

Harworth Estates

Former North Gawber Colliery, South Yorkshire

Remediation Strategy

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RSK GENERAL NOTES

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Client: Harworth Estates, AMP Technology Centre, Brunel Way, Waverley, Rotherham, South Yorkshire. S60 5WG

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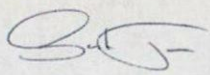
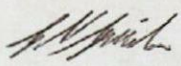
Signature		Signature	
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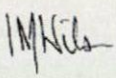
Signature	
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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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1 INTRODUCTION

The former North Gawber Colliery in South Yorkshire is proposed for redevelopment by Harworth Estates for up to 325 low rise residential properties.

Site assessments and investigations have been completed by RSK Environment Limited (RSK), during which a number of remedial requirements were identified to permit safe redevelopment of the site. RSK has subsequently developed this Remediation Strategy, which includes details of the work that needs to be carried out prior to, during and on completion of construction, to make the land suitable for a residential end-use, and gain approval of the regulators, including the Local Authority, Environment Agency, Coal Authority and the NHBC.

At this stage it is envisaged that Harworth Estates are likely to undertake enabling works including any necessary remedial operations. The site would then be marketed to developers who would, during the development process, implement additional remedial works required on a plot specific basis.

The scope presented in this document will need to be approved by the regulators. This document, when approved, will be incorporated into a package of tender documents to allow Harworth Estates to select contractors to complete the necessary enabling works before marketing the site. This document, with supporting documents and as-built information for the enabling works, will also be provided to prospective developers to allow them to cost the necessary plot-specific remedial measures required to obtain regulatory approval.

This report may need to be updated to address any unexpected conditions on-site encountered as development enabling works progress.

The comments given in this report and the opinions expressed are based on the ground conditions and findings within the previous investigations carried out by RSK:

- RSK, Appraisal of Ground Conditions: Former North Gawber Colliery, South Yorkshire, March 2014 (ref. 321370-R1)
- RSK, Former North Gawber Colliery, South Yorkshire, Coal mining risk assessment, March 2014 (ref. 321370-R2)
- RSK, Geo-environmental Site Assessment Report, Former North Gawber Colliery, South Yorkshire, March 2014 (ref. 321370-R3).

There may be conditions pertaining to the site that have not been disclosed by the investigation and which therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground may differ from that previously found. Also groundwater levels vary due to seasonal or other effects and, at times may vary significantly from those reported.

2 SITE INFORMATION

2.1 Site location

The site is located in Mapplewell, approximately 4km north-west of Barnsley. Figure 1 shows the site location and Figure 2 provides information relating to the site boundary. The approximate centre of the site is located at Ordnance Survey National Grid reference 433,050E 409,650N. The site occupies an area of approximately 16 hectares and comprises three main terraces, starting at an elevation of approximately 95m above Ordnance Datum (AOD) in the northern part of the site, falling to 70m AOD in its southern part.

2.2 Site description

The site, comprising mainly colliery spoil, is vacant. Some areas of the site are covered by trees, and grass-cover is sparse. There is a drainage ditch running north-west to south-east in the southern part of the site. Ordnance Survey mapping indicates that a public right of way runs alongside this drainage ditch.

To the north of the site there are modern warehouse and factory buildings. A car body repair garage is using a small hardstanding area of approximately 200m^2 in the north-east corner of the site to store cars. The site boundary passes along the edge of North Gawber Football Club's pitch, outside the north-west corner of the site.

There are residential properties and some industrial buildings off Carr Green Lane, which runs along the eastern boundary of the site. There are also residential properties on Spark Lane, which borders the site to the west.

A birch woodland defines the southern boundary, beyond which the reclaimed colliery tip is used as grazing land.

2.3 Proposed site use

It is understood that the site is being considered for redevelopment with residential properties, largely on the terraced areas of the site, and that outline planning permission was previously granted in January 2012. A new application is proposed which seeks planning permission for full planning consent for the remediation and restoration of the site and outline planning consent for up to 325 dwellings, open spaced and associated infrastructure. A copy of the masterplan (reference John R Paley Associates drawing number 13:4764:SK04) for redevelopment of the site is presented in Appendix A.

3 REVIEW OF PREVIOUS REPORTS

RSK have produced three previous reports for the site. A brief summary of points relevant to providing this remedial strategy for the site are included below.

3.1 Appraisal of ground conditions

Several existing reports carried out by Scott Doherty and Associates Limited (SDA) were reviewed by RSK and an appraisal report was presented in RSK document 321370-R1, dated March 2014.

The RSK report presented a revised assessment of contamination by comparing the data from the old investigations to current guidance. The old reports had identified widespread inorganic (metals) contamination and localised organic (speciated hydrocarbons and PAH) contamination. The RSK appraisal confirmed some exceedances compared with current guidance values and made recommendations for further intrusive investigation and assessment works, which were subsequently undertaken (see Section 3.3 below). The previous investigations had concluded that in respect to ground contamination a capping system would be required to protect end users; gas ingress preventative measures were required for buildings and remediation or excavation and removal of hotspot areas of hydrocarbon contamination would be required. Further comment is made in Section 6.4 on contamination hotspot areas following recent RSK intrusive investigation and assessment.

3.2 Coal mining risk assessment

The RSK Coal Mining Risk Assessment (CMRA) report is included in RSK document 321370-R2 (01), dated March 2014. This assessment was carried out in accordance with the guidance provided by the Coal Authority. It included a review of a number of sources of information in respect of ground conditions and coal mining, presented a risk assessment of all identified coal mining issues and based on this indicated an appropriate mitigation strategy. A brief summary of the key findings and mitigation strategy, as a series of bullet points for each coal mining hazard, is presented below.

Underground coal mining (recorded and probable workings at shallow depths)

- worked coal seams are present at shallow depths beneath the northern part of the site
- remedial treatment will be required in these areas beneath and immediately around building footprints. The treatment will include drilling and grouting consolidation works
- the remedial works will only be carried out once the final individual plot layouts are known and the treatment will be completed in stages as groups of plots are released for development.

Mine entries (shafts and adits)

- eight abandoned mine entries have been identified on or potentially affecting the site. Two of these appear to have been treated; three either lie off-site or close to the site boundaries and the remaining three are yet to be located
- additional works will be required to investigate the locations of a number of these mine entries. This should include geophysical surveys and direct intrusive investigations (excavation/drilling). This work will be undertaken as part of the remedial works
- the Coal Authority will be consulted to agree the scheme of remedial measures to treat the remaining mine entries.

Record of past mine gas emissions

- no data was available for the site when the CMRA report was written. Subsequent borehole investigation and a programme of monitoring have been completed by RSK (see Section 3.3 below). It was recommended that gas ingress preventative measures should be included within dwellings to provide protection to end-users. Furthermore no buildings would be constructed over or in the immediate vicinity of any mine entries.

Recorded coal mining surface hazard

- this included the potential of site mining operations to potentially contaminated soil and groundwater and was to be assessed as part of the RSK Environmental Site Assessment works (see Section 3.3 below).

Development constraints

- a draft site constraints plan was produced based on the CMRA findings. This has been revised based on the additional RSK Environmental Site Assessment works and a copy is included as Figure 2 of this report.

In summary, the CMRA has identified the requirement to undertake a number of remedial steps to mitigate against hazards for the legacy of previous coal mining. The required works included some operations which need to be carried out during the site enabling works and others which can only be carried out at a later stage when plot layouts are finalised and released for development. The necessary remedial steps are included in the appropriate later sections of this report.

3.3 Geo-environmental site assessment

RSK report, Geo-environmental Site Assessment Report, Former North Gawber Colliery, South Yorkshire, March 2014 (ref. 321370-R3) presented the findings of a geo-environmental assessment of the site. The scope of works comprised the following:

- the excavation of twenty-seven trial pits to a maximum depth of 4.4m
- nine cable percussion boreholes, sunk to depths between 4.18m and 12.73m with SPTs at 1.5m intervals
- six rotary boreholes drilled to depths between 9.2m and 30.0m

- nine shallow groundwater/ground gas monitoring installations installed in the cable percussion boreholes
- completion of four skip load tests, set up to monitor the long term settlement response of the made ground under loading.

The findings of the environmental assessment relevant to this remedial strategy include the following:

- remedial measures will be necessary to protect the future site users from direct contact with arsenic and sulphates, which were present at elevated concentrations across the site within shallow soils
- PAH concentrations with the potential to have an adverse effect on human health by direct contact or inhalation have been identified at some locations within the site soils. These appear mainly to be found in a distinct area in the northern and north-eastern parts of the site, but the investigation suggests that, in addition to this principal area of impact, isolated concentrations above acceptable levels may be present at any location within the site
- slight impact by TPH, above laboratory detection limits, is widespread in site soils, but this is not generally significant for human health
- the evidence of PAH and phenols in shallow soils suggests that chemical attack on potable water supply pipes is likely and appropriate protection will be required
- little leachable contamination was identified in soil and few exceedances of environmental quality standards were reported in groundwater samples. Consequently, it is considered that the site does not pose an overall risk to groundwater. It is not considered that there are any significant adverse effects on the watercourse crossing the site, and therefore the potential linkage between PAHs present in made ground and the river Dearne can be discounted
- the laboratory testing has indicated that potentially combustible material is only locally present in the made ground. It is considered that, post-development, the risks from combustible material in the made ground will not be significant
- on the basis that very little asbestos has been found during the investigations, it is considered that any asbestos contamination present is unlikely to be extensive. However, In view of the site history, it is likely that some asbestos remains in areas where demolition arisings are present and allowance should be made for removing unsuitable materials from site
- radon protective measures are not necessary for new housing development on the site.

4 REMEDIATION REQUIREMENTS

Based upon the findings of the RSK work, it will be necessary to carry out remedial measures to render the site suitable for residential development. The remediation will have to be carried out in two stages. The first of these are enabling works which are proposed to be carried out later this year and will address key issues to allow the site to be marketed to residential developers. The second stage will be carried out during development when plot layouts are finalised. These works are outlined below and further detail is included in subsequent sections of this report. It should be noted that remedial works to address site contamination are dependant upon the process of risk assessment and current guidance on acceptability criteria. However, it should be noted that re-evaluation of risk would be required if during the course of the enabling or development stages ground conditions not previously identified on site are encountered. On previously developed sites it is not uncommon for additional areas of potential contamination or highly variable ground conditions to be encountered. Consequently there must be flexibility in the remedial works to monitor ground conditions and ensure that such unforeseen conditions are appropriately addressed. For the development phase, especially where large sites (such as this) may be developed over a number of years the remediation strategy should be periodically revised to ensure it conforms with any future revisions to statutory guidance or industry standards.

4.1 Enabling works

The Remediation Strategy undertaken by Harworth Estates will achieve a site suitable for development. The site wide enabling works will comprise the following activities:

- establish accommodation and welfare facilities on site
- establish site boundary fencing
- diversion of public right of way to approval of current application
- preparation of site entrance to include any necessary traffic management
- construction of a section of site access road into the development site with associated utility provision
- removal of remaining trees and vegetation across the site
- identification and protection of statutory services which enter the site
- breaking of concrete slabs, foundations and areas of hardstanding and crushing/stockpiling for site re-use
- Formation and diversion of land drainage around western and southern perimeters as identified on masterplan
- completing any localised cut and fill earthworks to allow access onto site, to inspect and reposition existing stockpiles and to provide suitable building development platforms

- undertake all necessary works, including liaison with the Coal Authority in relation to assessment and treatment of mine entries
- allowance should be made for ex situ bioremediation of localised hydrocarbon impacted soils, with subsequent re-use on site.

4.2 Development works

Further remedial actions will have to be undertaken by one or more potential developers on a plot by plot basis, as required. These works will comprise:

- localised regrading of ground levels (anticipated to be largely accommodated in garden areas)
- placement of a clean inert cover system in open spaces and garden areas to protect site end users
- installation of ground gas protective measures in all properties
- assessment and/or remediation of any localised hot spots of contamination encountered during development
- protection of water supply pipes.

5 ENABLING WORKS PRE-START REQUIREMENTS

It is expected that the enabling operations would be carried out as a package of works either as part of a single contract or as a series of separate specialist works. In advance of the works a number of pre-start tasks will have to be completed and these are further detailed in the sections below.

5.1 Regulatory liaison and approval

In advance of site work the scope of the remedial works should be agreed with the local authority environmental health department and the Environment Agency (EA).

The remedial works in part also require liaison and agreement with the Coal Authority (further comments are provided in Section 6.2). They will also have to issue a permit for all works which will disturb their interests (both mine entries and shallow coal seams).

In accordance with the CDM (2007) Regulations appropriate health and safety documentation would be completed and an F10 form issued to the Health and Safety Executive.

5.2 Contractual arrangements

5.2.1 Preparation of contract documents

The enabling works will be let as a single contract.

5.2.2 Selection of contractors

The tender documents will be issued to a number of suitably experienced contractors, who will be required to visit site before preparing their costed proposals.

5.2.3 Contractual roles and responsibilities

Below we outline the anticipated roles and responsibilities for the implementation of the remediation strategy. Additional roles may be required dependant on the form of contract under which the works will be let.

Client

As client, Harworth Estates will be responsible for appointing and instructing the contractor. Should there be any failure by the contractor to implement the requirements of the remediation strategy, the client will issue written warnings stating the failure that has occurred and requiring works to stop until the operating methods have been corrected as necessary. It is possible that some of the client responsibilities could be delegated to the environmental supervisor or indeed to an "engineer" under particular contract formats.

Environmental supervisor

The Environmental Supervisor will be responsible for the design, supervision and validation of the remediation strategy, together with any technical consultations required with third parties such as the Environment Agency, Local Authority Planning and Environmental Health, and Coal Authority or NHBC. The Environmental Supervisor shall advise the client if there have been any breaches in the methods of working required by this remediation strategy so that appropriate action can be taken.

The Environmental Supervisor, in conjunction with the client, will be responsible for overall project management and implementation of the remediation strategy, with the Environmental Supervisor providing specialist environmental advice where necessary.

Groundworks contractor

The appointed Groundworks Contractor will be responsible for the execution and installation of the remedial works under the guidance of the Environmental Supervisor and in accordance with their confirmed contract with the client. This work may include removal of unknown contamination hotspots that may be encountered during the redevelopment. If unexpected ground conditions are encountered as development works progress, the Groundworks Contractor shall immediately contact the Environmental Supervisor to inspect the suspect material before further works in the area are carried out.

All materials requiring removal off-site will be disposed of at a suitably licensed facility approved by the client and the Environmental Supervisor. The Groundworks Supervisor will be responsible for identifying a suitably licensed facility and will also be responsible for following a Materials Management protocol (see Section 5.3) in respect to materials management. The Groundworks Contractor will be responsible for all material disposed of off-site under Duty of Care legislation and will provide the Environmental Supervisor with a copy of the relevant documentation on completion of its removal.

5.3 Completion of a materials management plan

In accordance with the *CL:AIRE Code of Practice* (2011) (CoP) materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Thus, contaminated material does not become waste until the aforementioned criteria are met.

Under the CoP, soils may be re-used on the site where they were produced provided they are:

- certain to be used
- are suitable for use both chemically and geotechnically
- only the required quantity is used.

The CoP requires the preparation of a materials management plan (MMP) that confirms the three criteria above will be met. This plan needs to be reviewed by a 'Qualified Person' who will then issue a declaration to the EA.

Therefore, before any enabling remedial works begin on-site, an MMP will need to be prepared to establish whether specific materials are classified as waste and how excavated materials will be treated and/or re-used in line with *The Definition of Waste: Development Industry Code of Practice, Version 2* (CL:AIRE, 2011).

5.4 On-site facilities

It is anticipated that the Groundworks Contractor will have established welfare facilities at the site by the time of the remedial operations, which will be available for use by the client and environmental supervisor. The facilities should include, as a minimum, toilet, washing facilities with clean potable water supply and a mess / canteen facility. For the Health and Safety of site operatives there will be a no-eating, no-drinking, no-smoking policy on site other than in the mess facility and / or designated clean areas.

6 ENABLING WORKS REMEDIAL OPERATIONS

The enabling works remedial operations will be undertaken by an experienced Groundworks Contractor employed by the client. Due to the range of remedial works required at the site, it is considered necessary to provide full-time environmental supervision during redevelopment works. The Environmental Supervisor will inspect and monitor progress of the works and ensure that appropriate records are maintained. Should any unexpected contamination be encountered, the Environmental Supervisor will determine an appropriate course of action.

The Environmental Supervisor will be responsible for record keeping (including photographs), visual assessment and any necessary validation testing throughout all remedial works, including the removal of any contaminated soils or groundwater that are encountered.

6.1 Site clearance works

6.1.1 Vegetation strip

Removal of trees, shrubs and vegetation will require an ecologist to be present on site to supervise the works and ensure correct agreed procedures are adopted.

An ecologist will survey the site to identify presence of any protected species or other important ecological features, though at present none have been identified or are anticipated.

6.1.2 Breaking out of hardstanding

All above ground structures have been removed from site, but it will be necessary to break out and remove hardstanding surfaces at the site that could affect development. The investigation of concrete obstructions undertaken during the site assessment revealed typical concrete thicknesses between 0.3m and 1.6m, although it should be recognised that, in some locations, these thicknesses may be exceeded, or concrete could be encountered beneath a covering of made ground. Broken hardstanding will be crushed and processed for re-use on site in accordance with the MMP. Known concrete obstructions are shown on Figure 3.

6.1.3 Topsoil strip

Topsoil was not generally encountered across the site, with exception of a small stockpile located in the south of the site. Any topsoil if encountered is likely to be of low ecological value.

6.1.4 Site drainage

Works will allow for diversion of the informal water drainage system on site, which will be incorporated into a formal drainage system as shown on the masterplan. These works

are likely to include minor grips and channels will be created as required to provide local drainage as work progress.

6.1.5 Health and safety

Standard Health and Safety provisions will be implemented during all remediation activities in accordance with a formal Health and Safety Plan prepared by the Groundworks Contactor prior to commencing works. This plan will include the following, as a minimum:

- no eating, drinking or smoking on site except for designated areas
- appropriate PPE used during the asbestos removal operations, which may include respiratory protection (masks). PPE should be identified within a formal health and safety risk assessment specific for the asbestos remedial work
- additional PPE including eye and hearing protection and dust masks shall be kept available on site for use if conditions demand
- all exposed ground areas to be kept damped down during dry weather to be prevent dust generation. If dust suppression is ineffective, the Contractor will cease operations until appropriate measures are developed to prevent dust from being generated.

6.2 Mine entry remedial works

It will be necessary to carry out detailed liaison with representatives of the Coal Authority (CA) to agree the proposed strategy for treatment of all mine entries and treatment of shallow workings. In our experience such discussions are likely to take a considerable period of time to conclude and are likely to involve meetings with a number of CA teams/staff (legal, licensing and permitting, public safety and subsidence, gas specialist). Consultations have already commenced and continue to allow the earliest date for agreement of works. It is likely that each mine entry would have to be considered separately and for each an agreement will be required including for example new building stand-off zones, stowing and capping requirements.

At this stage the following chronology of works are proposed:

1. liaison with the CA to agree an outline scheme of remedial works
2. obtaining a permit from the CA for the necessary works (NB permits are valid for a 12-month period but can be reviewed)
3. following site clearance works geophysical surveys will be carried out to investigate mine entry locations. These surveys will include on-site areas adjacent to entries which are located close to existing site boundaries. Attempts have been made during the recent RSK intrusive investigation to locate the two mine adits without success. This geophysical surveys proposed are additional works
4. following the geophysical surveys intrusive ground investigation works will be carried out to provide information on the mine entries. This work would include the excavation of trial pits/trenches and rotary probe drilling with surveying to accurately locate any identified features

5. following the investigation works a final scheme of remedial works would be agreed with the Coal Authority.
6. treatment of each mine entry is likely to require (a) drilling and grouting of each shaft with similar works required for the most shallow sections of the adits, (b) capping or stopping-up of the shafts or adits and (c) provision of an agreed cover system
7. a verification report for the works, including as-built drawings of the treatment completed, would then be produced which would be issued to the Coal Authority.

6.3 Cut and fill works

At this stage a mass balance cut and fill operation will be undertaken across the site. In addition localised earthworks will be required both during the enabling works and in the future by house-builders as plots are developed.

The localised earthworks will include:

- works at the site entrance/site compound
- works to inspect and move existing stockpiles
- local works at limited locations around the site boundary
- local works in the vicinity of mine entries
- possible works where steep slopes are currently present
- attenuation pond
- boundary ditch
- foundation arisings.

These operations are likely to be limited to shallow cut depths and fill thicknesses of less than 1.0m and will only use locally generated materials from site. During the RSK investigation work (see Appendix L of report 321370-R3) a number of samples of representative shallow made ground have been subject to laboratory geotechnical testing including compaction tests and natural moisture content determinations.

The made ground is variable but much of it is considered likely to fall under the specification for Class 2C (stony cohesive material) in accordance with the Specification for Highways Works (SHW) Series 600 Earthworks document. The made ground had a range of maximum dry densities of between 1.35 and 1.73 Mg/m^3 and optimum moisture contents between 15 and 22 percent.

Table 6/1 of the SHW indicates that compaction requirements for material Class 2C should be in accordance with Method 2 of Table 6/4 of the specification. Method 2 provides a range of compaction methods (layer thicknesses and number of passes required) dependant upon the type of mechanical plant and compactive effort to be used.

It is recommended that this general approach (Method 2) is followed on site to provide the compaction necessary to provide a suitable platform for development and for NHBC endorsement. Given the range of in situ densities, the variable nature of the made ground and shallow depths of infill it is not proposed to stipulate any performance

criteria. This is on the basis that the appropriate compaction methodology, including correct layer thickness and minimum number of passes, are followed by the contractor. If any areas are identified where greater thicknesses of infill are required these requirements would be re-assessed and target densities and moisture contents to be achieved in situ may be used to control the works.

Any materials which are deemed to be unsuitable (including for example materials with a high moisture content or oversized materials) cannot be placed within the infill area. Such materials may become suitable for use subject to the approval of the environmental supervisor, however this would be subject to them being workable which could for example require them to be stockpiled and air-dried or tracked over/crushed.

At the onset of the works a trial will be carried out, at a location to be agreed with the environmental supervisor, to confirm that the Contractors working methodology achieves the required end product described within the earthworks specification to achieve a platform suitable for development. In areas to be raised by infilling particular attention is required for the base layer. In these areas topsoil should be removed together with any underlying pockets of soft or wet (based on visual assessment) natural soils. The environmental supervisor will then inspect the area and undertake testing of the formation with a hand shear vane to confirm that the natural cohesive soils are of firm or greater consistency.

6.4 Remediation of hydrocarbon impacted soils

The RSK ESA report has not identified any significant areas of hydrocarbon impacted soils. However, previous investigations recorded localised areas with soils impacted by hydrocarbons and PAH and it is possible that other localised pockets of contamination may be present in areas not previously accessible (where trees or hard standings are present for example) and at positions between investigation locations.

As part of the enabling works it will be necessary to carry out additional inspection, by trial pitting and trenching, in the following areas:

- at a spread of locations across the northwestern part of the site where previous investigations encountered a significant area of impacted soils
- in areas where dense vegetation and tree cover are removed
- in areas where surface hard standings are removed
- in any other areas previously not readily accessible for investigation (this would include for example the area within the northeastern part of the site used by the car body repair garage and the area adjacent to the specialist aerosol works on Carr Green Lane).

If these excavations identified any impacted soils they would be sampled for laboratory analyses (speciated banded hydrocarbons) and placed into an on-site stockpile at an agreed location. Options for treatment would be dependant upon the nature of the hydrocarbon impact, the physical nature of the soils and the volumes generated. If only very small volumes are encountered then it would be most cost effective to remove off-site directly to landfill. If greater volumes are encountered then a scheme of on site treatment would be undertaken.

On the basis of the findings of the investigations to date it is likely that the hydrocarbon impact will be heavier-end aliphatic and aromatic carbon bands and PAHs. On the basis of these contaminants being present the following outline of remedial works would be completed. Please note however that the scope of works would be dependant on the specific contaminants present which can only be determined after laboratory analysis.

The following stages of works would be carried out for bioremediation of hydrocarbon impacted soils:

- representative samples would be tested in the laboratory and based on this site-specific risk-based remedial targets would be determined appropriate for site residential end use
- stockpiled materials would be screened to remove oversized and unsuitable materials and the residual materials passed through screening and crushing buckets (allu or similar)
- treated material would then be placed into windrows and if required covered with fleeces
- the windrows would be periodically turned-over and reformed
- samples would be periodically taken and tested
- operations would progress until target values had been achieved on laboratory tested samples
- the materials meeting target values would then be released for re-use in suitable areas of the site. Any not meeting targets would continue to be worked in windrows or if not improving a decision would have to be made in respect of any additional treatment or other options for disposal
- all works would be supervised and a validation report prepared on completion.

Bioremediation is most effective in summer months when higher atmospheric temperatures promote biological activity. The timescale for the works is dependant upon the concentrations and hydrocarbon ranges present and indeed the target values to be achieved. Typically treatment is required for a period of 3 to 6 months although this could be higher if the treatment is carried out in autumn or winter months.

6.5 Unexpected areas of contamination

If, during the remedial works or subsequent development works, any visually impacted soils or unusual materials are encountered, the groundworks contractor shall advise the Environmental Supervisor who will inspect and sample the soils as necessary before deciding how to proceed. Depending n the assessment, material might be excavated and moved to a stockpile on site for laboratory testing to determine whether the material will be removed off site to a waste disposal facility, or, if suitable, placed into the stockpile for bioremediation (see Section 6.4 above) or be retained on site for reuse. Where organic contaminants are to be removed off-site, on-site screening and laboratory testing should be carried out to provide information with which to classify the waste for disposal purposes. In situ testing (by field test kits) will also control the extent of the excavation volumes (and costs) for land filling.

6.6 Waste disposal

During the enabling works materials may be encountered that are unsuitable to remain on site. Options for treatment of such materials will be considered in the MMP. Any materials that have to be taken off site will be carried by licensed hauliers to suitable licensed landfill sites with appropriate supporting documentation.

6.7 Infrastructure works

The scope of infrastructure development works required to be completed under the enabling contract has yet to be determined. It is likely to include some or all of the following:

- agreement with utility providers for the requirements of the residential scheme (electricity, gas, water, BT and communications)
- highways design, approval and procurement
- drainage design (foul and surface water), approval and procurement including attenuation.

It is anticipated that over the next 2 to 3 months (during planning review) details of the requirements will be confirmed.

6.8 Completion report

Once all enabling works remedial activities at the site have been completed, the Environmental Supervisor will produce a completion report, detailing all aspects of remedial work that have been undertaken.

The completion report will include site attendance records, photographic records, laboratory results and drawings, including as-built drawings for the enabling works. The completion report will conclude that all remediation activities detailed within the remediation strategy have been undertaken, and will show that the site has been appropriately treated to allow safe redevelopment of the site, with respect to all issues raised as being of potential concern by the site investigation and risk assessment phases of work.

7 DEVELOPMENT REMEDIAL WORKS

7.1 Treatment of shallow coal workings

Across much of the northern half of the site shallow workings are present in the Mapplewell and Kents Thin coal seams. A plan indicating the extent of these areas, which require drilling and grouting consolidation treatment, is included in Figure 2.

Once the final plot layout is agreed and planning approval obtained the developer will release a number of adjacent plots as a single phase for construction. Where such a phase, or part of that group of housing plots lie within the area requiring treatment then drilling and grouting consolidation works will be carried out for all affected plots.

The standard procedure for housing developments is for a specialist grouting contractor to attend site and treat the required plots for each development phase. The work, which is usually carried out immediately in advance of groundworks and foundation construction, requires probe drilling to be carried out beneath each house plot to determine the extent of workings and areas requiring consolidation. Treatment of each plot (including a perimeter zone outside the footprint) is then carried out by drilling (usually on a 6m or so grid) and grouting using a pulverised fuel ash (PFA) and cement mix grout (usually in a ratio of 10:1). In areas where high grout takes are recorded additional holes are drilled and grouted. Ground treatment works should be checked and validated and a completion report prepared including details of all boreholes drilled and quantities of grout used.

7.2 Provision of a cover system

In order to ensure that there is no complete linkage between contamination (principally arsenic, sulphate and PAHs) in soil and sensitive receptors on site, it will be necessary to provide a cover layer for all areas of soft-standing. This layer will have the dual effect of protecting future residents from direct contact with impacted soils and providing a suitable growing medium for planting on-site, avoiding any phytotoxic effects.

A cover thickness of 500mm is proposed for rear gardens across the majority of the site. The cover layer thickness should be increased to 600mm for gardens in the north-eastern part of the site where particularly high PAH concentrations were reported. In front gardens and areas of public open space a total cover thickness of 300mm is considered sufficient. This recommendation will need to be agreed with the local authority and building control (NHBC).

Any materials used for the cover layers should be visually assessed as being suitable for this use, and should also be analysed at a frequency agreed with the local authority and the quality of the soil verified as meeting agreed criteria. It is proposed that a frequency of one sample per 250m^3 of material would be suitable for material imported to site for this purpose.

The depth of placed material will be verified and it is proposed that the depth of cover in the rear garden of every second plot.

Low technology soil making techniques may be appropriate and will be assessed as a sustainable measure for the production of subsoil / topsoil.

7.3 Water supply pipes

The laboratory results indicate that there is a viable risk to water supply pipes, however, as final routes of supply pipes had not been determined at the time of the site investigation, a targeted investigation and specific sampling strategy may be required prior to their installation.

Further work may be necessary once the requirements of the water supply company have been ascertained, and it is recommended that they be consulted as soon as possible.

7.4 Ground gas ingress preventative measures

The RSK investigations have confirmed elevated carbon dioxide concentrations at the site and consequently a classification of "Amber 1" for housing development applies. This requires that basic gas ingress preventative measures be installed in all properties, including provision of a gas impermeable membrane and a ventilated sub-floor void.

Man entry into excavations should be limited as far as possible. Method statements should be in place, to include monitoring of ground gases within excavations, should any man entry be necessary.

Inspection of ground gas ingress preventative membranes should be independently completed, to allow a record to be kept of membranes being installed in all plots, and to provide assurance of the quality of the installation work.

7.5 Unexpected ground conditions

It is possible that as the site is developed with housing unforeseen ground conditions will be locally encountered. There will be areas where buried structures and hard standings are present and others were potential contamination is present. House builders selected for development of the site are to be made aware of the potential for such conditions and they should make sure they have systems in place to inspect all excavations and site arisings to assess for potential contamination. If contaminated soils or groundwater are encountered they should have arrangements in place to obtain professional advice.

7.6 Waste disposal

The MMP, which is to be produced in advance of the enabling remedial works, should be modified to cover material movement on site during the development phase. The house-builders operating on site and their contractors will be responsible for updating and following the requirements of the MMP and its future (as the site will be developed over a number of years).

Materials assessed as unsuitable maybe be encountered on site. All such materials will be segregated and, where possible, treated to minimise volumes requiring off-site

disposal. All such materials should be stockpiled and documented prior to being taken by licensed carriers to suitably licensed disposal facilities. Chemical analytical data within the site investigation report can only be used as a general indication of contamination levels and additional specific testing, including for example Waste Acceptance Criteria (WAC) testing, is likely to be required prior to agreeing the requirements for waste disposal.

FIGURES



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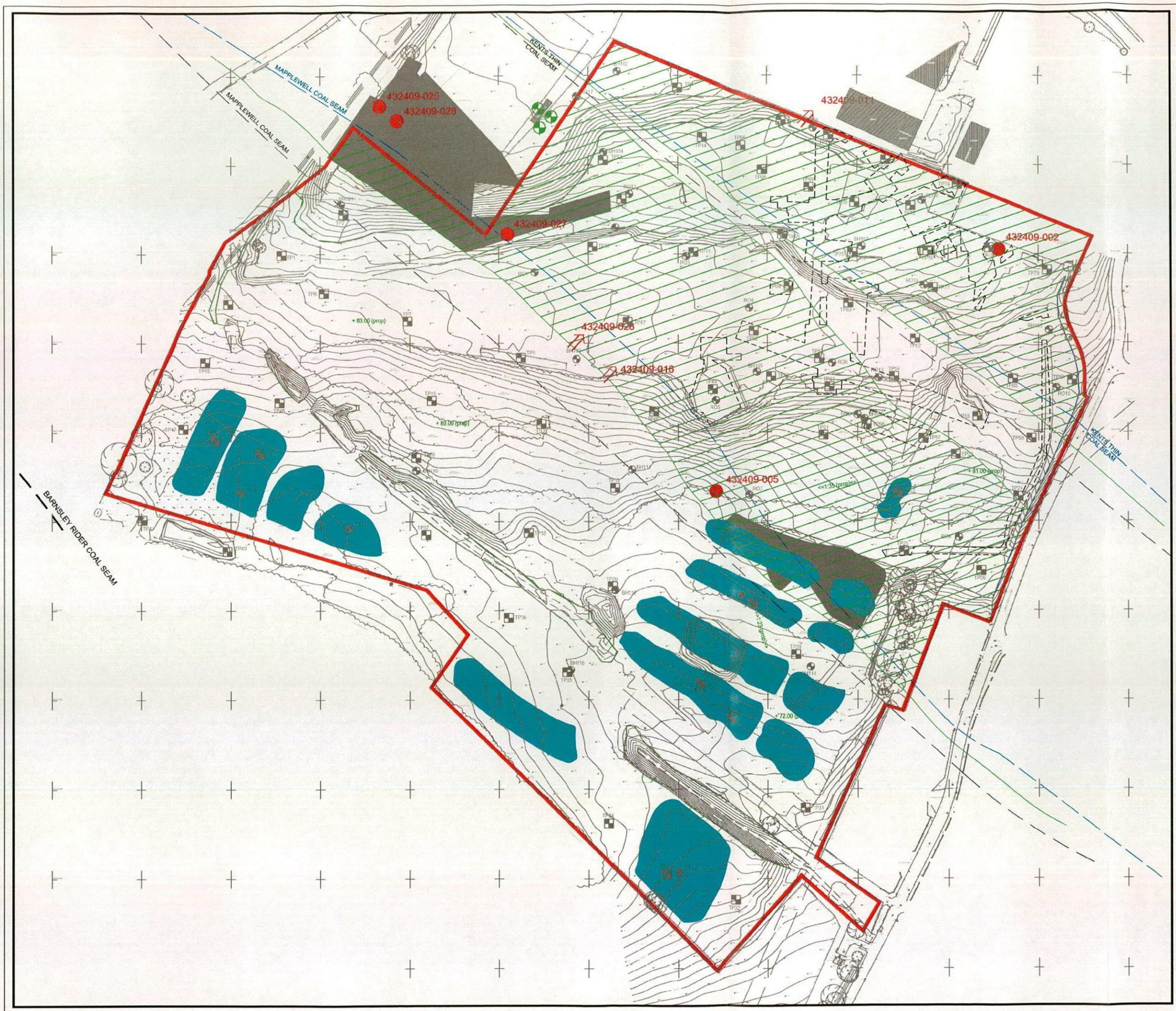
Client: HARWORTH ESTATES

Project Title: NORTH GAWBER

Drawing Title: SITE LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date	Project No.	Drawing File
HD	05.03.14	GMG	05.03.14	GMG	05.03.14	321370	321370-R4(00)D001A

Scale	Orig Size	Dimensions	Drawing No.	Rev.
NTS	A4	—	FIGURE 1	A



LEGEND:

- Indicative site boundary
- Adit
- Shaft
- Opencast backfill (highwall at perimeter)
- Old lagoons
- Footprint of historical buildings
- Inferred coal seam outcrop (information taken from geological survey map, scale 6 inch to 1 mile, 1932 edition)
- Gas vents (from SDA Dwg No. SDA/09002/19, figure 4 dated May 2010)
- Inferred coal seam outcrop (information taken from NCB North Gawber Colliery Spoil Tip Geological Plan)
- Best estimate of seam outcrop based on all information received
- Area where competent overburden does not exceed ten times seam thickness

NOTE:
Underground workings provided on other drawings

N

REV	DATE	DESCRIPTION	BY	CHD	APR
A	05.03.14	FIRST ISSUE	HD	GMG	GMG

Dimensions	Projection	Scale	Orig Size
m		1:2,000	A3

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CLIENT
HARWORTH ESTATES

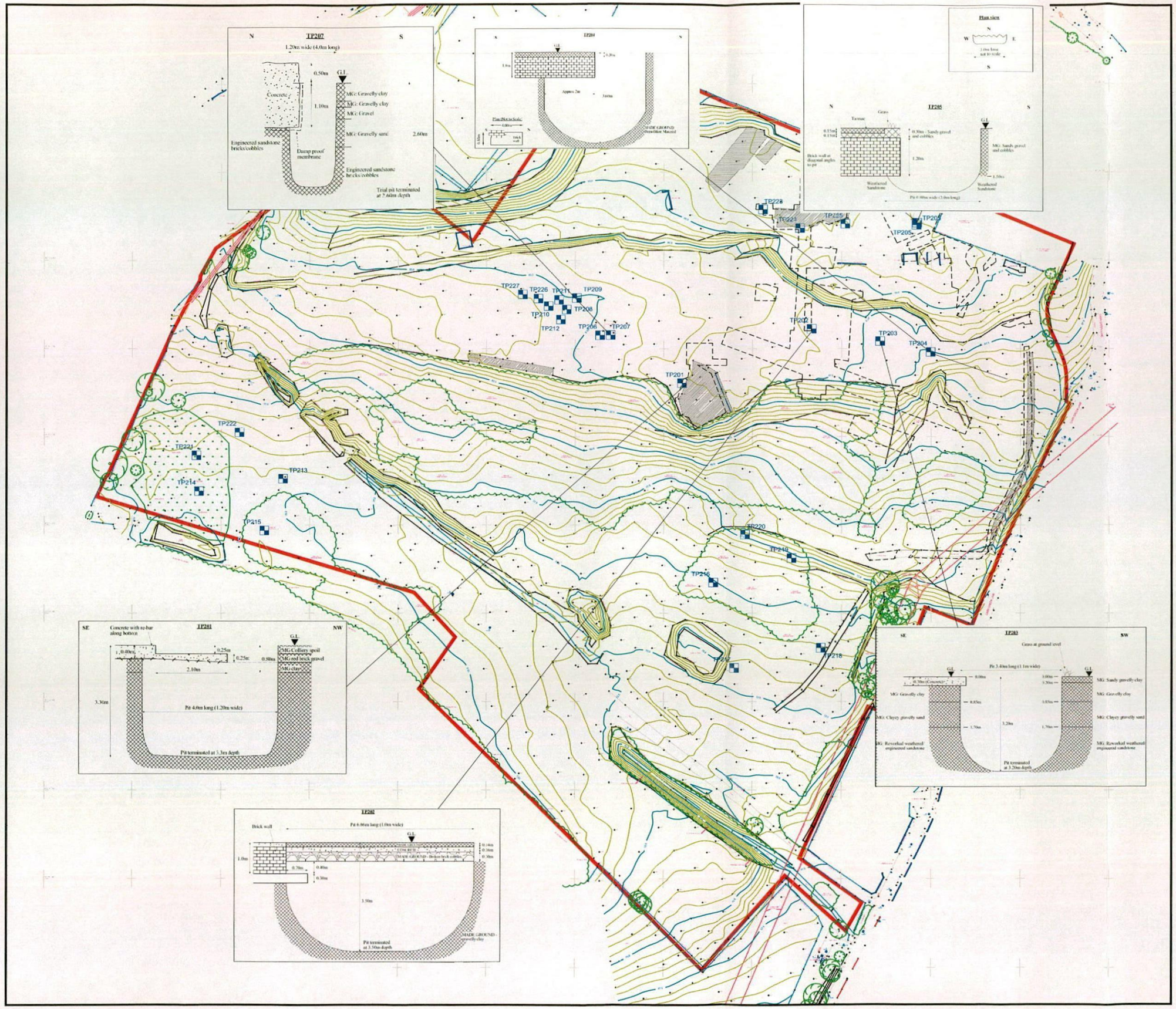
PROJECT
NORTH GAWBER

TITLE
SITE PLAN WITH CONSTRAINTS

JOB No.:	DRAWING FILE:
321370	321370-R4(00)D002A

BY:	DATE:	CONTRACT NO.		REV:
HD	05.03.14		FIGURE 2	A

Scale 1 : 2000
0 50 100 150 200m



LEGEND:

- Indicative site boundary
- TP202 RSK trial pit locations (2013)
- Identified surface concrete taken from Scott Doherty report (2008)
- Footprint of historical buildings

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
A	05.03.14	FIRST ISSUE	HD	GMG	GMG

Dimensions	Projection	Scale	Orig Size
m		NTS	A2

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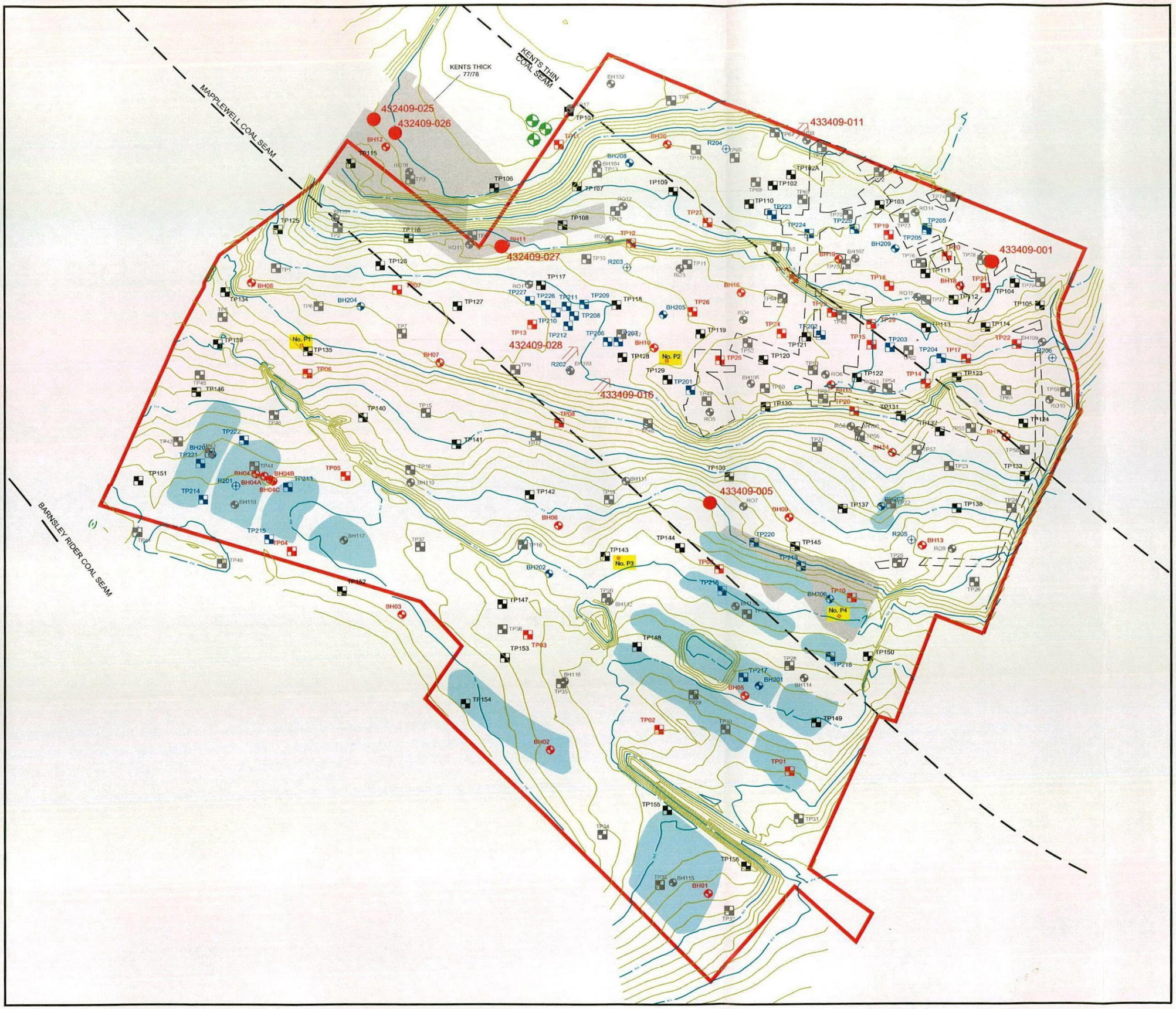
CLIENT
HARWORTH ESTATES

PROJECT
NORTH GAWBER

TITLE
PLAN INDICATING KNOWN CONCRETE OBSTRUCTIONS

JOB No.:	DRAWING FILE:
321370	321370-R400)D003A

BY:	DATE:	CONTRACT NO.		REV:
HD	05.03.14		FIGURE 3	A



LEGEND:

- Indicative site boundary
- Adit (inferred)
- Shaft (inferred)
- Opencast backfill (highwall at perimeter)
- Former lagoons (infilled)
- Gas vents (from SDA Dwg No. SDA/09002/19, figure 4 dated May 2010)
- TP01 — Trial pit (2005)
- BH01 — Borehole (2005)
- TP7 — Trial pit (2008)
- BH01 — Borehole (2008)
- R017 — Rotary borehole (2008)
- TP101 — Trial pit (2009)
- BH209 — RSK borehole locations (2013)
- R206 — RSK rotary borehole locations (2013)
- TP202 — RSK trial pit locations (2013)
- Footprint of historical buildings
- Inferred coal seam subcrop (information taken from geological survey map, scale 6 inch to 1 mile, 1932 edition)
- No. P4 — Skip load test location

N

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
A	05.03.14	FIRST ISSUE	HD	GMG	GMG

Dimensions	Projection	Scale	Orig Size
m		1:2,000	A3

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CLIENT: HARWORTH ESTATES

PROJECT: NORTH GAWBER

TITLE: EXPLORATORY HOLE LOCATION PLAN

JOB No.:	DRAWING FILE:
321370	321370-R4(00)D004A

BY:	DATE:	CONTRACT NO.		REV:
HD	05.03.14		FIGURE 4	A

Scale 1 : 2,000

0 20 40 60 80 100m

APPENDIX A
MASTERPLAN (JOHN R PALEY ASSOCIATES DRAWING NUMBER 13:4764:SK04)



0 20 40 60
(metres)

1. RETAINING STRUCTURE
2. EXISTING OVERHEAD POWERLINES
3. PRIMARY ENTRANCE
4. CONSTRUCTION ACCESS

CLIENT:	HARWORTH ESTATES
PROJECT:	NORTH GAWBER
DRAWING OF:	MASTERPLAN
DRAWING NO.:	13:4764:SK04
DRAWN BY:	SL
SCALE:	1:1000 @ A1
DATE:	25.02.2014

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• town planning
• landscape architecture
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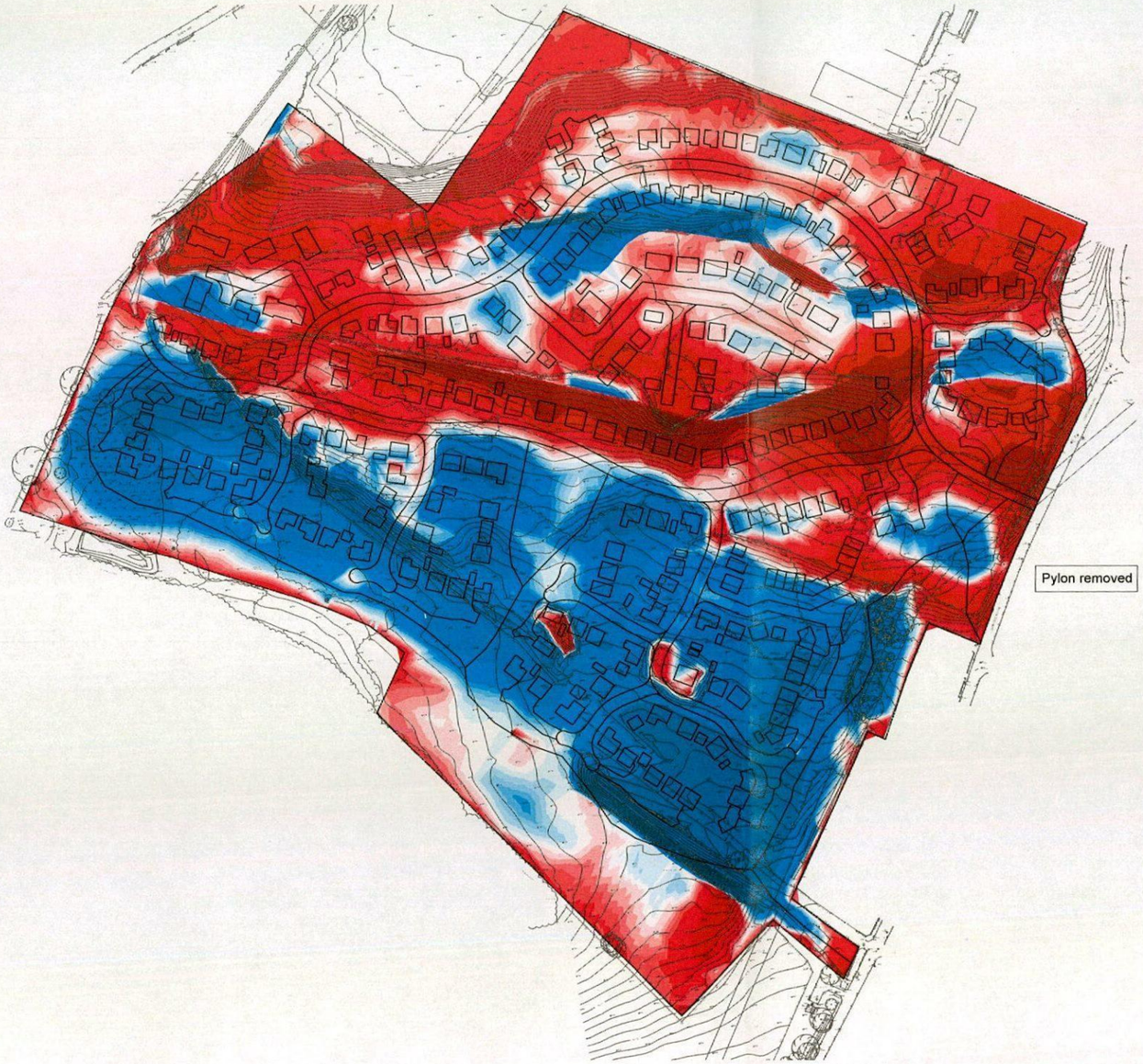
RTPI NHBC

APPENDIX B
CUT AND FILL VOLUMETRICS (DRAWING REFERENCE 880442 40-01P2)



CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:-

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Note:

1. This Drawing is to be read in conjunction with all engineering and architectural drawings.
2. The existing ground levels have been assumed from the APS SURVEYING SERVICES survey dated Apr 07.
3. All volumes noted do not include a bulking factor.
4. Volumes given do not take into account the suitability of materials, to be re-used in any particular area. Consideration will need to be given to the engineering properties to ensure suitability.
5. Earthwork volumes are based on the assumptions listed below.
6. It has been assumed that all materials in the cut and fill exercise are not contaminated and can be re-used as required.
7. Volumes do not take into account pile mat construction, or arisings from roads, drainage and foundation construction.

Models Used:

FOS Model	-	base.pds
Post Demolition levels	-	Existing.dgm
Finished Levels	-	Proposed formation.dgm

Criteria / Assumptions:

a. The volumes are derived from existing ground levels against proposed formation levels.
b. Topographical site levels have been taken from TOPO survey by APS Surveying Services .

Volumes:

Total Cut = 72093.7m³
Total Fill = 81469.6m³
Site Total = 9375.9m³ (Fill)

It may be necessary for a borrow pit to be utilised on site for the earthworks operation to achieve an approx cut & fill balance as the fill figure above does not take into account arisings. The approximate volumes associated with various arisings are shown below:

Pond	2500m³
Ditch	3500m³
Drainage	750m³

The remaining material is anticipated to come from the foundation arisings.

ISOPACYTHE BANDING LEVELS

CUT Depth Bands

Band 1	-0.00 -	-0.10
Band 2	-0.10 -	-0.20
Band 3	-0.20 -	-0.30
Band 4	-0.30 -	-0.40
Band 5	-0.40 -	-0.50
Band 6	-0.50 -	-1.00
Band 7	-1.00 -	-2.00
Band 8	-2.00 -	-5.00
Band 9	-5.00 -	-10.00
Band 10	-10.00 -	

FILL Depth Bands

Band 1	0.00 -	0.10
Band 2	0.10 -	0.20
Band 3	0.20 -	0.30
Band 4	0.30 -	0.40
Band 5	0.40 -	0.50
Band 6	0.50 -	1.00
Band 7	1.00 -	2.00
Band 8	2.00 -	5.00
Band 9	5.00 -	10.00
Band 10	10.00 -	

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P2	20.02.14	Revised in accordance with clients comments	MAR	CB	
P1	31.01.14	First Issue	MAR	CB	

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Client
Harworth Estates

Project Title
North Gawber

Drawing Title
Cut & Fill Volumetrics

Drawn	Date	Checked	Date	Approved	Date
MAR	JAN 14	CB	JAN 14		

Scale	Orig Size	Dimensions
1:1000	A0	

Project No.	Drawing File
880442	

Drawing No.	Rev.
40-01	P2

Scale
0 10 20 30 40 50m