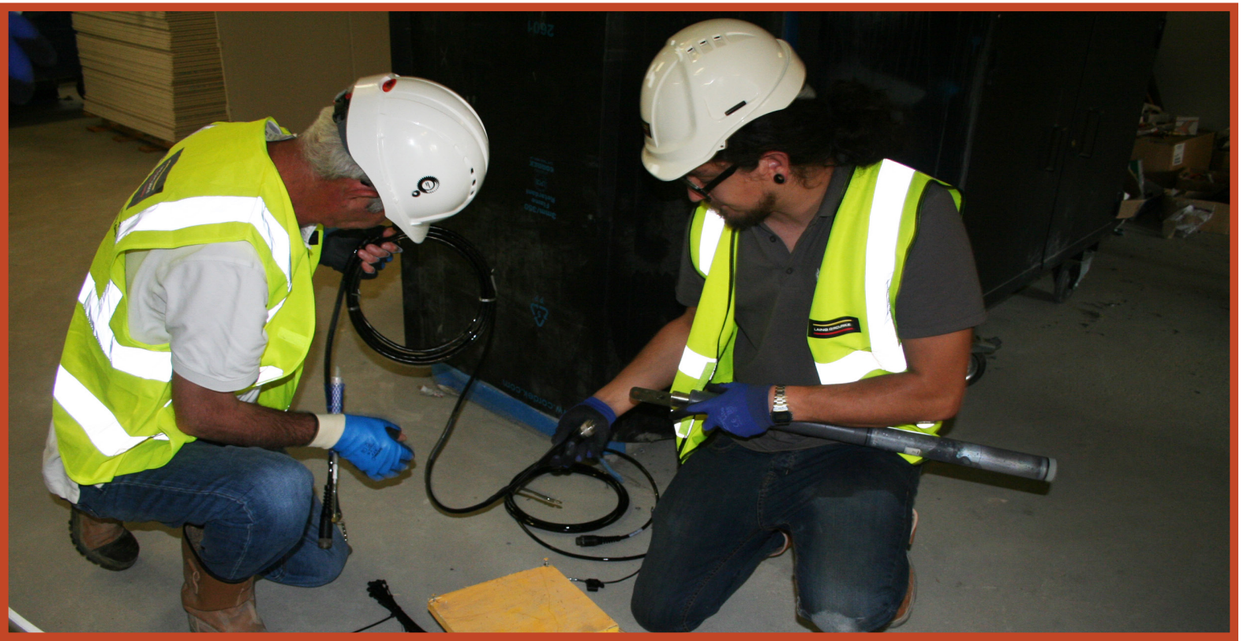
Case Study: Monitoring the Guys Hospital Roman Boat

A recent archaeological project in London required some careful design to allow a monitoring system to be installed around a buried Roman boat. Guys Hospital lies in the shadow of the Shard, adjacent to the River Thames. It has a long history, going back to the original medieval Priory, but in fact earlier archaeological remains lie beneath it, including a Roman boat dating to approx 200AD. The boat was discovered in 1958 and is of a Roman-Celtic design, used for transferring goods from large sea-going vessels inland, and through the channels of Roman Southwark. It has since been legally protected as a scheduled ancient monument, the highest form of designation for historic assets. It has lain quietly five metres below ground for decades, however, with the ever-increasing demand for development land, and the expanding population in London, the boat became threatened in 2009.

Historic England, who oversee protection of scheduled ancient monuments on behalf of the UK Government Department of Culture, Media and Sport were approached by the National Health Service Trust who run Guys Hospital to open discussions about the possibility of constructing a new fourteen-storey cancer centre above the site of the boat as they cannot currently meet the needs of cancer patients in the area. Generally, a request to construct a new building over an entire ancient monument would be met with refusal, owing to the significance afforded to ancient monuments and the presumption in favour of their preservation. Several reasons meant that this case merited additional consideration. Current planning guidance, the National Planning Policy Framework requires that consideration must be given to weighing heritage benefit against social benefit. It also states that developments on scheduled ancient monuments should only be considered in wholly exceptional circumstances. It was felt that this was such a case, based on the obvious social benefit of the provision of a major cancer treatment centre.

Discussions began between the NHS Trust, Historic England and the local authority (the London Borough of Southwark) on whether the boat should be preserved in situ or whether it was conceivable to lift it. Naturally, preservation in situ was the preferred option, following the central core of archaeology; to leave material in the ground, if conditions are stable, and the remains will not deteriorate. As the boat hadn't been seen for some time, and in fact only one end of the boat had ever been excavated, a small test pit was excavated over the projected centre point of the boat to establish whether it survived and what condition it was in. The excavation did indeed come down over the keel of the boat and the oak timbers and iron nails were well preserved. The trench was backfilled after a day of record-making, and negotiations continued.

The use of innovative materials in the building meant that the radioactive equipment needed to treat cancer could be housed above ground, meaning the boat could be left below ground as the requirement for basement space was less than first envisaged. Whilst this sounded good in theory, how would the boat cope with having such a large building constructed on it? The role of Historic England is to ensure scheduled monuments survive unchanged wherever possible, and the boat could be crushed, dewatered or otherwise damaged by such a large building. To permit the construction, firm safeguards needed to be put in place. This of course started with the design of the foundations. Structural engineers from Arup were asked if they could design a scheme which transferred all load away from the boat, and create a piling plan that not only was far enough from the boat not to harm it during construction, but to leave a passage free around the boat. It was decided by Historic England that should there be indications of deterioration that could not be remedied the boat would need to be excavated from under the building, so it was not lost without record. This is the first time nationally, that a 'plan B' has been not only drafted but legally secured for an archaeological site.



Robust monitoring was therefore going to be an essential element of the project, and the Museum of London Archaeology who were advising the NHS called upon the York Archaeological Trust to advise on this element. Head of Conservation, Ian Panter contacted Van Walt Ltd to design the scheme to gather data required by the legal agreement, binding the NHS Trust as part of their permission to construct the building.

Ancient organic remains are notoriously difficult to control in the ground and generally require unchanging fully anoxic conditions to survive. One of the earliest studies for this project was hydrological modelling undertaken by Arup which indicated reasonably stable groundwater conditions, flowing north to south and above the base of the boat. This study also predicted that there was a very small possibility that the construction of the new building could depress the water-table by up to 20mm. The report gave confidence for the project to move forward, and it was decided to make provision to introduce water into the system, firstly by diverting rainwater from the roof of the new building into the ground around the boat, and also to have a tap in the adjacent basement that could feed water in if necessary.

The key was to be reassured that groundwater level and quality were suitable for preservation of the boat. Five dipwells were sunk to a depth of between five and six metres below ground. Each dipwell contains multiple sensor sondes; the 600XL V sonde™ system developed by YSI, recording water level, redox potential, pH, temperature and conductivity (all sondes are fitted with conductivity sensors as standard). At Guys, water level and redox potentials are considered the two critical parameters to record in order to assess the effectiveness of in situ preservation. The advantage of these multiple sensor sondes is that additional probes can be fitted at a later date if necessary, for example, we may need to install a dissolved oxygen sensor, depending upon our interpretation of the recorded data. Each sonde has been adapted to run off a 12 V DC power unit instead of internal batteries (although initially the sondes will be battery powered as the external power supply isn't due to be installed until towards the end of the construction in 2016).

Each sonde is inserted to the base of the dipwell, ensuring the sensors are submerged under water, and suspended by a steel cable secured at the top of each well. At the head of each sonde arrangement is a datalogger storing captured data. Four of the five sondes will require manual download to a laptop or tablet, whilst the fifth unit will be connected to a STORM 3™ telemetry unit (sold by Xylem-WaterLOG) which will transmit live data using a GPRS network direct to a computer housed at Historic England, where staff can check on the status of the below-ground conditions. The boat will be monitored for five years from completion of the building, with a formal review of progress annually. Should all parameters be within the target zones set for water level, redox and pH after five years, monitoring will cease and the site will be deemed stable. The sondes will be recovered, but the dipwells will be capped but not filled. If the monitoring shows conditions are not stable, water will be introduced if necessary (and if it has not been before) and a further three years monitoring will be undertaken. If after 8 years, monitoring shows conditions are still not suitable, the NHS Trust will have one year to plan and implement the excavation of the boat. Many sites in the UK have been instrumented, but none have made provision for excavation should the data indicate conditions are likely to result in deterioration of the archaeology. This is clearly an unsustainable approach, potentially jeopardising significant archaeological sites which are neither comprehensively preserved nor recorded. Therefore this project is an important step forward in archaeological preservation in, in situ cases in the UK.