of probability vs. possible consequence(s), as shown in the table A1 below:

Table A1: Risk Categorisation

Probability (Likelihood)		Consequence			
		Severe	Medium	Mild	Minor
	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Not likely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Risk levels are described as follows:

Table A2: Risk Level Descriptions

Term	Description
Very High Risk	A high probability exists that severe / significant harm could arise to someone or something from the hazard which has been identified. Remedial action is required.
High Risk	Harm is likely to arise to someone or something from the hazard which has been identified. Remedial action is usually required.
Moderate Risk	Harm could potentially arise to someone or something from the hazard which has been identified without remedial action, although it is considered to be relatively unlikely that such harm would be severe.
Low Risk	Harm could theoretically arise to someone or something from the hazard which has been identified without remedial action, although it is considered that any effects would be mild.
Very Low Risk	Harm is not likely to arise to someone or something from the hazard which has been identified.

The NHBC / EA / CIEH document 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (2008) defines the following (reproduced verbatim):

"**Severity** (consequence) can be defined as the adverse effects (or harm) arising from a defined hazard, which impairs the quality of human health or the environment in the short or longer term. For example a consequence defined as "Severe" could be defined as "Highly elevated concentrations likely to result in 'significant harm' to human health as defined by the EPA 1990, Part 2A, if exposure occurs". The type and form of the contaminant needs to be known in order to understand the effect on humans and therefore severity of potential harm. For instance different forms of cyanide behave differently. Complex cyanide ("blue billy") is relatively "non toxic" whereas free cyanide is "highly toxic" (Environment Agency 2002b).

Probability can be defined as the chance of a particular event occurring in a given period of time. For example, a "High Likelihood" could be defined as "where an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution"."

APPENDIX I

DRAWINGS

Approx. Location of Third Party Boreholes

Approx. Location of Geo-Matters Boreholes

Approx. Location of Third Party Trial Pits

Approx. Location of Geo-Matters Trial Pits

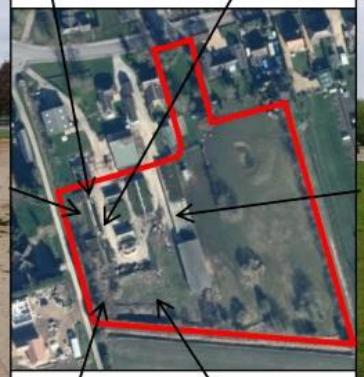


CLIENT:	TITLE:	DATE:	SCALE@SIZE:	
Shields Wilson Ltd *and* Scenic Homes Ltd	Extract of Geo-Matters Exploratory Hole Location Plan	Feb. 2022	NOT TO SCALE	Elemental GI Ltd
		DRAWING No: E22108_G-001	DESIGN/DRAWN: JR	











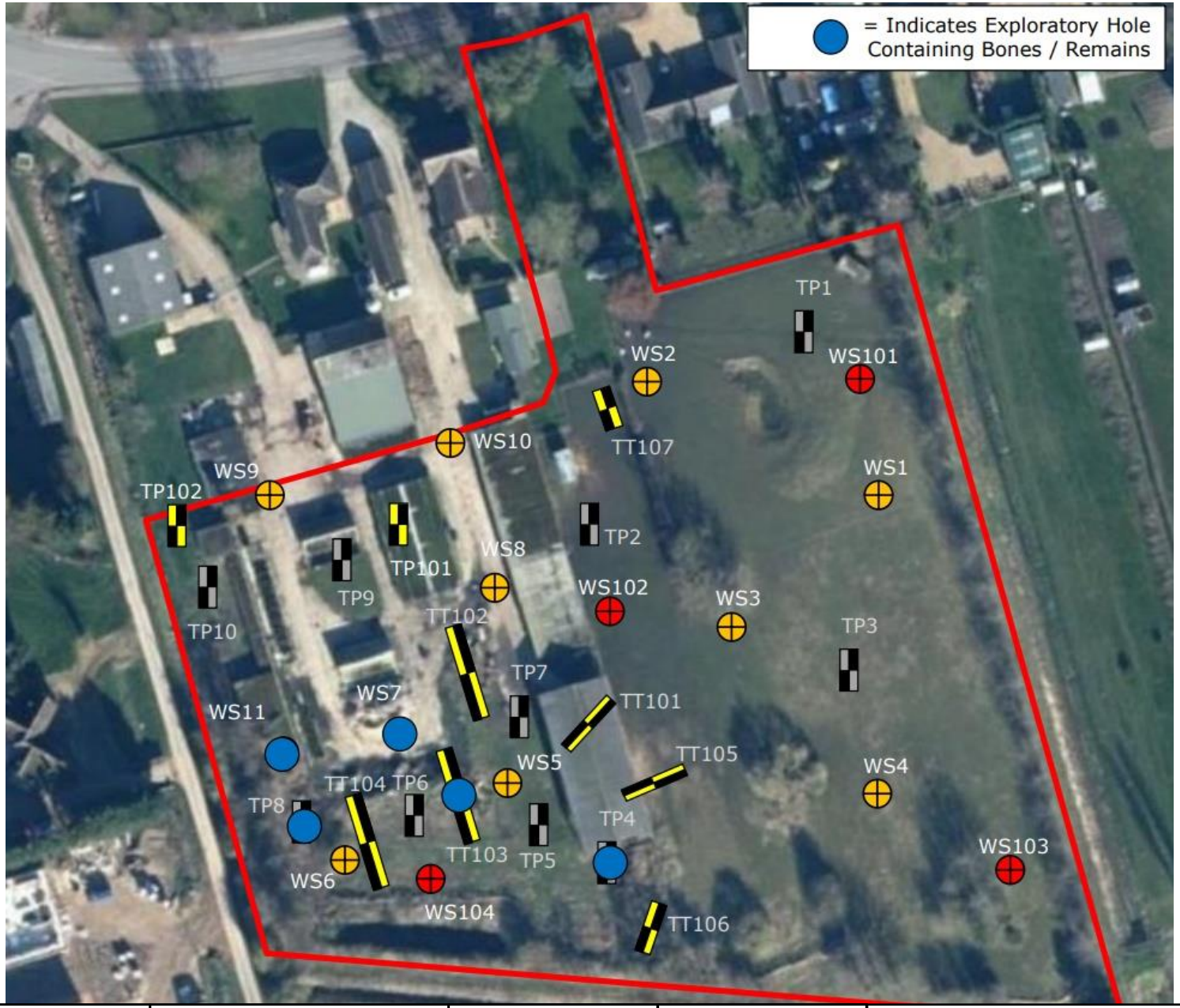




CLIENT:	TITLE:	DATE:	SCALE@SIZE:	
Shields Wilson Ltd *and* Scenic Homes Ltd	Extract of Geo-Matters General Photographic Record	Feb. 2022	NOT TO SCALE	Elemental GI Ltd
		DRAWING No: E22108_G-002	DESIGN/DRAWN: JR	



CLIENT:	TITLE:	DATE:	SCALE@SIZE:	
Shields Wilson Ltd *and* Scenic Homes Ltd	Extract of Geo-Matters Plan "Depth of Made Ground"	Feb. 2022	NOT TO SCALE	Elemental GI Ltd
		DRAWING No: E22108_G-005a	DESIGN/DRAWN: JR	



CLIENT:	TITLE:	DATE:	SCALE@SIZE:	
Shields Wilson Ltd *and* Scenic Homes Ltd	Extract of Geo-Matters Plan "Presence of Bones"	Feb. 2022	NOT TO SCALE	Elemental GI Ltd
		DRAWING No: E22108_G-005b	DESIGN/DRAWN: JR	



CLIENT:	TITLE:	DATE:	SCALE@SIZE:	
Shields Wilson Ltd *and* Scenic Homes Ltd	Extract of Geo-Matters Plan "Contaminant Distribution"	Feb. 2022	NOT TO SCALE	Elemental GI Ltd
		DRAWING No: E22108_G-005c	DESIGN/DRAWN: JR	



CLIENT:	TITLE:	DATE:	SCALE@SIZE:	
Shields Wilson Ltd *and* Scenic Homes Ltd	Extract of Geo-Matters Plan "Proposed Approx. Levels"	Feb. 2022	NOT TO SCALE	Elemental GI Ltd
		DRAWING No: E22108_G-005d	DESIGN/DRAWN: JR	