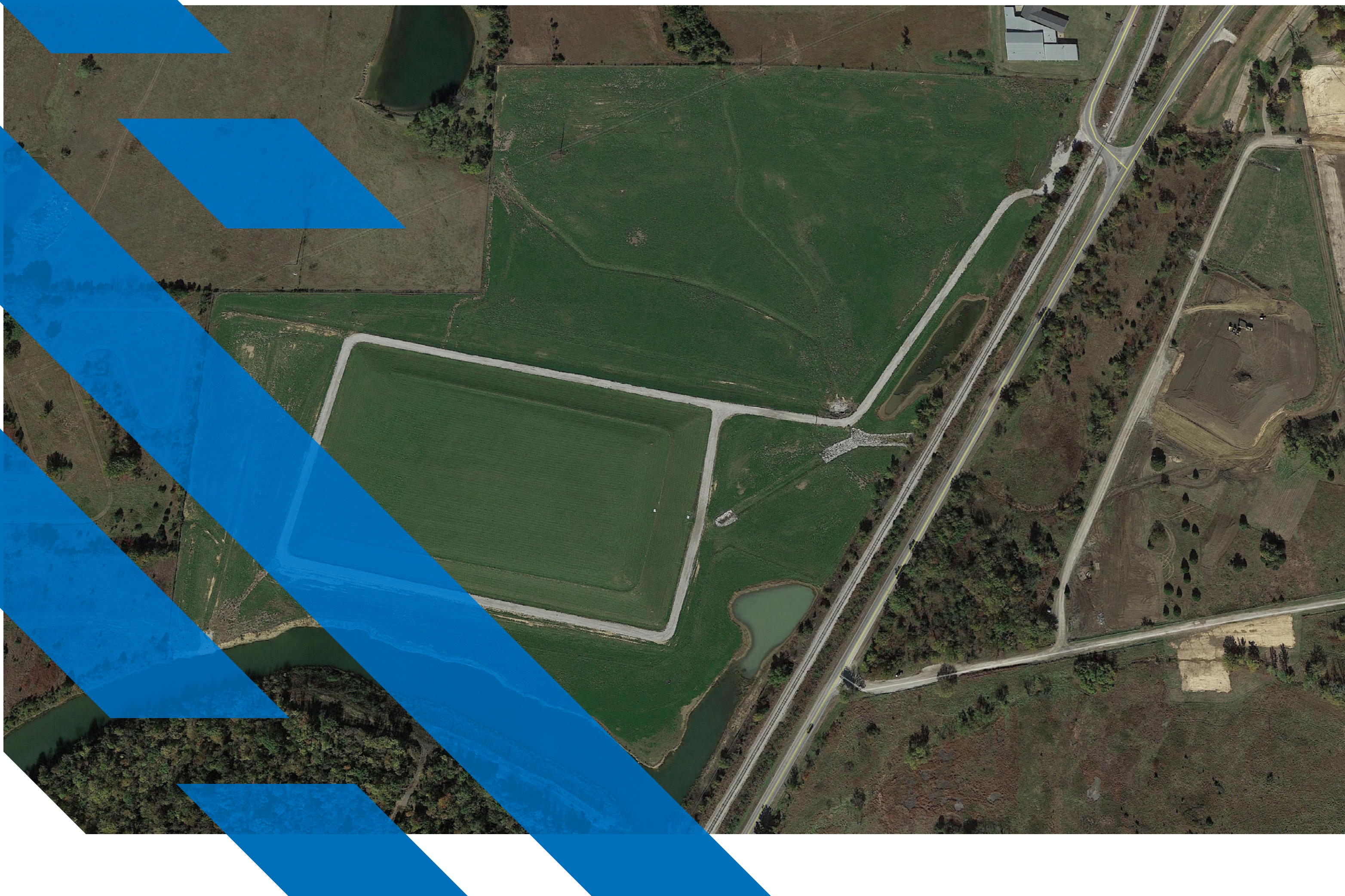
BURNS McDONNELL

CASE STUDY / **SUPERFUND SITE REMEDIATION**

ADAPTIVE REMEDIATION DESIGN CREATES SUSTAINABLE REUSE OPPORTUNITIES

An agile framework allowed a remediation design to evolve as issues arose on a Superfund site. This created opportunities to remove contaminants and transform the site into a green pasture that is home to honeybee hives.



MULTIDISCIPLINARY TEAM CONQUERS CHALLENGES SEAMLESSLY

A team of engineers, geologists, environmental scientists and regulators collaborated and capitalized on opportunities to implement sustainable solutions in real time.

PROJECT STATS

CLIENT
Oklahoma Department of Environmental Quality

LOCATION
Collinsville, Oklahoma

COMPLETION DATE
2018

60
ACRE CONTAMINATED SITE RESTORED

186K
CUBIC YARDS OF CONTAMINATED MATERIALS

25K
CUBIC YARDS OF EARTHWORK AND BACKFILL VOIDED

CHALLENGE

From 1914 to 1925, Tulsa Fuel and Manufacturing operated a lead roaster and zinc smelter on a 60-acre site in Tulsa County, Oklahoma. These smelting activities left behind large quantities of ash, bricks and other waste materials resulting in elevated levels of arsenic, cadmium, lead and zinc in the soil. This created an unacceptable threat to human health and the environment.

The U.S. Environmental Protection Agency (EPA) placed the property on the National Priorities List (NPL) of contaminated sites in 1999 before naming it a Superfund site in 2005. The Oklahoma Department of Environmental Quality (DEQ) received a grant from the EPA to complete site remediation, which included an investigation of the former smelter site and the design of a green solution that would support long-term sustainable reuse while also minimizing the environmental footprint of the cleanup.

On long-abandoned industrial sites like this one, conditions are often not always what they seem. When full-scale excavation begins, contamination can be found in places and quantities that bely earlier test results. Changes in waste quantity and location can impact and, in some cases, invalidate the remedial design plan. It was essential to develop an agile framework that allowed the design to evolve as new issues arose.

SOLUTION

The DEQ retained Burns & McDonnell to support the remediation investigation and design. Our team began by defining the nature and extent of the heavy metal contamination. Soil testing and other investigatory efforts identified widespread contamination throughout the site, especially on a 10-acre area where most of the former production occurred and significant contamination was concentrated.

As both design engineer and DEQ's representative during construction, our team was responsible for facilitating an adaptive design approach. We created a multidisciplinary team of civil engineers, geologists, environmental scientists, agronomists and regulators who could collaborate and capitalize on opportunities to implement sustainable solutions in real time. Team members remained on-site during construction to not only document the work performed and provide quality assurance oversight but also address changing conditions and recommend modifications on the spot.

The remedial design called for removing waste materials and shallow contaminated soils and then disposing of them in an on-site consolidation cell. The design placed a consolidation cell over the 10-acre area of deepest waste accumulation, which reduced the volume of materials that needed to

be excavated for incorporation into the cell, providing for greener remediation and cost savings. We also identified ways to expand the cell's capacity if the volume of contaminated material exceeded projections.

Further design adaptations were needed when old smelter furnaces were found during construction immediately adjacent to the consolidation cell's footprint. We determined that these furnaces and the associated waste mass were in an area that would eventually contain the consolidation cell's access road and berms. By demonstrating that the access road in combination with the cell's berms would provide a cover system equivalent to that of the consolidation cell, the team developed a solution to leave several thousand cubic yards of waste materials in place.

When waste removal at the property boundary resulted in excavations significantly deeper than anticipated, our team performed an advanced hydraulic analysis to demonstrate that stormwater control could be maintained using the expanded excavation area for water containment and diversion. By using the excavation area for stormwater management, the team saved fuel, earthwork and construction materials cost for the originally planned detention basin, avoiding the cost of 25,000 cubic yards of earthwork associated with its construction.

An estimated 186,000 cubic yards of smelter waste and contaminated soil and sediment were excavated from the site and placed within the 10-acre consolidation cell, a process that stripped most of the topsoil from the 60-acre site. Rather than bring in new topsoil at a significant cost, the team worked to develop an alternate site restoration strategy.

Initially, the team considered grinding trees from the site into wood chips that could be tilled into the poor-quality soil as a growth amendment. The agronomist however, warned that ammonia and additional fertilizer would need to be added to the mix to achieve adequate groundcover growth. The agronomist suggested another option: chicken litter. Composed of sawdust, feathers, manure and other composted poultry parts, chicken litter is high in nitrogen, phosphorus and potassium, making it less expensive and more effective than traditional fertilizer in amending the site clay matrix and developing topsoil. It was also readily available from nearby poultry houses.

A mechanical soil stabilizer was used to grind the surface clay and mix it with chicken litter across the site. The grinding broke up the hard clay to create a favorable growing environment, and the mixing minimized odors from the chicken litter. Following the application of the chicken litter, more than 40 acres at the site were replanted with a mix of grasses and clover to promote site restoration and minimize long-term maintenance.

RESULTS

By late 2017, the heavy metals that had presented a risk to human health and the environment had been excavated and placed in the consolidation cell, and the once-contaminated site was transformed into a green pasture. Following successful cleanup and site restoration, the Tulsa Fuel and Manufacturing Superfund site was fully delisted from the NPL in October 2020.

While the 10-acre cell is fenced, regularly inspected and unavailable for use, the family trust that controls the site sought a sustainable way to make use of the remaining 50 acres. Today, the site houses about 30 honeybee hives rescued and relocated from barns and places where the swarming bees presented a nuisance. The site will be home to more swarms in the future, helping to sustain the area's pollinator population and support a sustainable business.

In 2019, officials from EPA awarded the Tulsa Fuel and Manufacturing Superfund site with EPA's Greenovations Award, which honors Superfund site partners who emphasize sustainability and green remediation in their reuse.

"The Tulsa Fuel and Manufacturing site is an example of EPA's Superfund program at its best — a formerly contaminated site that has not only been cleaned up, but restored for a new purpose as home to beehives for local honey businesses," said EPA Regional Administrator Ken McQueen.

burnsmcd.com | Offices Worldwide

16381-SSR-0321