



Highbarns Chalk Mines Project

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Design Phase Ground Investigation Objectives



The main objectives of the ground investigation were to:

- 1) confirm the extents of the mine indicated by the microgravity survey, our Geotechnical Assessment Report and the previous ground investigation data.
- 2) confirm the conditions within the mineworkings including the extent of open voids and collapsed ground.



Design Phase Ground Investigation Objectives



3) install groundwater monitoring installations to establish groundwater levels within the chalk and the baseline groundwater quality as the site lies within a Groundwater Source Protection Zone.

This data was required to enable the detailed design of the treatment works.



Design Phase Ground Investigation Fieldworks



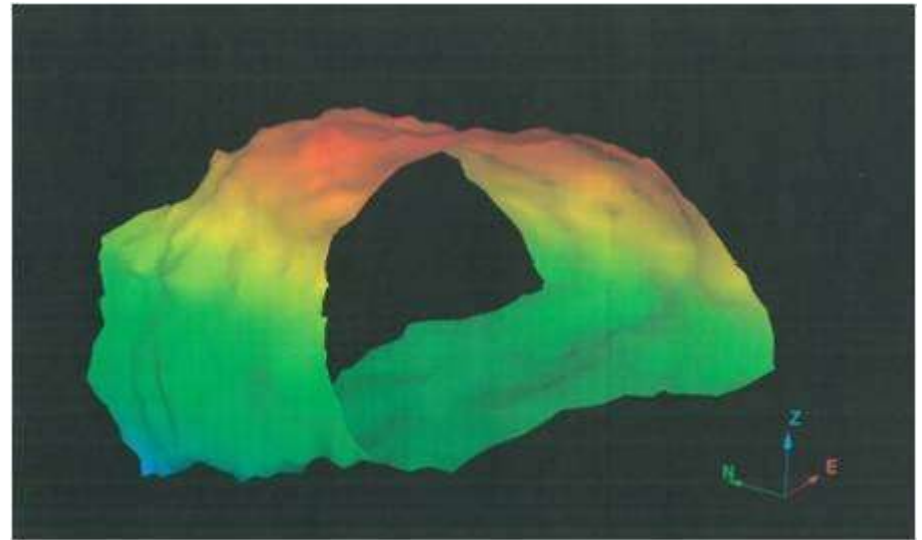
The fieldworks (16th April to 22nd June) included:

- 174 No dynamic probes sunk to depths of up to 25m in 21 No rows across the microgravity anomalies
- 22 No boreholes sunk to depths of up to 25m with downhole CCTV surveys
- 6 No boreholes sunk around the margins of the site to depths of up to 45m with groundwater monitoring installations
- a grouting trial to confirm the treatment methodology



A downhole laser survey was carried out by Inspectahire in late July/early August to determine the dimensions of large voids encountered.

The groundwater monitoring boreholes are currently being monitored and sampled on a monthly basis to establish the baseline groundwater quality.



Key Findings of the Ground Investigation



The ground investigation has achieved all of its objectives.

- The lateral and vertical extents and condition of the mine have been established.
- There is an excellent correlation between the identified mineworkings and the negative microgravity anomalies indicated by the geophysical survey.



Key Findings of the Ground Investigation



The mineworkings appear to comprise a single level of workings with:

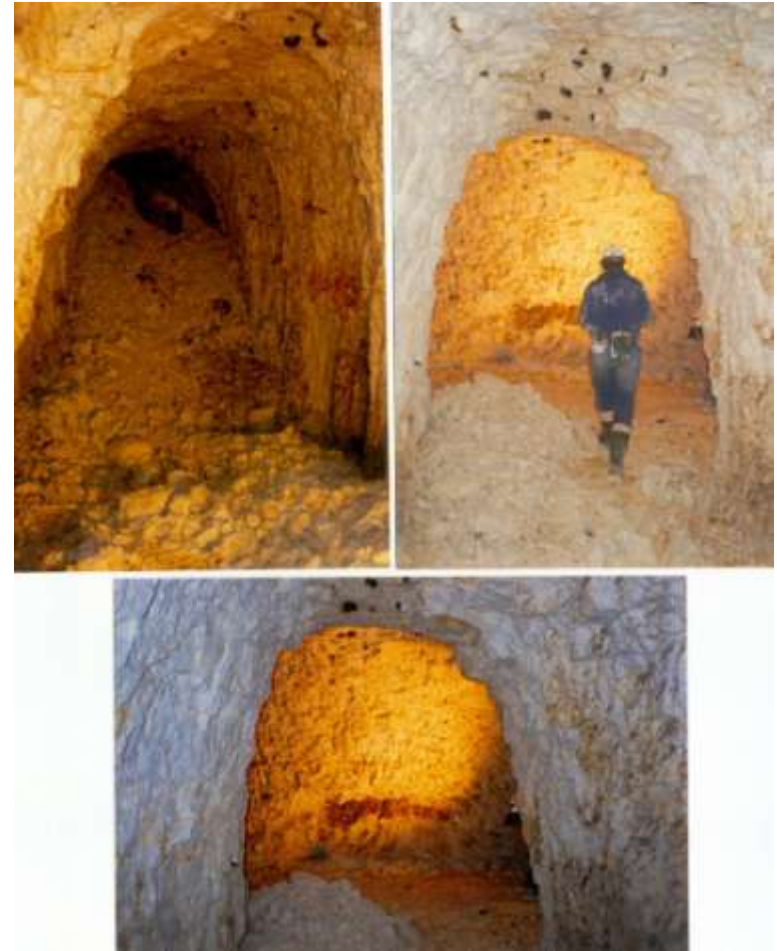
- The original floor of the mine at depths of between approximately 14m and 25m.
- The original roof of the mine at depths of between approximately 11.5m and 18.5m but void migration above this level to near surface/surface has locally occurred.
- Original mine heights and widths typically range between approximately 2m and 4m.



Key Findings of the Ground Investigation

The centre of the mine around the Highbarns/Pond Road/East Green road junction consists predominantly of open voids.

The majority of the mine galleries radiating out from the centre appear to be either partially or fully collapsed while some sections are likely to be infilled with backfill material.



Key Findings of the Ground Investigation



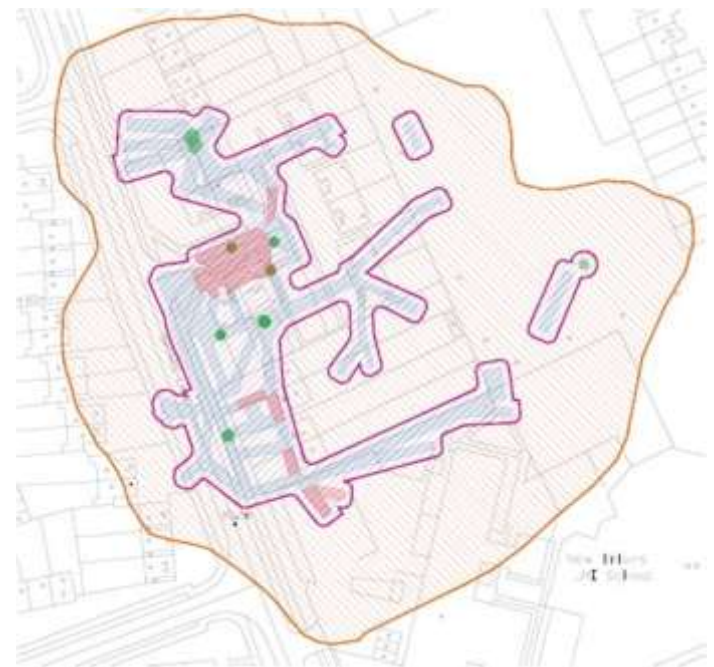
The extent of the mine confirms the key findings of the microgravity survey and our Geotechnical Assessment Report:

- the mine workings are centred on the Highbarns/Pond Road/East Green junction
- the mineworkings appear to comprise a single set of continuous mine workings
- the mineworkings are confined within the Derelict Land Clearance Order site boundary.



The detailed design of the remedial works has been completed and has involved preparation of the:

- Specification for Treatment Site Works
- Construction Drawings
- Traffic Management Plan



- Health and Safety Plan and Designers Risk Assessment
- Construction Environmental Management Plan
- Site Waste Management Plan



Treatment Works

- The treatment works are programmed to start on site in December 2012.
- The main site works are expected to last 16 weeks and should be completed by the end of April 2013.
- Reinstatement, final validation and demobilisation will take a further month so all on-site works should be completed by the end of May 2013.



Treatment Works Objectives



The principal objectives are to:

- address the known H & S risks posed by the presence of shallow mineworkings
- allow the safe occupation of houses and to remove the need for monitoring
- remove the blight of the area due to the presence of shallow mineworkings to allow house sales and normal development



Treatment Works



The treatment works is intended to address all significant long-term risks associated with the known mineworkings including:

- collapse of voids
- collapse settlements
- untreated shafts

The treatment works will comprise:

- bulk infilling of open voids
- compaction grouting of collapsed ground
- validation testing



Treatment Works



Disruption to residents will be minimised by:

- close consultation with local residents as part of the scheme communications strategy
- maintaining access as far as possible by temporary partial lane closures
- minimising the extent of temporary evacuations
- adopting measures to control noise, vibration and dust by implementing a Construction Environmental Management Plan



Treatment Works

Work will only be undertaken between the hours of 7.30am and 6.30pm Monday to Friday with noisy works being restricted to between 8.30am and 6pm with the remaining time used for quieter activities.

No drilling, grouting or deliveries will be allowed outside these hours.

24 hour site security will be provided.



Treatment Works – Compound Areas

The contractor will use three site compound areas:

- the triangular area of public open space situated beside Pond Road
- the central area of public open space adjacent to the junction of Highbarns and East Green
- a third site (to be confirmed)



Treatment Works - Sequence

There will be progressive phased treatment and validation of the site

- 1) Bulk infilling of voids
- 2) Compaction grouting of Nos 2, 4 & 6 Pond Road
- 3) Compaction grouting of the area around the Highbarns/Pond Road/East Green junction
- 4) Progressive compaction grouting towards the end of the galleries



Treatment Works - Validation

Following the drilling of inclined compaction grout holes beneath houses validation dynamic probing will be required within one room of each house.

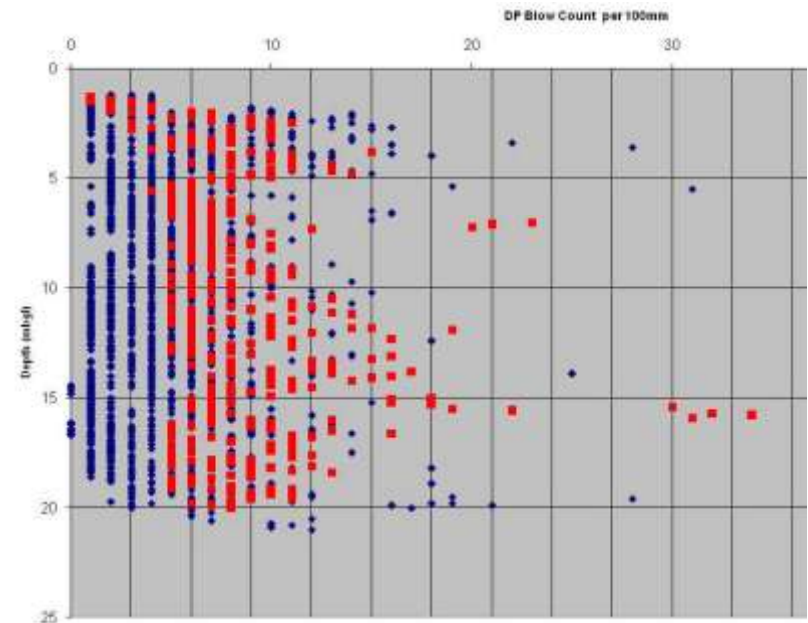
There will be monitoring of ground and building movements and around drilling and grouting works.



Treatment Works - Validation

Detailed validation of the treatment works will be undertaken based on the 3D Mine Model.

This model will be reviewed on site against drilling and grouting data in near real time to evaluate the treatment works in combination with validation tests.

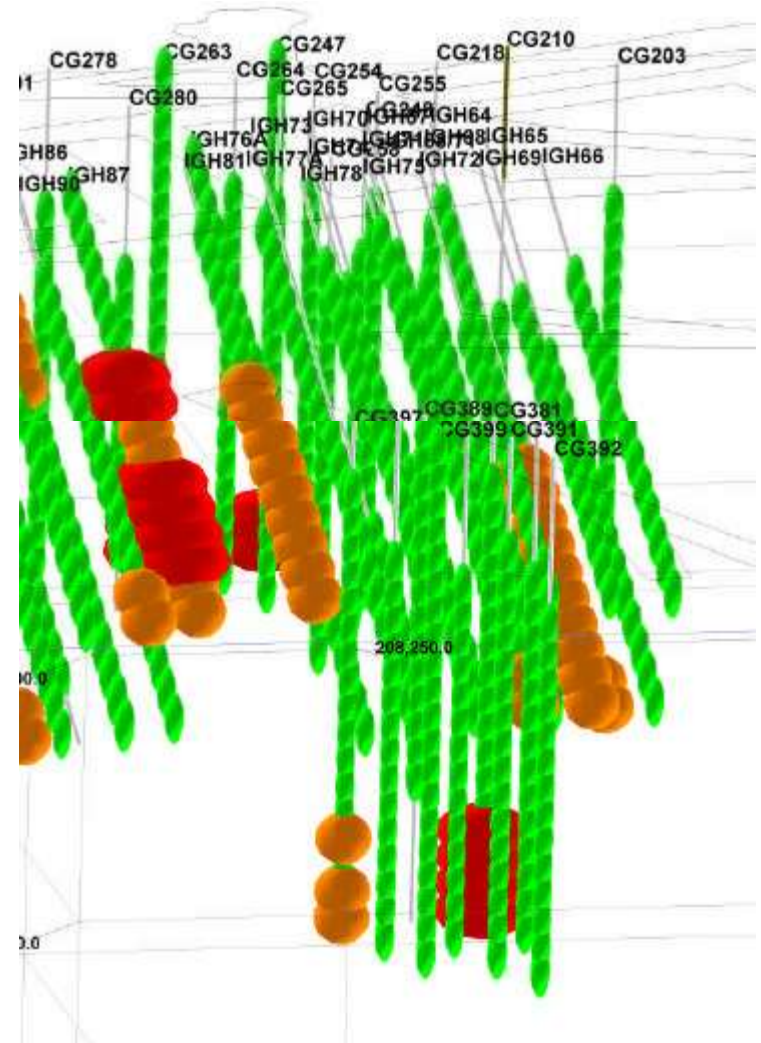


Treatment Works - Validation



This data will form the basis of the Validation Report for the site confirming that the works have met the objectives of the scheme

A brief Validation Report will be produced for each property confirming treatment of the workings adjacent to the property



Treatment Works - Reinstatement

Condition surveys of properties will be undertaken before and after the treatment works to determine the extent of reinstatement required, such as:

- the cleaning of any grout damage to buildings
- reinstatement of gardens
- repairs to highways and pavements

