



April 22, 2021

Mr. Bradley Roberts
Task Order Contracting Officer Representative
U.S. Environmental Protection Agency, Region 7
11201 Renner Blvd.
Lenexa, Kansas 66219

**Subject: Contract No. 68HERH19D0018; Task Order (TO) No. 68E0719F0190
Pine Lawn, 4315 Jennings Station Road, Pine Lawn, Missouri
Analysis of Brownfields Cleanup Alternatives Report (ABCA)**

Dear Mr. Roberts:

Toeroek Associates, Inc. (Toeroek) and our teaming subcontractor, Tetra Tech, Inc. (Tetra Tech), (hereafter "Toeroek Team") are pleased to present the Analysis of Brownfields Cleanup Alternatives report (ABCA) regarding the Pine Lawn site (the subject property) located at 4315 Jennings Station Road in Pine Lawn, Missouri. This deliverable has been reviewed internally as part of Tetra Tech's quality assurance program, as well as Toeroek's quality assurance program, and is consistent with Toeroek's Quality Management Plan for the Resource Conservation and Recovery Act (RCRA) Enforcement and Permitting Assistance (REPA) contract. Documentation of this review is retained in the Toeroek Team's project files.

If you have any questions or comments, please contact Paul Kieler at 303-407-0266 or Kaitlyn Mitchell at 816-412-1742.

Sincerely,

Paul Kieler
Toeroek Team Program Manager

Kaitlyn Mitchell
Toeroek Team Project Manager

Enclosure: ABCA

cc: Frank Novello, EPA Region 7
Lisa Dunning, EPA Region 7
Heather Wood, Tetra Tech
Toeroek Team Project Files

ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES REPORT

PINE LAWN 4315 JENNINGS STATION ROAD, PINE LAWN, MISSOURI



Prepared for

**U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 7**

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Prepared by	:	Toeroek Associates, Inc.
Project Manager	:	Kaitlyn Mitchell
Telephone	:	816-412-1742
EPA TOCOR	:	Bradley Roberts
Telephone	:	913-551-7279

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) tasked Toeroek Associates, Inc. (Toeroek) and its teaming subcontractor, Tetra Tech, Inc. (Tetra Tech), (hereafter “Toeroek Team”) to provide technical support to the EPA Region 7 Brownfields Program under Contract 68HERH19D0018, Task Order (TO) 68E0719F0190. EPA Region 7 requested that the Toeroek Team conduct an Analysis of Brownfields Cleanup Alternatives (ABCA) of the Pine Lawn site (the subject property) located at 4315 Jennings Station Road in Pine Lawn, Missouri (see Appendix A, Figure 1). The Toeroek Team prepared this ABCA report based on results of the Targeted Brownfields Assessment (TBA) Phase II Environmental Site Assessment (ESA) by the Toeroek Team (Toeroek 2021). According to the Brownfields Assessment Application (City of Pine Lawn, Missouri 2018), the current property owner, City of Pine Lawn, has shown interest in developing the parcel for residential and/or commercial purposes depending on findings from the TBA.

The Phase II ESA report concluded that further investigation of environmental media may be necessary based on results of surface soil sampling. This ABCA considers cleanup alternatives that conform to Missouri Risk-based Corrective Action (MRBCA) Lowest Default Target Levels (LDTLs) and Tier 1 residential Risked-based Target Levels (RBTLs) for soil. Additionally, this ABCA report includes preliminary cost estimates of evaluated cleanup alternatives.

2.0 BACKGROUND AND DESCRIPTION

The subject property is depicted on the Clayton, Missouri, U.S. Geological Survey (USGS) 7.5-minute topographic series map (USGS 1998) (see Appendix A, Figure 1). Coordinates at the approximate center of the subject property are 38.699007 degrees north latitude and 90.272419 degrees west longitude. The subject property is on an approximately 0.18-acre parcel with no structures (Toeroek 2021).

A Phase I ESA report by Terracon Consultants, Inc. (Terracon) in 2019 stated most of the property was undeveloped. The east adjacent parcel, 4311 Jennings Station Road, was developed at least as early as the 1930s and included an auto service garage and printer. The adjoining properties were developed in the late 1920s and early 1930s, primarily for residential use; however, the property to the north was developed as a filling station with auto service in the 1930s, and was later redeveloped into a different filling station and auto service facility.

The subject property lies in the northwestern suburbs of St. Louis, Missouri. It is bounded to the north by a parking lot, to the east-southeast by two abandoned buildings at 4311 Jennings Station Road, to the south by a vacant lot, and to the west by residential lots. The surrounding area is largely single-family residential, with several commercial businesses to the northeast (Terracon 2019).

3.0 PREVIOUS INVESTIGATIONS

Terracon identified the following RECs to the subject property during a Phase I ESA at the subject property in July 2019 (Terracon 2019):

- Historical uses of the east adjacent property for printing and auto service.
- Historical use of the north adjacent property for auto service.

The Phase I ESA report therefore recommended an additional investigation to evaluate subsurface conditions at the subject property.

Seagull Environmental Technologies, Inc. conducted an Area-Wide Inventory (AWI) of Pine Lawn at the subject property in early 2018 and did not identify any potential environmental concerns (Terracon 2019).

The Toeroek Team performed a Phase II ESA in 2020 (report completed in 2021) to confirm or eliminate RECs identified during the 2019 Phase I ESA by Terracon (Toeroek 2021). Surface and subsurface soil samples were collected and were submitted for analyses for the following parameters: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH) – gasoline-range organics (GRO), TPH – diesel-range organics (DRO), TPH – oil-range organics (ORO), and Resource Conservation and Recovery Act (RCRA) metals (including mercury). Sample locations are depicted on Figure 2 in Appendix A.

Sampling results during this Phase II ESA indicated presence of VOCs, SVOCs, and TPH in surface soil, and metals in surface and subsurface soil at the subject property. Concentrations of some of these constituents exceeded MRBCA LDTLs and EPA Regional Screening Levels (RSL). At one location (Direct Push Technology [DPT]-29), benzo(a)pyrene was detected at a level exceeding the MRBCA LDTL, residential MRBCA RBTL, and non-residential MRBCA RBTL for the ingestion exposure pathway; and lead was detected at concentration exceeding the residential land use limit for dermal contact. The benzo(a)pyrene and lead detections in surface soil appear localized because no exceedances were reported at any of the other three boring locations. Arsenic was detected at levels exceeding the MRBCA LDTL and both EPA residential and industrial RSLs in all samples; however, concentrations of arsenic were consistent with background concentrations in St. Louis County (USGS 2020). Based on analytical results from surface soil samples, additional sampling was recommended in the area of DPT-29 to delineate the extent of SVOCs and metals contamination.

4.0 FUTURE USE

Future use of the subject property is unknown; however, the current property owner has expressed interest in developing the parcel for residential and/or commercial purposes. The subject property is located in a mixed-use commercial and residential area of the northwestern suburbs of the City of St. Louis, Missouri. Groundwater in the subject property vicinity is not known to be a source of drinking water and no future use for this purpose is anticipated because the City of Pine Lawn currently derives its drinking water from a private utility supplier, Missouri American Water (Toeroek 2021). Based on analytical results from a surface soil sample, further investigation and/or remediation at the subject property would be necessary prior to any future development of the property. No remedial activities have occurred at the subject property to date.

5.0 POTENTIAL CLEANUP ALTERNATIVES

The overall goal of any Brownfields cleanup action is to address environmental conditions preventing or impeding the preferred type of subject property redevelopment, and to do so in a manner protective of human health and the environment. This ABCA considers cleanup alternatives that would conform to MRBCA LDTLs and Tier 1 residential RBTLs for soil.

The Toeroek Team evaluated Brownfields cleanup alternatives to address environmental impacts identified during the Phase II ESA (Toeroek 2021). The purpose of the ABCA is to present viable cleanup alternatives based on-site-specific conditions, technical feasibility, and preliminary cost evaluations.

The following sections describe Brownfields cleanup alternatives for addressing contaminated surface soil including a “No Action” alternative. Following the description, each alternative is evaluated in terms of its effectiveness, implementability, and cost. The purpose of evaluating each alternative is to determine its advantages and disadvantages relative to the other alternatives in order to identify key tradeoffs that would affect selection of the preferred alternative.

Effectiveness of an alternative refers to its ability to meet objectives of the Brownfields cleanup. Criteria applied to assess effectiveness of an alternative include the following:

- Overall protection of human health and the environment;
- Compliance with applicable or relevant and appropriate requirements (ARAR) and other criteria, advisories, and guidance;
- Long-term effectiveness;
- Reduction of toxicity, mobility, or volume through treatment/removal; and
- Short-term effectiveness.

Criteria applied to assess implementability of an alternative are:

- Technical feasibility;
- Administrative feasibility;
- Availability of services and materials required during implementation of the alternative;
- State acceptance; and
- Community acceptance.

Each alternative is evaluated to determine its estimated cost. The evaluations compare the alternatives' respective direct capital costs, which include equipment, services, and contingency allowances. The purpose of evaluating each alternative is to determine its advantages and disadvantages relative to the other alternatives in order to identify key tradeoffs that would affect selection of the preferred alternative.

5.1 EVALUATED CONTAMINATION

Contamination evaluated as part of this ABCA is to surface soil. The sections below discuss contaminants identified during the Phase II ESA at the subject property.

5.1.1 Surface Soil

As part of the Phase II ESA completed by the Toeroek Team, four surface soil samples were collected at four locations across the subject property (see Appendix A, Figure 2). All surface soil samples were collected within the default depth interval of 0 to 3 feet below ground surface (bgs). Samples were analyzed for VOCs, SVOCs, TPH-GRO, TPH-DRO, TPH-ORO, and RCRA metals, including mercury. Comparisons of analytical data to MRBCA LDTLs and Tier 1 residential RBTLs for Type 2 (silty) surface soils resulted in the following noteworthy findings:

- Benzo(a)pyrene was detected in one surface soil sample, DPT-29-SO-(0-2), at 4,450 micrograms per kilogram ($\mu\text{g/kg}$) exceeding the MRBCA LDTL (620 $\mu\text{g/kg}$) and the residential RBTL (620 $\mu\text{g/kg}$) for surface soil (silty soils) for the dermal contact (2,130 $\mu\text{g/kg}$) and ingestion exposure pathways (875 $\mu\text{g/kg}$).
- Lead was detected above residential land use concentrations for direct dermal contact in one surface soil sample, DPT-29-SO-(0-2). Lead was detected in all surface samples at levels exceeding the MRBCA LDTL (3.74 mg/kg); only lead concentrations in samples DPT-29-SO-(0-2) and DPT-32-SO-(0-3) exceeded the average concentration of lead in St. Louis County (40.95 mg/kg). Of these, the concentration of lead in sample DPT-29-SO-(0-2) exceeded the MRBCA residential land use limit for soil with direct dermal contact (260 mg/kg). Arsenic was detected at levels exceeding the MRBCA LDTL (3.89 mg/kg) and residential RBTL for ingestion (4.26 mg/kg) in all samples. However, concentrations of arsenic were consistent with background concentrations in St. Louis County (10.561 mg/kg) (USGS 2020).

Cleanup alternatives will address only benzo(a)pyrene and lead in surface soil at DPT-29-SO-(0-2).

Cleanup alternatives will not address arsenic in surface soil, as the detected arsenic is likely naturally occurring.

5.1.2 Subsurface Soil

As part of the Phase II ESA completed by the Toeroek Team, four subsurface soil samples were collected at four locations across the subject property (see Appendix A, Figure 2). Subsurface soil samples were collected within select intervals based on visual staining, detected odor, or elevated photoionization detector (PID) readings. If no staining/odor or elevated PID reading was noted, a sample was collected from directly above the water table or from the bottom of the soil core if the water table was not encountered. No staining/odor or elevated PID readings were noted in any borings; therefore, samples were collected from bottoms of the soil cores. Samples were analyzed for VOCs, SVOCs, TPH-GRO, TPH-DRO, TPH-ORO, and RCRA metals, including mercury. Comparisons of analytical data to MRBCA LDTLs and Tier 1 residential RBTLs for Type 3 (clayey) subsurface soils resulted with the following noteworthy findings:

- Arsenic was detected at levels exceeding the MRBCA LDTL (3.89 mg/kg) in samples DPT-29-SO-(29-30), DPT-30-SO-(29-30), and DPT-32-SO-(24.5-25.5). However, concentrations of arsenic were consistent with background concentrations in St. Louis County (10.561 mg/kg) (USGS 2020). Lead was detected in all subsurface samples at levels exceeding the MRBCA LDTL (3.74 mg/kg), but none exceeded the average concentration of lead in St. Louis County (40.95 mg/kg). No metal was detected at concentration exceeding its residential RBTL.

Cleanup alternatives will not address subsurface soil because arsenic and lead are likely naturally occurring.

5.2 EVALUATION OF CLEANUP ALTERNATIVES

Evaluations of cleanup alternatives are based on the anticipated future use scenario for a subject property—residential and/or commercial development. Because a risk assessment of the subject property has not been completed, cleanup levels for soil will be based on MRBCA Tier 1 residential RBTLs. Evaluations took into account MDNR Brownfields/Voluntary Cleanup Program (B/VCP) procedural requirements and MRBCA technical guidance—because cleanup projects implemented with EPA Brownfields Cleanup funding require participation in the MDNR B/VCP. For reference, fees associated with enrollment in the MDNR B/VCP include a \$200 application fee and refundable oversight deposit of \$5,000.

Regarding contaminated surface soils, three options were evaluated: (1) no action, (2) capping with institutional controls (IC), and (3) excavation. Each approach (excluding no action) is expected to achieve clearance criteria under the MDNR B/VCP.

Alternative 1: No Action

Alternative 1 (No Action) is presented for baseline comparison. This alternative would provide no containment, treatment, removal, or monitoring of contaminants.

Effectiveness

Because the no action alternative would not be protective of human health and the environment, it is not considered effective.

Implementation

Implementation of this alternative would require no effort because no containment, treatment, removal, or monitoring of contaminants would occur. Future redevelopment would have to consider the potential threat to human health and the environment.

Cost

This alternative would not involve any direct costs.

Alternative 2: Capping with ICs

Alternative 2 (Capping with ICs) would involve capping with a compacted soil and vegetative cover, thus leaving contaminated soils in place, and implementation of ICs to restrict land use at the subject property. This cap would consist of a 12-inch concrete foundation layer, 2 feet of low-permeability compacted clay, 6 inches of topsoil, and a vegetative layer. This engineering control would require long-term stewardship, an operations and maintenance (O&M) plan, and ICs (e.g., restrictive deed or environmental covenant) to restrict land use to non-residential use only.

This alternative is an indirect approach, as contaminated soils would be left on-site and ICs would be required to maintain contamination left in place. As such, this alternative is expected to achieve regulatory compliance if future use of the subject property is to remain non-residential.

The area of contamination is assumed to extend up to 20 feet in each direction from DPT-29 (20 feet to the northeast toward DPT-30, 20 feet to the southeast and northwest to the subject property boundary, and 10 feet to the southwest to the property boundary) because elevated concentrations of SVOCs and lead were not found in any other surface soil sample.

Additional sampling could occur to refine delineations of lateral and vertical extents of contamination within individual areas, and possibly reduce excavation volumes.

Effectiveness

Contaminated soils would be capped in place; along with ICs, this engineering control would provide suitable protection of human health and the environment from those contaminated soils left in place. This alternative would allow redevelopment of the subject property as proposed, but with restrictions pertaining to disturbance and management of the cap.

Implementation

A compacted soil and vegetative cap would be installed in the vicinity of DPT-29 where benzo(a)pyrene was detected at a concentration exceeding the MRBCA LDTL and Tier 1 residential RBTL, and lead was detected at a concentration exceeding the residential RBTL. The cap would encompass approximately 1,200 square feet—40 feet (northwest-southeast) by 30 feet (southwest-northeast).

Implementation of land use controls should include a restrictive covenant that would be filed with the Register of Deeds to ensure no disturbance of contamination left in place under any future use scenario, and solely non-residential use of the subject property. An O&M plan and long-term stewardship of the subject property would be required over the life of the cap. In addition, planning this process would require careful consideration of precautions concerning worker health and safety.

Cost

Total cost of Alternative 2 in 2021 dollars is estimated at \$170,000—\$21,000 for capital cost, \$38,000 for ICs, and \$111,000 for O&M over a 30-year time period. Costs were estimated by applying selected functions of RACER® Version 11.2.16.0 and professional judgment. Details of costs are in Appendix B.

Alternative 3: Excavation

Alternative 3 (Excavation) would involve excavation of surface soils within the localized area around DPT-29.

The area of contamination is assumed to extend to 20 feet in each direction from DPT-29 (20 feet to the northeast toward DPT-30, 20 feet to the southeast and northwest to the subject property boundary, and 10 feet to the southwest to the property boundary) because elevated concentrations of SVOCs and lead were not found in any other surface sample. Depth of excavation would be approximately 3 feet bgs. Estimated volume of soil excavation is 3,600 cubic feet (approximately 134 cubic yards).

Following excavation, 5-point confirmation samples would be collected from each wall and the floor of the excavation area to ensure contaminant concentrations in remaining soil are below MRBCA LDTLs. Soil would be stockpiled on-site for characterization prior to off-site disposal. Samples would be collected for toxicity characteristic leaching procedure (TCLP) analysis. If TCLP analysis determines that excavated soils require handling/disposal as hazardous waste, transport and off-site disposal of excavated soil to a RCRA Subtitle C landfill would occur. If TCLP analysis determines excavated soils can be handled as non-hazardous waste, transportation and off-site disposal of excavated soil to a local landfill would occur. Following excavation, clean fill would be brought in to fill in the excavated areas, and the subject property would be regraded appropriately. This alternative would be a more direct approach, as the soils containing contaminant concentrations above MRBCA LDTLs would be removed.

Additional sampling could occur to refine delineations of lateral and vertical extents of contamination within individual areas, and possibly reduce excavation volumes.

Effectiveness

Permanent removal of soils containing contaminant concentrations above MRBCA LDTLs and Tier 1 residential RBTLs would allow redevelopment of the subject property as proposed.

Implementation

Soil excavation by qualified equipment operators would accord with applicable state and federal regulations. Excavation of approximately 134 cubic yards of soil is assumed necessary to properly clean up the subject property. All waste soil excavated during this process would be sent for disposal off-site as non-hazardous or hazardous waste, dependent on results of TCLP analysis. For cost estimating purposes, assumption is that 25 percent of excavated soil would require handling/disposal as hazardous waste and 75 percent would be handled as non-hazardous waste. In addition, planning this process would require careful consideration of precautions concerning worker health and safety.

Cost

Total cost of Alternative 3 in 2021 dollars is estimated at \$51,000 for capital cost. Costs were estimated by applying selected functions of RACER[®] Version 11.2.16.0. Details of costs are in Appendix B.

5.3 RECOMMENDED CLEANUP ALTERNATIVES

This section recommends cleanup alternatives for soil at the subject property.

Alternative 3 (Excavation) is the recommended cleanup alternative for surface soil in order to redevelop the subject property for residential or commercial purposes. This alternative would be the most direct approach, as soils containing contaminant concentrations above MRBCA LDTLs and Tier 1 residential RBTLs would be removed. Estimated cost for Alternative 3 is also less than that of Alternative 2, as long-term maintenance and ICs would not be necessary.

Total cleanup costs are summarized in Table 1 below. Based on the recommended cleanup alternative, estimated total cleanup cost is \$56,200, which includes site enrollment in the MDNR B/VCP and technical consulting fees. The fee for site enrollment in the MDNR B/VCP program is \$5,200. Whether the subject property will be enrolled in the MDNR B/VCP program is unknown. As such, fees associated with the program have been included for planning purposes.

Additional soil sampling should occur to refine delineations of lateral and vertical extents of contamination within the area surrounding DPT-29, and possibly reduce excavation volume.

TABLE 1
SUMMARY OF COSTS
PINE LAWN, 4315 JENNINGS STATION ROAD, PINE LAWN, MISSOURI

Contaminant/Material	Recommended Alternative	Action - Cost	Total Cost
Soil	Alternative 3 – Excavation	Capital Cost – \$39,215	\$51,000
		30% Contingency - \$11,765	
		ICs – \$0	
		O&M – \$0	
MDNR B/VCP Fees			\$5,200
Total Cost			\$56,200

Notes:

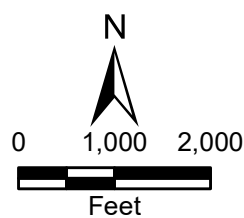
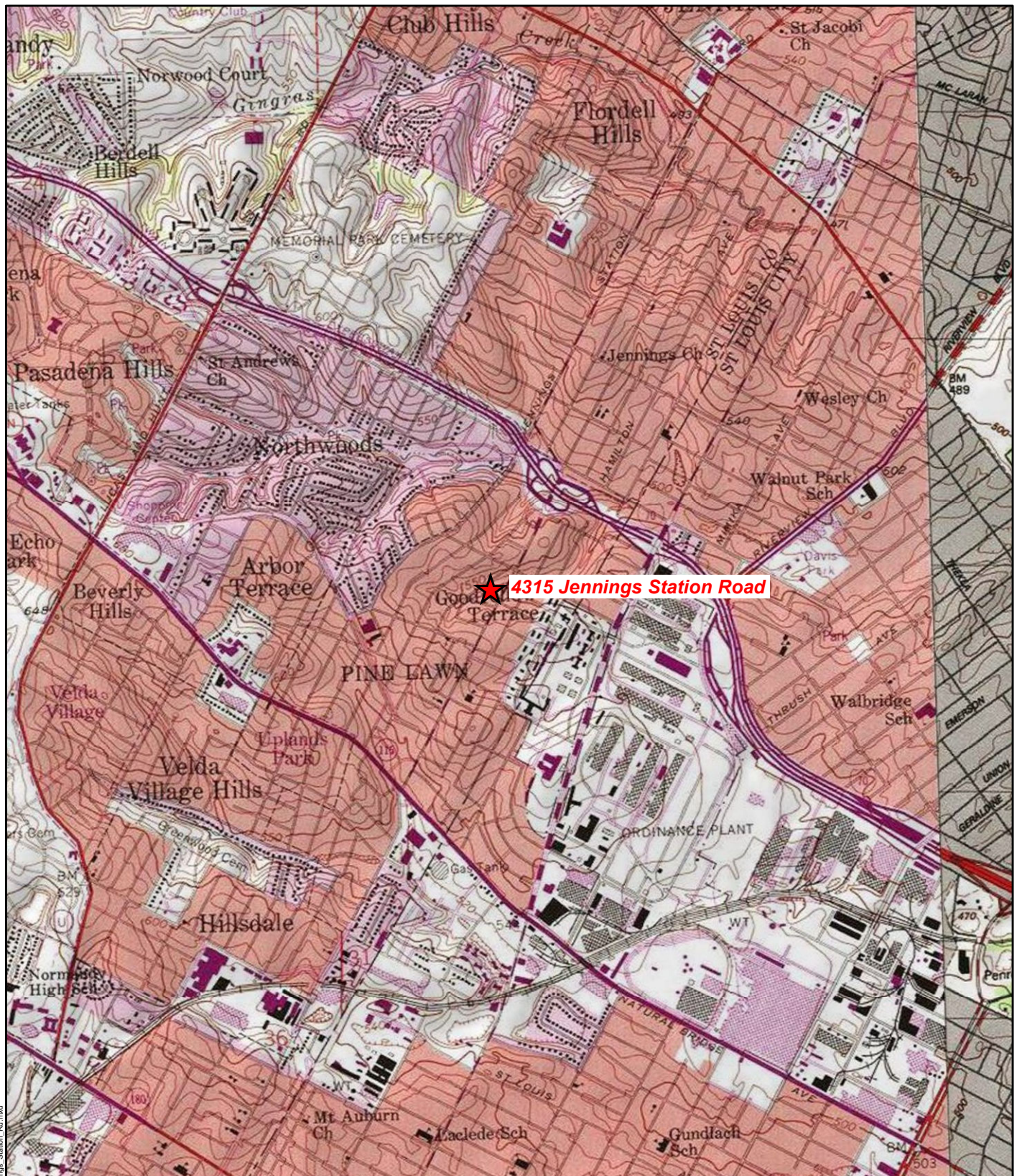
B/VCP Brownfields/Voluntary Cleanup Program
ICs Institutional Controls
O&M Operation and Maintenance
MDNR Missouri Department of Natural Resources

6.0 REFERENCES

- City of Pine Lawn, Missouri. 2018. Brownfields Assessment Application regarding the 4315 Jennings Station Road property, submitted to Missouri Department of Natural Resources (MDNR). June 28.
- Terracon Consultants, Inc. (Terracon). 2019. Phase I Environmental Site Assessment. 4315 Jennings Station Road, Pine Lawn, Missouri. July 11.
- Toeroek Associates, Inc. (Toeroek). 2021. Targeted Brownfields Assessment, Phase II Environmental Site Assessment, Pine Lawn, 4315 Jennings Station Road, Pine Lawn, Missouri. November 9.
- U.S. Geological Survey (USGS). 1998. Clayton, Missouri Quadrangle. USGS 7.5-Minute Topographic Series.
- U.S. Geological Survey (USGS). 2020. Average concentrations of elements in Saint Louis County, Missouri. <https://mrdata.usgs.gov/geochem/county.php?place=f29189&el=As&rf=east-central>

APPENDIX A

FIGURES



Pine Lawn
4315 Jennings Station Road
Pine Lawn, Missouri

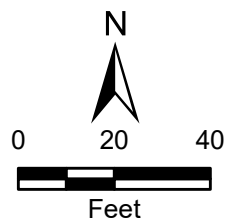
Figure 1
Site Location Map





Legend

- DPT soil sample location
- Approximate area proposed for cleanup alternatives 2 and 3
- Approximate site boundary
- DPT Direct push technology



Pine Lawn
4315 Jennings Station Road
Pine Lawn, Missouri

Figure 2
Sample Location Map



Date: 3/17/2021

Drawn By: Nick Wiederholt

Project No: 103G65210190.02.03.07

APPENDIX B

REMEDIAL ALTERNATIVES COST ESTIMATES

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

TABLE B-1					
COST SUMMARY					
Alternative	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
1	No Action	\$0	\$0	\$0	\$0
2	Capping with ICs	\$ 21,000	\$ 38,000	\$ 111,000	\$ 170,000
3	Excavation	\$ 51,000	\$ -	\$ -	\$ 51,000

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

ALTERNATIVE 2
CAPPING WITH ICs

Table B-2				
Cost Summary				
Alternative 2 - Capping with ICs				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Capital Cost	\$ 15,811	\$ 4,743	\$ 21,000
Table B-4	Institutional Controls	\$ 29,544	\$ 8,863	\$ 38,000
Tables B-5, B-8	Operation and Maintenance	\$ 85,709	\$ 25,713	\$ 111,000
Contingency		30%	\$ 39,318.99	
Total				\$ 170,000

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

Overhead and Profit (O&P)

RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	

Inflation	1.90%	Avg. annual inflation from 2015 to 2021
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Table B-3								
Capital Cost								
Alternative 2 - Capping with ICs								
Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Total Cost
	Construction Subtotal							\$ 10,904
	On-site Capping							\$ 10,904
1	Seeding, vegetative cover	0.03	ac	RACER	2015	\$ 4,075.49	\$ 6,158.29	\$ 185
2	Topsoil, 6-inches deep	30	lcy	RACER	2015	\$ 41.62	\$ 62.89	\$ 1,887
3	Clay, low permeability	134	cy	RACER	2015	\$ 30.87	\$ 46.65	\$ 6,251
4	Fill, 6-inch lifts (includes delivery, spreading, and compaction)	60	cy	RACER	2015	\$ 28.47	\$ 43.02	\$ 2,581
Construction subtotal								\$ 10,904
Construction management ¹								\$ 1,636
Remedial design ^{1,2}								\$ 2,181
Project management ¹								\$ 1,090
Capital Cost Subtotal								\$ 15,811

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

Table B-4								
Institutional Controls								
Alternative 2 - Capping with ICs								
Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Periodic Cost
	Institutional Controls Subtotal							\$ 29,544
	Prepare LUC Implementation Plan							\$ 24,214
5	Project manager	22	hrs	RACER	2015	\$ 76.23	\$ 115.19	\$ 2,534
6	Project engineer	30	hrs	RACER	2015	\$ 55.79	\$ 84.30	\$ 2,529
7	Staff engineer	45	hrs	RACER	2015	\$ 67.62	\$ 102.18	\$ 4,598
8	QA/QC officer	11	hrs	RACER	2015	\$ 63.57	\$ 96.06	\$ 1,057
9	Word processing/clerical	60	hrs	RACER	2015	\$ 34.31	\$ 51.84	\$ 3,111
10	Draftsman/CADD	30	hrs	RACER	2015	\$ 36.80	\$ 55.61	\$ 1,668
11	Attorney, partner, real estate	22	hrs	RACER	2015	\$ 244.43	\$ 369.35	\$ 8,126
12	Other direct costs	1	ls	RACER	2015	\$ 390.83	\$ 590.57	\$ 591
	Meetings with Agencies							\$ 3,931
13	Per diem (per person)	1	day	RACER	2015	\$ 174.00	\$ 262.92	\$ 263
14	Project manager	20	hrs	RACER	2015	\$ 76.23	\$ 115.19	\$ 2,304
15	Word processing/clerical	16	hrs	RACER	2015	\$ 34.31	\$ 51.84	\$ 830
16	Draftsman/CADD	8	hrs	RACER	2015	\$ 36.80	\$ 55.61	\$ 445
17	Other direct costs	1	ls	RACER	2015	\$ 59.20	\$ 89.45	\$ 89
	Restrictive Covenant							\$ 1,399
18	Overnight deliver, 8 oz letter	3	ea	RACER	2015	\$ 19.23	\$ 29.06	\$ 87
19	Project manager	1	hrs	RACER	2015	\$ 76.23	\$ 115.19	\$ 115
20	Word processing/clerical	3	hrs	RACER	2015	\$ 34.31	\$ 51.84	\$ 156
21	Attorney, associate, real estate	3	hrs	RACER	2015	\$ 172.46	\$ 260.60	\$ 782
22	Paralegal, real estate	3	hrs	RACER	2015	\$ 50.17	\$ 75.81	\$ 227
23	Other direct costs	1	ls	RACER	2015	\$ 21.18	\$ 32.00	\$ 32

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

Table B-5								
Operation and Maintenance								
Alternative 2 - Capping with ICs								
Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Periodic Cost
	Cap Repair and Maintenance (cost per year)							\$ 142
24	Topsoil, 6-inches deep	0.61	lcy	RACER	2015	\$ 41.62	\$ 62.89	\$ 38
25	Seeding, vegetative cover	0.01	ac	RACER	2015	\$ 4,075.49	\$ 6,158.29	\$ 62
26	Fertilize, 800 pounds per acre, push rotary	0.03	ac	RACER	2015	\$ 397.62	\$ 600.83	\$ 18
27	Mowing	0.06	ac	RACER	2015	\$ 262.94	\$ 397.32	\$ 24
	Inspection and Monitoring (cost per year)							\$ 2,500
28	LUC inspection and monitoring (annual drive-by inspection and restrictions enforcement)	1	ls	Professional judgment	2020	\$ 1,500.00	\$ 1,500.00	\$ 1,500
29	Reporting	1	ls	Professional judgment	2020	\$ 1,000.00	\$ 1,000.00	\$ 1,000

Notes:

Labor rates will be required to conform to the Davis-Bacon Act.

- 1
- Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000).
- 2
- Remedial design includes developing plans and specifications, such as a remedial action work plan, design analysis, and construction cost estimating.
- ac
- Acre
- CADD
- Computer-aided design
- cy
- Cubic yard
- ea
- Each
- EPA
- U.S. Environmental Protection Agency
- hrs
- Hours
- IC
- Institutional control
- lcy
- Loose cubic yards
- ls
- Lump sum
- LUC
- Land use control
- O&P
- Overhead and profit
- QA/QC
- Quality assurance/quality control
- RACER
- Remedial Action Cost Engineering and Requirements System

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

Annual Discount Rate:

30-Yr -0.3%

Table B-6			
Present Value Analysis			
Year	Annual Discount Factor ^{1, 2}	Alternative 2 - Capping with ICs	
		O&M Costs	
	30-Yr	O&M Future Cost ³	Present Value (2021)
0	1.000	\$2,642	\$2,642
1	1.003	\$2,642	\$2,650
2	1.006	\$2,642	\$2,658
3	1.009	\$2,642	\$2,666
4	1.012	\$2,642	\$2,674
5	1.015	\$2,642	\$2,682
6	1.018	\$2,642	\$2,690
7	1.021	\$2,642	\$2,698
8	1.024	\$2,642	\$2,706
9	1.027	\$2,642	\$2,714
10	1.031	\$2,642	\$2,723
11	1.034	\$2,642	\$2,731
12	1.037	\$2,642	\$2,739
13	1.040	\$2,642	\$2,747
14	1.043	\$2,642	\$2,756
15	1.046	\$2,642	\$2,764
16	1.049	\$2,642	\$2,772
17	1.052	\$2,642	\$2,780
18	1.056	\$2,642	\$2,789
19	1.059	\$2,642	\$2,797
20	1.062	\$2,642	\$2,806
21	1.065	\$2,642	\$2,814
22	1.068	\$2,642	\$2,823
23	1.072	\$2,642	\$2,831
24	1.075	\$2,642	\$2,840
25	1.078	\$2,642	\$2,848
26	1.081	\$2,642	\$2,857
27	1.085	\$2,642	\$2,865
28	1.088	\$2,642	\$2,874
29	1.091	\$2,642	\$2,883
30	1.094	\$2,642	\$2,891
Total Present Value of Periodic Cost			\$85,709

Notes:

- 1 Based on an annual discount factor of -0.3 percent, OMB Circular A-94 (2020)
- 2 Annual discount factor = $1/(1+i)^t$, where i = discount rate (includes inflation and
- 3 Current dollar cost of future event
- IC Institutional control

O&M Operation and maintenance
OMB Office of Management and Budget
yr Year

Reference:

OMB. 2020. OMB Circular No. A-94, Appendix C, Discount Rates for Cost-Effectiveness, Lease Pu

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

ALTERNATIVE 3
EXCAVATION

Table B-7				
Cost Summary				
Alternative 3 - Excavation				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-7	Capital Cost	\$ 39,215	\$ 11,765	\$ 51,000
NA	Institutional Controls	\$ -	\$ -	\$ -
NA	Operation and Maintenance	\$ -	\$ -	\$ -
Contingency		30%	\$ 11,764.58	
Total				\$ 51,000

Appendix B
Remedial Alternatives Cost Estimates
4315 Jennings Station Road
Pine Lawn, Missouri

Overhead and Profit (O&P)		
RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	
Inflation	1.90%	Avg. annual inflation from 2015 to 2021

Table B-8								
Capital Cost								
Alternative 3 - Excavation								
Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Total Cost
	Construction Subtotal							\$ 27,045
	Soil Excavation (~134 cubic yards)							\$ 11,917
1	Dump truck (12 cubic yards)	9	hrs	RACER	2015	\$ 111.15	\$ 167.95	\$ 1,512
2	Excavate soil (3/4 cubic yard bucket, hydraulic excavator)	134	bcy	RACER	2015	\$ 4.36	\$ 6.59	\$ 883
3	Backfill (includes delivery, spreading, and compaction)	174	cy	RACER	2015	\$ 28.47	\$ 43.02	\$ 7,485
4	Seeding, vegetative cover	160	sy	RACER	2015	\$ 1.58	\$ 2.39	\$ 382
5	Disposable materials for sampling	5	ea	RACER	2015	\$ 10.55	\$ 15.94	\$ 80
6	TCLP analysis	5	ea	RACER	2015	\$ 99.99	\$ 151.09	\$ 755
7	Project scientist	7	hrs	RACER	2015	\$ 77.53	\$ 117.15	\$ 820
	Off-site Transportation and Disposal							\$ 15,128
8	Transportation and disposal, hazardous waste	34	cy	RACER	2015	\$ 191.79	\$ 289.81	\$ 9,853
9	Transportation and disposal, non-hazardous waste	100	cy	RACER	2015	\$ 34.91	\$ 52.75	\$ 5,275
Construction subtotal								\$ 27,045
Construction management ¹								\$ 4,057
Remedial design ^{1,2}								\$ 5,409
Project management ¹								\$ 2,705
Capital Cost Subtotal								\$ 39,215

Notes:

Labor rates will be required to conform to the Davis-Bacon Act.

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000).
2	Remedial design includes developing plans and specifications, such as a remedial action work plan, design analysis, and construction cost estimating.
bcy	Bank cubic yard
cy	Cubic yard
ea	Each
EPA	U.S. Environmental Protection Agency
hrs	Hours
NA	Not applicable
O&P	Overhead and profit
RACER	Remedial Action Cost Engineering and Requirements System
sy	Square yard
TCLP	Toxicity characteristic leaching procedure

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.