

## Brownfield Case Study

Imagine that you are a member of a neighborhood association in your community.

You and the other members of your association have worked hard to improve the quality of life for people living in your community. Your group has worked to rehabilitate apartments and homes so that families with low incomes can have a safe and comfortable place to live. You have also helped local businesses and schools provide job training, English-as-a-second-language education, and jobs for local residents. Twice a year, you put on "Neighborhood Days," where people pitch in to clean up the neighborhood and then come together for a community celebration. Your neighborhood association has been around for a long time, and you are proud to be part of such a well-respected group.

Recently, Ileana and Thomas West, two long-time community members and owners of a vacant lot in the neighborhood, made a proposal to your group. Since the Wests closed down their trucking company 17 years ago, the 2.5-acre (equivalent to about two football fields) lot on

which it stood has been unused. When they were in business, the Wests used the site to maintain their trucks and trailers. The Wests want to sell this property to your neighborhood association for a low price so it can be used in a way that benefits the whole community.

Your association has many ideas and plans for potential uses of this property, and you appreciate the Wests' generosity in offering such a low sale price. The only problem with the sale is that the soil on the site (and possibly the ground water) may be contaminated from the oil, cleaners, fuel, and other products used to maintain the trucks.

A friend from the city's Department of Economic Development told you that your community development corporation might be able to get federal, state, and city funding and technical assistance for "brownfields" to help you figure out whether the site is contaminated, clean it up, and put it back to work for the community. A brownfield is an abandoned, idled, or underused piece of industrial or commercial land that is environmentally contaminated or is believed to be so. Brownfield sites sometimes also include buildings.

Because a property's current owner is responsible for cleaning up a contaminated site, no matter who caused the pollution in the first place, most people and companies are not willing to buy sites that may be contaminated. Many property owners cannot afford to pay for cleanup, are unable to sell the land, and end up abandoning these sites. Since 1995, the U.S. Environmental Protection Agency (EPA) has been administering the "Brownfield Initiative," a government-led effort to help clean up these properties and put them back into productive use.

For the purposes of this exercise, assume that your city has a Brownfields Redevelopment Program that receives money from the DPA. Staff in that office help people through the process of cleaning up and redeveloping brownfields. You learn that the first step is to do a "site investigation" to learn more about the contamination at the vacant lot. The next step is to develop a cleanup (or "remediation") plan that will prepare the site for its future use. Then, you will contract with companies to complete the cleanup. Oftentimes, the cost of cleanup is negotiated into the purchase price of the property. Once cleaned, the site can be used again.



*The Property at 17 Eastwood in Houston, TX prior to redevelopment.*  
COURTESY: CITY OF HOUSTON'S BROWNFIELDS REDEVELOPMENT PROGRAM



## Brownfield Case Study (con't.)

You have volunteered to be a part of the committee that works with Ileana and Thomas West, the city's brownfield initiative, the contractors, and the whole community to complete the cleanup and make sure the now-vacant lot is used to the benefit of your neighborhood.

Your committee will develop a proposal based on the results of the site investigation that includes a recommended cleanup method and future use for the site. Your teacher will give you the information you need to develop your proposal.

Your proposal should include:

1. A recommended cleanup plan that fits the site and the extent of contamination, along with an explanation of your reasons for choosing this approach. Your plan may incorporate more than one cleanup option. Use the information on the *Property Site Investigation Results* and *Cleanup Options* sheets.
2. A recommended future use for this site and an explanation of your reasons for choosing this use. In public meetings, residents of your neighborhood have come up with several ideas that are described in *Community Ideas for Site Use*. Use these ideas or come up with your own that reflect the best use of this 2.5-acre site for your community.
3. Any questions your committee may have. Just as in a real committee situation, you may not have complete information in this activity. Include in your proposal questions or areas where you need more research or information.

### Vocabulary used in *Cleanup Options* descriptions

**bioremediation**—using biological processes to remove contaminants from a polluted site

**carbon filtration process**—a process using carbon derived from coal, wood, and coconut shells to absorb and screen out contaminants

**contaminant**—any substance that enters a system (the environment, the human body, etc.) where it is not normally found

**degrade**—to break down

**excavation**—the digging or scooping out of soil

**in situ**—in its original or natural place or position

**microorganisms**—any living thing too small to be seen with the unaided eye

**organic**—referring to or derived from living organisms; in chemistry, any compound containing carbon

**petroleum hydrocarbons**—a family of chemical compounds derived from crude oil and composed of primarily hydrogen and carbon atoms

**phytoremediation**—using living plants to remove contaminants from a polluted site

**pollutant**—any introduced gas, liquid, or solid that makes a resource less useful or unfit for a specific purpose

**saturated**—1. thoroughly or completely filled; 2. thoroughly soaked with water, or wet

**toxic**—poisonous

**unsaturated**—not saturated

**vapor**—a substance in gaseous form

**vaporize**—to become converted into vapor

**volatile**—evaporating rapidly; passing off readily in the form of a vapor



## Property Site Investigation Results

### Scenario #1

**Property:** Former West truck maintenance yard

**Site condition:** Vacant

**Buildings:** None

**Total acres:** 2.5

**Total acres contaminated:** 2

**Contaminants identified:** Low levels of lead, arsenic, chromium, and petroleum hydrocarbons

**Soil contamination:** Contamination confined to top 12 inches of soil across the site. Contaminant levels exceed human health standards and must be cleaned up.

**Ground water:** Low levels of petroleum hydrocarbons found. Contaminant levels are below human health standards. Cleanup is not required.

### Scenario #2

**Property:** Former West truck maintenance yard

**Site condition:** Vacant

**Buildings:** None

**Total acres:** 2.5

**Total acres contaminated:** 2

**Contaminants identified:** Low levels of lead, arsenic, chromium, and petroleum hydrocarbons

**Soil contamination:** Contamination confined to top 12 inches of soil across the site. Contaminant levels exceed human health standards and must be cleaned up.

**Ground water:** Petroleum hydrocarbons found in the ground water under the site. Contaminant levels exceed human health standards and must be cleaned up.

### Scenario #3

**Property:** Former West truck maintenance yard

**Site condition:** Vacant

**Buildings:** None

**Total acres:** 2.5

**Total acres contaminated:** 2

**Contaminants identified:** High levels of lead, arsenic, chromium, and petroleum hydrocarbons

**Soil contamination:** Contamination mostly confined to top 3 feet of soil across the site, with deeper contamination reaching down to the water table in several places. Contaminant levels exceed human health standards and must be cleaned up.

**Ground water:** Petroleum hydrocarbons found in the ground water under the site. Contaminant levels exceed human health standards and must be cleaned up.



## Cleanup Options

### EXCAVATION AND OFF-SITE DISPOSAL

**Used for:** Soil

**Description:** Contaminated soil is dug up with heavy equipment and then trucked to a special landfill for hazardous waste. Approved landfills are designed to prevent contaminants from escaping into ground water, surface water, or the surrounding air and must be maintained forever.

**Benefits:**

- It is a simple process with proven procedures.
- It removes the source of contamination from the community quickly and completely.

**Drawbacks and limitations:**

- Excavation stirs up the soil, which can release dust, particles of heavy metals, and vaporized petroleum hydrocarbons into the air.
- It is more costly than other cleanup options when a large volume of soil is contaminated.
- Excavating saturated soils below the water table changes the natural flow of ground water and requires the additional expense of bringing in fill from a different site to avoid creating a pond or a boggy area.

### SOIL VAPOR EXTRACTION

**Used for:** Soil

**Description:** Vapors are pumped out of the soil through a system of underground wells. Air injection wells or air vents are sometimes used to increase the natural flow of air through the soil, boosting the rate at which the contaminants vaporize. Once pumped out of the ground, the vapors are treated, often with a carbon filtration process.

**Benefits:**

- It is a relatively simple and quick process.
- It can be used in combination with air sparging (see the "AIR SPARGING" card for details), a similar technique that cleans ground water.
- It provides an oxygen source that helps the phytoremediation of some contaminants (see the "PHYTOREMEDIATION" card for details).

**Drawbacks and limitations:**

- It can be used only in unsaturated soils.
- It works best for volatile organic compounds (compounds that easily turn into vapor form) such as petroleum hydrocarbons. It's not effective for removing heavy metals.

### AIR SPARGING

**Used for:** Ground water

**Description:** Air is pumped into the saturated zone to help vaporize the contaminants. Vapors then travel out of the saturated zone and into the unsaturated soils above, where they are pumped from the soil through a system of soil vapor extraction wells (see the "SOIL VAPOR EXTRACTION" card for more details).

**Benefits:**

- It is a relatively simple and quick process that can be combined with soil vapor extraction to clean both soil and ground water.
- It provides an oxygen source that helps the bioremediation of some contaminants (see the "IN SITU BIOREMEDIATION" card for more details).

**Drawbacks and limitations:**

- It works best for volatile organic compounds (compounds that easily turn into vapor form) such as petroleum hydrocarbons. It's not effective for removing heavy metals.



### SOIL STABILIZATION

**Used for:** Soil

**Description:** Contaminated soil is excavated and mixed with cement, which is used to create the concrete foundations for buildings erected on the site. Contaminants are bound in the concrete and prevented from being spread by water traveling through the soil.

**Benefits:**

- It keeps contaminated soil on site, eliminating the need to dispose of it in an approved landfill.
- It makes use of contaminated soil.

**Drawbacks and limitations:**

- Excavation stirs up the soil, which can release dust, particles of heavy metals, and vaporized petroleum hydrocarbons into the air.
- Excavating saturated soils below the water table changes the natural flow of ground water and requires an additional expense of bringing in fill from a different site to avoid creating a pond or a boggy area.
- This method usually works best for smaller volumes of soil because building foundations are of a limited size.

### PHYTOREMEDIATION

**Used for:** Soil, ground water

**Description:** Selected plant species that remove pollutants from soil and/or water are planted at contaminated sites. These plants take up organic pollutants (such as petroleum hydrocarbons from soil or water) and break them down into simple nontoxic molecules (such as carbon dioxide and water). Plants also take up metals and store them in their tissues. After the plants are allowed to grow, they are harvested and then burned or composted.

**Benefits:**

- It can be used to clean up metals, petroleum hydrocarbons, and other contaminants.
- It is inexpensive, aesthetically pleasing, and powered directly by solar energy.

**Drawbacks and limitations:**

- It takes a long time—sometimes years—to clean up contaminants.
- It works only on sites with shallow, low-to-moderate contaminant levels. Contaminants deep below ground are out of the range of most plant roots, and high contaminant levels can be toxic to plants.
- Because the plants used in phytoremediation are not intended for use as animal feed, the effects on wildlife that may graze on them is not well documented. Despite this lack of documentation, wildlife could be at risk if they graze on plant parts that store contaminants such as heavy metals. For example, the toxic metal mercury is known to pass up the food chain and be lethal.

### IN SITU (in place) BIOREMEDIATION

**Used for:** Soil, ground water

**Description:** Microorganisms such as yeast, fungi, or bacteria are used to break down contaminants into less toxic or nontoxic substances. Soil bioremediation often involves providing oxygen to encourage the growth of naturally occurring microorganisms by circulating air through the soil or injecting hydrogen peroxide into the ground. Ground water may be bioremediated by pumping some contaminated water from the ground; adding nutrients, an oxygen source, and/or additional microorganisms to the water; and then pumping the water back into the ground where the microorganisms degrade the contaminants. Because this “conditioned” water flows through the soil before reaching the saturated zone, this technology cleans both soil and ground water.

**Benefits:**

- Soil or ground water is treated in place instead of being excavated or pumped from the ground to be treated.
- It is generally less expensive than methods that require excavation and large-scale pumping.
- It enhances natural processes.

**Drawbacks and limitations:**

- It can be used to clean up organic compounds such as petroleum hydrocarbons, but it does not work for metals.
- Effectiveness is limited at sites with high concentrations of heavy metals because these compounds are toxic to the microorganisms.



## Community Ideas for Site Use

### Community Gardens and a Playground

Some people want to see this lot turned into garden plots that community members can use to grow their own food and flowers. Students from the local schools could help do the work needed to establish the garden plots, and classes could have their own plots that they use to learn about biology. Adding a playground would give neighborhood children a safe place to play and would help turn the vacant lot into a community gathering place.

### Manufacturing Facility

Some people want to find or start a company to build a manufacturing plant on the site. Local residents could be employed in the construction of the plant, and once it's completed, they could apply for jobs there. Having a facility like this in the neighborhood would mean that more community members could find work close to home instead of having to commute to jobs in other parts of the city.

### Mixed-Use Commercial and Residential

Some people want to build a combination of stores, offices, and residences such as apartments or townhouses on the property. Local residents could help to design and build the development, and they could also work in the shops and offices that lease space there or open their own businesses. Building new apartments or townhouses would increase the number of attractive places to live in the neighborhood.

### Movie Theater

Some people want to build a movie theater on this lot. A theater would provide entertainment for everyone in the neighborhood and even attract people from outside the neighborhood. People going to the theater would also give local restaurants and coffee shops more business. Community residents could be employed in the construction of the theater, and it could provide good part-time jobs for local youth.

### Senior Housing and Adult Day Care

Some people want to build housing for older community members so those with low incomes can have a good place to live that they can afford. Along with the apartments, they would like to build a center where older adults could be taken care of during the day while their families or other people who normally care for them are at work or doing errands. More and more people could use help caring for elderly family members.

### Community Center

Some people want to build a community center where all kinds of job training and classes for adults and children could be offered. The center could provide recreational and after-school programs as well as a meeting place for neighborhood groups. The community center could be a place where people from all over the neighborhood could come together.

### Other

Come up with your own idea for using the site after it has been cleaned up so it can benefit the community.



## The Rest of the Story

*The brownfield case study is based on a real site in Houston, Texas. It's known by its address, "117 Eastwood."*

Once a vehicle maintenance facility for a trucking company, 117 Eastwood sat vacant for 17 years before the owners approached a nonprofit community group called the Latino Learning Center about buying the property. The owners knew that the Latino Learning Center had been looking for land in the neighborhood where they could build senior housing, an adult day care center, and a community education and training center. The owners wanted the land to be cleaned up and used for the benefit of the community.

Because no one knew how badly contaminated the site was, the first step was to do a thorough environmental assessment. With help from Houston's Brownfields Redevelopment Program, the property owners and the Latino Learning Center confirmed that both the soil and ground water at the site were polluted. There were low levels of heavy metals such as lead, arsenic, and chromium, as well as substances called petroleum hydrocarbons, all of which were related to the past use of the site. Fortunately, the contamination was not severe. The soil contamination was limited to the top foot of soil across two acres of the site. Although pollutants were detected in the ground water, none were at high enough levels to require cleanup.

An environmental consulting firm helped the Learning Center and the property owners select excavation and off-site disposal as the cleanup method for the contaminated soils at the site. Because the contaminated layer was so shallow, excavation with heavy equipment was easy, and because the amount of soil to be moved to an approved landfill was relatively small, the method was cost-effective. It was also fast, which was important to the property owners, who were eager to sell the land, and to the Latino Learning Center, which intended to begin construction quickly.

The property owner paid for cleaning up the site and then sold the land to the Latino Learning Center. Construction of a 65-unit housing complex for senior citizens was completed in September 2000. A senior health care center, adult day care facilities, and a new community center will soon be constructed. The community center will include classrooms, recreational facilities, a large kitchen and dining hall, and a computer laboratory.

Even though the Latino Learning Center is less than half finished with the whole project, community members are already excited about the new addition to their neighborhood. Over time, the Eastwood redevelopment project will:

- create 150 construction jobs, at least half of which are set aside for local residents.
- provide 140 students with access to math, computer science, secretarial, and other classes.
- offer affordable housing to the growing elderly population.
- create five new full-time jobs for community residents.

It's no wonder that residents of Houston's East End are excited about what's been done to turn a vacant lot into such a positive addition to their community.



*A senior housing development now stands on the once-idle lot at 117 Eastwood in Houston, TX.*  
COURTESY: CITY OF HOUSTON'S BROWNFIELDS REDEVELOPMENT PROGRAM

