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# CASE STUDY

## StabOx / Chemical Oxidation
## E-Clay PRB / Offsite Disposal

**Wickside, East London**

**Client**

O'SHEA Galliard Homes

**Environmental Consultant**

GB Card + Partners
CONSULTING ENGINEERS

**Specialist Remediation Contractor**

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### Site Background & History

The site is located in Hackney Wick, East London. The area requiring remediation was on the eastern side of the overall site – this area has previously been used as a chemical / oil works and more recently as a waste transfer and recycling facility. The overall site is shown in Figure 1 below and covers an approximate area of 2.9ha.

The site is being redeveloped for circa 500 homes comprising of apartments, penthouses, garden studios and terraced housing. A number of the existing buildings are being retained as part of the new development. The site was vacant at the time of remediation.

Recent site investigation works undertaken by GB Card [GBC] (and previously by CGL) had identified gross hydrocarbon contamination in the eastern area of the site which was predominantly located within the shallow made ground and the underlying surface alluvial layer (see Figure 2 below). This gross contamination was impacting the underlying groundwater.

Figure 1 – Overall Site / Previous Usage

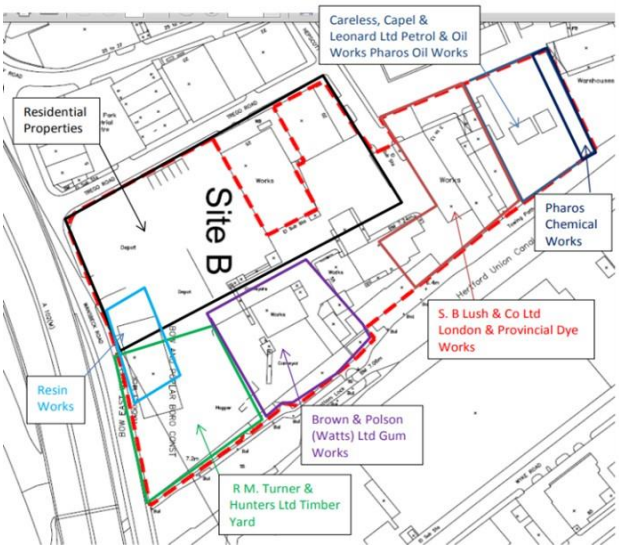
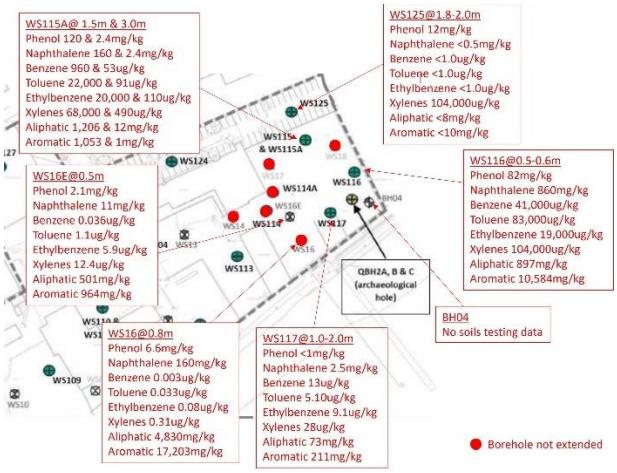



Figure 2 – Identified Contamination (Eastern Area)




C.J.O'Shea [CJOS] commissioned GBC to prepare a Remediation Strategy / Remediation Options Appraisal and a Remediation Plan. The GBC remediation strategy was approved by the regulators. GBC subsequently instructed Envirotreat to carry out the required remediation works which comprised of the following:

- The decommission of existing boreholes to prevent vertical migration of contamination into the deep aquifer

- The excavation and removal of identified underground storage tanks
- the removal and offsite disposal of the gross hydrocarbon contamination within the Made Ground (and the removal of obstructions)
- treatment of the surface layer of the underlying alluvial layer using Envirotreat's StabOx® technology (combining chemical stabilisation and chemical oxidation)
- the installation of a E-Clay® permeable reactive barrier
- the application of chemical oxidant to accelerate the degradation of the organic contaminants remaining within saturated soils
- the implementation of an environmental monitoring plan (incorporating mitigation and protection measures) to protect neighbouring receptors from contamination vapours and odour nuisance
- the provision of a final validation report on completion of the site remediation works

**Borehole Decommissioning**

A number of historical monitoring boreholes and a deepwater extraction well required decommissioning. Envirotreat undertook the decommissioning of these boreholes / extraction well in accordance with current guidance published by the Environment Agency i.e. 'Good Practice for Decommissioning Redundant Boreholes and Wells' dated October 2012.

The boreholes were infilled with bentonite pellets as required and concreted over. The decommissioning process is shown in Figure 3 below.

Figure 3 – Borehole Decommissioning

**Underground Storage Tanks [USTs]**

Three underground storage tanks were previously identified on-site and required removal. A fourth tank was subsequently identified during the works (also requiring removal).

The tanks were removed under strict controls (odour suppression and air monitoring). The excavated tanks were assessed as suitable for offsite disposal (recycling) and removed from site. The voids were infilled with suitable materials and the surrounding soils were tested to confirm absence of significant contamination associated with the tank contents. The tank excavation is shown in Figure 4 below.

Figure 4 – Excavation of USTs

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### Excavation of Grossly Contaminated Soils / Offsite Disposal

The designated remediation area was subdivided into a 10m x 10m grid as required by GBC – this was to minimise the potential environmental and nuisance risks as far as practically possible (ensuring that the exposed area was restricted to one 10m x 10m area at any one time). The grossly impacted soils were excavated directly onto wagons (with sufficient wagons to fully excavate the designated area without the need for stockpiling). The grossly contaminated materials were disposed of at suitably licenced waste repositories. The excavation works and the loading onto lorries is shown in Figures 5 and 6 below.

Figure 5 – Excavation of Contaminated Soils

Figure 6 – Loading Directly onto Wagons

### StabOx Treatment

Following excavation of each 10m x 10m area (and the full removal of grossly contaminated made ground materials) the base of the excavation and the surface layer of the underlying alluvium were treated with a StabOx formulation (combining chemical stabilisation / immobilisation with chemical oxidation). This provided an effective treatment for residual gross / significant contamination and more importantly prevented the release of further odours and VOCs. Any groundwater within the base of the excavations was pumped to storage tanks and used in the preparation of the Stabox treatment slurry. The StabOx treatment is shown in Figure 7 below.

Figure 7 – Treatment with StabOx

The process was repeated until all of the gross contamination within the designated remediation area had been excavated and removed from site. In total 169 loads were removed from site (including three loads subsequently removed from within an easement area). In total circa 3,000 tonnes of grossly contaminated materials were excavated and removed from site.

### Installation of a Permeable Reactive Barrier

Following completion of the gross source removal, Envirotreat installed an E-Clay Permeable Reactive Barrier [PRB] along the southern and eastern site boundaries to treat the groundwater leaving the site.

The PRB installation is shown in Figure 8 below.

Figure 8 – PRB Installation

## Chemical Oxidation

Further groundwater remediation in the form of in-situ chemical oxidation was undertaken to remediate the contamination identified within the superficial saturated soils and the Kempton Park Gravel Aquifer localised in the western and eastern areas of the site. This involved the drilling of a number of strategically placed dosing wells into the superficial soils and the Kempton Park Gravels. A chemical oxidant was dosed into the superficial soils and gravels at regular intervals over a number of months to facilitate in-situ chemical oxidation and to generate aerobic conditions (thereby facilitating the bioremediation of oxidisable hydrocarbon pollutants). The dosing wells are shown in Figure 9 below.

Figure 9 – Dosing Wells – Chemical Oxidation

Groundwater quality was monitored by sentinel wells placed on the southern and eastern site boundary. The key pollutants of concern were BTEX and naphthalene.

The groundwater quality was seen to be significantly improving during the dosing period (six rounds of dosing and monitoring). On completion of the dosing period it was agreed by all parties that the remediation aims had been achieved.

## Environmental Monitoring

GBC had identified a major concern in terms of the potential impact the works would have on the local residents in terms of odours, VOCs, noise and dust. GBC stated the following:

*'An air quality monitoring plan including mitigation and protection measures will be implemented throughout the duration of the works to prevent the identified neighbouring receptors from the exposure to contamination vapours and odour nuisance.*

*Odour and vapour mitigation and management measures will be implemented by the remediation contractor during the groundworks in order to reduce odour impacts off site as set out in the Acute and sub-chronic vapour risk assessment.'*

Envirotreat addressed this requirement by implementing a strategy incorporating an array of fixed and mobile spray misters, containing both an odour suppressant and a wetting agent (to 'drop' any potential asbestos fibres).

Monitoring stations were established on the northern, eastern and southern site boundaries and onsite from the western boundary (four in total). AreaRAE and MiniRAE units were stationed at each these locations, monitoring VOCs levels throughout the day. Sniff tests, dust monitoring (DustTrak) and noise monitoring were also carried out. Local weather conditions were recorded throughout.

The AreaRAE monitoring is shown in Figure 10 below.

Figure 10 – AreaREA Monitoring

Tenax tubes were also deployed around the site (thermal desorption tubes capable of measuring VOCs to very low levels).

GBC stated the following in relation to the monitoring thresholds:

*'A site boundary threshold value of 0.5ppm and a notification threshold of 0.3ppm for a PID calibrated using benzene were proposed for the initial stages of the works.'*

A few exceedances were recorded during the excavation phase of the works and measures were undertaken to reduce the exceedances to within acceptable predetermined limits.

**Conclusions**

The designated remediation works were carried out in accordance with the agreed remediation strategy, enabling the site to be redeveloped for the intended purpose. A validation report was produced on completion documenting the works undertaken and the results achieved.

The works and monitoring were audited weekly by a number of third-party stakeholders.

The reinstated remediation area is shown in Figure 11 below.
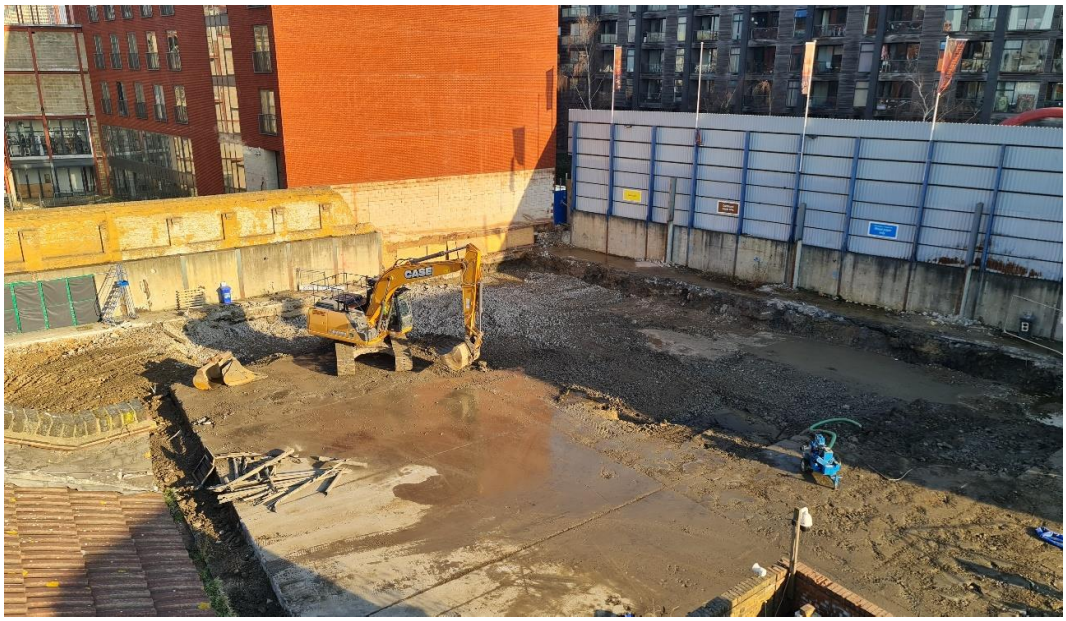
Figure 11 – Reinstated Treatment Area