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CASE STUDY

E-Clay Stabilisation

Stewart Park Middlesbrough

Client

Middlesbrough moving forward

Main Contractor

Improving our Environment... HELLENS WWW.HELLENS.CO.UK

Site Background & History

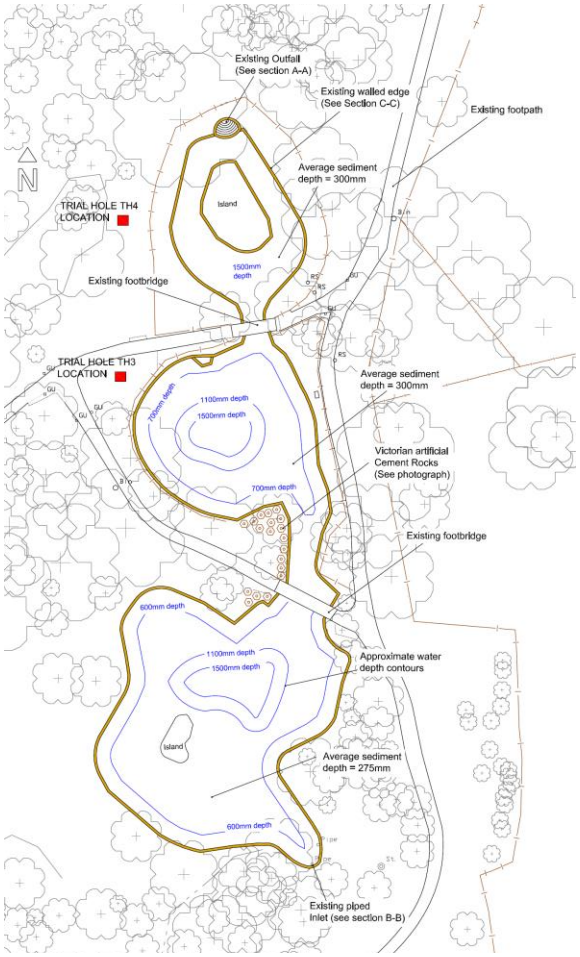
Stewart Park is a public park located in the suburbs of Middlesbrough. The park occupies an area of approximately 47 hectares and comprises of mature mixed woodland, open grass parkland and some sealed roads.

In October 2009 the Heritage Lottery Fund and the Big Lottery Fund announced that Stewart Park had been awarded a grant of circa £4.4M, This grant award underpinned the proposed £8M restoration of the park. The restoration programme included proposed improvements to the ornamental lakes within the park, including the reinstatement of the lakes to their former sizes and improvements to the planting.

The Upper Lakes are a chain of three small ornamental lakes fed from a culverted watercourse sourced from surface water drainage in nearby Marton. There is an additional supply of water from a number of land drains which have been installed in the ground surrounding the lakes. The outlet cascade at the end of the third lake creates a slow current drawing the water from the first lake through to the third lake where it passes through the outlet and is then piped below surface to Ormesby Beck.

The Upper Lakes and their interrelationship is shown in Figure 1.

Figure 1 – Existing Upper Lake Arrangement (Outlet Lake at the Top)



Land and Water Services Limited were commissioned by Middlesbrough Council to undertake a sampling and analysis of the sediment material deposited within the lakes to facilitate future installation of a sustainable urban drainage system within the park. It was considered necessary to carry out restoration of the lakes and to carry out improvements in land drainage in order to prevent flooding occurring in the future. The lakes were heavily laden with sediment and detritus and it was therefore necessary to dredge the lakes to increase water holding capacity.

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Land and Water determined that the sediment material was significantly contaminated with total petroleum hydrocarbons (TPH) and heavy metals, particularly lead and zinc. The samples were deemed hazardous as the concentration of TPH's in all samples was above the 1,000mg/kg threshold stipulated in the Environment Agency's Guidance Document "Hazardous Waste Threshold for Oily Waste and Waste Containing Oil," which is supplementary to Environment Agency Technical Guidance Notes WM2 for the Classification of Hazardous Waste.

Offsite disposal of the contaminated sediments was initially considered. This was discounted by the Council due to the envisaged costs – these costs also needed to include treatment [stabilisation] costs to improve the physical properties of the material to enable handling and transport. The offsite disposal costs were prohibitive notwithstanding the close proximity of hazardous waste landfill sites in the local area.

Hellens therefore commissioned Envirotreat to investigate viable remediation options for the sediments. Envirotreat proposed E-Clay Stabilisation to enable retention and reuse of the material on site.

A possible reuse option was identified as part of the overall park restoration. This involved the construction of a new footpath and earthwork mound requiring fill materials.

It was therefore decided to proceed with E-Clay Stabilisation as the preferred remediation approach.

Remediation Objectives

Envirotreat were commissioned by Hellens to undertake the following:

1. Formulation and approval of a remediation strategy to satisfy planning and EA requirements
2. Management and implementation of the agreed remediation strategy involving the treatment of contaminated sediments to enable reuse on site [utilising E-Clay Stabilisation]
3. Validation of the treated sediments to confirm compliance with the designated remediation criteria for reuse on site (as a substitute for imported fill)
4. Preparation and submission of a full validation report to satisfy the requirements of the Council and the EA

Methodology

Envirotreat produced a Method Statement, outlining the site history, contamination issues, proposed remediation strategy & technical rationale, environmental protection measures required during remediation works and validation protocols for key aspects of the remediation.

At the commencement of the remediation works in December 2010 the weather conditions were extremely adverse and as a consequence the excavation and treatment elements of the works were severely impacted. There was significant snowfall during December and the following January with night temperatures as low as -15^{o}C and daytime temperatures not rising above freezing. These adverse conditions resulted in the sediments being frozen on excavation and within the storage bunds which significantly hampered the natural dewatering of the sediments prior to treatment. The remedial works were also [subsequently] hampered by excess storm water entering the lake system during periods of natural thawing.

The excavated sediments are shown in Figure 2. As can be seen the sediments exhibited high moisture content with minimal physical strength properties.

Figure 2 – Excavated Sediments

The contaminated sediments were treated in batches utilising a predetermined quantity of E-Clay slurry to treat each batch of sediment.

Following treatment the treated sediments were stockpiled and allowed to cure, prior to validation and subsequent reuse.

The treated sediment stockpile is shown in Figure 3 below.

Figure 3 – Treated Sediment Stockpile

The treated volumes were initially estimated to be 521m^3. In practice significantly higher volumes of sediments were excavated and treated from the three lakes, amounting to 1100m^3 in total.

Validation

Following a suitable "curing" period 6 representative samples of the treated sediments were taken for validation purposes. The samples were taken throughout the full period of the remediation works at the agreed sampling frequency of one sample taken for every 200m^3 of treated sediment. The samples were validated by leachate testing – the summary results are shown in Table 1.

Table 1 – Leachate Results

	Screening Threshold Value	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Nickel	30	-	13	15	-	-	-
Chromium	50	-	< 10	< 10	-	-	-
Cadmium	5	-	< 0.8	< 0.8	-	-	-
Copper	2000	-	0.14	0.29	-	-	-
Lead	25	< 0.02	< 10	< 10	< 1	< 1	< 1
Zinc	n/a	0.082	12	320	10.4	4.0	12.0
Arsenic	10	-	< 10	< 10			
Mercury	1	-	< 5	< 5			
TPH	<10	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	30	< 2	< 1	< 1	< 0.1	< 0.1	< 0.1
Toluene	50	< 2	< 1	< 1	< 0.1	< 0.1	< 0.1
Ethylbenzene	20	< 2	< 1	< 1	< 0.1	< 0.1	< 0.1
Xylene	30	< 2	< 1	< 1	< 0.1	< 0.1	< 0.1

All results in µg/l.

Following successful validation the treated sediments were reused on site as shown in Figure 4.

Figure 4 – Reuse of Treated Sediments On-Site

Conclusions

Envirotreat were able to demonstrate through a comprehensive Validation Report that the overall remediation strategy was successfully implemented.

The project has demonstrated a sustainable and commercially viable approach to remediation by the treatment and reuse of materials on site. This approach negated any requirement for offsite disposal of contaminated sediments at a landfill site and additionally reduced the requirement for imported fill materials.

Figure 5 – Artist's Impression of Completed Lake Restoration