

# CASE STUDY

Geo-environmental &  
Geotechnical Ground Investigation

## HMS Ganges, Shotley Gate

**Client**



WAVENSMERE  
HOMES

**Geo-Environmental & Geotechnical  
Consultant**



envirotreat®

### Site Background & History:

One of the most interesting and significant places on the Shotley Peninsula is Shotley Gate, at the very end of the peninsula.

From Shotley Point, there are superb views across the Orwell and Stour Rivers, over to the busy ports of Felixstowe (the largest container port in the country), and to Harwich and Parkeston Quay.

It was at Shotley Point that the wooden ship HMS Ganges was berthed from 1899 to be used as a cadet training ship for the Royal Navy. In 1905 when the Ganges vessel was finally retired (and towed away to Chatham), the training facility, still named HMS Ganges, moved ashore.

The facility remained there until its closure in June 1976, when its training function moved to HMS Raleigh, Torpoint, Cornwall. During its operational period, more than 150,000 Navy recruits passed through the gates of HMS Ganges.

The site later opened as a police training centre, but this too came to an end in the 1990s.

The HMS Ganges site is shown in Figures 1 and 2 below.

Figure 1 – HMS Ganges Site



Figure 2 – HMS Ganges Site



The site extends to approximately 200,000m<sup>2</sup>, with residential development across circa 110,000m<sup>2</sup>. The site is bounded to the west by the existing settlement of Shotley Gate, to the north by agricultural land and to the south and east by King Edward VII Drive, with Shotley Point Yacht Club and the River Orwell beyond. The site generally slopes gradually down from the northwest to the southeast.

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## Project Outline:

Wavensmere Homes, in a joint venture with Galliard Homes, are to build 385 homes on the 60-acre development, which is planned to be called Barrelman's Point. The proposed development is shown in Figure 3 below.

Figure 3 – Proposed Development



Parts of the site had been subject to phases of outline site investigation for 20 years. Envirotreat designed a geo-environmental and geotechnical site investigation for the entire site. This comprised 166 no exploratory holes across 3 weeks of site work. Works were coordinated with the resident ecologist to ensure adequate access and avoidance of harm to the numerous protected species across the site.

## Site Investigation:

The objectives of the site investigation were as follows:

- Update the historical desk study with additional historical site information (Phase 1)
- Undertake a comprehensive intrusive investigation to provide detailed information on the geo-environmental and geotechnical quality of the ground

- Undertake a generic quantitative risk assessment to ascertain whether potentially unacceptable pollutant linkages exist
- Identify any potential geotechnical constraints and provide information to allow geotechnical design
- Complete a remediation strategy to allow the site to be safely developed

Based on the findings of the Phase 1 updated desk-top study, a plan for an intrusive ground investigation was prepared to better understand the risks / linkages indicated.

The intrusive scope of work included for windowless boreholes, cable percussion boreholes, trial pitting, soil laboratory analysis (geo-environmental and geotechnical), soakage testing and assessment of potential soil / groundwater contamination associated with above ground fuel tanks.

The site is mostly underlain by sand and gravel of the Kesgrave Formation, with the London Clay underlying this. The Kesgrave Formation outcrop ends within the site boundary and thus there are areas directly underlain by London Clay. Understanding this geological boundary was key in developing foundations solutions for the site.

The Phase 2 scope of works comprised the following:

- Forming 126 No. trial pits to 3.5m, or natural soils, whichever was shallowest
- Drilling of 6 No. cable percussion boreholes to depths of 15.45m
- Drilling of 34 No. windowless boreholes to 5m or refusal
- Soakage testing of 5no trial pits
- Completion of hand shear vane tests in cohesive soils
- In-situ SPTs (standard penetration tests)
- Installation of water level monitoring points
- Collection of soil samples for geo-environmental and geotechnical laboratory analysis
- Topographic surveying of exploratory holes

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General site coverage was achieved with trial pits due to the speed and low cost. Windowless sampler boreholes were used to obtain in-situ data on the density, and thus bearing capacity of, the granular soils. Selected boreholes were completed with groundwater level monitoring wells.

Deeper cable percussion boreholes were drilled to facilitate piled foundation design. Deepened foundations were likely in parts of the site due to thick Made Ground and the presence of bunkers that were to be removed and infilled prior to development.

Borehole Drilling:

Windowless boreholes were advanced using a tracked windowless drilling rig. The boreholes were initially drilled at 101mm diameter and cased through the Made Ground. Casing in subsequent granular soils was advanced until refusal. Sampling progressed with narrower diameter barrels. Where granular soils could not be cased, boreholes were advanced using a 2m long 47mm barrel.

Cable percussion boreholes were advanced using a cable percussion drilling rig at 150mm diameter. The boreholes were cased through granular soils. The cable percussion borehole installation is shown in Figure 4 below.

Figure 4 – Cable Percussion Borehole Installation



The boreholes were drilling by Endeavour Drilling Ltd.

Groundwater monitoring wells were installed in 20no boreholes and were screened across the Made Ground and granular soils.

Trial Pit Excavations:

Trial pits were excavated using a JCB 3CX. The trial pitting is shown in Figure 5 below.

Figure 5 – Trial Pitting Excavations



Soakage Testing:

Soakage testing was undertaken at 5 No. locations within the Kesgrave Formation – these tests were designed to complement previously undertaken soakage testing. The soakage testing is shown in Figure 6 below.

Figure 6 – Soakage Testing



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### Above Ground Storage Tanks (ASTs):

Four above ground fuel storage tanks were identified during the site walkover. Trial pitting was carried out in the vicinity of the tanks to ascertain the presence of contamination as shown in Figure 7 below.

Figure 7 – Trial pit excavation around ASTs



The extent of the exploratory site investigations is shown in Figure 8 below.

Figure 8 – Extent of Exploratory Locations



### **Reporting:**

On completion of the site work and laboratory testing a detailed Phase 2 Site Investigation report was prepared for the client.

A remediation strategy was also developed based on the findings of the Phase 2 Site investigation.