Specification for the investigation and treatment of shallow workings & mine entries

Land at Balderstone Hall, Mirfield

For Bellway Homes Limited

Report no: 5670/1A

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SPECIFICATION FOR TREATMENT OF SHALLOW MINEWORKINGS OF LAND BENEATH BALDERSTONE HALL, MIRFIELD

1 INTRODUCTION

1.1 Background

1.1.1 Lithos Consulting Limited, have been commissioned by Bellway Homes Limited to prepare a Specification for the Treatment of Shallow Mineworkings and mine entries at Balderstone Hall, Mirfield.

1.1.2 Lithos have previously undertaken a site investigation, the findings of which are presented in:

- Geoenvironmental Appraisal of land off Balderstone Hall, Mirfield (Lithos Report No. 1668/1F, dated December 2022).

1.1.3 Report No. 1668/1F included findings a soil strip, undertaken in September 2018, with examination of the exposed natural Subsoil. The area stripped (c. 2.7 ha) was based on the proposed housing layout at that time.

1.1.4 There are 12 mine entries within the site which are likely bell pits and/or shallow shafts accessing relatively localised workings. There is a further mining feature in the southwest of site, likely a backfilled excavation /small quarry, or possibly a group of collapsed bell pits.

1.1.5 As such, there are significant surface stability risks at the site.

1.1.6 The settlement or collapse of backfill in a bell pit can lead to differential settlement and crown hole formation.

1.1.7 Ground stability problems above workings can arise as the roof collapses. Progressive deterioration means that there may be a subsidence delay of over 100 years. The mechanism of roof collapse involves progressive upward migration of a void until it is either choked by the spalled roof debris, or reaches the surface as a crown hole.

1.1.8 CIRIA SP32[1] suggests voids resulting from mineral extraction are unlikely to migrate more than 10 times the seam thickness through competent bedrock. CIRIA C758D[2] notes that the use of this 10 times 'rule-of-thumb', as the design basis for treatment depth, has been observed to be successful over many years for a wide range of mineworkings and overlying rock/soil strata scenarios. However, consideration must always be given to site specifics such as nature of roof strata, strata dip, groundwater, extraction ratio etc.

1.1.9 Lithos' previous investigation concluded that coal/workings are typically at sufficient depth to mitigate the risks posed to surface stability by underground workings. However, risk are greater around the mine entries and proof drilling of plots within the immediate vicinity of the mine entries was recommended. This will either confirm the absence of workings or allow for the grouting of any voids or broken ground that could affect surface stability.

[1] *CIRIA SP32 (1984) - Construction over abandoned mine workings*

[2] *CIRIA C758D (2019) – Abandoned mine workings manual*

1.2 The proposed development

1.2.1 A proposed layout has been provided by Bellway (Parker Peel Architecture Drawing Reference 2520-SI-02F, dated October 2025) which is reproduced as Drawing 1668/2 Revision E in Appendix A.

1.2.2 The proposed layout shows a residential development comprising 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers.

1.2.3 Access to the development will be from Woodward Court (via Wellhouse Lane).

1.2.4 As noted above, a soil strip undertaken in 2018 was based on the proposed housing layout at that time which comprised 61 plots. The current layout includes more plots (75) and shows development in areas beyond that previously stripped.

1.2.5 Prior to commencement of the works described in this Specification, Bellway will commission further soil stripping to allow examination of the exposed natural Subsoil beneath the entire footprint of the development currently proposed (including the SuDS basin).

1.2.6 The proposed additional area of soil strip is shown on Drawing 5670/22.

1.2.7 If any further mine entries are encountered during the additional strip, this Specification will be revised and re-issued.

1.3 Available information

1.3.1 The following information will be sent to all Contractors who confirm their intention to submit a tender for the Drill & Grout Works described in this document.

- Geoenvironmental Appraisal of land at Balderstone Hall, Mirfield (Lithos Report No. 1668/1F, dated December 2022).
- Topographic Survey, Proposed Plot Layout, Grouting Grid (all in AutoCAD format)
- Service Drawings (electric, gas etc). The appointed Contractor will be expected to obtain up to date plans prior to commencement of the works.

1.4 Contractor appointment

1.4.1 The successful Contractor will be engaged in accordance with Bellway's terms and conditions. The successful Contractor will be appointed by Bellway as Principal Contractor for the duration of the Drill & Grout Works.

1.4.2 The objectives of the Drill & Grout Works are to:

- Investigate the mine entries to confirm their depth and that they are completely infilled (not blocked several meters below ground levels with open voids below).
- Proof drill Plots 9, 11 to 14, 43, 48, 51, 57 to 64, 69 to 72 which are located within 12m of mine entries
- Substantially fill the old workings and any voids or broken ground found in the overlying rock strata via the injection of a suitable grout via boreholes.

1.4.3 All works should be carried out in accordance with current UK health and safety legislation, HSE guidance, the Construction Design Management (CDM) Regulations and the Construction Phase Health and Safety Plan.

1.4.4 On appointment, the Contractor shall submit an application (with the associated fee) to the Mining Remediation Authority[3] (MRA) for 'Permission to enter MRA mining interests'.

1.4.5 The proposed Drill & Grout Works shall be undertaken in accordance with BS EN12715:2000 'Execution of Special Geotechnical Work: Grouting', and the Mining Remediation Authority's "Permission to Enter or Disturb Mining Remediation Authority Mining Interests" (to be applied for by the successful Contractor).

2 SITE INVESTIGATION

2.1 Site description

2.1.1 Site details are summarised below.

Detail	Remarks
Location	Northeast of Mirfield, about 7km northeast of Huddersfield town centre.
NGR	SE 209 210
Approximate area	4.8 hectares (11.8 acres)
Known services	Overhead electricity runs along northeastern site boundary. Overhead communications immediately beyond southeastern corner.

2.1.2 The site's location is shown on Drawing 1668/1 in Appendix A.

2.2 Mining investigation

2.2.1 Whilst the site is crossed by two geological **faults** which divide the area into three fault blocks (see Drawing 1668/3 in report 1668/1F), bedrock across the entire site comprises the Falhouse Rock (a sandstone unit within the Lower Coal Measures).

2.2.2 BGS maps show that two coal seams underlie the site at shallow depth, these are:

- **Blocking Rider** 0.0m to 0.2m thick, possibly absent, about 2m below the Falhouse Rock.
- **Blocking Coal** 0.2m to 0.6m thick, about 7m below the base of the Falhouse Rock.

2.2.3 It should be noted that the Blocking Coal is also referred to as the Top Silkstone Coal in some literature relating to this site and the wider area.

2.2.4 A Mining Remediation Authority (MRA) mining report states that no known shallow workings or mine entries are recorded within the site's boundary, but that shallow coal and probable shallow workings are expected.

Mineworkings & Mine entries

2.2.5 A ground investigation has been completed which comprised the drilling of 19 rotary open-hole probeholes, a Topsoil strip of the majority of the development footprint, and the excavation of 7 trenches across possible mining features identified during a 3rd party archaeological investigation.

2.2.6 The investigation identified coal, broken ground and voids as summarised in the Table on Page 16 of Lithos Report 1668/1F.

[3] *On 28th November 2024, the Coal Authority changed their name to the Mining Remediation Authority.*

2.2.7 Analysing the data obtained from the ground investigation, it is apparent that:

- The Blocking Coal (reportedly up to 0.6m thick) is present from depths of between 9.2m and 18.5m and has been worked by underground methods.
- 12 mine entries are located within the site, although one (MF005) does not extend into rock. It is likely an exploratory mine entry, abandoned before reaching coal, possibly due to difficult geological or economic conditions.
- There is a further mining feature in the southwest (MF004), likely a backfilled excavation /small quarry, or possibly a group of collapsed bell pits.
- There are 3 backfilled sandstone quarries within 150m of the site's boundary.

3 SITE SET-UP, ORGANISATION AND SAFETY

3.1 Site works shall be supervised throughout by a suitably qualified Engineer, who will report to a Project Manager.

3.2 Site cabins and welfare facilities are to be established at a location to be agreed with Bellway. All welfare facilities must be established in accordance with the relevant health & safety statutory requirements. Provision shall be provided on site for car parking for all site employees.

3.3 The Engineer will require use of the Contractor's welfare facilities, including the sole use of a dedicated desk and power supply.

3.4 All site personnel shall undergo a site-specific health and safety induction prior to commencement of work on site.

3.5 If at any time during the works personnel begin to feel unwell, they are to inform the Engineer and Contractor's Drilling Foreman, who will determine appropriate action.

3.6 Access into excavations etc. must be controlled and only undertaken in accordance with the Confined Spaces Regulations 1997. The atmosphere in shored trenches in excess of 1.2m should be monitored for oxygen and hazardous gas (methane & carbon dioxide), prior to personnel entering such excavations. Monitoring should continue whilst personnel are working in deep excavations.

3.7 All visitors to site must enter and register at the main Site Office.

4 CONTRACTOR'S RESPONSIBILITIES

4.1 Prior to the commencement of any works the Contractor, in agreement with the Engineer, shall:

- Comply with any requirements of Bellway's contract documentation.
- Prepare a Method Statement detailing how the Drill & Grout Works will be undertaken (and obtain approval from the Engineer & Bellway).
- Inform the Engineer of any risk, identified and assessed, which could impact upon the Engineer's activities
- Submit an application (with the associated fee) to the Mining Remediation Authority's "*Permission to Enter or Disturb Mining Remediation Authority Mining Interests*".
- Establish the boundaries of the site and the working areas.
- Undertake a dilapidation survey of site boundaries, adjacent properties and highways, via dated photographs or video footage.
- Liaise with the Local Authority regarding working hours, noise\dust\odour control, and protected trees.
- Liaise with the Local Water Company regarding water supply and any proposed discharge to sewer.
- Complete a full services search and liaise with all relevant utility companies regarding work in close proximity to their apparatus.
- Prepare the necessary COSHH statements and Health & Safety Plan in accordance with CDM regulations.
- Organise setting-out of the grout grid.

4.2 The Contractor shall satisfy the Health & Safety Executive with regard to all matters concerning the health, safety and welfare of persons on the site.

4.3 The Contractor shall ensure that:

- Personnel, plant, materials and other equipment related to the contract are confined within the boundaries of the site.
- Any live services lying within the site boundary are marked and protected, or appropriate arrangements made to truncate them.
- Good practices relating to personal hygiene are adopted.
- Suitable precautions are implemented at all times to prevent off-site migration of pollutants via airborne dust and vapours.
- Suitable precautions are taken to prevent the spread of mud and debris on public highways.
- Refuelling of mobile plant is undertaken in a designated area. Above ground oil storage tanks shall comply with the requirements of Pollution Prevention Guideline PPG2. A spill kit shall be kept on site, adjacent to the designated refuelling area.

4.4 Within one week of completion of the Drill & Grout Works, as agreed by the Engineer, the Contractor shall ensure that the site is reinstated to the satisfaction of Bellway. For the avoidance of doubt, this will require the Contractor to:

- Pull any sacrificial plastic casings\tubes from the ground
- Remove any "mole-hills" of drill arisings and grout from around each borehole
- Remove any remaining stockpiles of PFA etc from site
- Clear the temporary site compound of cabins, plant, materials etc

5 ENGINEERING SUPERVISION AND VERIFICATION

5.1 The Engineer will ensure that the requirements of this Specification are complied with in a safe and orderly manner.

5.2 The responsibilities of the Engineer shall include, but not be limited to, the following:

- Ensuring that all site personnel are suitably qualified and given an appropriate induction at the beginning of their first day
- Supervision of the Drill & Grout Works
- Guidance on the appropriate protective clothing and safety equipment that is to be made available and used
- Ensuring that personal hygiene arrangements are adequate
- Liaison with statutory authorities as required

5.3 The Engineer will maintain records of the works to include the following:

- A summary of the day's activities
- Date and weather conditions
- Visitors
- Aspects relating to Health and Safety, Environmental Control, or non-compliance with either this Specification or the Contractor's Method Statement
- Borehole details (depths, ground encountered, grout take etc)
- Test results (including flow, bleed and cube crushing)

5.4 Copies of "template" record sheets to be used by the Engineer are included in Appendix B.

5.5 On satisfactory completion of all the works the Engineer will prepare a Verification Report. Copies of the Verification Report will be issued to Bellway, the Local Authority and NHBC.

5.6 The Verification Report will stand as certification that the Drill & Grout Works have been carried out in accordance with this Specification.

5.7 The Verification Report will include:

- A summary of the Drill & Grout Works undertaken, including any works associated with unforeseen conditions (such as previously unrecorded mine entries)
- Copies of any correspondence with Regulators relating to specific aspects of the remediation works

6 INVESTIGATION & TREATMENT OF SHALLOW MINE WORKINGS

6.1 Background

6.1.1 Previous Lithos investigation found 11 mine entries which may have associated shallow underground workings. The mine entries have been backfilled, although it is unlikely that backfilling was undertaken to an engineering specification. As a result of the presence of backfill the conductivity of mineworkings is expected to be very low (i.e. injected grout is unlikely to 'flow' any great distance through the underground workings).

6.1.2 Prior to commencement of the works described in this Specification, Bellway will commission further soil stripping to allow examination of the exposed natural Subsoil beneath the entire footprint of the development currently proposed (including the SuDS basin); see Drawing 5670/22.

6.1.3 If any further mine entries are encountered during the additional strip, this Specification will be revised and re-issued.

6.2 Proof drilling

6.2.1 There are 20 plots that are within 12 meters of a mine entry or the potential quarry in the southwest (MF004). It is proposed to proof drill these plots in a 'domino 5'.

6.2.2 Proposed drilling locations are shown on Drawing 5670/21, presented in Appendix A.

6.2.3 All holes are to be grouted, further details in Section 6.4 below.

6.2.4 Where workings are found, further holes might be instructed by the Engineer.

6.2.5 Further holes will also be instructed by the Engineer in areas of high grout take (to confirm filling of void space).

6.2.6 The Contractor should make allowance for 10 further holes within their fixed price for this project.

6.2.7 Additional "test" holes will be instructed by the Engineer; see Section 10. The Contractor should make allowance for 10 further holes within their fixed price for this project.

6.3 Drilling procedures

6.3.1 All holes to be used for the injection of grout, including those which strike solid coal, shall be drilled by rotary or rotary percussive methods down to the base of the old workings. One metre of solid rock shall be proved below the base of the old workings.

6.3.2 The drilling system and flushing medium to be used shall be approved by the Engineer. It should be noted that in accordance with Mining Remediation Authority requirements, air flush is only permitted where the distance to nearby properties is greater than 50m. Therefore, proof drilling of plots near the western boundary (Plots 57 to 64 & 69 to 72) and southern boundary (Plot 48 and the garage of Plot 49) will require water flush.

6.3.3 The minimum diameter of the holes shall be 90mm unless otherwise specified by the Engineer. When it is impracticable to drill at the minimum diameter for the full depth, the diameter of the holes shall be increased in the upper sections.

6.3.4 The holes shall be cased through made ground and superficial deposits down to the rockhead as directed by the Engineer. Casing could either be sacrificial plastic, or temporary, recoverable steel tubes.

6.3.5 The holes shall be kept open until grout injection into the workings is complete.

6.3.6 Where a hole proves abortive, because it becomes obstructed, or fails to achieve the required depth, it shall be re-drilled at a larger diameter and re-cased, or a new hole drilled and cased at the Contractor's expense.

6.3.7 The Contractor is expected to recover all borehole casing employed in any borehole and no payment will be made for any borehole casing abandoned in any borehole on completion of the Contract.

6.3.8 The Contractor should extend any holes encountering solid coal in the upper seam down to the lower seam.

6.4 Grouting procedures

6.4.1 Grout shall be introduced into all boreholes drilled.

6.4.2 Immediately prior to grouting each hole, the Contractor shall check that it is unobstructed to the required depth, and able to receive the tremie pipe. Obstructions shall be dealt with as described in 'drilling procedures' above.

6.4.3 Grout shall be tremied down each hole via an approved T-connection and flexible tube, or a series of steel tubes, placed to the base of the hole or to such other depth as specified by the Engineer. Provision shall be made for monitoring the pressure of the grout and the quantity being delivered in the line.

6.4.4 Grouting shall proceed upwards from the base of each borehole to the base of the superficial deposits. It is not intended that, as a general rule, significant quantities of grout shall be injected into the superficial deposits unless specified otherwise.

6.4.5 The grout shall be injected at the approved rates until either a limiting pressure of 10 kN/m^2 per m of overburden, or a maximum of 200 kN/m^2 is reached, or grout appears near the point of injection, when the hole shall be deemed complete. If one of these criteria is reached quickly, the grout tube or pipes shall be lifted to check that a local obstruction is not preventing the flow of the grout into the strata.

6.4.6 Pressure shall be applied to the grout in every hole where:

- Voids were encountered during the drilling of that hole
- Broken rock was encountered during the drilling of that hole
- Soft ground (including possible packed waste) was encountered below rockhead during the drilling of that hole
- The grout level in that borehole has fallen before the application of the pressure
- Solid rock and coal were encountered in the borehole and the Engineer requests that pressure be applied

6.4.7 If pressure is not achieved, or grout has not appeared at the point of injection after 15 tonnes of grout materials have been placed, then sand and/or pea gravel (gravel which passes through a 6.33mm sieve and is retained on a 2.36mm sieve) may be added to the mix, or placed down the hole with the permission of the Engineer.

6.4.8 When the holes have been cased through rock, grout injection shall continue at gauge pressures to be approved by the Engineer, subject to the maximum of 10 kN/m^2 per m of overburden with an upper limit of 200 kN/m^2 whatever the depth, as the casing is withdrawn.

6.4.9 No more than four holes shall be filled with grout before pressure is applied.

6.4.10 No more than two adjacent drillholes shall have pressure applied at the same time.

6.4.11 If a time interval elapses between filling a borehole with grout and applying the pressure which, in the opinion of the Engineer is excessive (i.e. the grout has become too set) then that borehole shall be re-drilled within one metre of the original position and fresh grout introduced; all at the expense of the Contractor.

6.4.12 The Contractor's attention is drawn to the need to check for underground services etc. In particular when injecting grout, the Contractor shall ensure by regular inspections (via lifted manhole covers) at hourly intervals that grout is not entering adjacent drains, culverts etc.

7 TREATMENT OF MINE ENTRIES

7.1 Known shafts

7.1.1 There are 12 known mine entries on the site, and a 13th feature (MF004).

7.1.2 The mine entries encountered were unlined and are likely to represent bell pits or shallow shafts. They likely targeted the Blocking Coal (encountered by Lithos between 9.2m and 18.5m depth).

7.1.3 Treatment recommendations shall be submitted to the Mining Remediation Authority, the Local Planning Authority and NHBC for comment\approval.

7.1.4 MF005 was bottomed out at 3.4m and likely represents an exploratory mine entry which was abandoned before reaching coal. Due to the shallow depth of this mine entry, and its distance from proposed properties (11.6m beyond Plot 5), treatment is not required.

7.1.5 MF004 is likely to be a backfilled excavation /small quarry, or possibly a group of collapsed bell pits. The Mining Remediation Authority have requested that no construction takes place over this feature, and no treatment is required.

7.1.6 All the remaining 11 shafts lie within gardens or areas of open space. Consequently, subject to MRA approval, treatment could either take the form of:

- A shaft cap, at or below rockhead, or
- Consolidation of shaft backfill (full depth) by grouting.

7.2 Drilling (mine entries)

Investigation

7.2.1 A steel safety platform, on which the drilling rig can be positioned, should be established centrally over the location of each mine entry.

7.2.2 The mine entry should be drilled to its full depth to determine the nature of its backfill, and whether or not it has been entirely filled, or it is still open beneath any intermediate staging(s). Prior to commencement of any drilling, a steel safety platform shall be established centrally over the mine entry.

7.2.3 Site workers who need to work within 5m of the mine entry should be equipped with a suitable harness and extending safety lanyard securely anchored to a point remote from the shaft.

7.2.4 Rockhead should be encountered at depths of between 0.7m and 2.2m.

7.2.5 Any mine entries found to contain open void(s) will require a minimum of 3 treatment boreholes. The boreholes should be evenly spaced across the footprint of each shaft, to the satisfaction of Lithos.

7.2.6 Holes to be drilled for the injection of grout should be drilled by rotary techniques, and extend 1m into solid natural strata below the base of the mine entries. Air, or perhaps air-mist, should be appropriate as the flushing medium for the majority of holes. Where holes are located within 50m of existing buildings, water flush will be required. This will need to be agreed with the Mining Remediation Authority.

7.2.7 Where the entry has only been partly backfilled (i.e. backfilled above a platform or obstruction at depth), it should be filled with pea gravel from the base up via a borehole of suitable diameter.

7.2.8 Where a hole proves abortive, because it becomes obstructed or fails to achieve the required depth, it should be re-drilled at a larger diameter and re-cased, or a new hole drilled and cased at the Contractor's expense.

7.2.9 The Contractor should be expected to recover all borehole casing employed in any borehole.

Treatment (alternative to capping)

7.2.10 Backfilled shafts should be treated by the introduction of grout down the following minimum number of boreholes depending upon the diameter of the shaft.

Diameter of shaft (m)	Minimum number of grout boreholes
Up to 1.5	1
1.5 to 2.5	2
2.5 to 3.5	3
Greater than 3.5	4

7.2.11 Holes to be drilled for the injection of grout should be drilled by rotary techniques. The drilling system and flushing medium to be used shall be approved by the Engineer. It should be noted, in accordance with the Mining Remediation Authority[4] requirements, that air flush is only permitted where the distance to nearby properties is greater than 50m.

7.2.12 The minimum diameter of the holes shall be 90mm unless otherwise specified by the Engineer. When it is impracticable to drill at the minimum diameter for the full depth, the diameter of the holes shall be increased in the upper sections.

7.2.13 The holes should be temporarily cased through shaft backfill down to rock head. The holes shall be kept open until grout injection is complete.

7.2.14 Where the entry has been backfilled to its base, holes should be drilled to extend 2m into solid natural strata below the base of the shaft.

[4] *On 28th November 2024, the Coal Authority changed their name to the Mining Remediation Authority.*

7.3 Grouting (mine entries)

If capping is preferred treatment

7.3.1 As the mine entries encountered to date are not beneath proposed plots, if a cap is the preferred treatment, grouting will only be **required** where a shaft is found to contain voids.

7.3.2 The Contractor shall consolidate any mine entry voids by the introduction of PFA:OPC grout as described in Section 6.4.

7.3.3 In any mine entry which has required the addition of sand and/or pea gravel in order to achieve pressure, a minimum of one other hole shall be drilled and grouted in order to ensure full consolidation of the backfill.

If grouting is preferred treatment

7.3.4 Immediately prior to grouting each hole, the Contractor shall check that it is unobstructed to the required depth, and able to receive the tremie pipe. Obstructions should be dealt with as described in 'drilling procedures' above.

7.3.5 Grout should be tremied down each hole via an approved T-connection and flexible tube, or a series of steel tubes, placed to the base of the hole or to such other depth as specified by the Engineer. Provision should be made for monitoring the pressure of the grout and the quantity being delivered in the line.

7.3.6 Grouting should proceed upwards from the base of the shaft to ground level in 3m stages. The grout shall be injected at the approved rates until either limiting pressure of 10kN/m^2 per metre of overburden or a maximum of 200kN/m^2 is reached or grout appears near the point of injection. If one or these criteria is reached quickly the grout tubes or pipes shall be lifted to check that a local obstruction is not preventing flow of the grout into the strata.

7.3.7 If pressure is not achieved or grout has not appeared at the point of injection after 3 tonnes of grout materials have been placed in any 3m lift then sand and/or pea gravel (gravel which passes through a 6.33mm sieve and is retained on a 2.36mm sieve) may be added to the mix or placed down the hole with the permission of the Engineer.

7.3.8 The injection of grout should then be continued as described above. If pressure cannot be achieved after the addition of sand and/or pea gravel then the Contractor should consult the Engineer to determine whether the injection is to be continued or other measures, such as waiting for twelve hours and drilling secondary holes in the shaft, should be adopted.

7.3.9 In any shaft which has required the addition of sand and/or pea gravel in order to achieve pressure, a minimum of one other hole shall be drilled and grouted in order to ensure full consolidation of the backfill.

7.3.10 Further details regarding constituent grout materials, mixes etc are provided in Section 8.

7.4 Cap

7.4.1 A cap for each mine entry should be designed by a competent structural engineer, following the principles detailed below.

7.4.2 The reinforced concrete cap should be constructed at or below rockhead of sufficient bearing capacity for the expected loading. Alternatively, the cap could be founded on a suitably grouted base.

7.4.3 The width of the cap should be a least twice the external diameter of the shaft (i.e. inclusive of any shaft lining). The structural engineer should specify cap thickness and reinforcement.

7.4.4 A vent pipe might be required where the cap is constructed over shaft backfill.

7.4.5 It is worth noting that the MRA offer a cap design service, and it would be prudent to at least consult the MRA to confirm requirements.

8 GROUTING

8.1 Constituent materials

8.1.1 Water shall be from the mains supply, unless otherwise approved by the Engineer.

8.1.2 Cement shall be CEMI 42.5 (Ordinary Portland Cement) conforming to BS EN 197-1:2011.

8.1.3 Pulverised Fuel Ash (PFA) shall be conditioned hopper ash, or dry powder ash, of a type suitable as a constituent for grout, obtained from an approved supplier and conforming to BS3892:1997, Parts 1 and 3.

8.1.4 Sand shall comply with BS EN 12620:2002+A1:2008, and be of a grading suitable for use in the Contractor's plant and approved by the Engineer using guidance provided in PD 6682-1:2009.

8.1.5 Pea gravel shall comply with BS EN 12620:2002+A1:2008, and be of grading approved by the Engineer using guidance provided in PD 6682-1:2009.

8.1.6 If required, thixotropic additives shall conform to relevant British/European standards and be approved by the Engineer.

8.2 Storage and use of materials

8.2.1 Storage of materials shall be such as to prevent loss, contamination or deterioration. OPC shall be kept in a dry location, and the sequence of deliveries recorded so that OPC can be used in rotation.

8.2.2 PFA shall be stored under sheets which shall be weighted down to prevent dust nuisance and to retain the moisture.

8.3 Grouting plant

8.3.1 The Contractor shall submit to the Engineer, for approval, details of the proposed method of mixing, batching and pumping of grout to the injection points, together with the means of monitoring grouting pressures and the quantities injected. The materials shall be introduced into the mixer via approved weight batching equipment.

8.3.2 Continuous batching will **not** be permitted; each mixing pan must be emptied of grout prior to adding further PFA etc.

8.3.3 The grout mixer shall be capable of producing an intimate homogenous mix, all particles being thoroughly wetted, without segregation.

8.4 Grout mixes

8.4.1 The filling material shall generally consist of a PFA/OPC grout which should typically be mixed in the proportion of 10:1. The exact proportion of the mix to be used at any one time may be revised by the Engineer; most notably where water is present within the mineworkings and/or where cube crush strengths are considered unsatisfactory.

8.4.2 Where excessive lateral flow of grout is anticipated or experienced, the Engineer may order the addition of sand or pea gravel to the PFA/OPC mix. The specified grout mix shall have the minimum water content consistent with effective pumping.

8.4.3 The water:(OPC + PFA) ratio shall generally be in the range of 0.4 to 0.45 (including the moisture in the aggregates).

8.4.4 The actual proportions to be used initially for the various grouts shall be agreed with the Engineer paying due regard to the conditions encountered during drilling and the results of any trial grouting carried out before work commences.

8.5 Grout properties and testing

8.5.1 With the mixes described in Section 8.4 above, the grout should yield flow readings of between 300mm and 600mm, when measured in a meter of the "Colcrete" type.

8.5.2 A minimum of two flow tests shall be performed by the Contractor per shift, or as directed by the Engineer.

8.5.3 The sample for the flow test shall be obtained by the Contractor at the point of injection; i.e. from the end of the tremie pipe.

8.5.4 High bleed grouts shall be avoided, because they do not fill cavities efficiently. Bleed capacity should be limited to a maximum of 5%, unless agreed otherwise with the Engineer.

8.5.5 A minimum of two bleed capacity tests shall be performed by the Contractor per shift, or as directed by the Engineer. The sample of grout for the test shall be taken from the point of injection; i.e. the end of the tremie pipe.

8.5.6 Bleed capacity shall be measured in a clear plastic or glass graduated cylinder which has an internal diameter not less than 50mm and with a volume of approximately 1,000ml. After placing the grout, a cover shall be placed over the cylinder to avoid evaporation. Bleed capacity shall be read at hourly intervals. For neat OPC grout, readings should continue for not less than 3 hours, and for PFA: OPC grouts not less than 6 hours.

8.5.7 The Contractor shall prepare one set of 6 test cubes from one batch of grout per week, or as directed by the Engineer.

8.5.8 Each cube shall be of 100mm side, or as agreed with the Engineer, and shall be taken from the grout at the point of injection; i.e. the end of the tremie pipe.

8.5.9 The Contractor shall arrange for them to be tested by crushing at 7 and 28 days, in accordance with BS1881:2006. The testing shall be carried out by an independent laboratory agreed with the Engineer.

8.5.10 The mixes shall produce cubes with crushing strengths of not less than 1.0 MN/m^2 at 28 days (Note: the 7 day test is performed to indicate that the 28 day strength is achievable; i.e. a 7 day value of about 0.5 MN/m^2 would probably be considered on target).

8.5.11 If the Engineer considers the results of the tests indicate that a change of mix proportions is required, the Contractor shall make such modifications as the Engineer may direct.

8.5.12 All grout test samples (i.e. flow tests, bleed tests & strength tests) shall be obtained by the Contractor under the supervision of the Engineer.

9 SERVICES AND ROADS

9.1 The appointed Contractor will be expected to obtain up to date plans for all known underground services prior to commencement of the works. It shall be the Contractor's responsibility to confirm that each borehole is clear of all underground services, above ground services, equipment, property and the like prior to commencing operations.

9.2 The Contractor shall take all necessary precautions, including making all reasonable investigations to ascertain the positions and depths of underground services and drains passing through the site.

9.3 The Contractor shall make full allowance in their tender for working around and protecting live services and drains.

9.4 The Contractor shall maintain and be responsible for any damage (caused by their own workers, subcontractors' or suppliers' employees or vehicles) to: public or private roads; paved areas; footpaths; fences; and sewers, drains water, gas and electric mains, telephone and other services. The Contractor shall make good all such damage and meet and settle at their own cost all claims in connection therewith.

9.5 The Contractor shall be responsible for maintaining close liaison with the Local Authority and the Public Utility Authorities so as to avoid any disruption of the existing services.

9.6 The Contractor shall keep all public and private roads, paved areas, and footpaths etc free at all times of mud\debris etc, and allow for all labour, brushes, hoses etc necessary for removal, cleaning or reinstating. If such work has not been done to the Engineer's satisfaction, then the Engineer reserves the right to make their own arrangements in respect of such necessary cleansing, and the cost shall be a charge on the Contractor and deducted from any sum due in the final settlement of accounts.

9.7 The Contractor shall keep the public and private roads clear of all obstructions other than those permitted by the police and highway authority, or the owners, and shall abide by all other police regulations.

9.8 When introducing grout into any borehole the Contractor shall ensure by regular inspections at hourly intervals (via lifted manhole covers) that the grout is not entering adjacent drains, services, culverts, ducts and the like. Manhole covers must be securely replaced between inspections, unless manhole sites have been made secure, to the satisfaction of the Engineer, via locked barriers to prevent unauthorised access.

9.9 In the event that any leakage into drains etc is detected the Contractor shall immediately suspend the grouting operations and commence to remove any accumulated grout.

9.10 The cost of removing any accumulations of grout from services and the like, on and adjacent, to the site shall be borne by the Contractor and the work shall be to the satisfaction of the Authority or Undertaker concerned. No claims will be entertained by the Engineer for the costs of any such work arising out of the negligence of the Contractor to ascertain the position of such services or their failure to make regular inspections.

10 TEST HOLES & IN-SITU TESTING

10.1 Additional "test" holes will be instructed by the Engineer in areas of high grout take (to confirm filling of void space). The Contractor should make allowance for 10 further holes within their fixed price for this project

10.2 If directed by the Engineer, the Contractor shall test the consolidated ground for permeability. On the Engineer's instructions the Contractor shall carry out permeability tests on specified boreholes. The test carried out shall be the single packer test as defined in BS EN ISO 22282:2012 "Code of practice for geotechnical investigation and testing.

10.3 Permeability by grout acceptance testing shall be checked by drilling test holes in positions to be selected by the Engineer, and injecting grout at pressures appropriate to the depth, all in accordance with the requirements for infilling grouting. If the Engineer considers that the quantities of grout accepted are excessive, further holes shall be drilled and grouted.

10.4 After testing, holes shall be completed in accordance with the requirements for grouting infill holes.

10.5 Where deemed appropriate, the strength of consolidated ground shall be tested by taking sample cores either in newly drilled and cased holes, or in re-drilled existing holes, at such places and times during the contract as the Engineer may direct. When the samples have been taken, the hole shall be filled up with grout injected in accordance with the requirements for infill grouting.

11 RECORDS

11.1 The Contractor shall prepare, and keep available for inspection on site, plans showing the positions and surface levels of all holes, and Daily Drilling Records (see below). All levels shall be given with reference to a datum to be determined by the Engineer.

11.2 The plans shall be updated daily in conformity with the Records noted below. On completion of the Works, the Contractor shall give fair copies of the plans to the Engineer.

11.3 As work proceeds the Contractor shall maintain separate Daily Records, in a form to be approved by the Engineer, for:

- Drilling
- Grouting
- Materials and Plant Received

11.4 The Daily Records signed by the Contractor's agent shall be submitted each day to the Engineer for their agreement. The Contractor shall provide one copy of the agreed Record for the Engineer's retention and keep a further copy available for inspection on site.

11.5 Daily Drilling Records shall be provided which summarise daily and cumulative meterage drilled, and for each hole drilled provide the following information:

1) Job title and location
2) Hole reference number
3) Date(s) drilled
4) Depth of completed borehole
5) Method of drilling, flushing medium and type of drill bit
6) Type, diameter and depth of casing used
7) Diameter and depth of hole at the beginning and end of each working day or shift
8) Loss of any flushing medium during drilling
9) Depth to each major change of stratum
10) Description of the stratum, and whether it is intact or broken
11) Details of any voids or suspected workings
12) Each depth at which groundwater is encountered (if apparent) and any steps taken to seal the flow
13) Plant in use, crew members and hours worked
14) Standing time, with reason, or time lost overcoming obstructions
15) Details of underground services located
16) Details of any settlement or ground heave
17) Depths at which any samples are taken
18) Details and results of any permeability tests ordered by the engineer
19) Details of any emissions of gas, water, etc

11.6 Daily Grouting Records shall be provided for each hole and contain the following information:

- Job title and location
- Hole reference number
- Date(s) grouted
- Type of grout mix and mass of grout injected each day
- Grout pressures recorded, with the corresponding depths
- Details of type of injection grout-line dimensions (e.g. Tremie injection through 50mm diameter line)
- The results of all flow and bleed tests
- Details of any casing abandoned
- The nature, frequency and results of all inspections of services to check for grout penetration
- Plant in use, crew members and hours worked
- Details of all stoppages or delays and any other relevant information

11.7 The Daily Records of Materials and Plant Received shall show in particular quantities delivered and used, by weight of each type of material, that day and cumulatively. With the Daily Records, the Contractor shall submit to the Engineer copies of receipts or invoices for all materials delivered and he shall keep them on site until the Works are complete.

11.8 Notwithstanding the information listed above, the Contractor shall provide any other information required by the Engineer.

Appendix A

Drawings

LITHOS CONSULTING
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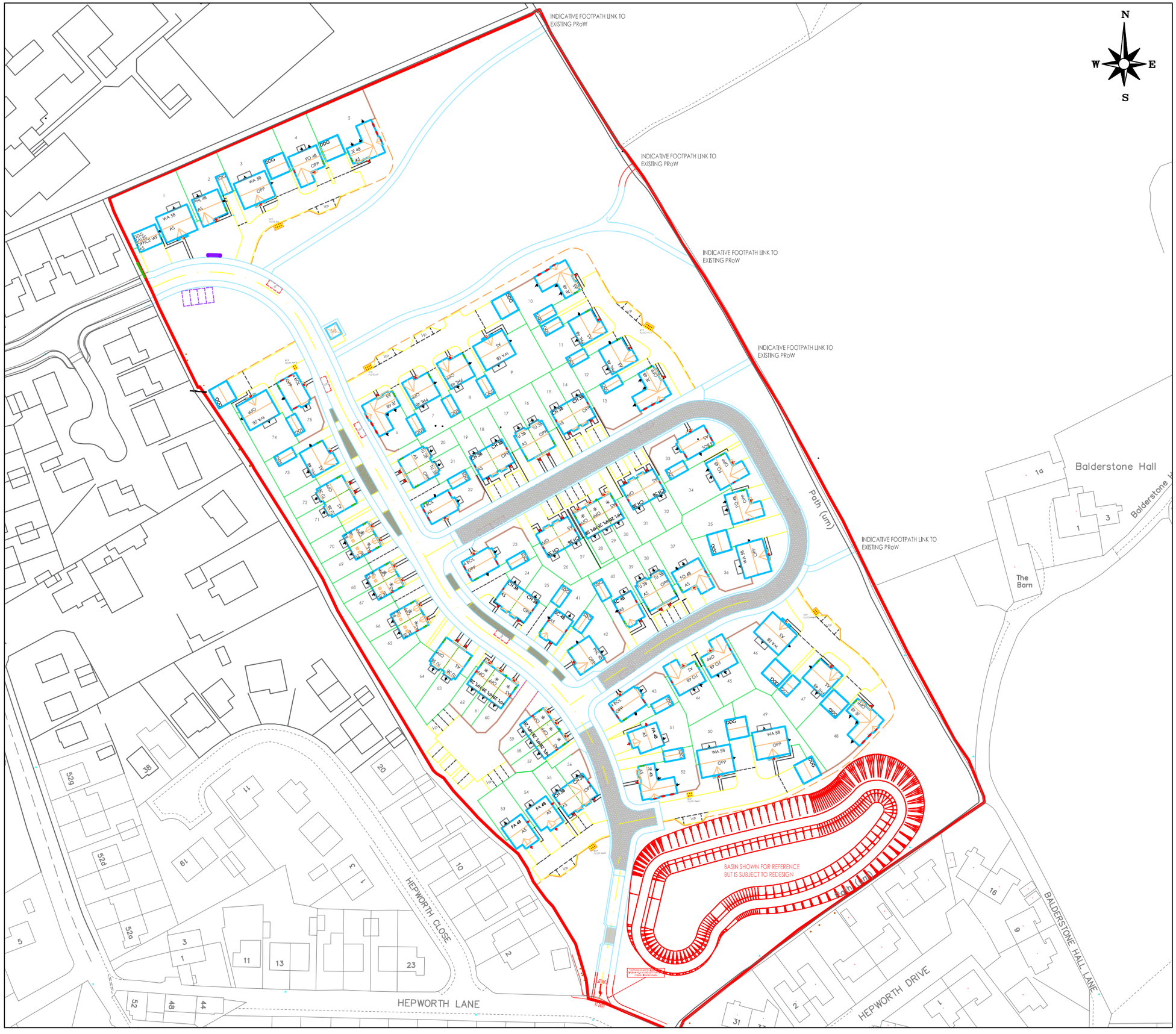
www.lithos.co.uk
Tel 01937 545330

CLIENT	BELLWAY HOMES YORKSHIRE
JOB TITLE	BALDERSTONE HALL, MIRFIELD
DRAWING TITLE	SITE LOCATION PLAN
DRAWN	GLM
DATE	22/11/2022
CHECKED	REG
DATE	22/11/2022
STATUS	FOR COMMENT ☐ DRAFT ☐ FOR APPROVAL ☐ FINAL ☑
SCALE	1:25,000
SHEET	A4
DRAWING NO.	1668/1
REVISION	A



NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM PARKER PEEL ARCHITECTURE DRAWING FOR BELLWAY HOMES. DRAWING REFERENCE 2520-SI-02F, DATED OCTOBER 2025.

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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Tel 01937 545330

CLIENT

BELLWAY HOMES

JOB TITLE

BALDERSTONE HALL, MIRFIELD

DRAWING TITLE

PROPOSED SITE LAYOUT

DRAWN	DATE	STATUS
CD	06 01 25	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	07 01 25	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1250	A3	5670/ 20	E

N
W E
S

NOTES

- PROPOSED PROOF DRILL HOLE
- MINING FEATURE INVESTIGATED JUNE & JULY 2018
- NO BUILD ZONE OF INFLUENCE
- APPROXIMATE SITE BOUNDARY

REPRODUCED FROM PARKER PEEL ARCHITECTURE DRAWING FOR BELLWAY HOMES. DRAWING REFERENCE 2520-SI-02F, DATED OCTOBER 2025.

REV.	DESCRIPTION	DATE

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CLIENT

BELLWAY HOMES

JOB TITLE

BALDERSTONE HALL, MIRFIELD

DRAWING TITLE

PROPOSED PROOF DRILLING

DRAWN	DATE	STATUS
CD	06 01 25	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	07 01 25	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1250	A3	5670/21	

N
W E
S

NOTES

AREA OF SOIL STRIPPED IN 2019

PROPOSED FURTHER AREA OF SOIL STRIP

LAYOUT REPRODUCED FROM PARKER PEEL ARCHITECTURE DRAWING FOR BELLWAY HOMES. DRAWING REFERENCE 2520-SI-02F, DATED OCTOBER 2025.

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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www.lithos.co.uk

Tel 01937 545330

CLIENT

BELLWAY HOMES

JOB TITLE

BALDERSTONE HALL, MIRFIELD

DRAWING TITLE

ADDITIONAL SOIL STIP

DRAWN	DATE	STATUS
CD	06 01 25	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	07 01 25	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1250	A3	5670/22	

Appendix B

Engineer's

Records Sheets

Job No.	5670
Client:	Bellway Homes
Site:	Balderstone Hall, Mirfield
Sheet:	**DAILY DRILL & GROUT TOTALS**

Date:	
Weather	
Visitors	
Summary of Activities	
H&S, Environmental, or non-compliance issues	

Job No.	5670
Client:	Bellway Homes
Site:	Balderstone Hall, Mirfield
Sheet:	**DAILY DRILL & GROUT TOTALS**

Date	Drilling		Grouting	
	Daily	Cum. Tot.	Daily	Cum. Tot.

Job No.	5670
Client:	Bellway Homes
Site:	Balderstone Hall, Mirfield
Sheet:	**BOREHOLE SUMMARY**

LITHOS

BH Ref.	Date Drilled	Depth (m)	Made Ground (m)		Void (m)		Broken Ground (m)		Intact Coal (m)		Total Grout Take (tonne)
			From	To	From	To	From	To	From	To	

Job No.	5670
Client:	Bellway Homes
Site:	Balderstone Hall, Mirfield
Sheet:	**BLEED TEST RESULTS**

LITHOS

Date	Start Time	2 hours	4 hours	6 hours	Bleed Level (ml)	%

LITHOS

Job No.	5670
Client:	Bellway Homes
Site:	Balderstone Hall, Mirfield
Sheet:	**FLOW TEST RESULTS**

Date	Test no	Time	Flow