Wallasea Island Wild Coast Project

Project Background

The Wallasea Island Wild Coast Project is a flagship site for the RSPB who partnered with Crossrail to provide an innovative, sustainable solution in reusing excavated Crossrail construction spoil from across London, to create a new wetland nature reserve. BAM Nuttall was appointed to implement these works, who in turn employed Ecologia as materials management and contamination specialists.

The site is located eight miles north of Southend-on-Sea and covers a total area of 677 hectares of reclaimed saltmarsh. The project is a landmark conservation and engineering scheme for the 21st century, and is the largest of its type in Europe. It combined ecological research and environmental vision with commerce and innovative industrial engineering for the benefit of future generations.

The project is an innovative and progressive approach of how waste material from large scale infrastructure projects can be put to beneficial reuse in a sustainable manner. Crossrail is one of the most significant infrastructure projects undertaken in the UK and includes 42km of new tunnels beneath central London, which has required a materials and logistical management exercise rarely attempted at such a scale in the UK previously.

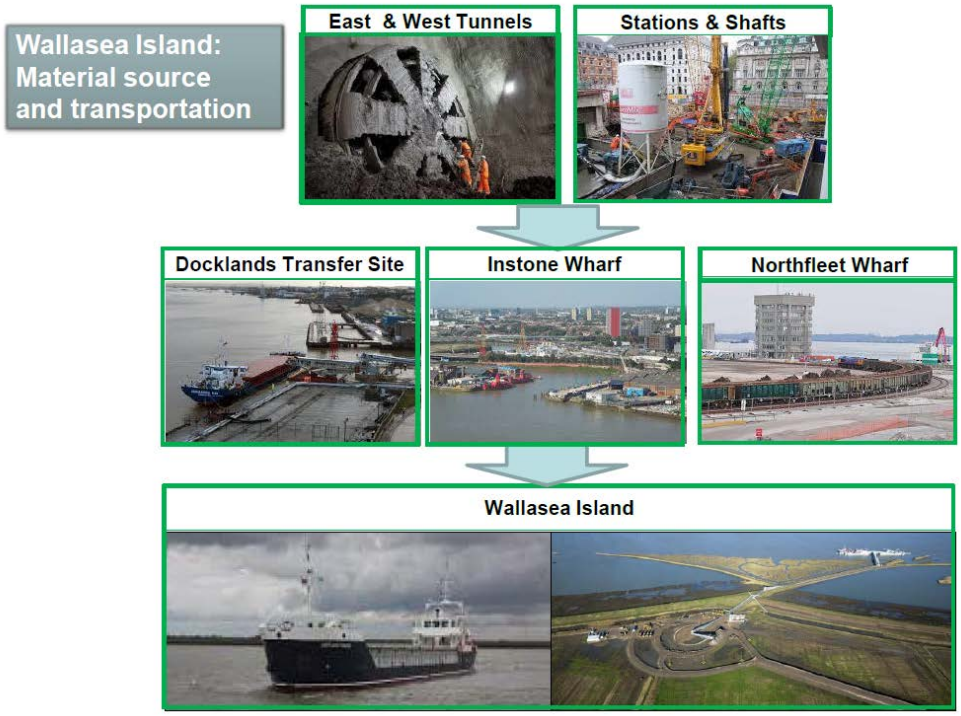
The project was completed 12 months ahead of original programme by BAM Nuttall, with a 'right-first-time' approach and within budget. Phase 1, latterly named 'Jubilee Marsh' by the RSPB was opened to the public earlier than anticipated in September 2015.

The following key outcomes of the project are demonstrated:

- **Innovative thinking and adaptation, rather than proprietary materials used in their usual place**
  - Beneficial and cost effective reuse within a large conservation land reclamation scheme. 3 million tonnes of waste material from the Crossrail Project from across London were reused. Due to the operational constraints and timescales of the scheme these typically would have gone to landfill.
- **Technique or adaptation that can be cost effectively applied to other schemes**
  - The adoption of on-site Rapid Measurement Techniques has been key, providing a cost effective solution to large scale materials testing and allowed a robust but fast turnaround of materials analysis. This enabled efficient loading and unloading of shipping which otherwise would have been a major constraint.
  - A computerised waste tracking system allowed more efficient gate acceptance procedures and supported a, full chain of custody in relation to materials tracking. This was fundamental in managing the large amounts of spoil and hundreds of truck movements per day.
  - The project has demonstrated that methods of non-road haulage / marine transportation can be a feasible, efficient, cost effective and innovative option for future large-scale infrastructure projects.
- **Sustainable reuse of materials within the economic timescale of the needs of the project**
  - Transportation of excavated Crossrail spoil by water to Wallasea Island significantly reduced the amount of heavy transport that would have been required across the London and Essex road network.
- **Reuse of Materials under the CL:AIRE Definition of Waste: Development Industry Code of Practice**
  - The scheme design largely predated the Code of Practice's common use which was at the time in its early days. Due to the complexity and scale of the scheme, a bespoke risk based Environmental Permit for waste recovery was considered the most appropriate approach. The approach was adopted following discussion and agreement with the Environment Agency.
  - A robust materials management (Waste Acceptance Procedure) and verification process was derived and implemented.

Approach

Crossrail tunnelling works commenced in 2012 and were planned to maximise the use of non-road transport for the removal of excavated material for onward transportation to Wallasea Island. As a result Crossrail spoil was transported by a mix of conveyor, trucks and freight trains to transfer sites and then by ship to Wallasea Island.



The approach to materials management was initially investigated prior to the adoption of the *CL:AIRE Definition of Waste: Development Industry Code of Practice* as common practice. Although the Code of Practice had been launched by the time of the project, the designers assessed its suitability given the multiple, complex waste streams and the high environmental sensitivity of Wallasea Island. In consultation with the Environment Agency a bespoke risk based Environmental Permit for waste recovery was adopted. The Permit was obtained in 2012. This allowed the permanent deposition of Crossrail spoil on the basis of the clay material placed being similar in nature to the main geological formation underneath Wallasea Island. This therefore maintained the hydrogeological characteristics and ground chemistry of the site. The Wallasea Island *Waste Acceptance Procedure* (WAP) was subsequently produced to manage excavated Crossrail spoil in support of the Environmental Permit. In general the approach comprised:

- No specific controls for deep naturally occurring soils from the main tunnelling operations, subject to a number of exceptions such as in faulting areas; and,
- Materials management controls for materials originating from stations and shafts at greater risk of historical contamination.

The WAP approach was underpinned with the agreement of the Environment Agency subject to the following principles:

- Natural uncontaminated excavated material originating below 5m of Clay; or, where a Desktop study shows no risk of contamination, did not require testing and could be deposited anywhere at Wallasea Island.
- Material suspected of possible contamination that passed specifically derived Crossrail WAC levels, and did not include discernible concentrations of hazardous substances, could be deposited anywhere at Wallasea Island.
- Material suspected of possible contamination that passed Crossrail WAC levels, but might have contain low levels of hazardous substances, could only be suitable if placed above the water table and/or above placed clean London Clay.
- Material suspected of possible contamination that failed Crossrail WAC levels, were not suitable for use under the agreed approach, and were subject to additional risk assessment.

The WAP was continually updated during the project by Crossrail; its advisors; and, BAM / Ecologia to maintain its currency and a degree of flexibility. This covered for example the approved use of additives in the tunnelling works; and, recognising that London Clay (and other natural soils) may contain elevated levels of naturally occurring elements. In relation to the latter a hydrological risk assessment was undertaken in order to derive Crossrail specific Waste Acceptance Criteria (WAC) levels.

The WAP consisted of three steps to identify and periodically check the main characteristics of the waste:

LEVEL 1 - Basic Characterisation

- Undertaken at the point of excavation the material was assessed (desk study) where 5m of clay cover was not present.
- If a risk of contamination was identified a Hazardous Properties Assessment was undertaken.
- An assessment against the Crossrail specific WAC was undertaken.
- To record the results of the above, a Waste Information Form (WIF) was completed for the transfer facility to review the acceptability of the materials for deposition at Wallasea Island.

LEVEL 2 - Compliance Checking

- Periodic testing at the point of excavation and an assessment of hazardous properties and compliance with the Crossrail derived WAC.

LEVEL 3 - On-site Verification

- Regular testing at Docklands Transfer Site (DTS) where excavated materials are ostensibly from stations and shafts where the risk of contamination is greater.

Implementation

The Docklands Transfer Site (DTS) was constructed by BAM Nuttall for the receipt of Crossrail spoil. This was mainly from stations and shafts sites with a higher risk of contamination than the tunnelled materials, and an Environmental Permit was obtained for its operation. The DTS received 1.7 million tonnes of material during the project. Multiple waste streams with several hundred lorry deliveries a day meant a bespoke automated booking system (Codegate Waste Booking System) was selected by BAM Nuttall, to track loads. This replaced more traditional paper based transfer / consignment note systems which would have been unmanageable given the timescales and volume of information. All consigning sites were required to book in loads, and a rapid scanning system was employed on all lorries which logged the incoming loads. This allowed a fast turnaround avoiding delays and back ups at the gate.

Level 2 compliance checking was also undertaken at DTS on material from stations and shafts where the risk of contamination was greater. Incoming loads were randomly selected for testing using Codegate with over 10% of all loads tested during the project.

Due to the vast number of samples requiring testing it was not economically feasible to send soil samples to a traditional laboratory. The use of Rapid Measurement Testing (RMT) techniques allowed a large volume of testing to be economically undertaken. To support the data collection and allow verification a temporary on site laboratory was set up. This employed RMT techniques for heavy metals, hydrocarbons and chlorinated solvents. This provided a far larger data set than would have been possible with traditional laboratory testing approaches, and as such provided a greater level of robustness and surety in relation to materials control, quality and verification.

In total over 12,500 samples were analysed using RMT techniques with a 24 hour turnaround from receipt of spoil to ship loading during the project using the following equipment:

- QED HC-1 UVF hydrocarbon analyser.
- AQR Color-Tec for chlorinated solvent analysis.
- XRF for heavy metals testing.

All the results were continuously checked and assessed by Ecologia, in order to identify any exceedances of the thresholds, reject unsuitable loads and to monitor trends in the data / material.

As part of the WAP each Crossrail site producing spoil for import to Wallasea Island was required to complete a Waste Information Form (WIF) detailing the material and providing any supporting information. These were reviewed by Ecologia for acceptance before transportation to Wallasea Island.

Planning restrictions at Wallasea Island prohibited the import of material by road, and indeed the road network along the narrow lanes would not have accommodated such traffic. Therefore transportation by ship was considered the most feasible option. Movement of excavated material from London on this scale by water had never been attempted before. A number of 2,000t specialist cargo ships were used to move 3 million tonnes of Crossrail spoil during the project. This resulted in 1,500 voyages over 2½ years on a continual 24 hour basis. Marine transport prevented over 150,000 lorry journeys equivalent to 12 million road miles by the end of the project.

In order to receive the spoil BAM Nuttall constructed an unloading facility at Wallasea Island. This comprised a temporary pontoon with a half-mile conveyor system to carry material on to the land, threaded through protected RSPB breeding grounds. The conveyor deposited the unloaded material via a radial stacker and earthworks plant transported the material to be placed in the permanent works. The locations of placed material were designed as part of an innovative hydraulic model to allow 1.1 million m^3 of tidal flow, creating pools, lagoons and channels to offer varied habitats for various breeds of migratory birds.

Initial problems were encountered with the heavy clay consistency of the tunnelled material which clogged and blocked the unloading facility. However, modifications were quickly introduced to the material handling equipment to overcome this, with a series of augers installed at intersections of the conveyor to prevent blockages. A system of transporting a mixture of cohesive with dryer excavated materials resulted in better handling properties for the materials unloaded onto the conveyor. This also resulted in an increase in productivity and cost effectiveness. All facets of the system including analysis of the unloading / loading times of the vessels were continually monitored and improved, providing reliability of service and maximising throughput resulting in an average 32,000 tonnes of import per week.

Ultimately on completion of the works, BAM Nuttall successfully surrendered the Environmental Permit for Wallasea Island. This was achieved by demonstrating compliance with all the permits requirements and by Ecologia preparing Verification Reports for Wallasea Island compliance testing and a separate Consolidated Report in relation to the RMT testing at DTS.

Conclusion

The Wallasea Island Wild Coast Project has demonstrated that large scale infrastructure projects with significant volumes of excavated waste materials can be cost effectively recovered using innovative methods.

A combination of factors have made this possible ranging from using on site RMT techniques and computerised tracking systems to provide efficient and fast turnaround of materials, to the use of alternative transport options to road haulage to provide sustainable and safe solutions. Regulatory and stakeholder engagement has also been key in ensuring that the systems put in place are robust and appropriate given the large scale of the scheme and the complexity of the waste streams.