CASE STUDY

E-Clay ex-situ stabilisation

Anne Street, Waterford, Ireland

Plate 1 – Completed David Flynn residential apartment block on adjacent site.

Development:	Residential Development
Developer:	David Flynn Ltd
Contractor:	FLI Environmental
End Value:	£2m

Site Overview

The site in Waterford, Ireland was being developed as one of nine David Flynn apartment blocks comprising of three storey apartment blocks together with associated parking facilities, access roadways and general landscaping. The history of the site was as a spray painting and panel beating workshop.

Historical use resulted in widespread soil contamination across the site. During initial earthworks development, extensive and unexpected ground contamination was identified. Site investigation indicated the presence of shallow made ground with a thin layer of sand and gravel which were contaminated with hydrocarbons up to a maximum depth of around 3m across the whole of the site. Elevated levels of Total Petroleum Hydrocarbons (TPH) were identified within the made ground and perched groundwater.

As construction had already commenced the main contractor required a rapid remediation technique in order to minimise disruption and maintain project viability.

Objective

The remediation strategy for the Anne Street site was designed to address the source contamination on-site and indirectly the pathway contamination issues, with the intention of protecting Human Health and the identified groundwater receptors.

Methodology

A number of proven remediation techniques (see table 1) were considered for the site within the framework of specific constraints. Each technique was assessed against the specified constraints to identify the one which gave the best performance overall. Only stabilisation / solidification with Envirotreat E-clay® was found to meet all the constraints.

The modified organophillic clay was designed on a site specific basis prior to the commencement of the remedial works. Rapid Bench and site trials were an important part of the design process.

The remediation strategy employed on-site by Envirotreat for the treatment of over 800m^3 of contaminated soils was *ex-situ* soil mixing.

The works were conducted over a 2 week period under the auspices of Envirotreat's Mobile Process Licence (MPL). Specialist technology, materials and supervision were supplied by Envirotreat, whilst FLI Environmental supplied all the required plant, and labour for application of the Envirotreat® Process.

Plate 2 – Remediation of site using 'allu' bucket.

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The mixing was undertaken with a specialist bucket attachment that was used to screen out coarse material and then mix the soils.

Plate 3 – Mixing of clayey soils with E-clay® slurry using the specialist processing bucket attachment on a conventional excavator.

The modified organophillic clays and cement were produced in a grout mixer and then combined in 5m³ batches with the contaminated soils in a skip. The layout of the treatment area was such that the excavator did not need to move around significantly. The treatment area was located on a robust impermeable membrane to contain any spillages and prevent cross contamination of the underlying soils. The treated soils were then temporarily stockpiled before being reused on-site as a substitute for imported clean fill, thus preventing the need for offsite disposal.

Results & Validation

Validation of the treated material was carried out on 6 No. batch samples, which were leached and analysed on behalf of Envirotreat by a UKAS accredited laboratory.

Table 2 presents the Maximum Contaminant Level (MCL) of TPH contamination present at the Waterford site prior to remediation and the results of leachate analysis post-treatment. The Site Specific Target Level (SSTL) has been adopted from a Groundwater Risk Assessment conducted by White Young Green, this value is also equivalent to the Dutch Intervention Standards for TPH in groundwater.

Plate 4 – Treated soils re-deposited ready for the construction phase to begin.

The remediation project was successfully completed, with the results illustrating that the objective of protecting human health and the groundwater receptors (i.e. The River Suir) was achieved, together with meeting the constraints of achieving the overall project objectives.

The contaminants of concern have been fully addressed with leachate levels falling below the agreed Site Specific Target Levels for TPH, thus allowing the material to be re-deposited on-site.

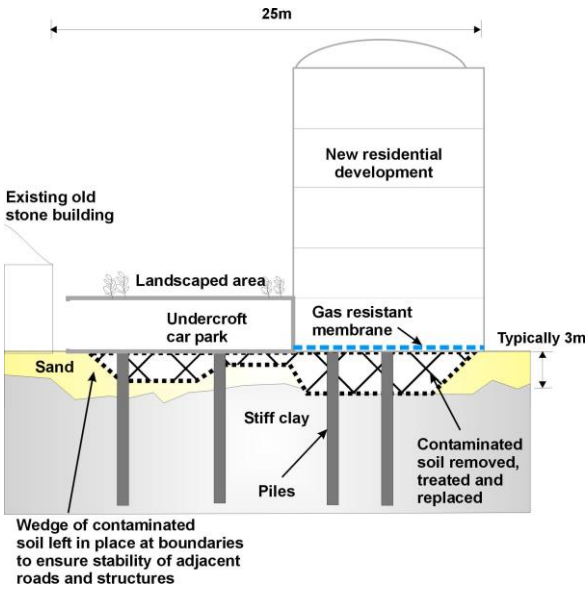

Figure 1 Schematic of completed project.

Table 1 Decision matrix for remediation options

Remediation technique	Cost	Estimated time	Space required	Able to deal with contaminants?	Suitable for ground conditions?	Flexibility	Traffic impact
Stabilisation /solidification	Moderate	2 weeks	Acceptable	Yes	Yes	Very good	Low
Ex-situ bioremediation	Low	6 mths +	Not practical	Yes	Yes	Average	Low
In-situ bioremediation	Moderate	12 mths +	Acceptable	Yes	Not ideal	Poor	Low
Dig and dump	Very high	1 week	Acceptable	Yes	Yes	Very good	High
Soil washing	High	6 weeks	Not practical	Yes	Yes	Average	Moderate
Soil vapour extraction	Moderate	6 to 12 +	Acceptable	Some but not all	Not ideal	Poor	Low

Table 2 – Summary of treated soils leachate results compared to SSTL derived from GW Risk Assessment conducted by White Young Green and agreed with the Environment Agency

Contaminant of Concern	Maximum Soil Concentration (mg/kg)	Site Specific Target Level (µg/l)	DIV for groundwater (µg/l)
Total Petroleum Hydrocarbons	8,736	600	600

Sample Number	Volume (m^3)	TPH Concentration (µg/l)
W01	50	<100
W02	100	<100
W03	200	<100
W04	400	130
W05	600	<100
W06	800	110

SSTL adopted by Envirotreat is equivalent to Dutch Intervention Value for TPH in Groundwater.