



Case study 3: **developing on deep made ground**

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KEY FACTS

- ▶ 3.2 Ha residential development site
- ▶ Old quarry up to 25m deep
- ▶ Requirement to raise levels by up to 6m
- ▶ Contamination from quarry waste

The challenge

This old ironstone and limestone quarry covered an area of 3.2 Ha and at the time of GRM's involvement was derelict and heavily overgrown. Ground levels varied from 63 to 75m AOD, as a result of quarrying activities and uncontrolled filling.

Ground investigation and desk top research confirmed that the quarry was of a much greater depth than originally thought - in places up to 25m deep - with an irregular base and highly variable infill.

A re-modelling scheme was designed which resulted in the raising of ground levels by up to 6m. This meant that in places the depth of made ground exceeded 30m.

The client's aim was to produce a more practical site, with regards to ground levels, that was easy to develop. GRM were selected because of our significant experience in decontamination and earthworks coupled with our in-house structural engineers and site inspection team.

geoenvironmental
civil
structural

The solution

Preventing settlement problems

GRM prepared an earthwork specification designed to limit differential settlement of roads, services and hard-standings.

Supervision of the earthworks involved regular monitoring to assess the degree of compaction and regular checks to ensure that the imported material comprised clean naturally derived soils. A total of 25000m³ of material was imported, with around 10000m³ of pre-existing fill re-modelled.

As part of the validation process, all imported materials had their moisture content / dry density relationship determined. The placed fill was tested for compaction by means of a Nuclear Density Meter at a total of 72 locations.

In addition to the in-situ testing, two semi-permanent levelling points were established; these were monitored for settlement at regular intervals. Settlements up to 50mm were anticipated; in fact actual settlements recorded were between 2mm and 9mm.

Assessing contamination risk

The planning permission contained conditions related to contamination. GRM used risk assessment techniques to demonstrate that no remediation was required and the local authority approved this risk-based approach.

The foundations for a mixture of apartments and houses were all piled. The piling method GRM selected allowed for pre-boring at each pile location, to limit abortive time and costs due to obstructions within the pre-existing fill. Alternative foundation solutions such as rafts were considered but discounted due to the likely variability of the pre-existing fill and risk of differential settlement.

Conclusion

GRM's client invested in pre-purchase advice to assess the viability of the scheme. By a combination of ground investigation, risk analysis and detailed design, GRM took a derelict site that possessed numerous development constraints and dealt with them all. This enabled a high quality development to be constructed in a way that offered considerable cost savings, whilst increasing the acreage of developable land.

