

## The Greening of Brownfield Technology

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Brownfields Renewal

For many years, construction boomed in Boston. Transportation projects such as the Central Artery/Third Harbor Tunnel project, known as the “Big Dig,” and the Massachusetts Bay Transit Authority (MBTA) Silverline Transit Line entailed the construction of thousands of feet of tunnels beneath an active, bustling city.

New office buildings, healthcare and academic complexes, apartments and condominiums, hotels and mixed-use buildings were erected throughout the city. Because Boston is a dense, highly-developed urban area, this construction often includes going underground—sometimes very deep—which almost always means managing contaminated soils. And in Massachusetts, it means complying with complex state regulations for the cleanup of contaminated properties.

Boston is a city created on filled land. The original 1630 Boston Peninsula was approximately 487 acres and is now surrounded by approximately 500 acres of manmade land, including the areas known as the Back Bay, Beacon Hill and the South End.

Landmaking was not limited to downtown Boston and an additional 5,000 acres of Boston’s communities were generated for development, including Charlestown, East Boston, South Boston and Dorchester. This land was created by a wide assortment of fill material such as dredge spoil, building demolition material, wood and coal ash and other by-products of industrial activities. This historic fill often contained a wide variety of contaminants, such as polycyclic aromatic hydrocarbons (PAHs), heavy metals including lead, arsenic and chromium and petroleum constituents. Managing this fill during modern construction is a critical element of building in Boston.

In Massachusetts, contaminated properties are cleaned up and developed under Chapter 21E of the Massachusetts General Laws and the Massachusetts Contingency Plan (MCP) regulations. Almost 20 years ago, the state created a “privatized program” to clean up hazardous waste, including brownfields sites. Licensed Site Professionals (LSPs) are engineers and scientists licensed by the state who are specially trained to oversee the investigation and cleanup of contaminated properties. An owner will hire an LSP to oversee construction on their land and then the LSP submits a report to the state at key stages in the cleanup process, including a final statement when the cleanup is complete. Construction on these historic fill and brownfields sites typically requires an LSP to file cleanup plans to the Department of Environmental Protection (DEP),

document the cleanup, and then sign-off on it.

### Soil management plan

Building sites in Boston typically feature tight spaces where the footprint of the proposed building often occupies the entire lot. Even if a small portion of the site remains without a structure, the opportunities for placing excess fill and raising site grades are very limited. Soil needs to be excavated minimally for foundation elements and if underground parking is constructed, tens of thousands of cubic yards of soil will need to be removed from the site.

The soil, even if it is not significantly contaminated by a known release, such as spill or a leaking underground storage tank, is likely historic fill requiring characterization and controlled off-site disposal. Although these conditions are typically “background” and are similar on surrounding properties, the concentrations of contaminants often trigger the reporting requirements of the MCP. Even if the available reporting exemptions can be used, off-site disposal of excess soil from a site must still be controlled.

A well-designed and comprehensive “soil management plan” that accurately characterizes soils for off-site disposal is critical in managing the substantial costs of soil disposal by defining the quantity of soils to be disposed. Disposal of soil off-site also requires an LSP to sign-off on most of the transport



A view of the Boston East parcel from Boston’s Inner Harbor. The parcel is 3.5 acres which will become a condominium development, with a portion remaining for use as a marine facility. Visible in this photograph are the remains of the drydock system, and the marine rail. Portions of these systems will be left in place to retain the nautical feel of the property. *photo credit: Thomas Barrasso, City of Boston Department of Neighborhood Development*

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paperwork.

To dispose of soil off-site in Massachusetts, soil must be well characterized, which means that it typically must be collected from soil every 500 cubic yards. Comprehensive in situ site characterization programs are normally completed early in the development process so that soils can be excavated and loaded directly onto trucks for disposal. Although in situ programs are more expensive than sampling stockpiled soils, most urban sites don't have room for stockpiles of soils awaiting laboratory testing results. In situ characterization also eliminates the need for a contractor to handle soils twice. Depending on the testing results, historic fill and other types of contaminated soils may be re-used as landfill cover, recycled at asphalt batching plants, disposed of at landfills or even disposed of as hazardous wastes.

Lead found in historic fill may cause the soil to be characterized as waste, which requires in situ soil stabilization prior to excavation. The re-use criteria for soil at Massachusetts landfills is fairly conservative and relatively low levels of total PAHs or metals may preclude in-state disposal options, making more expensive out-of-state disposal the requirement.

Each re-use and disposal option has a cost associated with it, which re-use escalates as the more the soil is contaminated and must be handled further and further away from the point of generation. Costs for in situ characterization and off-site disposal escalate substantially if polychlorinated biphenyls (PCBs), requiring compliance not only with the MCP but also the Toxic Substances Control Act (TSCA), are encountered.

Construction of two or three levels of underground parking, often a necessity for Boston building projects, can incur millions of dollars in off-site soil disposal costs. Some project proponents may not adequately account for the costs of soil disposal, scrambling to cover these unanticipated costs.

Although comprehensive pre-characterization is often adequate enough to categorize soils for off-site disposal, it doesn't completely remove the uncertainties of underground construction. Once excavation begins, particularly on historic and industrial sites, unknown structures such as underground storage tanks (USTs), buried debris, concrete vaults and other unknowns may be encountered. These encounters often trigger new regulatory reporting and approval requirements, thus slowing down construction and increasing costs.

In some cases, removal of all contaminated soils may not be required. The MCP is a risk-based cleanup system and cleanup goals are established based on how the property will be used. Usually the less sensitive the use of the property, the less cleanup is necessary. Cleaning up an industrial property for re-use as a commercial building often requires less cleanup than for a property slated for residential development. The degree of cleanup reflects how the property will be used, now and in the future, and this use is locked in by a deed restriction, which is known as an Activity and Use Limitation (AUL).

### **Various treatment options**

Various strategies are employed for managing groundwater



The property is vacant with no buildings, but the remains of a once thriving drydock. Every kind of marine industry was once located on the parcel, from shipbuilding, blacksmiths, boiler works, and fuel storage. The entire harbor area of East Boston was once home to renowned ship builder Donald McKay and the great clipper ships, like the Flying Cloud. *photo credit: Thomas Barrasso, City of Boston Department of Neighborhood Development*

dewatering effluent. The simplest solution is to recharge dewatering product directly back into the ground on site. When this is not possible, the dewatering effluent must be permitted for discharge to the area's waterways or to the local treatment works, and typically needs to be treated and monitored. Often stringent effluent limitations are placed on the discharge, requiring treatment for solids, metals, petroleum and volatile organic compounds (VOCs) under the oversight of a licensed treatment plant operator.

Properties throughout Boston are contaminated with VOCs from historic commercial or industrial operations. In addition to managing soil and groundwater contamination, consideration must be given to the potential vapor intrusion pathway. To mitigate these contaminants, strategies such as vapor barriers and sub-slab venting systems can be designed into new buildings or renovations, and once these measures have been taken, post-construction monitoring may be necessary to demonstrate effectiveness.

Any underground construction, particularly in urban environments, can encounter contamination. However, recognizing the potential for contamination, even in historic fill, and incorporating remedial plans into the design and construction of the project is necessary to control costs and avoid construction schedule delays. Being prepared to manage and dispose of contaminated soil, treat and discharge dewatering effluent and mitigate vapors is critical for a successful project. Like other underground constraints, contamination is just another site condition, and with the proper preparation and due diligence, a solution can be planned, engineered and incorporated into the construction project.