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**Subject:** Delavan Spray Technologies Interim Removal Action Work Plan

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Cynde,  
Attached is the Interim Removal Action Work Plan that we discussed earlier this month. Please contact us with any questions.

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**Our office will move effective June 24, 2021. Please note our new address:**

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# **Interim Removal Action Work Plan**

**Delavan Spray Technologies Site  
4334 Main Highway  
US Highway 301 South  
Bamberg, South Carolina**

**VCC 13-4762-RP**

*Prepared by:*

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10 Patewood Drive  
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Greenville, South Carolina

June 2021

## INTERIM REMOVAL ACTION WORK PLAN

### DELAVAN SPRAY TECHNOLOGIES SITE BAMBERG, SOUTH CAROLINA

#### RESPONSIBLE PARTY VOLUNTARY CLEANUP CONTRACT NUMBER 13-4762

The undersigned certify that they have reviewed the attached document and that the document is in material compliance with the guidelines and requirements of the State of South Carolina and the South Carolina Department of Health and Environmental Control (SCDHEC) and specifically, requirements under the SCDHEC Voluntary Cleanup Contract (VCC). The data presentations contained herein are consistent with generally accepted practices in the environmental profession.

**Prepared by:**



Caleb Krouse, PE  
AECOM Project Engineer

6/18/21

Date

**Reviewed by:**



Conan Fitzgerald, PE  
AECOM Project Manager

6/18/21

Date

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## **1.0 INTRODUCTION**

AECOM Technical Services, Inc. (AECOM) has prepared this Interim Removal Action Work Plan (IRAWP) to describe the proposed installation and activation of a soil vapor extraction (SVE) system at the Delavan Spray Technologies Site (the Site). The Site is located at 4334 Main Highway (US Highway 301 South) in Bamberg, South Carolina (**Figure 1**). A Voluntary Cleanup Contract (VCC) (VCC 13-4762-RP) for the Site was signed between South Carolina Department of Health and Environmental Control (SCDHEC) and Delavan Spray, LLC (Delavan) on July 13, 2013 (SCDHEC, July 2013). Delavan is a wholly owned subsidiary of Collins Aerospace, a division of Raytheon Technologies Corporation (Raytheon Technologies).

This report provides background information and defines the interim removal action objectives (**Section 2**), describes the planning and permitting activities required for SVE system installation (**Section 3**), describes the proposed SVE system design and summarizes the system installation and operation procedures (**Section 4**), describes the anticipated waste management activities associated with the removal action (**Section 5**), and summarizes the future reports proposed to document the SVE system installation and operations for SCDHEC review (**Section 6**). Cited references are provided in **Section 7**. **Figures** are included following the report text.

**2.0 BACKGROUND AND INTERIM REMOVAL ACTION OBJECTIVES**

Assessment activities were initiated at the Site in 2003, after chlorinated volatile organic compounds (VOCs) were detected in groundwater beneath the Site. The primary compounds of concern (COCs) were reported to be tetrachloroethene (PCE) and its degradation products trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethene (1,1-DCE), and vinyl chloride (VC). A Remedial Investigation (RI) was implemented in accordance with the VCC in February and March 2014 (AECOM, July 2014). Several supplemental soil and groundwater investigations were performed between 2014 and 2020, including the recent high-resolution site characterization (HRSC) investigation within and surrounding the main facility building (AECOM, March 2021b). Based on the results of these investigations, elevated concentrations of PCE in soil directly below the building represent the most significant PCE release areas at the Site. During a meeting attended by SCDHEC, Raytheon Technologies, and AECOM on June 1, 2021, AECOM described the proposed installation of a horizontal well SVE system to expedite removal of PCE mass in soil below the building. This IRAWP is intended to formally propose implementation of the SVE system interim removal action for SCDHEC approval. The objectives of SVE system installation and operation are summarized as follows:

- Remove PCE mass from areas of vadose zone impacts delineated during the HRSC investigation, and
- Provide vapor capture infrastructure for future groundwater remediation (i.e. capture vapors produced from future air sparging or vapor byproducts produced from other future groundwater remediation alternatives, such as in-situ chemical or biological oxidation or reduction).

The water table below the building ranges from approximately 10 to 15 below ground surface (bgs) based on water level measurements collected from monitoring wells MW-19 and MW-20 between March 2014 and October 2020 (AECOM, March 2021a). As such, the proposed interim removal action is intended to remediate PCE within vadose zone and capillary fringe soils located above approximately 15 feet bgs.

The proposed interim action is not intended to represent a comprehensive remedy for the Site. As discussed with SCDHEC during the June 1, 2021 meeting, a Feasibility Study report intended to present, evaluate, and select the comprehensive remedial action(s) for the Site is scheduled to be submitted for SCDHEC review and approval in 2022.

### 3.0 PLANNING AND PERMITTING

The following sections describe the planning and permitting activities required for installation of the horizontal SVE wells and SVE system equipment at the Site.

#### 3.1 Contracting Approach

AECOM will manage the project on behalf of Raytheon Technologies as owner's representative and engineer. AECOM will subcontract qualified drillers, equipment suppliers, and remediation contractors to provide and install the SVE wells and equipment. Bid request packages will be prepared to detail horizontal SVE well installation, SVE equipment requirements, and on-Site equipment and piping installation requirements. The bid request packages will include detailed specifications and drawings developed in such a way as to require the applicable subcontractor to bid and perform Site work in accordance with this IRAWP.

#### 3.2 Permitting

Well construction and permitting requirements under South Carolina (SC) Regulations 61 - 71 are not applicable to the proposed horizontal SVE wells because the wells will not breach the water table. As such, no well permits will be obtained for the proposed horizontal SVE wells. In addition, an SC licensed water well driller will not be required to oversee installation.

Installation of the SVE system equipment will require submittal of a building permit application to the Bamberg County Inspection Department (County). The electrical service entry weatherhead and meter box for the equipment will be installed on-Site by an appropriately licensed electrician. Following permit approval and inspection by the County, electrical service will be activated by the Bamberg Board of Public Works Electric Utility.

The total area of land disturbing activities associated with the SVE well vaults, piping trench, and equipment pad is estimated at approximately 0.2 acres. Per South Carolina (SC) Regulation 72, "[f]or land disturbing activities involving two (2) acres or less of actual land disturbance which are not part of a larger common plan of development or sale, the person responsible for the land disturbing activity shall submit a simplified stormwater management and sediment control plan meeting the requirements of R.72-307H. This plan does not require approval by the implementing agency and does not require preparation or certification by the designers specified in R.72-305H and R.72-305I." Compliance with this regulation will be accomplished by submitting the *Notification Form for Sites Disturbing Less Than 1-Acre (Not Part of a Larger Common Plan, Non-Coastal County)* (DHEC Form 2628) and the required attachments to SCDHEC prior to land disturbance. SCDHEC notice of receipt documentation will be included in the Construction Completion Report discussed in **Section 6**.

The proposed SVE system will not require a new air quality construction permit nor modification of the Delavan facility's existing Bureau of Air Quality State Operating Permit. Based on AECOM experience with similar systems and a review of Site soil and groundwater concentrations, the VOC mass extracted by the system will qualify for exemptions from air quality permitting under SC Regulation 61-62.1. Specifically, the

total mass of applicable VOCs extracted by the system will fall below the 1,000 pound per month permitting exemption threshold under SC Regulation 61-62.1, Section 2(B)(2)(h) and the extracted mass of individual toxic air pollutants will fall below the applicable de minimis values under SC Regulation 61-62.1, Section 2(b)(6)(c). Most notably, mass extraction is expected to remain below the SC Toxics De Minimis value of 40.2 pounds per day for PCE. During SVE system testing and start-up, real-time photo-ionization detector (PID) and air flow measurements will be utilized to immediately screen for elevated mass discharge rates. If these measurements unexpectedly indicate mass discharge rates approaching the exemption criteria, the SVE system extraction flow rate will be decreased so that additional air quality permitting is not required. During SVE system operations, PID measurements and confirmatory laboratory analytical samples will be collected to calculate and document the longer-term SVE system mass extraction rates. Lastly, the vapors extracted by the SVE system will be treated via activated carbon prior to discharge. This voluntary vapor discharge treatment is unrelated to the air quality permitting exemption criteria, which are based on uncontrolled (pre-treatment) extraction rates. Nevertheless, the activated carbon will initially be implemented as a voluntary best practice to eliminate VOCs from the actual SVE discharge.

Conditions F.1.7 and F.1.8 of the Delavan facility's current permit grants the facility permission to construct and operate sources meeting the exemptions described above (SCDHEC, August 2020). Condition F.3 of the permit requires that the facility document specific information pertaining to permit exempt activities in its on-Site implementation log (OSIL). Condition F.5 of the permit requires the permittee to submit OSIL documentation to the SCDHEC once every five years. Based on these requirements, a summary of SVE system installation and operations, including documentation of calculated total VOC and individual constituent mass extraction rates, will be included in the OSIL and in the next applicable OSIL SCDHEC submittal. The OSIL will also document the use of voluntary activated carbon treatment, which may eventually be discontinued based on future vapor sampling results.

### **3.3 Access and Site Security**

The Delavan facility is secured to prevent access by pedestrians or bystanders by a 6-foot-tall, chain-link perimeter security fence. As such, potential exposures to Site COCs or SVE system installation construction hazards will be limited to Delavan facility staff, AECOM, and AECOM subcontractors. AECOM will utilize barricades throughout the construction process to isolate work areas from facility traffic and facility personnel. Safety risks to construction workers will be managed based on the procedures outlined in the health and safety plan described under **Section 3.5**.

### **3.4 Utility Clearance**

A private utility locating company will be contracted to locate and mark underground activities within the proposed work area prior to intrusive activities. The South Carolina One Call service will be contacted prior to mobilization and to maintain an active ticket throughout intrusive work activities. Soft digging methods will be utilized where well drilling entry points or piping trenches are excavated within 5 feet of a known utility.

### **3.5 Health and Safety Plan**

Health and safety plans will be developed in accordance with 29 CFR 1910 to designate procedures and equipment required to protect the health and safety of Site workers. The health and safety plans will include the following components:

- Site control measures in accordance with the control program required in 29 CFR 1910.120 and 29 CFR 1926.
- Procedures applicable to relevant local, state, and federal health and safety standards, regulations, and guidelines implemented through Occupational Safety and Health Administration (OSHA), the South Carolina Department of Transportation (SCDOT), and SCDHEC.
- Training requirements to be in compliance with 29 CFR 1910.120 including 40-hour OSHA HAZWOPER training.
- Job safety and hazard analysis documentation and field assessment forms for the work activities proposed.
- An emergency response plan meeting federal, state, and local requirements for safe and effective responses to emergencies. Explanation of potential emergencies and contingency plan of action, including description of the route to the nearest appropriate hospital, hospital route map, and posting of emergency telephone numbers at the Site.

## 4.0 SOIL VAPOR EXTRACTION SYSTEM INSTALLATION AND OPERATION

The following sections summarize the proposed design components and procedures for horizontal SVE well installation, piping installation, equipment installation, and system start-up and operations.

### 4.1 Horizontal SVE Well Installation

A total of seven horizontal wells will be installed below the main Delavan facility building via horizontal directional drilling (HDD) techniques. The proposed well locations are shown on **Figure 2**. Proposed SVE well construction details are presented on **Figure 3**. As shown, the horizontal well screens will be installed approximately 6 feet below the building slab within the vadose zone soils. Well locations and depths may be modified in the field based on identification of utilities or other obstructions or based on new information gathered during well installation. During the installation process, AECOM will temporarily apply vacuum to one of the horizontal SVE wells to determine the achievable well flow rate and optimum extraction vacuum. Data collected during the test will be used to confirm and/or finalize the system equipment design discussed in **Section 4.2**.

### 4.2 SVE Conveyance Piping and Equipment Installation

Following horizontal well installation, a trench will be excavated between each horizontal SVE well and the SVE system equipment area for installation of soil vapor conveyance piping. The piping will connect to each well inside of a wellhead access vault. The proposed SVE well vaults, piping trench, and SVE system equipment area locations are shown on **Figure 2**. The SVE system equipment will be pre-assembled within a standard shipping container and transported to the Site for installation within the proposed system equipment area. A process and instrumentation diagram for the SVE system equipment is presented on **Figure 4**. As shown, the system equipment will include a control panel, blower, moisture separator, condensate transfer pump, condensate storage tank, and two vapor-phase activated carbon vessels.

### 4.3 SVE System Start-up and Operations

Following SVE system installation, the system will be activated by gradually introducing vacuum to each of the seven horizontal SVE wells. An optimum flow and vacuum will be determined for each well to maximize VOC mass removal and confirm vacuum influence across the entire area targeted. As discussed in **Section 3.2**, multiple rounds of PID and flow measurements will be collected during start-up to confirm that mass extraction rates conform to air quality permit exemptions. If these measurements unexpectedly indicate mass discharge rates approaching the exemption criteria, extraction flow rates will be temporarily decreased so that additional air quality permitting is not required. Over time, VOC concentrations in the extracted vapor will decrease as the subsurface VOC mass is progressively removed.

AECOM will initially perform operations and maintenance (O&M) Site visits up to four times per month following start-up. The SVE system will include remote telemetry and will notify the operator of system warnings (e.g. high condensate level) and system shutdown alarms. The frequency of O&M visits will decrease over time after consistent SVE system performance has been established. O&M site visit tasks

will include vacuum and flow readings and adjustments, blower inlet filter change outs, cleaning of system components, checking float switches and alarms to confirm functionality, collection of vapor influent PID readings and laboratory analytical samples, and troubleshooting unplanned system alarms and shutdowns. The vapor-phase granular activated carbon vessels will be changed out as needed based on SVE effluent PID or laboratory sample results. As needed, the condensate storage tank will be emptied and the condensate will be disposed of as discussed in **Section 5**. In addition to visits by the O&M technician, remote on-line system monitoring and data logging will be performed by the Project Engineer.

## **5.0 WASTE MANAGEMENT**

Waste generated during SVE system installation will include used drilling mud, well borehole drill cuttings, equipment decontamination wash water, and excess soils from SVE piping trenches. Waste generated during system operations will include condensate water collected by the moisture separator. Waste will be characterized via the collection of Toxicity Characteristic Leaching Procedure (TCLP) samples for analysis of VOCs and any other constituent analysis requested by the applicable disposal facility. Waste is anticipated to be characterized as non-hazardous based on sample results for soil and groundwater investigation derived waste (IDW) generated during previous investigations below the main facility building. Following characterization, wastes generated during system installation and operations will be disposed of in accordance with applicable State and Federal regulations.

## **6.0 REPORTING**

An interim removal action Construction Completion Report will be submitted to SCDHEC within 60 days following SVE system start-up. The report will include as-built drawings of the horizontal SVE wells, piping trenches, and SVE system equipment, waste manifests for waste generated during system installation, documentation of the permits and notifications discussed in **Section 3.2**, system start-up flow and vacuum data, system start-up PID and laboratory analytical vapor sample results, and calculated extraction rates for total VOCs and individual vapor constituents.

Following start-up, SVE operations data will be included in the semi-annual groundwater monitoring reports submitted to SCDHEC in approximately March and September of each year. The reports will include a summary of SVE system O&M activities, vacuum and flow measurement data, a summary of SVE vapor PID and laboratory analytical vapor sample results, and calculated extraction rates for total VOCs and individual vapor constituents.

As discussed in **Section 3.2**, a summary of SVE system installation and operations will also be included in the facilities OSIL and in the next applicable OSIL SCDHEC submittal.

## **7.0 REFERENCES**

AECOM, July 2014. *Remedial Investigation Report, United Technologies Corporation, Delavan Spray Technologies Site, 4334 Main Highway, Bamberg, South Carolina*. July 3, 2014.

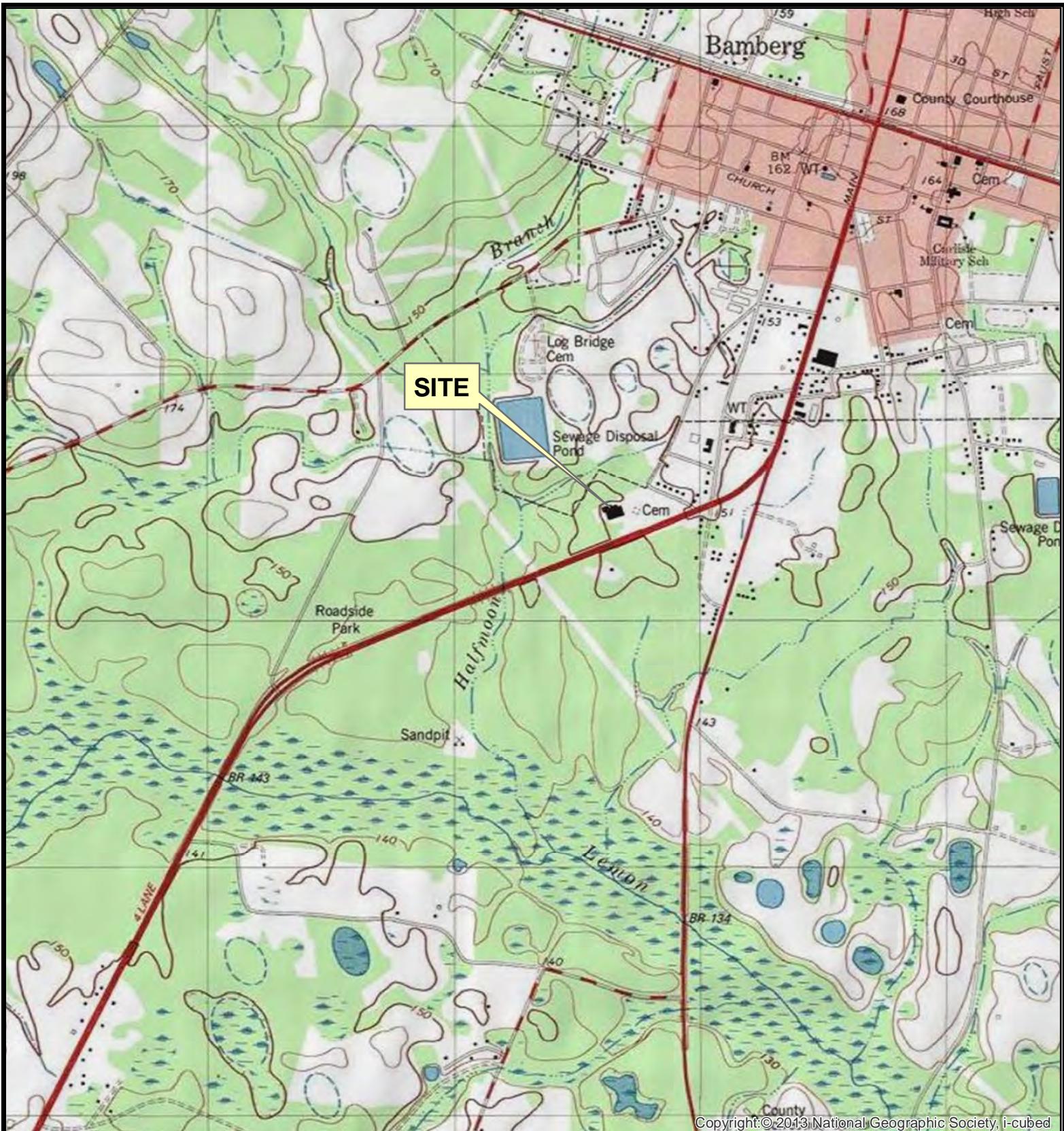
AECOM, March 2021a. *Fall 2020 Semi-Annual Groundwater Monitoring Report, Delavan Spray Technologies Site, Bamberg, South Carolina*. March 5, 2021.

AECOM, March 2021b. *High Resolution Source Characterization Report, Delavan Spray Technologies Site, Bamberg, South Carolina, VCC 13-4762-RP*. March 9, 2021.

SCDHEC, July 2013. Voluntary Cleanup Contract 13-4762-RP. July 3, 2013

SCDHEC, August 2020. *Bureau of Air Quality State Operating Permit, Delavan Spray, LLC, 4334 Main Highway Bamberg, South Carolina 29003, Bamberg County Permit Number: SOP-0260-0013*. Issue Date: August 11, 2020. Effective Date: October 1, 2020.

**FIGURES**



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Feet



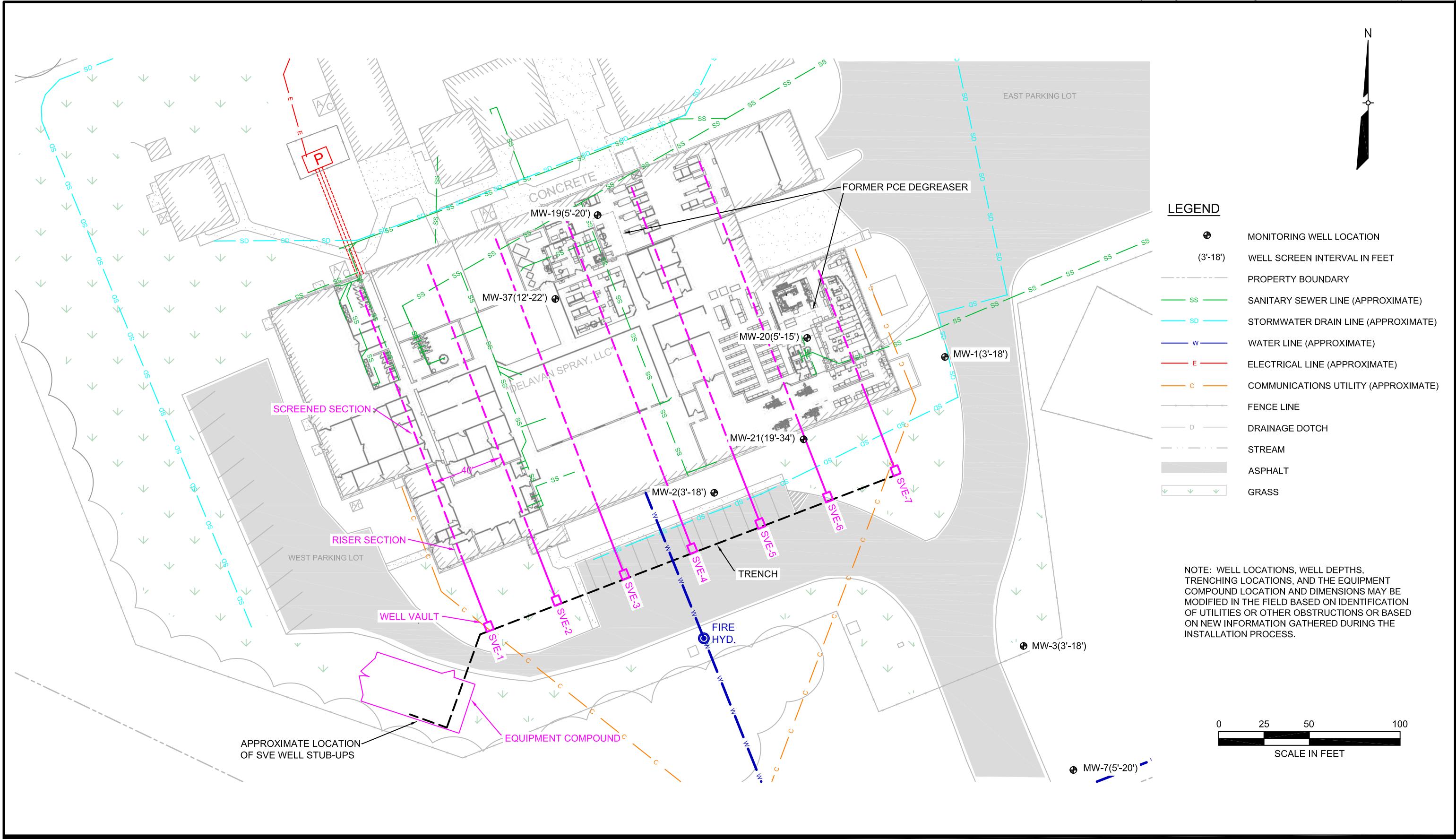
U.S.G.S. QUADRANGLE MAP  
BAMBERG, SC 1979 (PHOTO REVISED 1987)  
QUADRANGLE  
7.5 MINUTE SERIES (TOPOGRAPHIC)

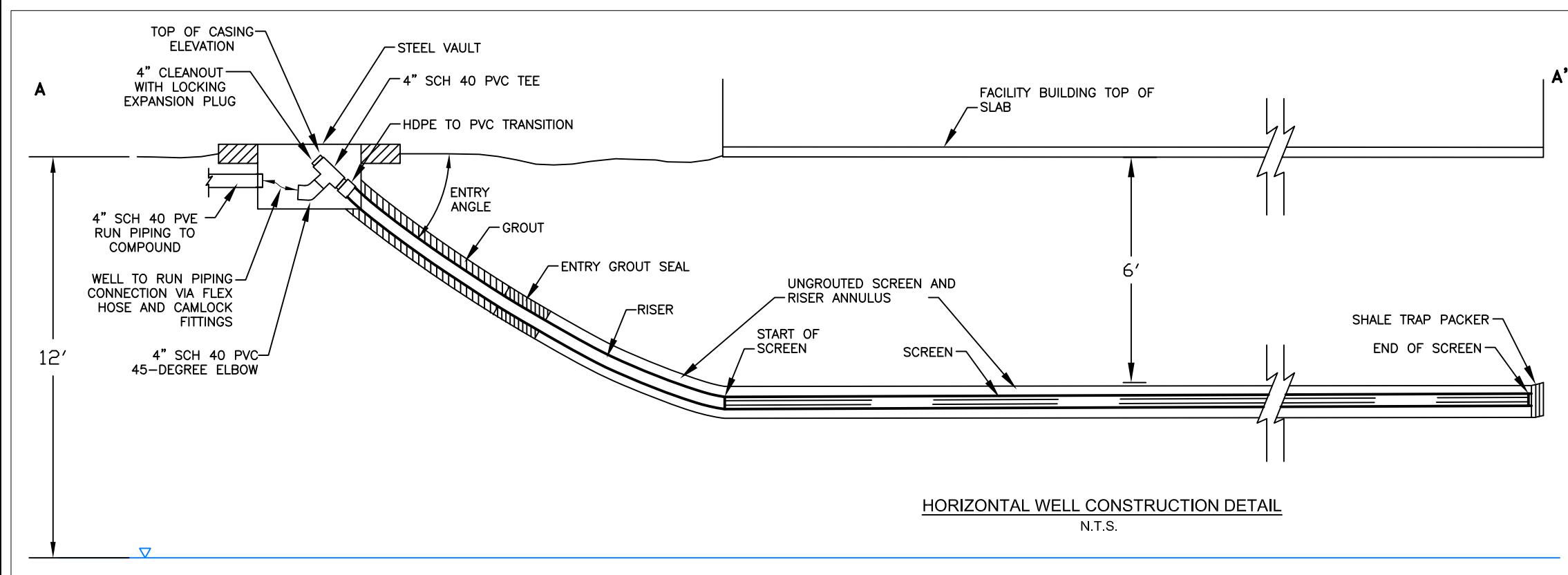
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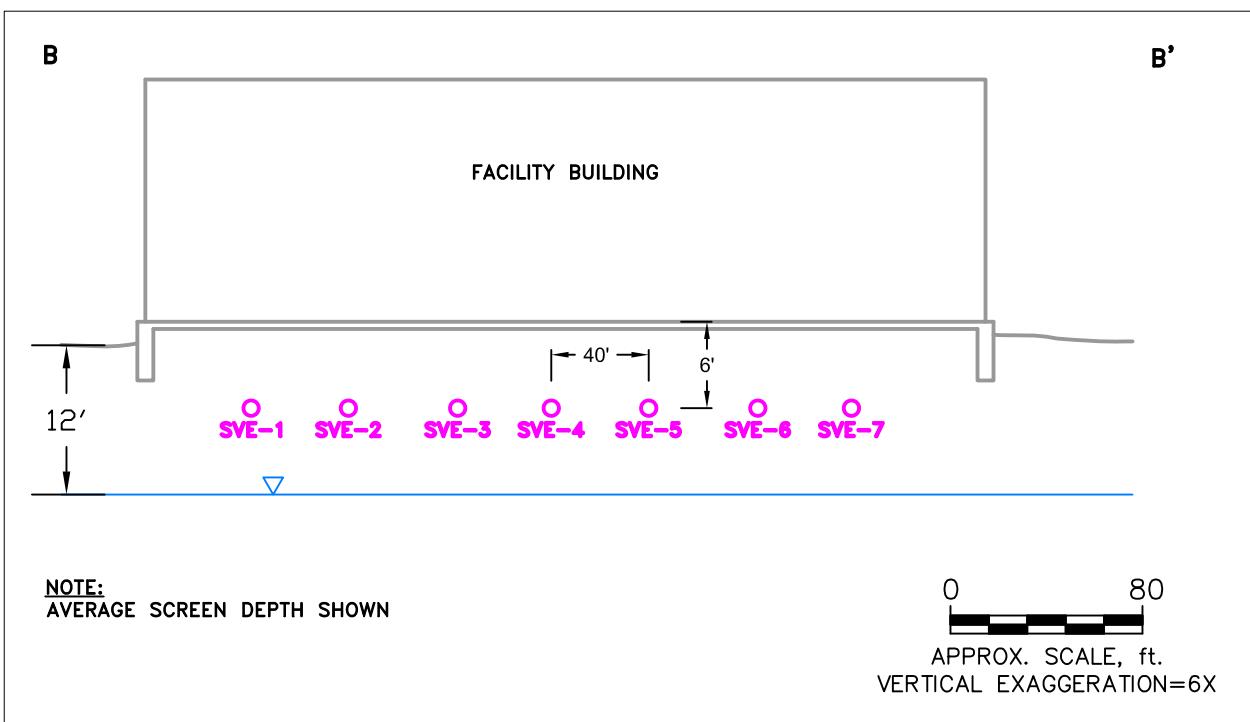
Delavan Spray Technologies Site  
Bamberg, South Carolina  
Site Location Map

Project No. 60629985	Prepared by KCG	Date January 2021	Figure 1
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LEGEND

APPROXIMATE WATER TABLE

CROSS-SECTION A-A'

SVE Well ID	Orientation	Well Diameter (inches)	Screen Depth (ft bgs)	Entry Angle (degrees from horizontal)	Screen Length (ft)	4-inch Riser Length (ft)	Total Bore Length (ft bgs)	4-inch Pipe Run Length (ft)
SVE-1	Horizontal	4	6	8	150	50	200	100
SVE-2	Horizontal	4	6	8	150	50	200	140
SVE-3	Horizontal	4	6	8	150	50	200	180
SVE-4	Horizontal	4	6	8	150	50	200	220
SVE-5	Horizontal	4	6	8	150	50	200	260
SVE-6	Horizontal	4	6	8	150	50	200	300
SVE-7	Horizontal	4	6	8	70	50	120	340
		Total	970	350	1,320	1,540		

PROPOSED WELL CONSTRUCTION

