

Date: 24th March 2026  
Ref: 15-280-L4-1

**Barratt & David Wilson Homes North West**  
303 Bridgewater Place  
Birchwood  
Warrington  
WA3 6XF

## **GAS CUT-OFF BARRIER SPECIFICATION CHERRYFIELD DRIVE, KIRKBY**

### **1. OVERVIEW**

E3P have previously prepared a gas ventilation trench specification for the proposed residential development at the site located south of Cherryfield Drive, Kirkby (Ref: 15-580-L3-1, dated February 2026). The specification was required in order to address the ground gas risk from the off-site historical landfill located along the site's western boundary.

Following consultation with the regulators, the NHBC have expressed a preference not to adopt an active gas ventilation trench as a form of gas mitigation, due to potential long-term maintenance considerations over the lifespan of the development.

E3P have subsequently been commissioned by Barratt & David Wilson Homes (the Client) to prepare a specification for a gas cut-off barrier, together with a scope for post-remediation and earthworks ground gas monitoring for the proposed residential development.

This letter sets out the proposed design and installation methodology for the gas cut-off barrier, as well as the scope of the post-remediation and earthworks ground gas monitoring regime. The proposed gas cut-off barrier is intended to interrupt potential gas migration pathways laterally within the ground, rather than rely on active ventilation measures to dilute or disperse ground gases. As such, it represents a passive, low-maintenance solution that reduces the potential for long-term performance and maintenance issues.

These proposals will be subject to agreement with the regulators, including Knowsley Metropolitan Borough Council, the Environment Agency, and NHBC, prior to implementation.





## 2. BACKGROUND

E3P have been provided with previous reports prepared for the site. E3P is of the understanding that the client does not have reliance on these previous reports.

**Table 2.1 Previous Reports**

| AUTHOR                                   | TITLE                                                                                                    | REFERENCE               | CLIENT                                | DATE           |
|------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------|----------------|
| Clancy Consulting                        | Preliminary Geoenvironmental Appraisal Report for Phase 2 Site, Cherryfield Drive, Knowsley              | Ref: 10/1519/001        | Knowsley Metropolitan Borough Council | May 2020       |
|                                          | Geo-Environmental Appraisal Report for Knowsley Community College, Liverpool                             | Ref: 10/1533/001        | Knowsley Metropolitan Borough Council | July 2020      |
| Resource & Environmental Consultants Ltd | Geoenvironmental Site Assessment                                                                         | Ref: 45759Fp1r0         | Knowsley Metropolitan Borough Council | September 2014 |
| ALM Consult Limited                      | Interpretative Report                                                                                    | Ref: 30090/11           | Knowsley Metropolitan Borough Council | September 2015 |
|                                          | Hazardous Gas Risk Assessment                                                                            | Ref: 30090/11/2         | Knowsley Metropolitan Borough Council | December 2015  |
| ESG                                      | Factual Report on Ground Investigation                                                                   | Ref: F5013-15           | 2020 Knowsley Limited                 | February 2016  |
| Ian Farmer Associates                    | Factual Report on Ground Investigation                                                                   | Ref: 41989              | St Modwen Developments Limited        | March 2017     |
| RPS                                      | Due Diligence Information for Land Development                                                           | -                       | St Modwen Developments Limited        | June 2017      |
| Atkins                                   | Phase 1 Geo-Environmental Desk Study                                                                     | Ref: 5145660            | St. Modwen (Kirkby 2) Development Ltd | December 2016  |
| Buro Happold                             | Ground Engineering Site Appraisal                                                                        | Ref: 021706             | -                                     | December 2006  |
|                                          | Geoenvironmental and Geotechnical Interpretative Report: Phase 1 Ground Investigation (GDO 205 Landfill) | Ref: 021706             | -                                     | November 2007  |
| Cundall                                  | Geotechnical Due Diligence Brief                                                                         | Ref: 1028732.SPC.GL.001 | Barratt Developments Plc              | June 2021      |

The pertinent points from the above report are summarised in Section 3.5 of the E3P Phase I & II Geoenvironmental Site Assessment (Ref: 15-280-R1-6, dated November 2024).

In addition to the above, E3P has completed the following geoenvironmental assessments for the site:



- ✳ **E3P** – *Phase I & II Geoenvironmental Site Assessment*. Ref: Report 15-280-R1-6, dated November 2024, Prepared for Barratt and David Wilson Homes;
- ✳ **E3P** – *Ground Gas Addendum Report*. Ref: Report 15-280-R3-2, dated November 2025, Prepared for Barratt and David Wilson Homes; and,
- ✳ **E3P** – *Remediation and Enabling Works Strategy*. Ref: Report 15-280-R2-7, dated November 2025, Prepared for Barratt and David Wilson Homes.

The pertinent points from the E3P Ground Gas Addendum Report are summarised in Section 2.4 of the E3P Remediation and Enabling Works Strategy (Ref: 15-280-R2-7, dated November 2025), and are presented in Section 2.1 below.

## 2.1. GROUND GAS ADDENDUM SUMMARY

Ground gas has been assessed by E3P as part of the E3P Geoenvironmental Site Assessment, with the final assessment detailed within the E3P Ground Gas Addendum Report (Ref: 15-280-R3-2, dated November 2025). The assessment was completed in accordance with the methodology outlined in BS8485, utilising the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions are summarised in Table 2.2.

This indicates that, based on the peak flow rates, the majority of the monitoring visits are classified as Characteristic Situation (CS)1 – Very Low Gas Risk, with areas of the site characterised as CS2. In addition, a localised area of the site associated with the adjacent landfill and historically deposited materials has been characterised as CS4 due to significant concentrations of methane and carbon dioxide. Data obtained from flooded monitoring wells or during flooded visits has been excluded from the assessment.

**Table 2.2 Gas Risk Profile and Location**

| LOCATION | MAX CH <sub>4</sub><br>(% v/v) | GSV<br>(l/hr) | MAX CO <sub>2</sub><br>(% v/v) | GSV<br>(l/hr) | CHARACTERISTIC<br>SITUATION |
|----------|--------------------------------|---------------|--------------------------------|---------------|-----------------------------|
| WS101    | 6.8                            | 0.0068        | 8.5                            | 0.0085        | CS2*                        |
| WS102    | 3.7                            | 0.0037        | 10.8                           | 0.0108        | CS2*                        |
| WS105    | 0.1                            | 0.0001        | 6.9                            | 0.0069        | CS2*                        |
| WS106    | 0.4                            | 0.0004        | 7.7                            | 0.0077        | CS2*                        |
| WS108    | 46.1                           | 0.0461        | 10.3                           | 0.0103        | CS2*                        |
| WS110    | 0.1                            | 0.0001        | 1.5                            | 0.0015        | CS1                         |
| WS111    | 6.2                            | 0.0062        | 5.3                            | 0.0053        | CS2*                        |
| WS113    | 0.1                            | 0.0164        | 3.1                            | 0.1984        | CS2                         |
| WS115    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS117    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS118    | 0.1                            | 0.0001        | 0.3                            | 0.0003        | CS1                         |
| WS119    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS120    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS121    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |



| LOCATION | MAX CH <sub>4</sub><br>(% v/v) | GSV<br>(l/hr) | MAX CO <sub>2</sub><br>(% v/v) | GSV<br>(l/hr) | CHARACTERISTIC<br>SITUATION |
|----------|--------------------------------|---------------|--------------------------------|---------------|-----------------------------|
| WS123    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS124    | 13.7                           | 0.0137        | 5.4                            | 0.0054        | CS2*                        |
| WS125    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS126    | 0.4                            | 0.0016        | 3.2                            | 0.0128        | CS1                         |
| WS128    | 0.1                            | 0.0001        | 1.1                            | 0.0011        | CS1                         |
| WS130    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS132    | 0.1                            | 0.0001        | 1.2                            | 0.0012        | CS1                         |
| WS133    | 0.1                            | 0.0001        | 2.3                            | 0.0023        | CS1                         |
| WS135    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS136    | 0.1                            | 0.0001        | 0.8                            | 0.0008        | CS1                         |
| WS137    | Flooded                        |               |                                |               |                             |
| WS138    | 0.1                            | 0.0253        | 0.3                            | 0.0003        | CS1                         |
| WS140    | 0.1                            | 0.0001        | 0.8                            | 0.0008        | CS1                         |
| WS141    | 0.1                            | 0.0001        | 2.4                            | 0.0024        | CS1                         |
| WS142    | 0.1                            | 0.0001        | 1.1                            | 0.0011        | CS1                         |
| WS144    | 0.1                            | 0.0001        | 0.8                            | 0.0008        | CS1                         |
| WS147    | Flooded                        |               |                                |               |                             |
| WS149A   | 0.1                            | 0.0001        | 0.8                            | 0.0008        | CS1                         |
| WS151    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS152    | 0.8                            | 0.0008        | 4.8                            | 0.0048        | CS1                         |
| WS153A   | 0.1                            | 0.0001        | 0.8                            | 0.0008        | CS1                         |
| WS157    | 0.1                            | 0.0001        | 0.2                            | 0.0002        | CS1                         |
| WS161    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS169    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS171    | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| CP/RB101 | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| CP/RB102 | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| CP/RB103 | 0.1                            | 0.0001        | 0.1                            | 0.0001        | CS1                         |
| WS201    | 74.5                           | 4.5612        | 26.5                           | 1.5372        | CS4 (methane)               |
| WS202    | Flooded                        |               |                                |               |                             |
| WS204    | 0.1                            | 0.0019        | 1.0                            | 0.0114        | CS1                         |
| WS206    | 0.1                            | 0.002         | 0.6                            | 0.006         | CS1                         |

\* Classified as precautionary CS2 based on high concentrations observed. GSV however noted to fall under CS2 threshold.



E3P has assessed the previous variables and has made the following conclusions based on the ground gas monitoring programme:

- ✳ Ground gas monitoring has been split into sections based on observed or theorised ground gas sources, with the key sources identified as the adjacent landfill, the historically deposited landfill materials across the site, and the former petrol filling station.
- ✳ The key source of ground gas identified within the Conceptual Site Model is the adjacent landfill at Bewley Road (Ref: EAHLD06985), which is noted to include household waste and was active from the 1950s to circa 1974.
- ✳ In addition, deep Made Ground has been encountered across the site, with the deepest deposits noted in the central region, associated with historical upfilling with landfill materials, as delineated in the Buro Happold report (Ref: 021706, dated November 2007).
- ✳ To the north of the site, in the area of the former petrol filling station and in the supplementary investigation to the northwest, volatile hydrocarbon contamination has been encountered. The area will be fully remediated, with the tanks removed and validated to ensure there is no unacceptable risk to future end users or the wider environment. None of the wells in the location of the former filling station indicated elevated concentrations of carbon dioxide or methane.
- ✳ The highest concentrations of ground gas observed were in monitoring wells WS201 and WS108, both located adjacent to the Bewley Road Landfill site.
- ✳ In WS201, methane was recorded at a maximum concentration of 72.8 % v/v and GSV reading of 4.56 l/hr, with consistently high concentrations recorded throughout all visits. WS201 also indicates high levels of CO<sub>2</sub> with a maximum concentration recorded as 26.5 % v/v and GSV of 1.54 l/hr. Concentrations above the limit of detection of hydrogen sulphide (H<sub>2</sub>S) were also identified within WS201. Hydrogen sulphide can be a corrosive gas, and it is therefore essential that if plots are to be built in this area, the manufacturer of the gas-resistant membrane on any plot must be consulted to ensure that it is suitable for the levels of sulphide observed.
- ✳ The GSV for methane is currently within a CS4 classification in WS201. This borehole is located adjacent to the north of the off-site landfill. In addition, Made Ground with a hydrocarbon odour and decaying timber was noted.
- ✳ Monitoring well WS108 is situated in the southern central region of the site, directly adjacent to the Bewley Road Landfill site. It has recorded a maximum methane concentration of 46.1 % v/v and a carbon dioxide concentration of 10.8 % v/v. Despite high concentrations recorded, minimal flow has been recorded in this location, and it is therefore considered to fall within the CS2 category, alongside all other plots adjacent to the landfill.
- ✳ The increased flow rate observed in WS113 during visit 1 (6.4 l/hr) is likely associated with the known landfill located directly adjacent to the western boundary, however, across a total of 30 visits completed, only one visit noted any indication of gas flow, with the majority of visits encountering carbon dioxide and methane at the limit of detection.
- ✳ Several monitoring wells across the site have identified elevated concentrations of methane and/or carbon dioxide, however with GSV thresholds noted to be below the CS2 criteria. These wells include: WS101, WS102, WS105, WS106, WS108, WS111 and WS124. In general, all of the above noted locations can be associated with the infilling of ground in the central parts of the site and adjacent to the known landfill. It is considered by E3P that precautionary CS2 membranes should be placed in these areas.
- ✳ Regarding potential ground gas pathways across the site, it has been noted that the majority of wells are predominantly underlain by both granular SANDS and cohesive CLAY at depths of 0.10 m bgl to 6.10 m bgl, and it is, therefore, unlikely to fully restrict the migration of ground gases.
- ✳ Ground gas migration pathways are likely to alter during the development, drainage could introduce preferential pathways for gas migration into buildings.

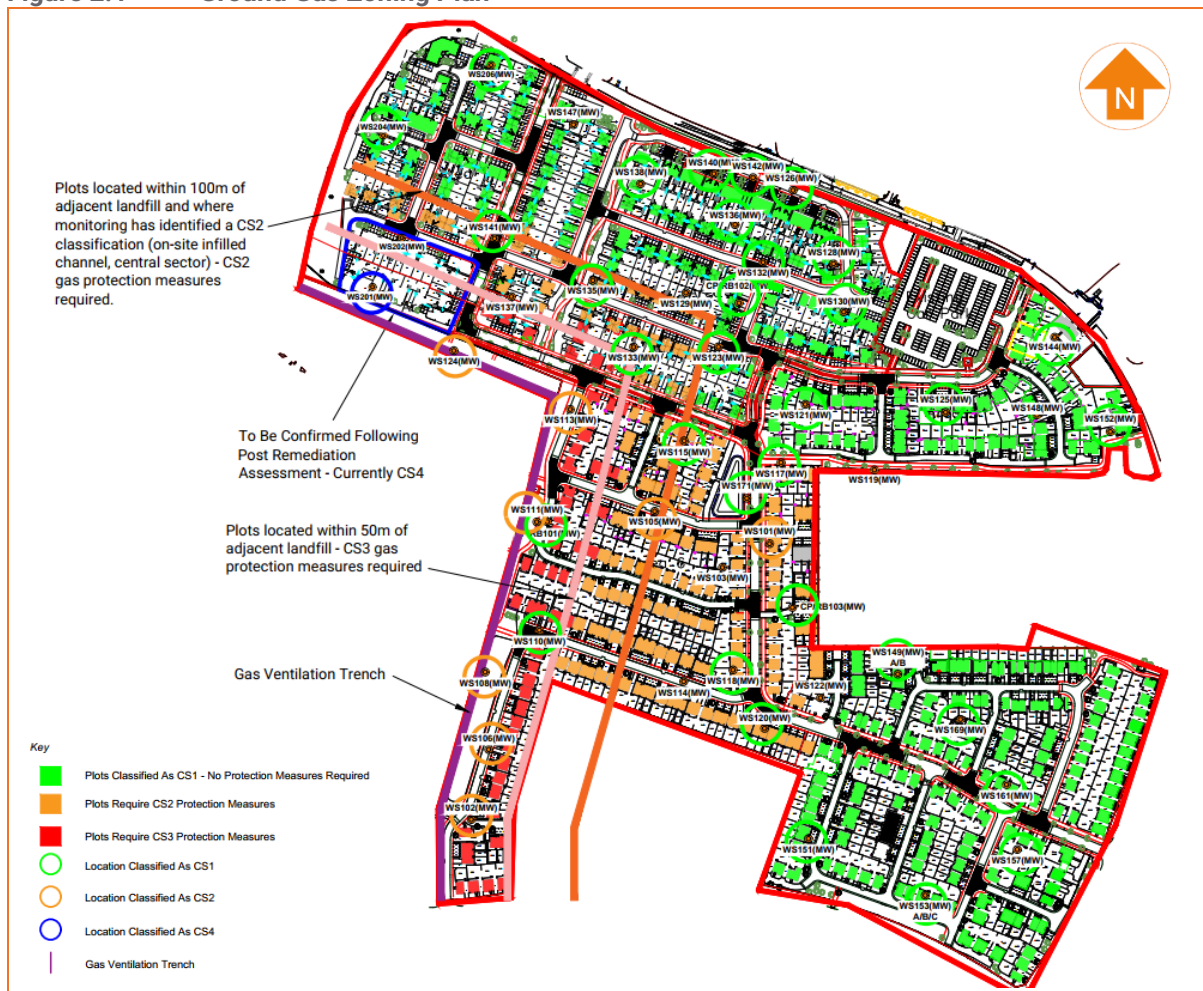


- ✳ High groundwater levels have been observed across the site, therefore the soils are largely saturated. The proposed development will result in a change in the hydrogeology, and this has the potential to change the anaerobic and aerobic environment, which may result in the increased generation of CH<sub>4</sub> and CO<sub>2</sub>.
- ✳ Migration of ground gas from the adjacent landfill has been identified and this has the potential to act as a significant ongoing source of ground gas. The ternary plot indicates that the concentrations of methane and carbon dioxide in WS101, WS111 and WS124 are indicative of landfill gas migration. In addition, elevated flow rates and GSVs were recorded in WS201 and WS113 located to the north of the adjacent landfill. Ground gas is considered to be actively migrating along the infilled channel through the central sector of the site.
- ✳ The flux box tests and surface emissions survey identified elevated concentrations of methane and carbon dioxide in the vicinity of WS201. Given the observed gas concentrations within the adjacent landfill, a gas ventilation trench is considered to be required along the boundary with the landfill to act as a pressure relief pathway and reduce the ground gas concentrations in this area of the site. The gas ventilation trench will need to be designed and installed by a suitably qualified specialist and validated through a programme of post remediation monitoring.
- ✳ Made Ground deposits within the vicinity of WS201 will require excavation to their full depth and all deleterious and putrescible materials removed for off-site disposal.
- ✳ Further post remediation assessment will be required in the location of WS201 to confirm the ground gas classification, given this location is currently classified as CS4 due to significantly elevated concentrations of methane and carbon dioxide. Post remediation monitoring will be required following the installation of the gas ventilation trench and remedial excavation works in order to confirm the reduction of recorded ground gas concentrations.
- ✳ With due consideration of the Conceptual Site Model, it is considered that following the installation of the gas ventilation trench, CS3 mitigation measures will be required for all plots located within 50 m of the adjacent landfill, and CS2 mitigation measures will be required for all plots located within 100 m of the adjacent landfill and where monitoring has identified a CS2 classification in the area of the on-site infilled channel in the central sector. It is considered that plots located in the south east, east and north of the site can be classified as CS1 and gas protection measures are not considered to be required in these locations.

Based on the above conclusions, a detailed ground gas zoning plan has been created and is presented as Drawing 15-280-020 (appended to this letter) to indicate the plots that will require ground gas mitigation to ensure no risk to future end users. A snapshot of the ground gas zoning plan is presented as Figure 2.1.



Figure 2.1 Ground Gas Zoning Plan



## 3. GAS CUT-OFF BARRIER DESIGN

### 3.1. DESIGN RATIONALE AND PERFORMANCE OBJECTIVES

As stated in Section 1, the NHBC have expressed a preference not to adopt an active gas ventilation trench as a form of gas mitigation, due to potential long-term maintenance considerations over the lifespan of the development.

Given that the off-site landfill is considered to represent a declining source of ground gases over time, it is E3P's recommendation that a precautionary physical barrier is installed between the off-site landfill and the proposed development to interrupt any potential preferential ground gas migration pathways.

The proposed gas cut-off barrier has been designed to provide a robust, passive ground gas mitigation measure along the western boundary of the site, adjacent to the Bewley Road landfill. The cut-off barrier is intended to function as a pathway interception system, reducing lateral migration of landfill gas into the site and lowering ground gas concentrations beneath proposed residential plots. Furthermore, no long-term maintenance of the cut-off barrier is deemed necessary, given that it will be developed and constructed as part of the remedial earthworks.



The design has been developed by E3P on behalf of Barratt & David Wilson Homes, with due regard to the Conceptual Site Model, the findings of the ground gas monitoring programme, and the guidance set out within BS8485 and CIRIA C665.

The cut-off barrier and remedial earthworks will address the variability in gas concentrations, flow regimes, and migration pathways identified across the site.

### **3.2. CONCEPTUAL BASIS FOR CUT-OFF BARRIER DESIGN**

Ground gas monitoring has demonstrated that the ground gas risk along the western boundary is influenced by active migration from the adjacent Bewley Road landfill, variability in gas flow rates with locally high concentrations but generally low to moderate flow in some areas, a combination of granular and cohesive strata that may partially restrict vertical gas migration while allowing lateral movement through Made Ground horizons, and elevated groundwater levels which may suppress vertical gas migration and promote lateral movement along preferential pathways.

In response to these conditions, a cut-off barrier and remedial earthworks arrangement have been selected to ensure effective gas interception under both low-flow/high-concentration and higher-flow conditions.

### **3.3. CUT-OFF BARRIER – FUNCTION AND JUSTIFICATION**

The gas cut-off barrier has been designed to act as a passive impermeable barrier, with its primary functions of intercepting laterally migrating ground gas originating from the adjacent landfill and infilled channel deposits, providing a low-resistance preferential pathway for vertical gas movement towards the surface outside the proposed development boundary, and reducing gas pressure build-up at shallow depth, particularly beneath areas of Made Ground and proposed infrastructure.

The cut-off barrier element is particularly important given that several monitoring locations adjacent to the landfill recorded high methane and carbon dioxide concentrations with limited associated flow, indicating a diffusion-dominated gas regime.

### **3.4. INTERACTION WITH REMEDIAL EXCAVATION WORKS**

The gas cut-off barrier design has been developed in parallel with the proposed remedial excavation works.

Along the northern boundary of the off-site landfill, it is proposed to excavate all Made Ground deposits and remove deleterious materials down to the natural stratum within approximately 25 m of the site boundary, including materials within the vicinity of WS201 which previously recorded elevated methane concentrations.

Along the western boundary of the off-site landfill, it is proposed to excavate a 2.00 m wide cut-off trench, and remove all Made Ground deposits and deleterious materials down to the natural stratum. Within the vicinity of the on-site infilled channel in the central sector, where Made Ground deposits have been recorded to a maximum depth of 6.30 m bgl, the cut-off trench will be stepped in along an area of POS to accommodate a stepped batter.



The resulting excavations / trench will be backfilled with site-won cohesive deposits and compacted in accordance with the E3P Geotechnical Specification. Site-won cohesive deposits will undergo chemical and geotechnical testing in accordance with frequencies outlined within the E3P Remediation and Enabling Works Strategy (Ref: 15-280-R2-7, dated November 2025) to confirm their suitability for re-use. The suitability of the site-won cohesive deposits will also be confirmed by via a visual inspection of the material by a qualified geoenvironmental consultant prior to placement.

During the placement of the site-won cohesive deposits, in-situ permeability testing (300 mm by 300 mm soakaways) will be undertaken every 1.00 m of upfill at a rate of 1 per 25m<sup>2</sup> along the northern boundary, and 1 every 50 linear meters along the western boundary to confirm the placed site-won cohesive deposits are impermeable (i.e. have a permeability of <1.00 x10<sup>-6</sup>).

Furthermore, plots located within the immediate vicinity of the off-site landfill will utilise a driven pile foundation rather than vibro stone column solution, due to the potential for creating a preferential pathway for ground to migrate via the granular columns.

Recovered Made Ground deposits will undergo chemical and geotechnical testing in accordance with frequencies outlined within the E3P Remediation and Enabling Works Strategy (Ref: 15-280-R2-7, dated November 2025) to confirm their suitability for re-use, and subject to these results, may be re-used in areas of low sensitivity (i.e. Public Open Space) or taken off-site for disposal at an appropriately licensed waste management facility.

These works will seek to reduce on-site gas generation potential, remove low-permeability obstructions and preferential pathways, and allow the gas cut-off barrier to interface directly with competent underlying strata, improving gas interception efficiency.

The combined remediation and pathway interruption measures are therefore expected to result in a measurable reduction in ground gas concentrations and gas flux entering the site.

### **3.5. PERFORMANCE VERIFICATION AND MONITORING**

To demonstrate the effectiveness of the gas cut-off barrier, a programme of post-remediation and earthworks ground gas monitoring will be undertaken.

Monitoring wells will be installed on the development side of the cut-off barrier at approximately 50 m intervals, as well as in strategic locations across the wider development in order to confirm that ground gas concentrations and flow rates have been reduced to levels consistent with the proposed gas protection measures, validate the cut-off barrier installation and construction quality, and support confirmation of the revised ground gas Characteristic Situation in the vicinity of the western boundary.

The results of post-remediation and earthworks monitoring will be reported to Knowsley Metropolitan Borough Council, the Environment Agency, and the NHBC for review and agreement.

### **3.6. SUMMARY**

The gas cut-off barrier has been designed to reflect the site-specific ground gas regime and Conceptual Site Model. The system provides a passive, durable and verifiable mitigation measure that reduces lateral and vertical gas migration from the adjacent landfill, supports the proposed ground gas zoning and plot-specific mitigation measures, and protects future residents and the built environment from ground gas risk. Furthermore, no long term maintenance of the cut-off barrier is deemed necessary, given that it will be developed and constructed as part of the remedial earthworks.



Subject to validation and post-remediation and earthworks ground gas monitoring, the proposed design is considered appropriate and proportionate to the identified risks at the site.

E3P have prepared a detailed Gas Cut-Off Barrier Design, which illustrates the proposed layout and design of the cut-off barrier, and locations of the post remediation and earthworks ground gas monitoring wells within Drawing 15-280-046 and 15-280-047 (appended to this report). A snapshot of the proposed layout is presented as Figure 3.1, and snapshots of the proposed design is presented as Figure 3.2, Figure 3.3, and Figure 3.4.

**Figure 3.1 Gas Cut-Off Barrier and Post Remediation and Earthworks Monitoring Well Location Plan**

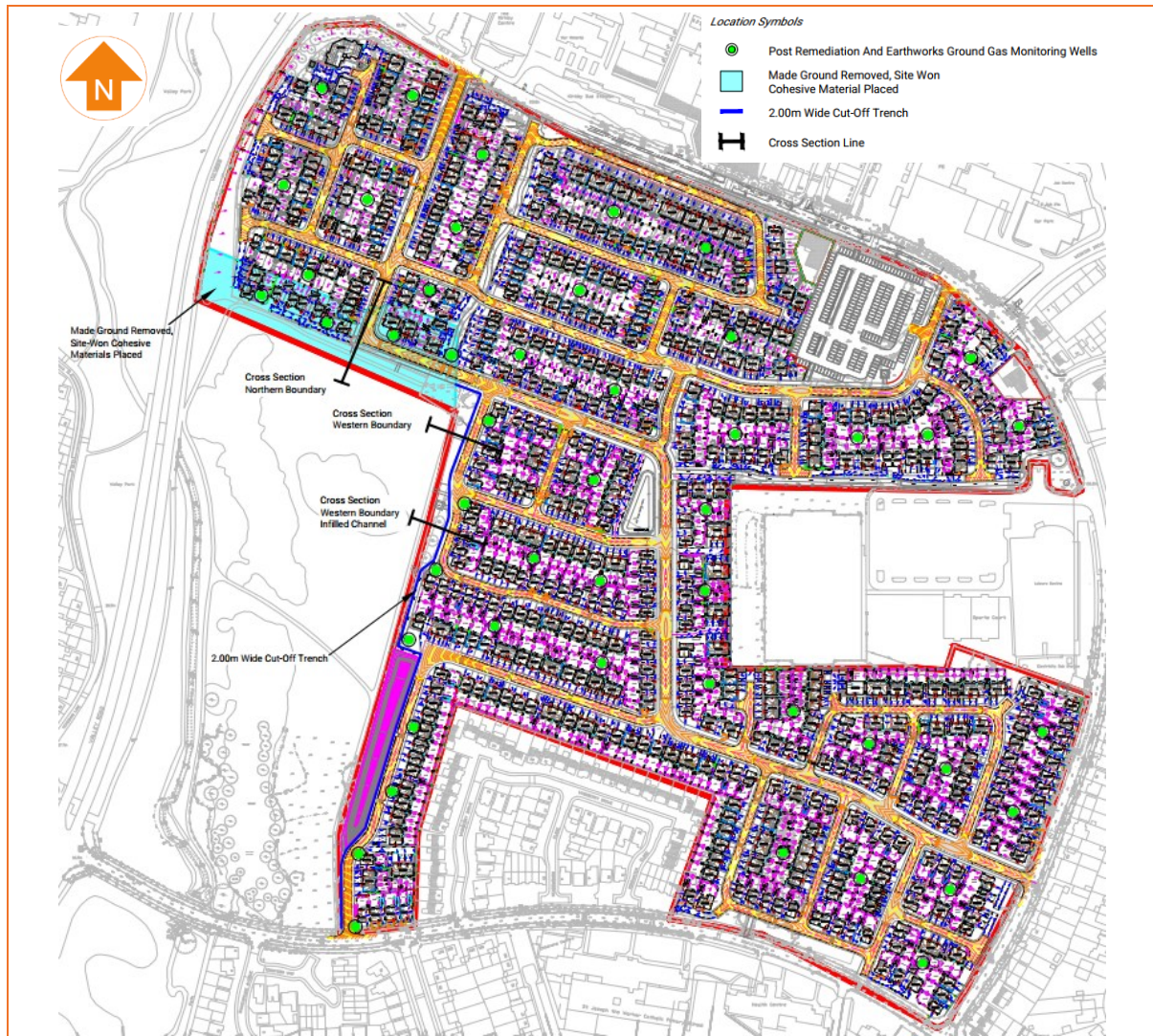




Figure 3.2 Gas Cut-Off Barrier Design – Northern Boundary

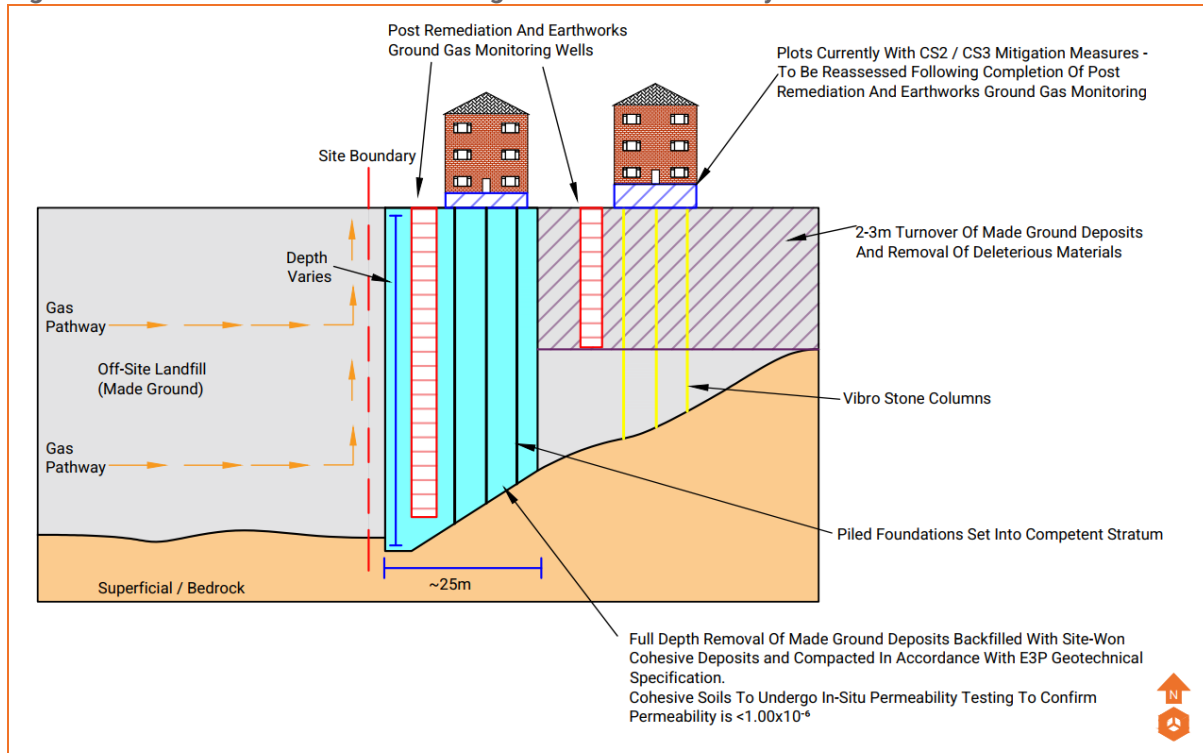
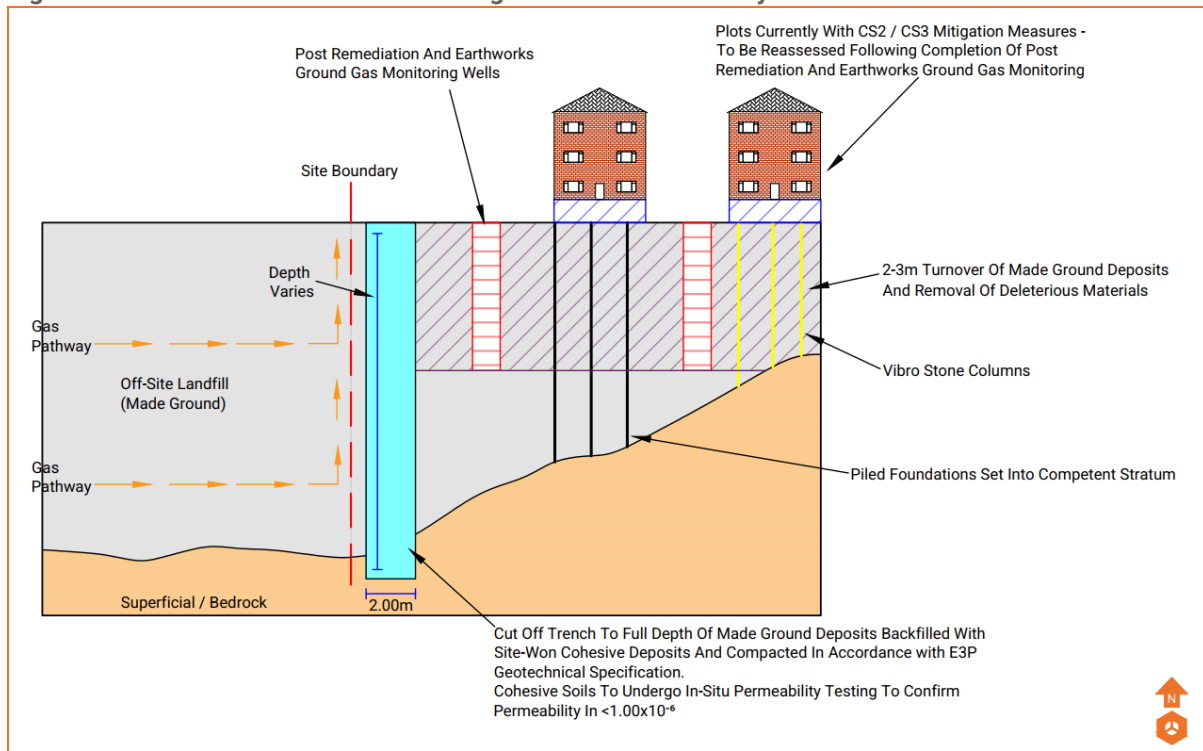
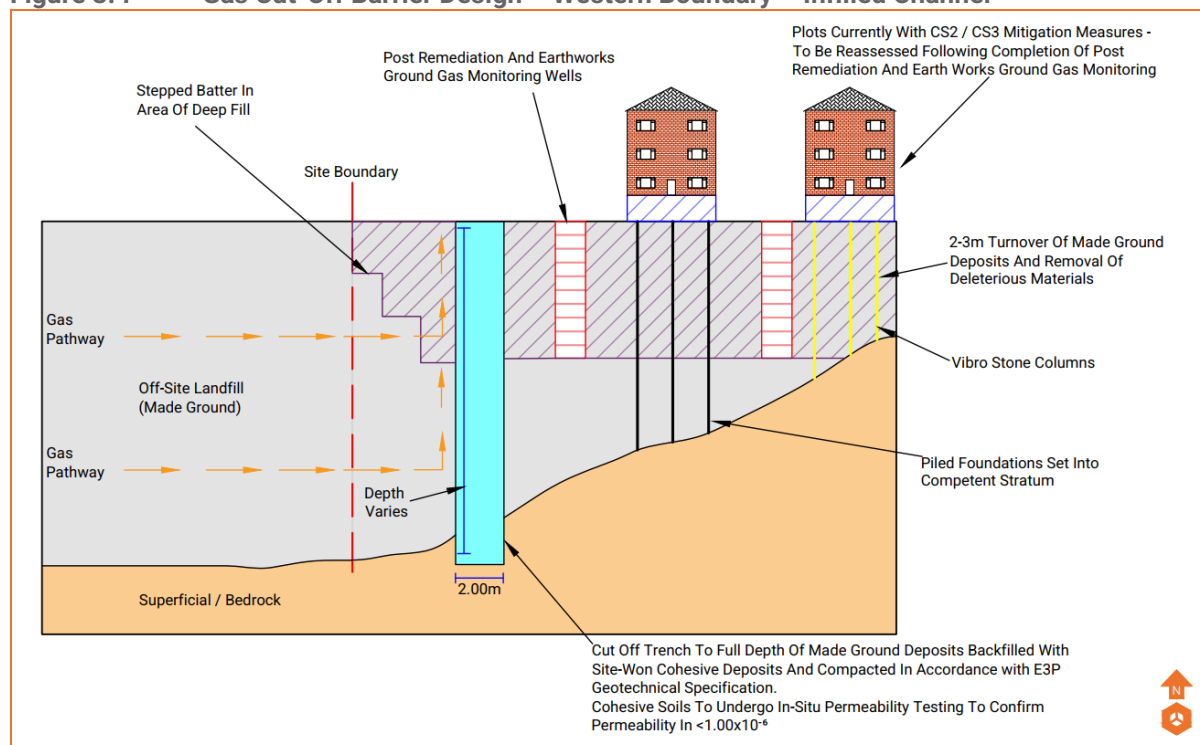


Figure 3.3 Gas Cut-Off Barrier Design – Western Boundary





**Figure 3.4 Gas Cut-Off Barrier Design – Western Boundary – Infilled Channel**



## 4. GAS CUT-OFF BARRIER METHOD STATEMENT

All works to expose and remove deleterious and putrescible materials from within the Made Ground along the northern and western boundaries, including within the vicinity of WS201, and to install the new gas cut-off barrier will be completed under the supervision of a suitable qualified geoenvironmental engineer to ensure no unacceptable environmental risk and to demonstrate that all works have been completed to the highest standard with appropriate validation testing.

A proposed sequence of operations is presented in Table 4.1.

**Table 4.1 Sequence of Operations**

| SEQUENCE | OPERATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | <p>Prior to the commencement of any works on-site, the area will be fenced to ensure no unauthorised personnel enter the area of work.</p> <p>It is recommended that a gas analyser is utilised throughout the works and in particular if personnel enter any excavations (suitably battered or trench box utilised) to ensure any works are stopped if any gas concentrations are encountered to mitigate against any potential for asphyxiation or explosion.</p> <p>All detailed risk assessments including working with a confined space will be completed prior to the commencement of any works.</p> <p>Smoking shall be strictly prohibited within 50 m of the landfill at all times.</p> |



| SEQUENCE | OPERATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2        | <p>It will be necessary to identify the location of the proposed location of the gas cut-off barrier in a controlled manner to allow full inspection of the Made Ground deposits to be removed.</p> <p>The location of the new gas cut-off barrier will be marked out on the site at the beginning of the works.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 3        | <p>Recent intrusive ground investigations have identified Made Ground deposits along the site's boundary with the adjacent landfill to be at proven depths of between 2.20 m bgl, and a maximum recorded depth of 6.30 m bgl. Due to the variable depths of Made Ground deposits along the site's boundary with the adjacent landfill, excavations will be required to be completed down to the natural superficial deposits.</p> <p>Made Ground deposits within 25 m of the northern boundary (including those within the vicinity of WS201), and within the footprint of the 2.00 m wide cut-off trench along the western boundary will be carefully removed in a controlled manner using excavation plant down to the underlying natural superficial deposits.</p> <p>Deleterious and putrescible materials within the Made Ground deposits will require removal in their entirety for off-site disposal, with a confirmation inspection by a qualified geoenvironmental consultant.</p> <p>A stepped batter will be required in order to remove all deleterious and putrescible materials at extensive depths (&gt;4.00 m bgl).</p> <p>A trench box will be utilised to ensure stability of all excavations along the western boundary.</p> <p>All removed materials will be stockpiled on-site on an impermeable membrane. Materials will be removed from site by a licensed waste management company to a suitable facility. Chemical analysis and, if applicable, WAC analysis and WM3 classification, will be required of materials to be exported off-site.</p> <p>Recovered Made Ground deposits will require chemical and geotechnical testing to confirm their suitability for re-use, and subject to these results, may be re-used in areas of low sensitivity (i.e., Public Open Space) or taken off-site for disposal at an appropriately licensed waste management facility.</p> |
| 4        | <p>Following the removal of all Made Ground deposits, the resulting excavations / trench will be backfilled with site-won cohesive deposits and compacted in accordance with the E3P Geotechnical Specification, in order to segregate the infill remaining outside of the development area.</p> <p>Site-won cohesive deposits will undergo chemical and geotechnical testing in accordance with frequencies outlined within the E3P Remediation and Enabling Works Strategy (Ref: 15-280-R2-7, dated November 2025) to confirm their suitability for re-use. The suitability of the site-won cohesive deposits will also be confirmed by via a visual inspection of the material by a qualified geoenvironmental consultant prior to placement.</p> <p>During the placement of the site-won cohesive deposits, in-situ permeability testing (300 mm by 300 mm soakaways) will be undertaken every 1.00 m of upfill at a rate of 1 per 25m<sup>2</sup> along the northern boundary, and 1 every 50 linear meters along the western boundary to confirm the placed site-won cohesive deposits are impermeable (i.e., have a permeability of &lt;1.00 x10<sup>-6</sup>).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



| SEQUENCE | OPERATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5        | <p>Following the installation of the gas cut-off barrier, a series of post remediation and earthworks ground gas monitoring wells will be installed on the proposed development side of the newly installed cut-off barrier at approximately 50 m intervals, as well as in strategic locations across the wider development in order to demonstrate effective construction and mitigation/protection to the proposed dwellings to the north and east of the adjacent landfill.</p> <p>Monitoring well response zones will be installed within engineered upfill material.</p> <p>A monitoring programme, comprising either interval monitoring (6 visits over 6 weeks) or continuous monitoring (over a period of 3 weeks), should be completed and agreed with the regulators.</p> |
| 6        | <p>Following the completion of the post remediation and earthworks ground gas monitoring programme, a post remediation and earthworks ground gas addendum report will be completed and submitted to regulators for approval.</p> <p>Following approval of the post remediation and earthworks ground gas addendum report by the regulators, the monitoring wells will be decommissioned, with pipework removed and holes backfilled with bentonite pellets.</p>                                                                                                                                                                                                                                                                                                                     |

Approval of this specification by the regulators will be sought prior to any works commencing.

We trust this information is satisfactory to your requirements, and should we be able to be of any further assistance, please do not hesitate to contact us.

Yours sincerely,

**For and on behalf of E3P Ltd**

Written by:  
**Mark Wilson**  
**Principal Geoenvironmental Consultant**

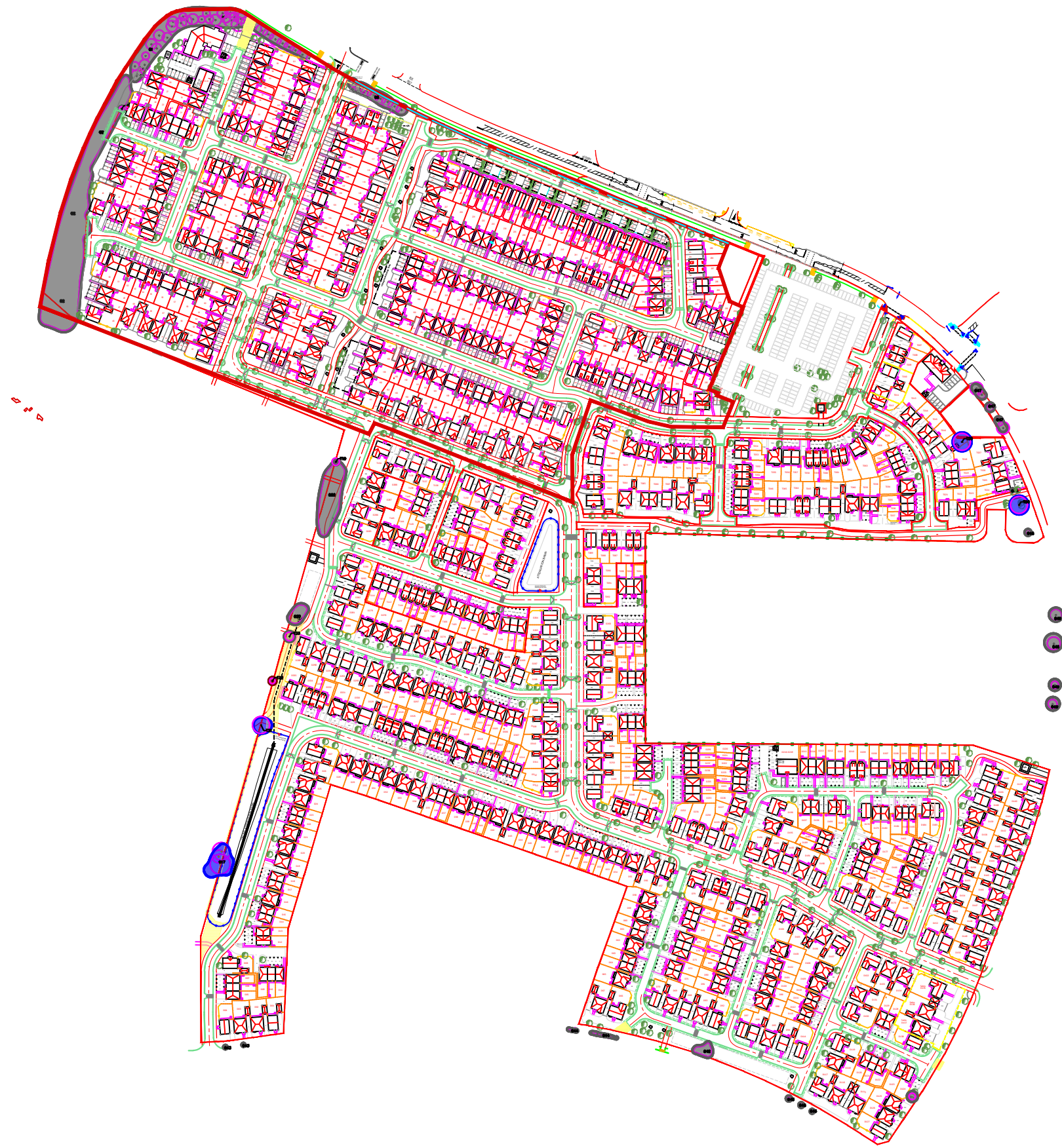
Approved by:  
**Martin Dyer**  
**Director**



**Enclosed:**

Drawing 15-280-001 – Site Location Plan  
Drawing 15-280-002 – Proposed Development Plan  
Drawing 15-280-020 – Ground Gas Zoning Plan  
Drawing 15-280-046 – Gas Cut-Off Barrier Layout Plan  
Drawing 15-280-047 – Gas Cut-Off Barrier Design





| Notes: |       |            |       |         |
|--------|-------|------------|-------|---------|
| P1     | REVE  | 05.03.2025 | CB    | NS      |
| P1     | REVD  | 28.02.2025 | TG    | BH      |
| P1     | REVC  | 03.05.2024 | OW    | BH      |
| P1     | REVB  | 04.12.2022 | LM    | BH      |
| P1     | REVA  | 20.04.2022 | LM    | BH      |
| Phase  | Issue | Date       | Drawn | Checked |

|            |                           |
|------------|---------------------------|
| Client:    | DWH                       |
|            | Cherryfield Drive, Kirkby |
| Job Title: |                           |

|                |        |
|----------------|--------|
| Job No:        | 15-280 |
| Drawing No:    | 002    |
| Drawing Title: |        |

|                           |            |
|---------------------------|------------|
| Date:                     | 05.03.2025 |
| Scale:                    | NTS        |
| Proposed Development Plan |            |



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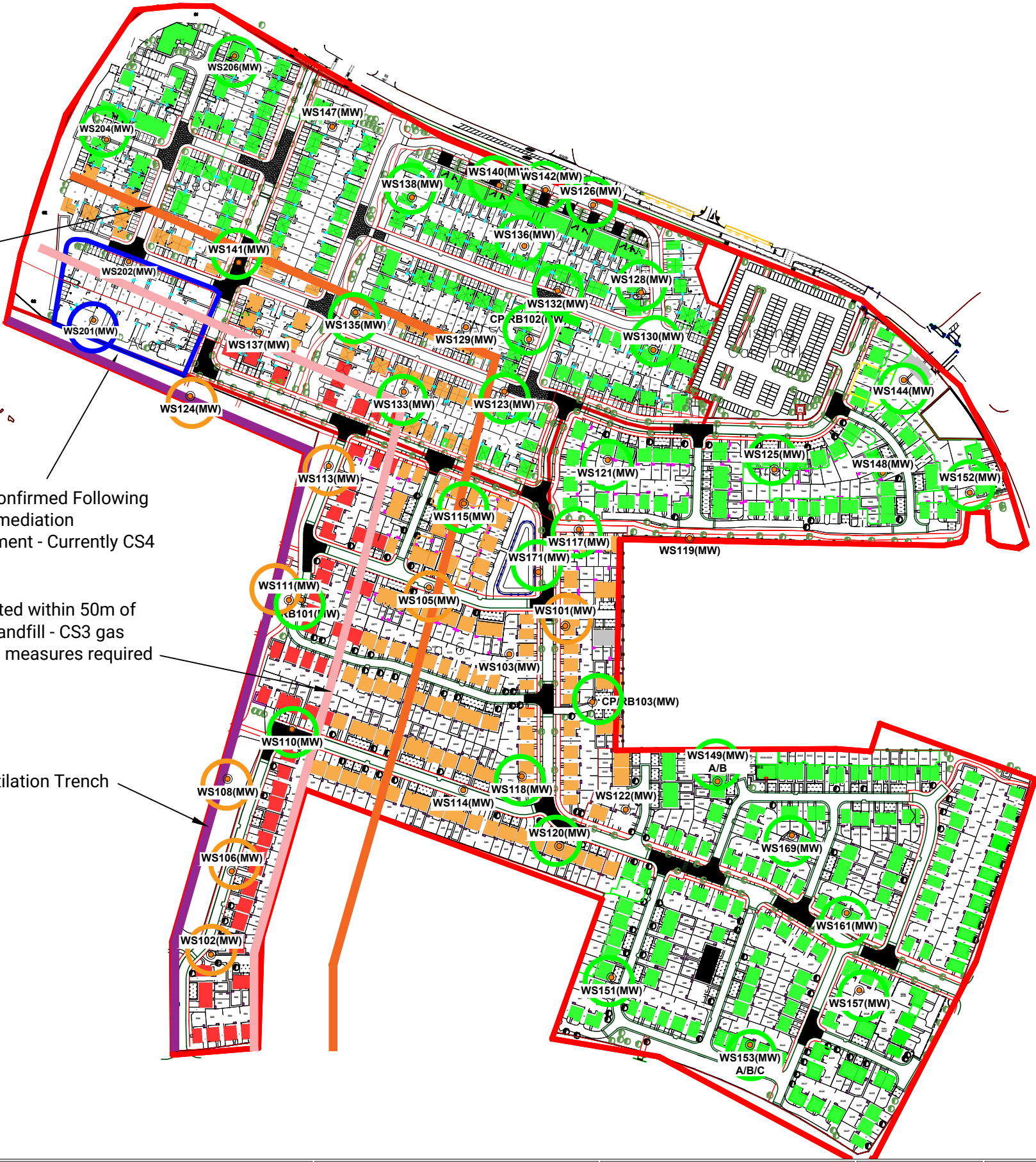
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Plots located within 100m of adjacent landfill and where monitoring has identified a CS2 classification (on-site infilled channel, central sector) - CS2 gas protection measures required.

To Be Confirmed Following Post Remediation Assessment - Currently CS4

Plots located within 50m of adjacent landfill - CS3 gas protection measures required

Gas Ventilation Trench



Location Symbols

Window Sample with Monitoring Well

Approximate Cable Percussive/Rotary Borehole Location With Install

- Key
- Plots Classified As CS1 - No Protection Measures Required
  - Plots Require CS2 Protection Measures
  - Plots Require CS3 Protection Measures
  - Location Classified As CS1
  - Location Classified As CS2
  - Location Classified As CS4
  - Gas Ventilation Trench

Notes:

|       |       |            |       |         |
|-------|-------|------------|-------|---------|
| P1    | REVD  | 19.11.2025 | CB    | MW      |
| P1    | REVC  | 07.04.2025 | TG    | NS      |
| P1    | REVB  | 11.03.2025 | TG    | NS      |
| P1    | REVA  | 05.03.2025 | CB    | NS      |
| Phase | Issue | Date       | Drawn | Checked |

Client:

DWH

Job Title:

Cherryfield Drive, Kirkby

Job No:

15-280

Drawing No:

020

Date:

19.11.2025

Scale:

NTS

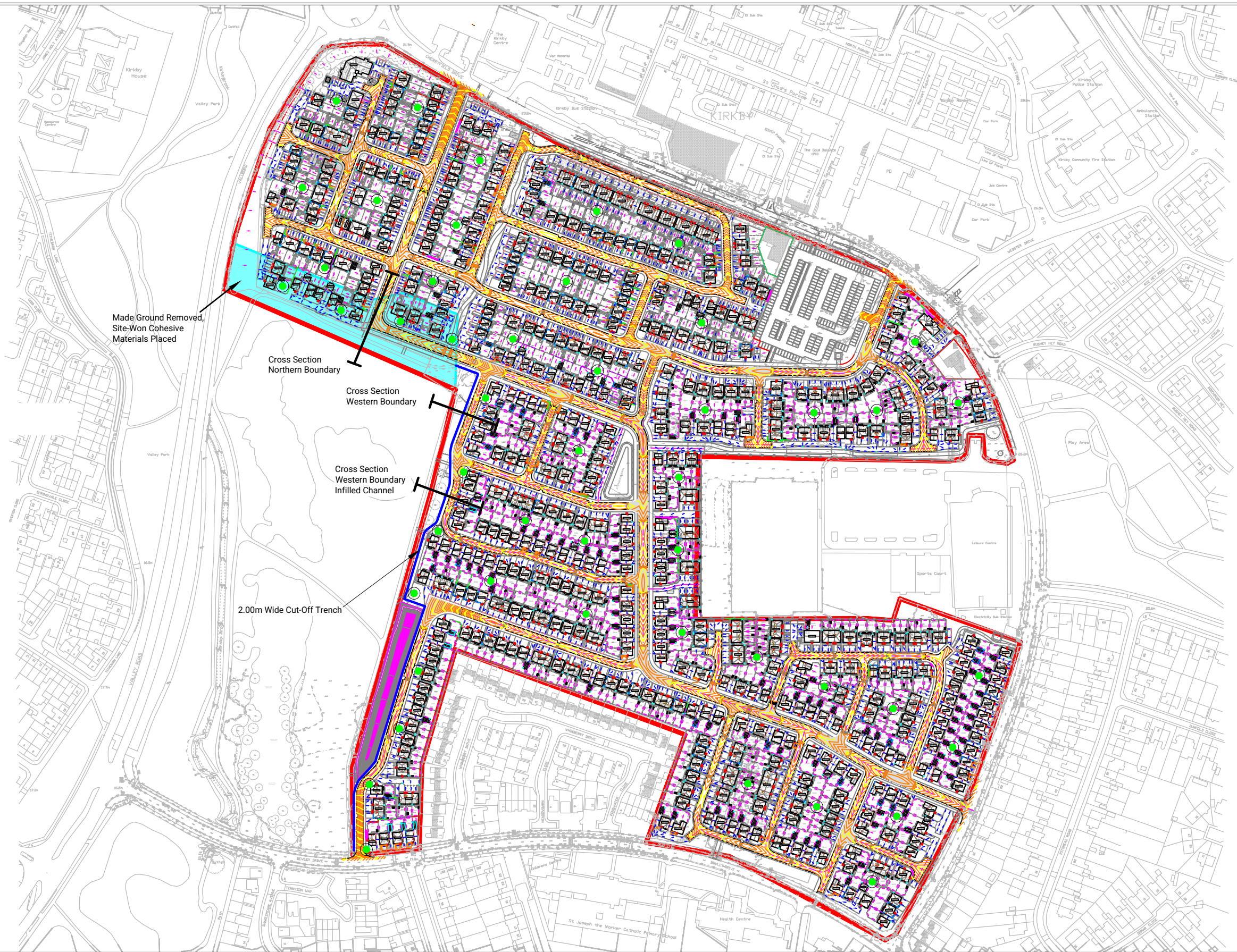
Drawing Title:

Gas Zoning Plan



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- Location Symbols
- Post Remediation And Earthworks Ground Gas Monitoring Wells
  - Made Ground Removed, Site Won Cohesive Material Placed
  - 2.00m Wide Cut-Off Trench
  - I Cross Section Line

Notes:  
Post Remediation And Earthworks Ground Gas Monitoring Wells To Be Decommissioned And Removed Following The Completion Of The Monitoring Programme And Acceptance Of The Post Remediation And Earthworks Ground Gas Addendum By The Regulators

Client:  
  
DWH

Job No:

15-280

Date:

23.03.2026

Drawing No:

046

Scale:

NTS



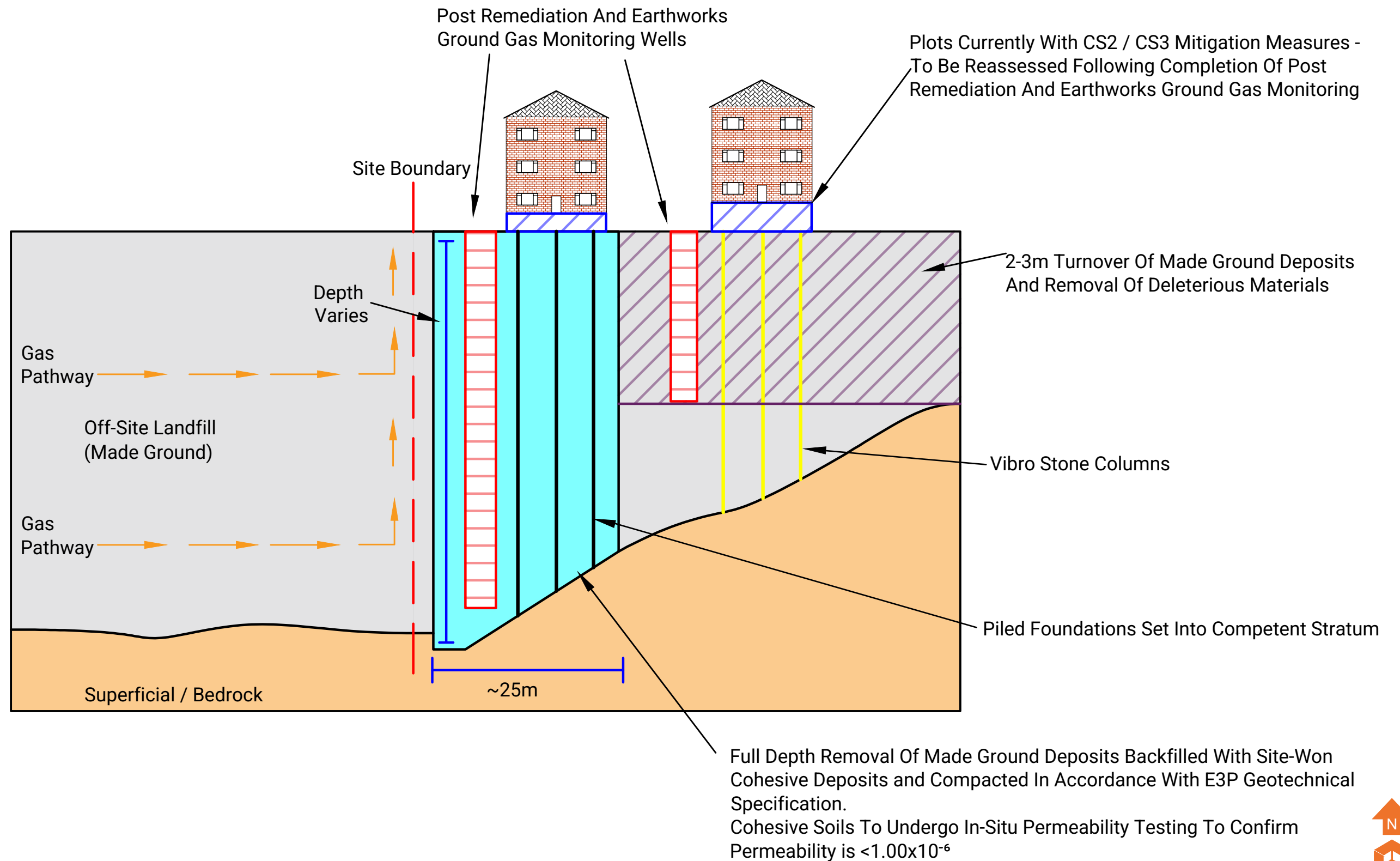
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|       |       |            |       |         |    |
|-------|-------|------------|-------|---------|----|
| P1    | REVA  | 23.03.2026 | TG    | MW      | MW |
| Phase | Issue | Date       | Drawn | Checked | PM |

Job Title:  
  
Cherryfield Drive, Kirkby

Drawing Title:  
  
Gas Cut Off Barrier Layout Plan

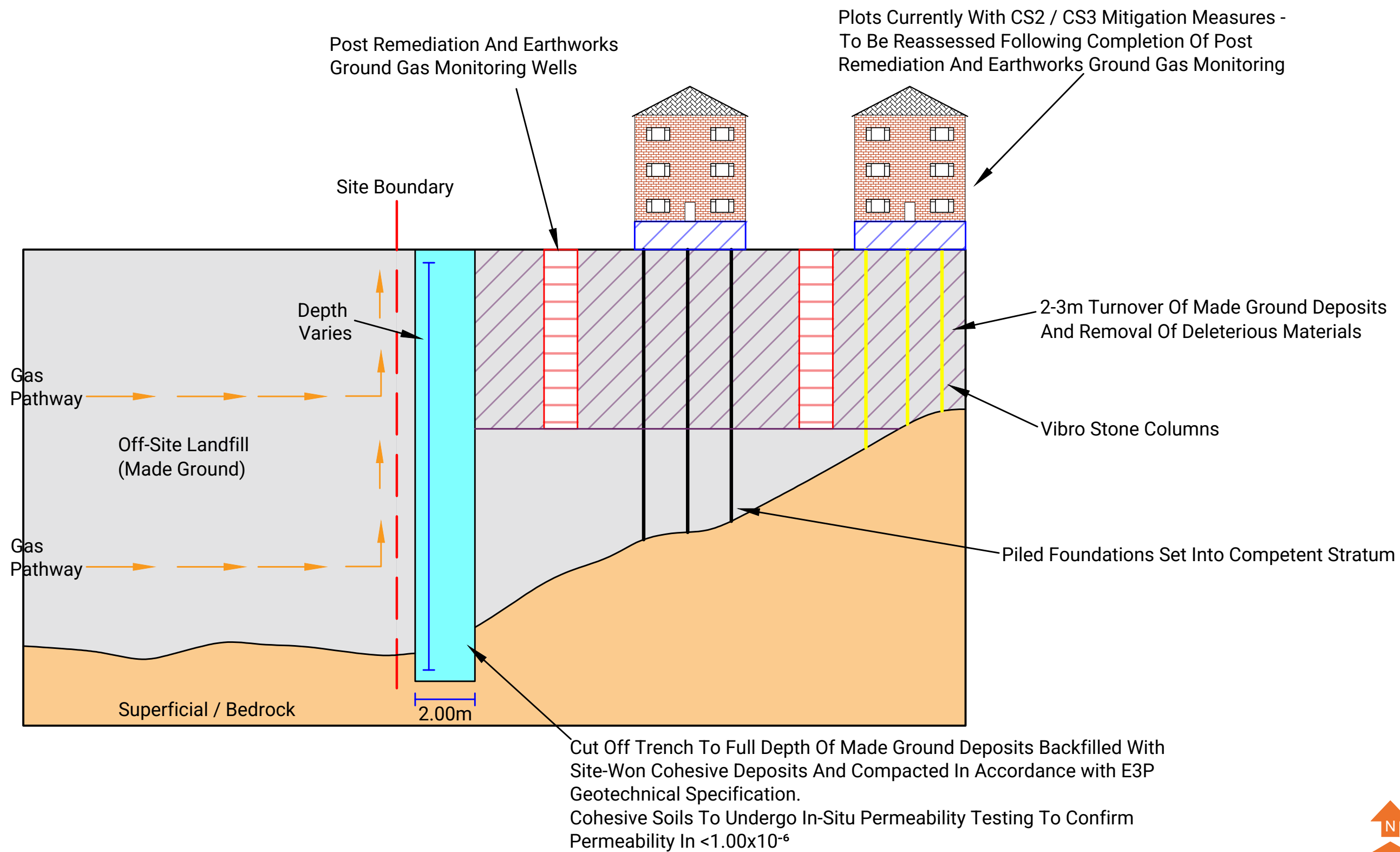
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- Location Symbols
- Site-Won Cohesive Material
  - Off-Site Landfill (Made Ground)
  - Superficial / Bedrock
  - Ground Gas Monitoring Wells
  - 2-3m Turnover Of Made Ground Deposits

|                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| Notes:                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |  |  |  |
| Client:                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |
| DWH                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |  |  |
| Job No:                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |
| 15-280                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |  |  |  |
| Date:                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |  |  |
| 23.03.2026                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |
| Drawing No:                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |  |  |  |
| 047                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |  |  |
| Scale:                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |  |  |  |
| NTS                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |  |  |
| Job Title:                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |
| Cherryfield Drive, Kirkby                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |  |  |  |
| Drawing Title:                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |
| Gas Cut Off Barrier Design<br>- Northern Boundary                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |  |  |
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- Location Symbols
- Site-Won Cohesive Material
  - Off-Site Landfill (Made Ground)
  - Superficial / Bedrock
  - Ground Gas Monitoring Wells
  - 2-3m Turnover Of Made Ground Deposits

|                           |       |            |       |         |    |
|---------------------------|-------|------------|-------|---------|----|
| Notes:                    |       |            |       |         |    |
| Client:                   |       |            |       |         |    |
| DWH                       |       |            |       |         |    |
| Job Title:                |       |            |       |         |    |
| Cherryfield Drive, Kirkby |       |            |       |         |    |
| P1                        | REVA  | 23.03.2026 | TG    | MW      | MW |
| Phase                     | Issue | Date       | Drawn | Checked | PM |

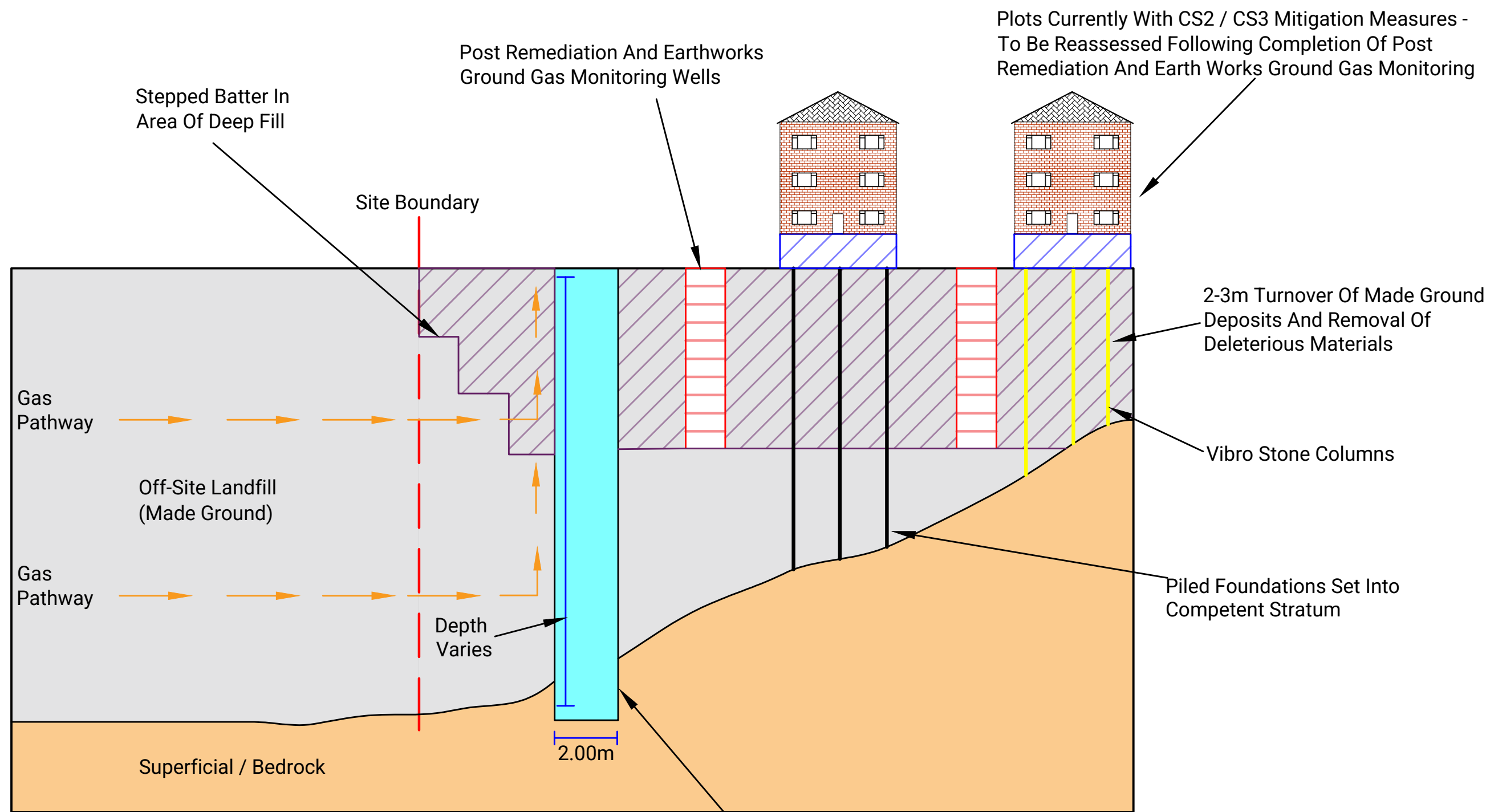
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|---------------------------|--|
| <i>Client:</i>            |  |
| DWH                       |  |
| <i>Job Title:</i>         |  |
| Cherryfield Drive, Kirkby |  |

|                                                  |               |
|--------------------------------------------------|---------------|
| <i>Job No.:</i>                                  | <i>Date:</i>  |
| 15-280                                           | 23.03.2026    |
| <i>Drawing No.:</i>                              | <i>Scale:</i> |
| 047                                              | NTS           |
| <i>Drawing Title:</i>                            |               |
| Gas Cut Off Barrier Design<br>- Western Boundary |               |



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Cut Off Trench To Full Depth Of Made Ground Deposits Backfilled With Site-Won Cohesive Deposits And Compacted In Accordance With E3P Geotechnical Specification.  
Cohesive Soils To Undergo In-Situ Permeability Testing To Confirm Permeability In  $<1.00 \times 10^{-6}$



- Location Symbols
- Site-Won Cohesive Material
  - Off-Site Landfill (Made Ground)
  - Superficial / Bedrock
  - Ground Gas Monitoring Wells
  - 2-3m Turnover Of Made Ground Deposits

Notes:

Client:

DWH

Job No:

15-280

Date:

23.03.2026

Drawing No:

047

Scale:

NTS



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|-------|-------|------------|-------|---------|----|
| P1    | REVA  | 23.03.2026 | TG    | MW      | MW |
| Phase | Issue | Date       | Drawn | Checked | PM |

Job Title:

Cherryfield Drive, Kirkby

Drawing Title:

Gas Cut Off Barrier Design  
- Western Boundary  
(Infilled Channel)

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