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CASE STUDY

E-Clay Reactive Barrier

Commercial Development

Client

Crown Crest (Leicester) Plc

Developer

Hallam Contracts
'together we build'

Site Background & History

The site was the former Timken Desford Steel Works, Desford Lane, Kirby Muxloe. Following site closure in 2007, site investigations have been undertaken by Pick Everard to gain a better understanding of the ground conditions and possible contamination issues on the site.

The site was dominated by a large concrete slab on which the (now demolished) steelworks building was constructed (see Figure 1). Some office buildings remain in the north of the site but are largely unused at present.

The site is bordered to the north by Desford Lane and to the south by a railway line and Rothley Brook. The site is bordered by a sports field to west and a warehouse building to the east. The site is being developed as a new 45,000m^2 storage and distribution centre.

Figure 1 – Site Prior to Development

The prime environmental receptor was identified as the Rothley Brook, located approximately 100m south of the site. Human health protection is provided by means of the warehouse concrete base (the hardstanding being an effective pathway break).

The site investigations identified the presence of soil and groundwater contamination with free product identified in a number of locations. Organic odours and black staining was recorded in many of the boreholes. Analytical evaluation showed this contamination to be predominantly "weathered" total petroleum hydrocarbons (TPH). The identified soil TPH values were as high as 34,000mg/kg with a maximum groundwater TPH concentration of 96,000µg/l). Groundwater was identified at depths ranging from 0.3m and 2.0mbgl; the groundwater levels appeared to be influenced by the presence of underground structures and buried concrete in a number of locations. Pick Everard conjectured that the groundwater flow was in a southerly / south-western direction in the west of the site and in an easterly direction in the central part of the site, ultimately flowing in both a north easterly and south easterly direction at the eastern area of the site.

Several remediation options were considered. Off-site disposal was prohibitively expensive due to the likely volumes involved. Bioremediation was discounted due to the presence of recalcitrant 'highly weathered' petroleum hydrocarbons. A cut off wall was considered but this would have necessitated a requirement for a pump and treat system, which was considered impracticable and prohibitively expensive. The preferred remediation method was the installation of a permeable reactive barrier system along the full southern boundary of the site. This system provided a viable remediation solution for the site which was acceptable to the Environment Agency and enabled planning conditions to be discharged, allowing the development to proceed.

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Envirotreat worked closely with Hallam Contracts and the Environment Agency to develop the remediation solution for the site. The permeable reactive barrier system was designed to incorporate pillared E-Clay technology.

Remediation Strategy

Envirotreat were commissioned by Hallam Contracts to undertake the following works.

1. Formulate a remediation strategy to satisfy planning and EA requirements, including RTM [P20] modeling.
2. Produce a Design Statement for the proposed E-Clay Reactive Barrier, including further trial pitting and treatability trials.
3. Deployment of a Mobile Treatment Licence, together with supporting documentation demonstrating appropriate environmental monitoring and implementation of protection measures.
4. Project management and implementation of the proposed remediation strategy on-site.
5. Discharge of relevant planning conditions.
6. Subsequent groundwater monitoring.

Methodology

Envirotreat produced a Method Statement, which included a summary of the identified contamination issues, proposed remediation strategy & technical rationale, the P20 modelling for the site, environmental monitoring and requisite environmental protection measures during the barrier installation works. Following a consultation period with the Environment Agency, the necessary approvals were obtained to undertake the proposed remediation works.

Trial pitting was carried out along the full length of the proposed barrier alignment to determine the required barrier depth – this was determined to be 2.0 to 2.5m bgl on average with some sections of the barrier requiring a deeper installation.

As the barrier was relatively shallow it was decided to install a trench reactive barrier system whereby the soils within the barrier alignment were excavated and treated *ex-situ* with the E-Clay treatment media followed by reinstatement. The trench barrier methodology enabled visual confirmation of the soil mixing process and provided the opportunity for visual observation of changing geology along the line of the barrier and verification that the correct barrier depth had been achieved.

The ex-situ soil mixing process and E-Clay production area are shown in Figure 2 below.

Figure 2 – Ex-Situ Soil Mixing and E-Clay Production Area

The re-emplaced treated soils are shown in Figure 3.

In total a 650m length of barrier was installed using this methodology.

The barrier was installed over a four week period.

The barrier location is shown in Figure 4.

Figure 3 – Re-emplaced Treated Soils

The works were undertaken in line with our Method Statement which was based around guidance contained within the document entitled “Protection of Workers and the General Public During the Redevelopment of Contaminated Land” (HS(G)66).

VOC and dust monitoring was undertaken throughout the remediation works.

As part of the remediation strategy four boreholes were installed downstream of the barrier location for ongoing groundwater monitoring. The initial results are encouraging.

Conclusions

Envirotreat have installed a permeable reactive barrier at the Kirby Muxloe site in accordance with the Design and Method Statements. Initial groundwater monitoring has demonstrated acceptable groundwater water quality downstream of the barrier installation. The reactive barrier installation has been demonstrated to be a cost effective and practical remediation solution for the site.

Figure 4 – Barrier Location in Relation to the Site [source Google Maps - predevelopment]