# NJDEP Public Notice & Comment Period

The N.J. Department of Environmental Protection (NJDEP) is issuing a Proposed Plan to address contamination at the former Struthers-Dunn, Inc. (SDI) Site at 568 Lambs Road, Mantua Township, Gloucester County.

**Comment Period**:
NJDEP solicits public comments on the SDI Proposed Plan during the public comment period that runs from **July 30, 2018 to August 31, 2018.** No decision on the Proposed Plan will be made until all public comments are evaluated. Please provide NJDEP with any written and verbal comments. Contact information is provided below.

**Background**
SDI manufactured mechanical and electrical relays and timers from 1944 to 1994. Facility processes included molding, machining, electroplating, and assembly operations. All the buildings have been demolished with only the building slabs left in-place. The land use surrounding the site is mixed industrial and residential. The primary contaminants of concern associated with this site are trichloroethylene (TCE) and tetrachloroethylene (also known as perchloroethylene [PCE]), which were used as solvents in machinery degreasers at the SDI facility until 1978. These compounds have been detected in both soil and groundwater at the site and in a groundwater contaminant plume migrating from the site.

Based on the findings of the Remedial Investigation, as well as results from prior investigations, PCE and TCE contamination is found most extensively in Area of Concern or AOC-1, an area along the southwestern edge of the site. The AOC-1 source area extends more than 500 feet laterally and approximately 65 feet deep, on to the adjoining lot. During recent sampling, elevated concentrations were observed in monitoring wells located next to and beneath the Chestnut Branch, indicating that the groundwater plume extends at least 1,100 feet downgradient from the source area. Results of the well search conducted during the Remedial Investigation indicated that the residences within ½ mile downgradient of the site are provided with public water, and the public water supply is not adversely affected by the site

**Source Remediation Alternatives Analysis**
NJDEP evaluated seven remedial alternatives for the source area, and three for the downgradient plume, for effectiveness, ease and safety of implementation, and cost. The recommended remedy for the source area involves a form of excavation using large diameter augers. Excavated soils would be dewatered, then transported off site for disposal. The excavations would be backfilled. The recommended remedy for the downgradient ground water plume involves a downgradient biobarrier wall. This effort would take place between the source area and the Chestnut Branch and involve bioremediation using injection wells at different depth intervals. Monitoring wells downgradient of the biobarrier will be sampled to evaluate its effectiveness. Post remediation groundwater monitoring for the source area is included with this remedial alternative.

**The Proposed Plan for SDI is available for review at the office of:**
Jennica Bileci, Township Administrator
401 Main Street
Mantua, NJ 08051
856-468-1500 x 120 or jbileci@mantuatownship.com

**For more information and to submit comments, please contact:**
Mark Herzberg
NJDEP Office of Community Relations
401 East State Street, PO Box 420
Trenton, NJ 08625-0420
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**Proposed Plan**

# Struthers-Dunn Inc. Site

## 568 Lambs Road

## Mantua Township, Gloucester County

**New Jersey Department of Environmental Protection** **July 2018**

### PURPOSE OF PROPOSED PLAN

This Proposed Plan identifies the Preferred Alternative for addressing contamination from the former Struthers-Dunn Inc. (SDI) site, and provides the rationale for this preference. The Preferred Alternative addresses contaminated soil at Area of Concern (AOC-1) and calls for excavation of soil in the source area using large diameter augers (LDA). Excavated soil from the source area will be dewatered, then contaminated soils will be loaded onto trucks and hauled to an acceptable disposal facility. Upon completion of soil excavation, the area will be backfilled to match existing exterior site grade. The Preferred Alternative also addresses the potential discharge of contaminated ground water to the Chestnut Branch of the Mantua Creek through installation of a downgradient biobarrier wall. Monitoring wells downgradient of the biobarrier will be sampled to evaluate its effectiveness. Finally, post remediation groundwater monitoring for the source area for five (5) years is included with this remedial alternative.

**PUBLIC COMMENT PERIOD:**
**July 30, 2018 to August 31, 2018**
NJDEP will accept written comments on the Proposed Plan during the public comment period.

**For more information, see the Administrative Record at the following location:**

Mantua Twp. Municipal Building
401 Main Street
Mantua, NJ 08051
ATTN: Jennica Bileci, Twp. Administrator
856-468-1500 x 120
jbileci@mantuatownship.com

Hours: Monday – Friday 8:30 AM to 4:30 PM

The Proposed Plan includes a description of the Preferred Alternative, and also provides a summary of all other cleanup alternatives evaluated for this Site. This proposed plan was developed by the New Jersey Department of Environmental Protection (NJDEP). NJDEP will select a final remedy for the Site after reviewing and considering all information submitted during the public comment period. NJDEP may modify the Preferred Alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

This Proposed Plan summarizes information that can be found in greater detail in the July 2017 Focused Feasibility Study, the October 2014 Pre-Design Investigation Report, and the December 2008 Remedial Investigation Report. NJDEP encourages the public to review these and other documents in order to gain a more comprehensive understanding of the Site and the investigations and studies that have been conducted there.

### SITE BACKGROUND

#### Site Description

The 12-acre SDI property (NJDEP Site Remediation Program Interest #026976) is located at 568 Lambs Road in Mantua Township, Gloucester County, New Jersey and includes Tax Block 254.01, Lots 24 and 31. In addition, the adjoining lot to the east (Block 254.01, Lot 30) was formerly part of the SDI property until it was subdivided for development as a daycare facility in 1993 (currently known as Bright Beginnings Pre-School). The Site is bounded to the north by wooded

land, to the west by Total Turf Experience sports facility and the Chestnut Branch of Mantua Creek, to the east by a parking lot and daycare facility, and to the south by Lambs Road. A densely populated residential neighborhood is located further south across Lambs Road. The land use surrounding the Site is mixed industrial and residential. All buildings on the property have been demolished with only the buildings slabs left in-place. A site location map is provided as **Figure 1.**

Prior to the mid 1940's, the Site was part of a larger agricultural farm field. The SDI facility manufactured mechanical and electrical relays and timers from 1944 to 1994. Facility processes included molding, machining, electroplating, and assembly operations. Facility records indicate that metals such as nickel, cadmium, copper, chrome, silver, tin, chromium, and brass were used for wire and switch plating at the facility in the 1940's.

Historically, the Site was improved with ten buildings (Building 1 through 10). All the buildings have been demolished, leaving the building slabs in-place. Spent degreaser containing tetrachloroethene (PCE) and trichloroethene (TCE) was reportedly disposed of into the ground west of Building 3 and the attached "Rumble Room". PCE and TCE were regularly brought onsite in 55-gallon drums and were used as the primary solvents in machinery degreasers at the SDI facility until 1978.

The source of soil and groundwater contamination within AOC-1 is believed to have originated from the "Rumble Room" associated with former Building No. 3 and associated drainage piping, an old concrete tank, a septic system, and potentially historic dumping practices. Contamination in AOC-1 consists of chlorinated volatile organic compounds (CVOCs), primarily PCE and TCE. CVOC contamination in the AOC-1 source area extends more than 500 feet laterally and approximately 65 feet deep, on to the adjoining lot (Block 254.01, Lot 32).

The primary receptor associated with the potential exposure to the public and the environment is groundwater discharge to the Chestnut Branch of Mantua Creek located approximately 1,100 feet downgradient from AOC-1. During recent sampling, elevated VOC concentrations were observed in monitoring wells located next to the Chestnut Branch and in pore water beneath the Chestnut Branch, indicating that the VOC groundwater plume extends at least 1,100 feet downgradient from the source area. However, elevated surface water VOC concentrations were not observed in the Chestnut Branch itself. The results of the well search conducted during the Remedial Investigation indicated that the residences within ½ mile down-gradient of the site are provided with public water, and the public water supply is not adversely affected by the site.

### Site Geology and Hydrogeology

The Site is underlain by the unconsolidated sediments of the New Jersey Coastal Plain. Borings advanced at the Site, by both CDM Smith and the Louis Berger Group (Berger), have identified five formations/units encountered in the following order starting from ground surface: Cohansey Sand; Kirkwood Formation including the Upper Kirkwood Sand and lower Kirkwood Silty Clay; Vincentown-Hornerstown-Navesink unit; Mount Laurel-Wenonah unit; and Marshalltown Formation.

Previous investigations at the Site have recorded the depth to the shallow groundwater table between 5 and 15 feet bgs, within the Kirkwood-Cohansey aquifer. The horizontal flow direction of shallow groundwater from AOC-1 is generally to the southwest, towards the Chestnut Branch of Mantua Creek. Previous groundwater and surface water gauging performed by Berger east and west of the Chestnut Branch showed flows toward the Chestnut Branch, and as such Chestnut Branch was interpreted to be the discharge boundary.

## NATURE AND EXTENT OF CONTAMINATION

### Investigation Activities

Environmental media investigated during historical site investigations included surface water, porewater, sediment, subsurface soil, and groundwater.

The primary investigation reports submitted to NJDEP include the *Remedial Investigation Report* submitted in December 2008, the *Pre-Design Investigation Report* submitted in October 2014, and the *Focused Feasibility Study* submitted in July 2017.

### Investigation Results

*Subsurface Soil*

Shallow soil contamination containing PCE and TCE was detected in the unsaturated zone (4 to 12 feet bgs) beneath AOC-1 in the former Rumble Room and terra-cotta drainage piping at concentrations up to 160 milligrams per kilogram (mg/kg). In general, the highest concentrations of soil contamination present in the unsaturated zone were observed between the depths of 3.5 and 7.5 feet bgs in the area of the terra-cotta piping and beneath the building slab. In the shallow saturated zone soil (Kirkwood-Cohansey aquifer), soil contamination was observed to have migrated vertically to the top of the Kirkwood Formation and west-southwest from the source area downgradient, parallel to the groundwater flow direction.

The highest concentrations of PCE and TCE in soil in the saturated zone were identified within the lower silty clay layer of the Kirkwood Formation (30-65 ft. bgs). Soil concentrations were as high as 3,150 mg/kg of PCE at the top of the lower Kirkwood silty clay layer immediately downgradient of the Rumble Room and terra-cotta piping, with concentrations decreasing with depth. In the source area, contamination extends vertically through the Kirkwood Formation and into the upper portion of the Vincentown-Hornerstown-Navesink unit. Laterally, contamination within these units extends downgradient of the site, but is primarily found within the significant sand zone within the lower silty clay layer of the Kirkwood Formation.

*Groundwater*

Groundwater contamination was observed to originate in the area of the former Rumble Room and the terra cotta piping and extend downward within the Cohansey Sand and Kirkwood Formation and to the west-southwest, in the direction of groundwater flow. Historical releases of VOCs as dense non-aqueous phase liquids (DNAPLs) resulted in the vertical migration of contaminant mass driven by gravity. In the AOC-1 source area, the groundwater contamination extends vertically through the Kirkwood Formation into the upper portion of the Vincentown-Hornerstown-Navesink unit. High concentrations of contaminants, indicative of the presence of residual DNAPL, are present at the interface of the Upper Kirkwood Sand and Lower Kirkwood Silty Clay units and within the Lower Kirkwood Silty Clay representing a continuing source of groundwater contamination. Beneath the Rumble Room source area, the bulk of contaminant mass lies within the Lower Kirkwood Silty Clay unit (approximately 31 to 65 feet bgs). Approximately 50 feet downgradient of the Rumble Room, PCE concentrations range from 12 to 75 percent of the solubility limit (206 milligrams per liter [mg/L]) between 27 and 58 feet bgs. Also at this location, TCE concentrations range from 2 to 4.4 percent of the solubility limit (1,280 mg/L) between 47 and 58 feet bgs. The NJDEP Groundwater Quality Standard for PCE and TCE is 1 microgram per liter (µg/L).

The dissolution of DNAPL has resulted in high concentrations of contaminants in groundwater, which are advectively transported laterally and vertically dictated by prevailing hydraulic gradients. Advective transport of the high concentration contaminant plume within the Kirkwood Formation is primarily occurring through higher permeability sand units (Upper Kirkwood Sand and interbedded sand layers within the lower Kirkwood Silty Clay at varying thickness between 40 to 60 feet bgs) acting as preferential pathways in a west/southwesterly direction. Approximately 200 feet downgradient of the Rumble Room high concentrations of TCE (69.1 mg/L) have been observed. The plume has also spread by mechanical dispersion around the center of mass. In addition to the residual DNAPL sources associated with the Rumble Room, adsorption of VOCs onto the soil and sediment as well as diffusion into low permeability silts and clays adjacent to high conductivity sands conveying the high-concentration groundwater plume may be significant storage mechanisms. Over time, desorption and back-diffusion may act as long-term secondary sources of contamination.

The dense low permeability silt present within the Vincentown-Hornerstown-Navesink unit appears to be inhibiting the vertical migration of contamination into the Mount Laurel Wenonah formation below. In general, VOC concentrations decrease with depth, and are generally above 65 feet bgs. The exception is some low-concentrations of TCE (50-150 µg/L) observed at approximately 155 feet bgs in one monitoring well.

*Surface water, sediment, and porewater*

Sampling of surface water, sediment, and sediment porewater (benthic water) was performed along the Chestnut Branch of Mantua Creek and an unnamed tributary along the western side of the Site. The results identified minimal VOC impacts to the surface water and sediment in both the Chestnut Branch of Mantua

Creek and the unnamed tributary. No VOCs were identified in the surface water above NJDEP Surface Water Quality Standards (GWQS) (acute, chronic, and human health criteria). However, VOCs were identified in water in the pore water below the Chestnut Branch downgradient of AOC-1. Specifically, TCE, PCE 1,1-dichloroethene (DCE) and cis-1,2-DCE were identified at maximum concentrations of 9.4 micrograms per liter (µg/L), 2.7 µg/L, 17 µg/L, and 300 µg/L, respectively.

The pore water sample results identified that only vinyl chloride exceeds NJDEP GWQS downgradient of AOC-1. Vinyl chloride results were 1.5 µg/L and 3 µg/L (NJDEP GWQS for vinyl chloride is 1 µg/L). TCE, PCE 1,1-DCE and cis-1,2-DCE were not identified at concentrations above GWQS in the pore water. Groundwater samples were collected in monitoring wells located immediately upgradient of the Chestnut Branch of Mantua Creek to determine the relationship between groundwater and porewater in the Creek. Groundwater sample results from monitoring wells MW-36C and 37C, immediately upgradient of the Chestnut Branch of Mantua Creek, have concentrations of AOC-1 contaminants TCE, 1,1-DCE and cis-1,2-DCE above GWQS.

## SUMMARY OF REMEDIAL ALTERNATIVES

This section describes the identification and screening of the potential remedial technologies and process options to address the AOC-1 source area at the Site and the groundwater contaminant plume migrating from the Site.

The remedial alternatives evaluated in the Focused Feasibility Study for the AOC-1 source area are listed below:

- Alternative 1: No action
- Alternative 2: Institutional Controls
- Alternative 3A: Conventional Excavation
- Alternative 3B: Large diameter auger (LDA) excavation
- Alternative 4: *In situ* stabilization/ solidification
- Alternative 5A: *In situ* reduction
- Alternative 5B: *In situ* soil mixing

The remedial approaches to address the downgradient portion of the plume are listed below:

- Monitored Natural Attenuation (MNA)
- Biobarrier - 1,000 µg/L VOC Plume
- Biobarrier - 5,000 µg/L VOC Plume

Each of the remedial actions listed above are described and evaluated in detail in the Focused Feasibility Study Report, dated July 2017. A summary of the scores and costs for all remedial actions evaluated are provided in **Table 1**.

## PREFERRED REMEDIAL ALTERNATIVE

Based upon an evaluation of the various alternatives against the remedial action goals, NJDEP proposes to implement Remedial Alternative 3B, LDA excavation, to address the AOC-1 source area, and a biobarrier to address the 1,000 µg/L VOC plume at the SDI Site. Figure 2 shows the planned layout for LDA excavation and downgradient biobarrier.

*Alternative 3B – Large Diameter Auger (LDA) Excavation, Transport and Disposal*

This remedial action involves advancing large-diameter casings into the source area of interest to the target depth with the appropriate vibratory equipment followed by removal of the impacted soil with a hydraulic drill rig. The excavation is expected to reach a depth of at least 65 feet below surface grade. The excavated soil will be segregated into hazardous and non-hazardous stockpiles for testing, and certified clean flowable fill will be used to backfill the excavated column. Following proper waste characterization, the stockpiled soil will be disposed off-Site at either a Subtitle D lined landfill or a hazardous waste landfill.

Due to the high VOC concentrations associated with the source area, groundwater removed from the excavation during implementation of LDA excavation will be treated onsite using liquid granular activated carbon. The treated water can be subsequently used for preparation of the flowable fill or disposed of offsite as non-hazardous waste as applicable. To minimize the risk of downgradient contaminant migration, LDA excavation will first be performed in the Southwestern portion of the source area.

In order to protect the immediate receptor (Chestnut Branch of Mantua Creek) during remedial activities, the downgradient biobarrier wall will be installed prior to commencing LDA excavation. The biobarrier will be located immediately downgradient of the estimated combined 1,000 µg/L PCE/TCE plume.

Following implementation of the source area excavation, a mass discharge evaluation will be performed via quarterly sampling at monitoring wells located immediately downgradient of the targeted source treatment area to document stable or decreasing trends and to justify monitored natural attenuation of the plume, or to show if additional remedial action of the source is needed.
Long-term monitoring will be performed for the source area on an annual basis for 5 years following completion of the mass discharge evaluation.

The estimated cost to implement the LDA excavation is approximately $6,250,000. A breakdown of the costs associated with various tasks to implement Alternative 3B is provided in **Table 2**.

LDA excavation with off-site disposal of contaminated soil is a viable and effective method of source area remediation for the SDI Site. It is intended to remove the majority of the DNAPL from the source area; therefore, significant reduction in contaminant mass as well as contaminant mass discharge is expected. Additionally, because the contaminant mass is physically removed, the permanence of this remedial alternative is high. The implementation of LDA excavation will limit exposure to the public by reducing the migration of contaminants to downgradient receptors. This remedial alternative is readily implementable, technically feasible (having been demonstrated at many contaminated sites), and can be accomplished with commercially available equipment.

*Downgradient Biobarrier*

Between the source area and the Chestnut Branch of Mantua Creek, an enhanced anaerobic bioremediation (EAB) "biobarrier" will be implemented using injection wells in three different depth intervals: shallow (30-40 feet bgs), intermediate (37.5-52.5 feet bgs), and deep (50-65 feet bgs). The wells are intended to overlap vertically to ensure complete vertical mixing in the treatment zone. The injection amendment would consist of a diluted emulsified vegetable oil enhanced with nutrients and ethyl lactate, xanthan gum, and sodium bicarbonate. Bioaugmentation would be required. Two rounds of injections in the biobarrier wall are anticipated to treat at least 3 pore volumes of groundwater migration between the downgradient edge of source treatment area and the biobarrier.

An EAB pilot study was recently conducted at the site to evaluate the effectiveness of this technology. The study showed that an EAB barrier can be effective to distribute amendments and mitigate downgradient migration of VOCs via sequential dechlorination of PCE and TCE to ethene and carbon dioxide. The *Enhanced Anaerobic Bioremediation Pilot Study* report was submitted to NJDEP in May 2016.

The biobarrier is an effective method to treat dissolved VOCs in groundwater during and following source treatment. It is estimated that the biobarrier will reduce PCE and TCE concentrations resulting in concentrations below 10-100 µg/L and cis-1,2-DCE and vinyl chloride concentration below 100-200 µg/L. These concentrations immediately downgradient of the biobarrier will be low enough for natural attenuation processes to further degrade the contaminants to below regulatory limits before reaching the receptor (Chestnut Branch of Mantua Creek). This technology is readily implementable and can be accomplished with commercially available equipment and materials.

To monitor long-term effectiveness of the biobarrier wall, performance monitoring consisting of a baseline sampling event and four quarterly sampling events for the first year will be performed at monitoring wells downgradient of the biobarrier. The monitoring well results will be evaluated against results from existing upgradient wells to evaluate effectiveness of the biobarrier. This would be followed by long-term monitoring of the downgradient plume, consisting of semi-annual monitoring and evaluation of groundwater and surface water for years thereafter.

The estimated cost to implement the biobarrier for downgradient plume treatment is approximately $2,709,000. A breakdown of the costs associated with the various tasks to implement this is provided in **Table 3**.

Because impacts to the immediate receptor (Chestnut Branch of Mantua Creek) have not been observed to date, an aggressive remedy to address the groundwater plume is not planned.

## PUBLIC COMMENTS OR QUESTIONS

The New Jersey Department of Environmental

Protection has established a public comment period to solicit citizens' opinions on the Proposed Plan. The public comment period will run from July 30, 2018 through August 31, 2018.

This Proposed Plan is open for public review, and public comment on the proposed remedial action will be solicited before any final decision on the AOC-1 remedy for the SDI Site is made.

Any written or oral comments or questions can be directed to Mark Herzberg, NJDEP Community Relations Coordinator for this site, at the following:

NJDEP Office of Community Relations
401 E. State Street
P.O. Box 420
Mail Code 401-05H
Trenton, NJ 08625-0420

Mark Herzberg
Community Relations Coordinator
(609) 633-1369
(800) 253-5647
mark.herzberg@dep.nj.gov

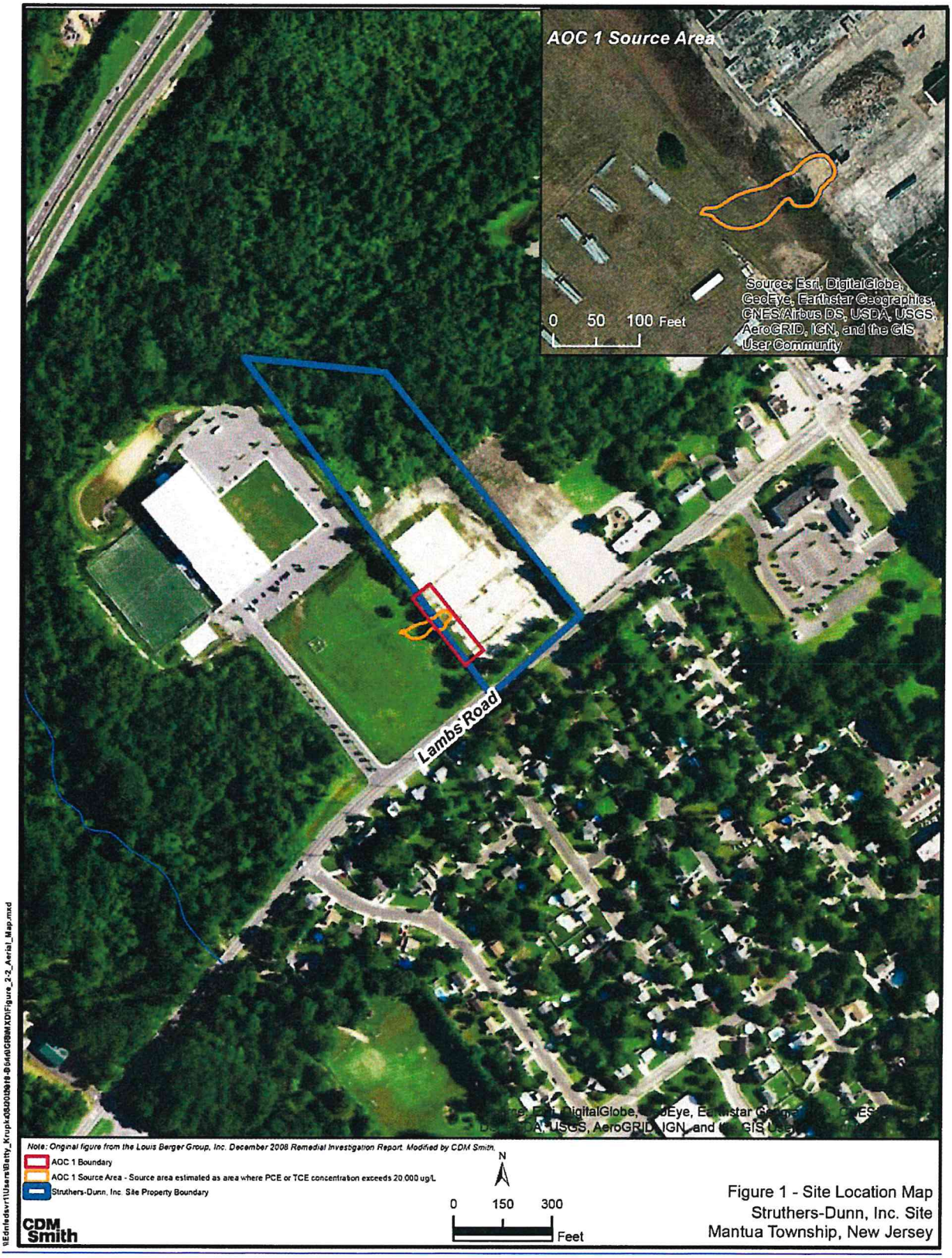
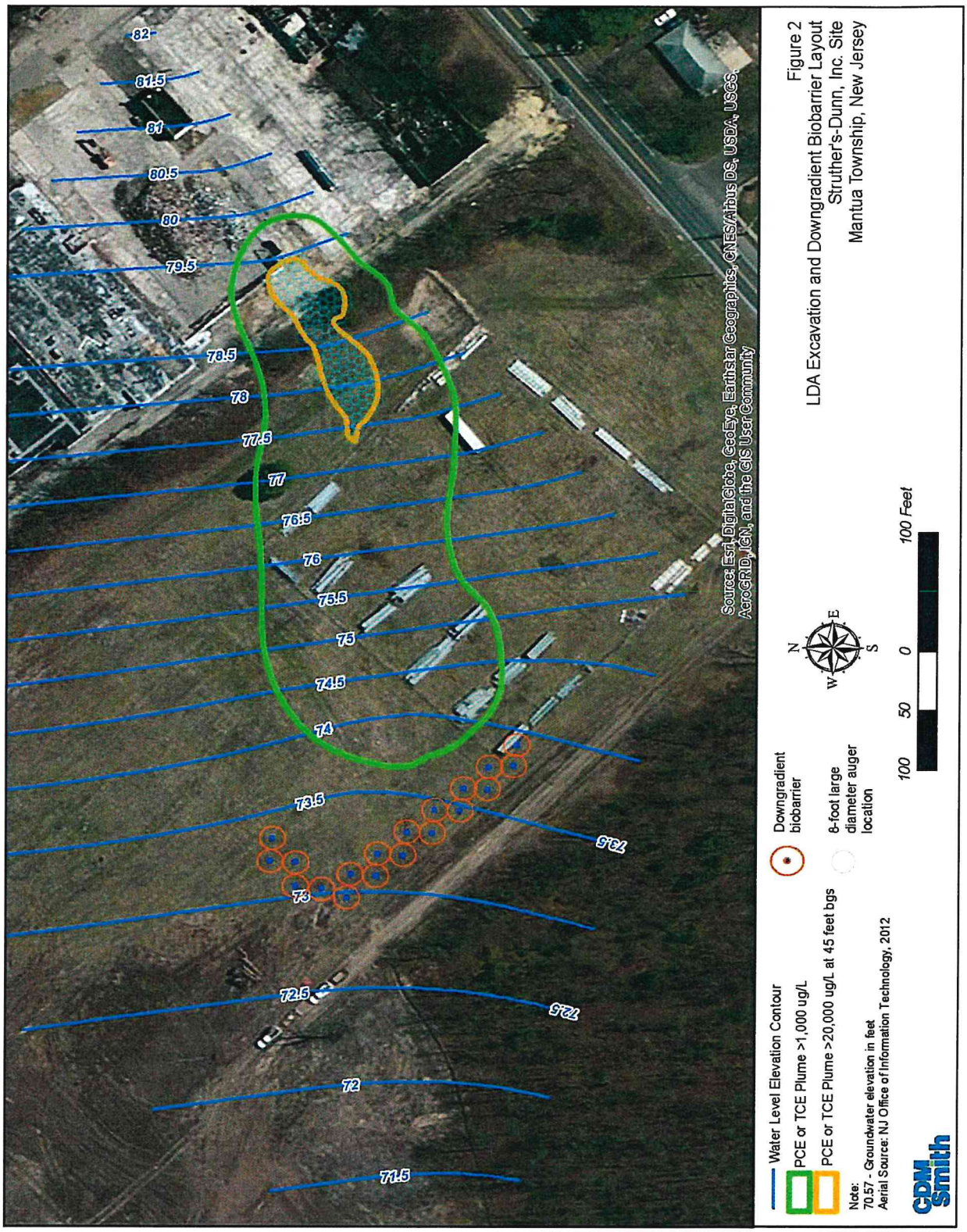



Figure 1 - Site Location Map
Struthers-Dunn, Inc. Site
Mantua Township, New Jersey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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Figure 2
LDA Excavation and Downgradient Biobarrier Layout
Struther's-Dunn, Inc. Site
Mantua Township, New Jersey
N
E
S
W
100 50 0 100 Feet
Water Level Elevation Contour
PCE or TCE Plume >1,000 ug/L
PCE or TCE Plume >20,000 ug/L at 45 feet bgs
Downgradient biobarrier
8-foot large diameter auger location
Note:
70.57 - Groundwater elevation in feet
Aerial Source: NJ Office of Information Technology, 2012
CDM Smith

**Table 1 – Summary of Remedial Alternative Comparison**

| Remedial Technology | Source Design and Implementation Timeframe | Total Source Remedy Cost |
|---|---|---|
| Alternative 1: No Action | | $ - |
| Alternative 2: IC | 3 months | $ 130,000 |
| Alternative 3A: Conventional excavation | 15 months | $ 14,863,000 |
| Alternative 3B: LDA excavation | 6 months | $ 6,250,000 |
| Alternative 4: *In Situ* Solidification/Stabilization | 12 months | $ 3,066,000 |
| Alternative 5A: *In situ* reduction (biotic and abiotic) | 246 months | $ 3,845,000 |
| Alternative 5B: *In Situ* Soil Mixing | 6 months | $ 4,315,000 |
| | | |
| **Remedial Technology** | **Downgradient Design and Implementation Timeframe** | **Total Downgradient Remedy Cost** |
| MNA | 12 months | $ 1,137,000 |
| *In situ* biobarrier - 1,000 µg/L VOC Plume | 69 months | $ 2,709,000 |
| *In situ* biobarrier - 5,000 µg/L VOC Plume | 69 months | $ 2,011,000 |

*__*Notes*__:

- MNA: monitored natural attenuation
- LDA: large-diameter auger
- ISS: *in situ* solidification/stabilization
- IC: institutional control
- ZVI: zero-valent iron

| Table 2 - Alternative 3B - LDA Excavation Cost Estimate Summary | | | |
|---|---|---|---|
| **Item** | **Item Description** | **Extended Cost** | |
| **CAPITAL COSTS** | | | |
| 1a. | Remedial Design - Preparation of RA-Specific Documents | $ | 57,200 |
| 1b. | Remedial Design - Post-RA Performance Monitoring | $ | 40,000 |
| 2a. | Implementation - Source Treatment with LDA excavation | $ | 4,345,000 |
| 2b. | Implementation - Well Installation for Performance Evaluation | $ | 116,000 |
| | Management cost (10%) | $ | 456,000 |
| | Contingency (20%) | $ | 912,000 |
| | ***SUBTOTAL - CAPITAL COSTS*** | **$** | **5,926,200** |
| **O&M COSTS** | | | |
| 3. | O&M | $ | - |
| 4. | Performance Monitoring - Mass Discharge Monitoring (Year 1) | $ | 115,000 |
| 5. | Long-Term Performance Monitoring (Years 2-5) | $ | 53,000 |
| 6. | Reporting | $ | 80,000 |
| | Management cost (10%) | $ | 25,000 |
| | Contingency (20%) | $ | 50,000 |
| | ***SUBTOTAL - O&M COSTS*** | ***$*** | ***323,000*** |
| | **TOTAL COSTS** | **$** | **6,250,000** |
| Note: Cost estimates are based on conceptual design, actual costs can range from +50% to -30% of this estimate. | | | |

| Table 3 - *In Situ* Biobarrier - 1,000 µg/L VOC Plume Cost Estimate Summary | | | |
|---|---|---|---|
| **Item** | **Item Description** | **Extended Cost** | |
| **CAPITAL COSTS** | | | |
| 1a. | Remedial Design - Preparation of RA-Specific Documents | $ | 67,000 |
| 1b. | Remedial Design - Post-RA Performance Monitoring | $ | 27,000 |
| 2a. | Implementation - Injection Well Installation for *In Situ Reduction* | $ | 466,000 |
| 2b. | Implementation - Well Installation for Performance Evaluation | $ | 81,000 |
| 3. | Implementation - *In situ* injections | $ | 713,000 |
| | Management cost (10%) | $ | 136,000 |
| | Contingency (20%) | $ | 271,000 |
| | ***SUBTOTAL - CAPITAL COSTS*** | **$** | **1,761,000** |
| **O&M COSTS** | | | |
| 4. | Performance Monitoring - Mass Discharge Monitoring (Year 1) | $ | 72,000 |
| 5. | Long-Term Performance Monitoring (Years 2-20) | $ | 422,000 |
| 6. | Reporting | $ | 235,000 |
| | Management cost (10%) | $ | 73,000 |
| | Contingency (20%) | $ | 146,000 |
| | ***SUBTOTAL - O&M COSTS*** | ***$*** | ***948,000*** |
| | **TOTAL COSTS** | **$** | **2,709,000** |
| Note: Cost estimates are based on conceptual design, actual costs can range from +50% to -30% of this estimate. | | | |

## Glossary

**Biobarrier:** A treatment zone/wall created by the systematic injection of an amendment into the subsurface to treat contaminated groundwater that passes through it.

**Chlorinated Volatile Organic Compound (CVOC):** Chlorine and Carbon-containing chemicals that evaporate readily at room temperature. Examples of products that contain CVOCs include dry cleaning fluid and degreasing agents.

**Dense Non-Aqueous Phase Liquid (DNAPL):** A groundwater contaminant present in a separate immiscible phase when in contact with water. Physical and chemical differences between water and DNAPL prevent the compounds from mixing. DNAPL compounds have a density greater than water which causes the compounds to sink deep into groundwater.

**Granular Activated Carbon (GAC):** Type of filtration commonly used to adsorb volatile organic compounds, following this treatment, contaminants have been removed from the aqueous solution and groundwater can be discharged into local storm water sewers, under specific permits.

**Groundwater:** Subsurface water that fills pores between materials such as sand, soil or gravel.

**Groundwater Quality Standards:** The Class II-A GWQS for PCE is 1.0 µg/L

**In-Situ:** Treatment method refers to those actions that treat soil contaminants in place. In-Situ treatment of VOC contaminated soil generally includes methods to separate and remove contaminants or to degrade contaminants in place. Since minimal or no removal or handling is required for this method, the in-situ process tends to be more economical then ex-situ processes but may require a longer time to meet remedial objectives.

**Micrograms per Liter (µg/L):** Units of concentration used to express the levels of groundwater contamination at a site undergoing a *Remedial Investigation* or a cleanup.

**Milligrams per Kilogram (mg/Kg):** Units of concentration used to express the levels of soil contamination at a site undergoing a *Remedial Investigation* or a cleanup.

**Perchloroethylene (PCE):** Another name for tetrachloroethene, also known as "Perc." This chlorinated volatile organic compound (CVOC) has historically been used as a dry cleaning fluid and degreasing agent.

**Pore Water**: Water contained in pores in soil or rock. Pore water in the sediment beneath a stream is also referred to as benthic water.

**Remedial Investigation:** An in-depth study designed to gather data necessary to determine the nature and extent of contamination at a site and establish criteria for addressing it.

**Remediate:** To remedy or clean up.

**Trichloroethene (TCE)**: This chlorinated volatile organic compound (CVOC) has historically been used as a degreasing agent

**Volatile Organic Compound (VOC):** Carbon-containing chemicals that evaporate readily at room temperature. Examples of products that contain VOCs include gasoline, dry cleaning fluid and degreasing agents.