AECOM **Environment**

Submitted to
North Carolina Department of Transportation
Raleigh, NC

Submitted by
AECOM
Raleigh, NC
60297531.7
July 2013

Former Lee Paving Asphalt Testing Site Phytoremediation System Final Construction Report

North Carolina Department of Transportation
NCDOT Priority Testing Site No. 6-48 (34613.3.13)
240 Sugar Lake Road
Pittsboro, Chatham County, North Carolina

AECOM Environment

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List of Acronyms

1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
AECOM	AECOM North Carolina, Inc.
ARCADIS	ARCADIS Geraghty & Miller, Inc. of North Carolina, Inc.
bgs	below ground surface
CCEQD	Chatham County Environmental Quality Department
cis-1,2-DCE	cis-1,2-dichloroethene
CT	carbon tetrachloride
MOA	Memorandum of Agreement
NCDOT	North Carolina Department of Transportation
S&ME	S&ME, Inc.
Site	former Lee Paving Asphalt Testing Site (NCDOT Priority Testing Site #6-48) in Pittsboro, Chatham County, North Carolina
SVE	soil vapor extraction
TCE	trichloroethene
trans-1,2-DCE	trans-1,2-dichloroethene

1 Introduction

The North Carolina Department of Transportation (NCDOT) developed this construction completion report for the former Lee Paving Asphalt Testing Site (NCDOT Priority Testing Site #6-48) in Pittsboro, Chatham County, North Carolina (the Site) shown on Figure 1-1. This document was prepared for the NCDOT by AECOM Technical Services of North Carolina, Inc. (AECOM).

The property is owned by S.T. Wooten Corporation and operates as an asphalt production facility with an active onsite laboratory. The NCDOT has never owned or controlled the Site or the current and former on-Site laboratories. On-Site impacts are addressed by an existing remediation system and monitoring network, which includes the following components:

- Groundwater extraction wells (RW-1 and RW-2)
- An air stripper and granulated activated carbon treatment system that discharges treated water to an unnamed tributary of the Haw River under a National Pollution Discharge Elimination System Permit
- Twenty-two monitoring wells (48MW-1, 48MW-2, 48MW-3, 48MW-4R, 48MW-5, 48MW 10, 48MW-11R, 48MW-12, 48MW-13, 48MW-14, 48MW-15, 48MW-16, 48MW-17, 48DW-1, 48DW-2, 48DW-3, 48DW-4, 48DW-5, 48DW-6, 48DW-7, 48DW-8, and 48SVE-01)
- Monitoring wells 48MW-8 and 48MW-9 were reportedly destroyed prior to January 2003 (S&ME, Inc. [S&ME], 2003). Monitoring wells 48MW-6 and 48-MW-7 were permanently abandoned during April 2007 (ARCADIS Geraghty & Miller, Inc. of North Carolina, Inc. [ARCADIS], 2007). Wells 48DW-6, 48DW-7, 48DW-8, and 48SVE-01 were installed during March 2012.
- Five stream monitoring locations (48HS-1-SW/48SW-3, 48HS-2-SW/48SW-2, 48HS-3-SW/48SW-1, 48HS-4-SW, and 48HS-5-SW)
- Five pore water sample locations (48HS-1, 48HS-2, 48HS-3, 48HS-4, and 48HS-5)

The following section provides a brief Site description, history and a summary of the construction process for the phytoremediation system.

1.1 Site Background

The NCDOT periodically conducted asphalt testing at the Site in an asphalt testing laboratory owned by Lee Paving. S.T. Wooten Company currently uses the Site as an asphalt production facility. The approximate location of the current and former S.T. Wooten and Lee Paving testing laboratories are illustrated on Figure 1-2. In addition, Figure 1-2 shows the current layout of the asphalt plant and the location of the remediation system including the air sparging points, soil vapor extraction (SVE) points, recovery wells, groundwater monitoring wells, and surface water monitoring points.

The testing procedures employed at the former Lee Paving laboratory involved the use of chlorinated solvents, which may have included carbon tetrachloride (CT); 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE). In 1989, a Memorandum of Agreement (MOA) between NCDOT and the North Carolina Department of Environment and Natural Resources was entered to conduct site assessments at 72 former NCDOT asphalt testing sites. Additional MOAs dated July 1996 and February 1999 were issued to establish a list of target compounds and to address the preparation of Comprehensive Site Assessments and Corrective Action Plans at a selected number of these sites, including the Site.

The target compound list for the NCDOT sites, defined under the MOA, includes 12 chlorinated solvents associated with the former asphalt materials testing activities including the three primary compounds (CT; 1,1,1-TCA, and TCE) and associated daughter products (1,1-dichloroethene [1,1-DCE], 1,1-dichloroethane [1,1-DCA], trans-1,2-dichloroethene [trans-1,2-DCE], cis-1,2-dichloroethene [cis-1,2-DCE], vinyl chloride, chloroethane, chloroform, methylene chloride, and methyl chloride). Non-target compounds are other volatile organic compounds on the United States Environmental Protection Agency Method 8260 target compound list that, if present, may be associated with non-NCDOT related releases. A more detailed discussion of

historical investigation and remediation activities is provided in the Phytoremediation Interim Measures Work Plan (AECOM, 2013)

NCDOT Target Compound List: Primary Compounds and Associated *Daughter Products*		
TCE	**CT**	**1,1,1-TCA**
Cis-1,2-DCE	*Chloroform*	*1,1-DCA*
Trans-1,2-DCE	*Methylene chloride*	*Chloroethane*
1,1-DCE	*Methyl chloride*	
Vinyl chloride		

Recent monitoring at the Site indicated the presence of NCDOT target compounds in the surface waters of an unnamed tributary to the Haw River. As a result, a phytoremediation system was designed and installed to inhibit groundwater contaminant plume migration and remove contaminants from the saturated zone immediately adjacent to the stream (via a combination of phytovolatilization/diffusion and degradation within the rhizosphere). The following sections of this report discuss installation activities performed during implementation of the phytoremediation system.

1.2 Construction Overview

Upon receiving approval from NCDOT, AECOM prepared a detailed design to install black willow (*Salix nigra)* cuttings in a plot for groundwater remediation purposes. The phytoremediation system was installed in general accordance with the Phytoremediation Interim Measures Work Plan (AECOM, 2013). A plot was selected within the Site boundary adjacent to Sugar Lake Road that would provide the greatest opportunity for the survival of black willows and potential to uptake impacted groundwater. A site visit was conducted by AECOM (March 2012) to verify the location of a small wetland identified during an environmental impact assessment (Hal Owen & Associates, 2012). On March 18, 2013, AECOM and Dan LaMontagne from the Chatham County Environmental Quality Department (CCEQD) performed a site walk to confirm the location of the plot with respect to the wetland and to identify any applicable local ordinances. After discussions with CCEQD, it was established that the installation of the phytoremediation system was exempt from the Jordan Lake Watershed Management buffer ordinances due to the low impact (no grading of land and planting of native species) of the system (Chatham County Watershed Protection Ordinance, Section (I), J-3).

In accordance with the work plan, existing shrubs and trees with minimal water usage within and immediately adjacent to the plot were removed. Black willow cuttings were planted in rows perpendicular to groundwater flow (towards the unnamed tributary to the Haw River). The black willows were planted in borings backfilled with an amended soil mixture. Tree tubes were installed around each cutting and tied to a stake for support. Subsequent to tree installation, fescue seed was spread around the trees to assist in soil and sediment control within the plot.

2 Phytoremediation System Construction

A phytoremediation system was installed between wells 48MW-15, 48DW-4, 48MW-12 and the unnamed tributary to the Haw River in April 2013. The installation of the phytoremediation system, designed to inhibit groundwater contaminant plume migration and remove contaminants from the saturated zone (via a combination of phytovolatilization/diffusion and degradation within the rhizosphere), consists of 89 black willow cuttings (S*alix nigra*) planted on approximate 10-foot centers (See Figure 2-1).

The following sections describe the construction activities associated with the installation of the phytoremediation system.

2.1 Site Preparation

A site visit was conducted to inspect the plot and determine the feasibility of a phytoremediation system. Existing trees within and surrounding the plot were flagged for removal (See Appendix A). Approximately twelve medium to large trees were flagged for removal within the plot and another twelve were marked for removal from the boundaries of the plot to prevent excess shading of the new trees. The North Carolina 811 system was contacted to locate underground utilities. Underground utilities were not identified within the planting area.

Dan LaMontagne, with CCEQD, attended the site visit and provided concurrence of the tree removal and proposed planting location. Based on the site visit and conversations with the CCEQD, installation of the phytoremediation system was determined to be in compliance with local ordinances (Chatham County and Jordan Lake Watershed) and no applicable permit/plan (i.e., sediment and erosion control) or buffer was required for associated activities.

2.2 Tree Removal

Tree and shrub removal was completed by Environmental Field Management and Tyndall Tree Service under the guidance of AECOM. The goal of tree removal was to provide a clear planting area and open the canopy to allow sunlight to reach the willow cuttings. Undergrowth was removed with a brush cutter. Medium to large trees (predominantly sweet gum and pine) were felled in place and cut into manageable sections. A skid steer was used to feed smaller sections into a wood chipper, and larger sections were stacked adjacent to the plot or removed from the Site. Wood chips were spread on the ground within and adjacent to the plot. Photographs of tree removal activities are provided in Appendix A.

2.3 Sediment and Erosion Control

While it was not required, supplementary soil and erosion control measures were implemented as a best management practice. Approximately 175 feet of silt fence was installed along the unnamed tributary and small wetland. Woodchips from the existing trees and undergrowth were spread throughout the plot, a layer approximately 1-2 inches thick covered the majority of the plot (See Appendix A). In addition, fescue seed was spread throughout the plot along with a slow release fertilizer (up to four months) to support growth of the grass.

2.4 System Layout

The planting locations were marked in rows within the plot. Planting locations were plotted on 10-foot centers with 10 feet between each row (See Appendix A). Additional locations were also marked for planting between rows. These locations were added to optimize groundwater uptake and maximize the number of trees within the limited area of the plot.

2.5 Riparian Buffer

A buffer was not required between the creek and the phytoremediation plot due to minimal land impacts and planting of native black willows; however, an approximate 20-foot buffer was maintained as a precautionary measure. The 20-foot buffer was implemented along the unnamed tributary and the small wetland. AECOM personnel walked along the tributary marked the

20-foot set-back on 5-foot intervals with pin flags. Black willow cuttings were not planted within this buffer. In addition, fescue grass seed was spread along this buffer to minimize erosion of exposed soil.

2.6 Tree Installation

2.6.1 Creation of Boreholes

Boreholes were advanced (April 8 to 10, 2013) at each planting location using a track mounted AMS PowerProbe 9500-VTR and 4¼ -inch hollow-stem augers. Each borehole was advanced to the saturated zone, which ranged from 2 to 10 feet below ground surface (bgs). Groundwater was observed infiltrating and stabilizing within the majority of boreholes. Some boreholes were allowed to sit overnight to determine a stabilized depth to groundwater. Borehole depths are summarized in Table 2-1. Each borehole was backfilled with a compost and sand mixture (50 percent/50 percent by volume) and a slow release fertilizer (15-9-12 at a rate of approximately 2.5 pounds per yard) and saturated with water. The boreholes were tamped and allowed to settle to ensure the matrix was completely compacted. Where settling occurred, additional backfill was added and compacted prior to planting. Approximately 20 yards of backfill were required. The backfill was amended with a slow release fertilizer to provide nutrients to the cuttings over an extended period of time (approximately six months).

2.6.2 Black Willow Planting

Black willow cuttings were acquired from Hillis Nursery, a commercial grower located in Tennessee. The 6-8 foot cuttings were collected prior to leafing and stored in an industrial refrigerator to remain dormant until they were shipped for planting. AECOM received the cuttings on April 10, 2013 and planting was conducted between April 10 and 12, 2013. The black willow cuttings were installed using a dibble, and each cutting was planted approximately 2 to 5.5 feet bgs (See Table 2-1). The planting depths were based on the depth of the saturated zone observed during borehole installation.

A total of 89 black willow cuttings were planted in the plot covering an area of approximately 8,000 square feet (See Figure 2-1). Tree tubes (4 feet long) were installed around each of the black willow cuttings to deter animals (i.e., rabbits and deer) from grazing on the newly planted trees. The tree tubes are made of a semi-translucent material to allow sunlight to penetrate to the cuttings and are perforated for air circulation. Each tree tube was secured with a wooden stake (See Appendix A).

2.7 Investigative Derived Waste Management

The planting area is outside the extent of impacted soil at the Site. As a result, soil investigative derived waste generated during the creation of boreholes was spread on the ground surface within the planting area.

2.8 Location and Elevation Survey

The horizontal and vertical coordinates of each black willow cutting were surveyed by Stantec, Inc. a North Carolina-licensed surveyor. The survey was conducted on May 16, 2013.

3 Plot Establishment and Maintenance

Weekly site visits indicate that the willow cuttings began to produce buds less than one week following planting, and noticeable growth was produced during the first month following planting. Photographs will be taken on a weekly basis to monitor growth, and maintenance will be performed on an as needed basis. Maintenance may include weed removal, watering, and trimming. However, based on the shallow depth to groundwater in the plot area, watering requirements are expected to be minimal. The tree tubes will be removed once the trees are well established and are less susceptible to damage from foraging wildlife.

4 References

AECOM, 2013. Phytoremediation Interim Measures Work Plan, NCDOT Pittsboro Asphalt Site No. 6-48 (34613.3.13), 240 Sugar Lake Road, Pittsboro, Chatham County, North Carolina. May 2013.

ARCADIS, 2007. Semi-Annual Report on Groundwater Remediation System O&M and Monitor Well Sampling – January 2007 Through June 2007. Former Asphalt Testing Site #6-48, Pittsboro, North Carolina. August 2007.

Hal Owen & Associates, 2012. Environmental Impact Assessment, S.T. Wooten – Pittsboro Site, Sugar Lake Road, Pittsboro, NC. August 2012.

S&ME, 2003. Groundwater Monitoring Report, Former Asphaltic Materials Testing Laboratory Sites, Site NO. 6-48 (S.T. Wooten Construction, 240 Sugar Lake Road, Pittsboro, North Carolina. March 2003.

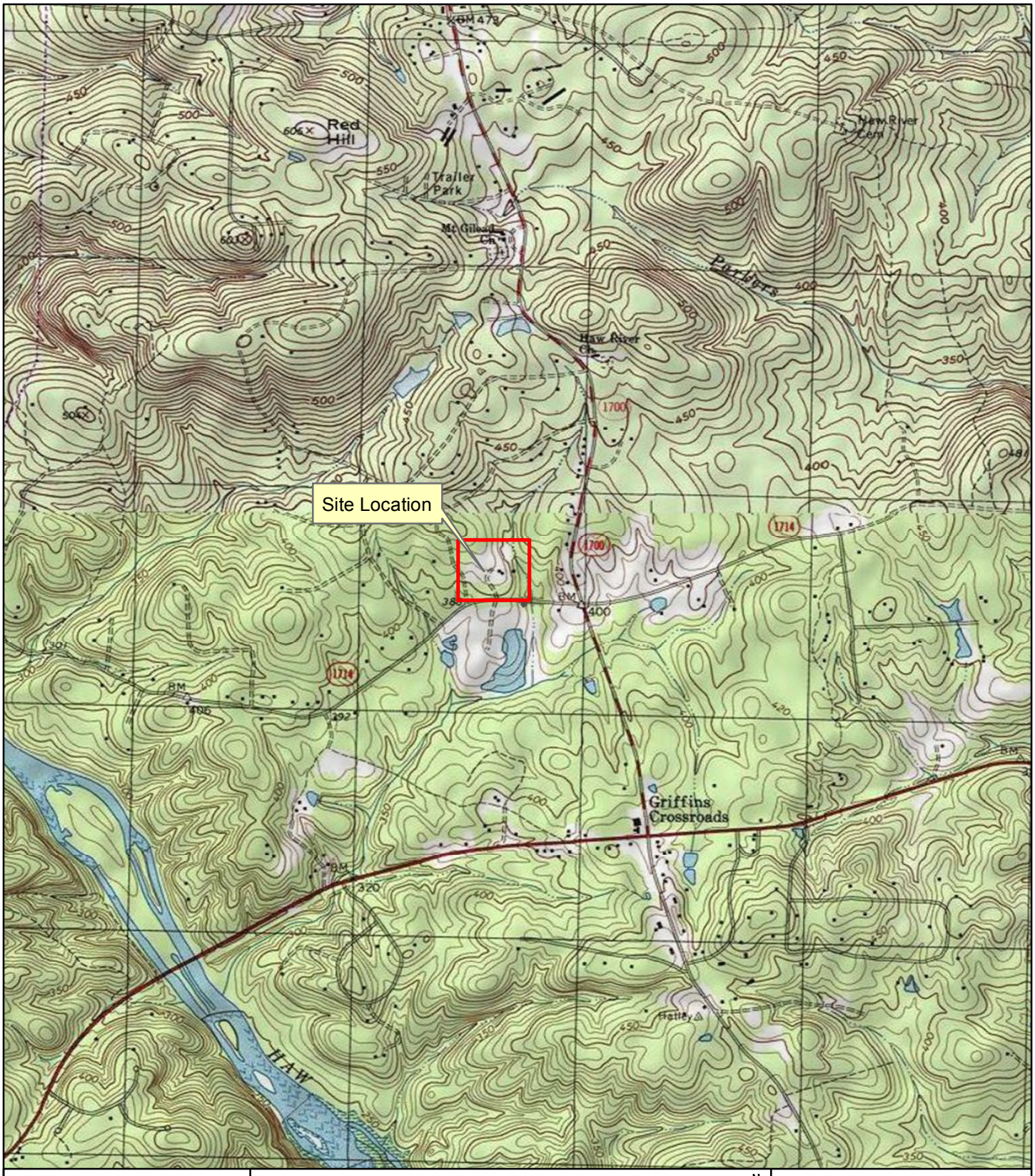
Tables

Table 2-1
Soil Borings and Black Willow Planting Depths
Former Lee Paving Asphalt Testing Site
NCDOT Priority Testing Site No. 6-48
Pittsboro, North Carolina

Tree Number	Boring Depth (ft bgs)	Depth to Water (ft bgs)	Planting Depth (ft bgs)	Northing	Easting	Ground Surface Elevation (ft msl)
1	7.5	5.5	3	726737.189	1973410.111	374.031
2	7.5	7	3	726740.615	1973400.605	374.706
3	7.5	7	3	726737.277	1973389.482	375.057
4	8.5	8	3	726742.915	1973384.428	375.321
5	9.1	8.2	4	726752.701	1973379.318	375.774
6	10	9	3.5	726750.059	1973369.028	376.183
7	8.5	~4.5	5	726757.263	1973365.835	376.37
8	10	5.5	4	726761.684	1973358.091	376.939
9	~5	~2.5	~3	726729.146	1973369.259	375.373
10	10	4	~3.5	726739.844	1973357.31	376.274
11	10	3.75	~3.5	726738.607	1973369.095	375.656
12	5	2.5	~2.5	726727.766	1973376.986	374.988
13	5	2.5	2.5	726724.894	1973389.015	374.77
14	5	2.3	2.5	726724.766	1973397.325	374.335
15	5.5	5	~5	726726.254	1973405.159	374.415
16	5	4	2.5	726715.915	1973399.634	374.156
17	5	4	2.5	726716.906	1973388.915	374.493
18	4.5	2.5	~2.5	726719.057	1973378.942	374.97
19	5.5	2.5	3	726719.246	1973369.046	375.433
20	5.5	~3	3	726720.176	1973358.288	375.899
21	~5.5	~2.5	~3	726730.416	1973358.054	376.053
22	5.5	~3	3	726738.133	1973378.85	375.394
23	5	~3	3	726711.111	1973358.679	375.932
24	5	~3	~3	726707.913	1973367.989	375.448
25	4.5	3	~3	726707.862	1973378.354	374.716
26	5	~2	2	726705.277	1973388.191	374.587
27	5.5	~2	~2	726704.93	1973397.265	373.959
28	2	~2	~2	726698.322	1973369.548	374.928
29	9	~5	3	726700.727	1973360.456	375.834
30	5	~5	2.5	726695.369	1973398.364	373.648
31	5	~3	2.5	726697.935	1973389.241	374.372
32	5	2	~2	726698.945	1973380.307	374.691
33	9	~5	3	726689.986	1973359.773	375.579
34	5	~3	~3	726689.206	1973369.112	374.81
35	4	3	~3	726688.222	1973378.652	374.437
36	5	2.5	~2	726687.079	1973388.806	374.023
37	5	2	~2	726685.745	1973397.77	373.194
38	5	~2.5	~2	726683.904	1973406.738	373.329
39	5	4	~4	726672.09	1973428.685	372.998
40	5	~2.5	~2	726672.874	1973420.083	373.308
41	5	1.5	~2	726675.139	1973410.15	373.181
42	5	2	~2	726676.171	1973399.852	373.647
43	5	~2.5	~2	726677.366	1973390.51	373.954
44	5	~2.5	~2	726679.137	1973382.143	374.247
45	7	6.5	~5.5	726678.691	1973371.045	374.616
46	8.5	~4.5	~4	726680.156	1973361.982	374.96
47	5	2.5	~2	726661.179	1973437.111	373.289
48	5.5	~2.5	~2	726665.183	1973429.249	373.185
49	5.5	2.5	~2	726665.558	1973416.97	373.393
50	5.5	~2.5	~2	726651.613	1973437.153	373.327
51	5	3.5	3	726713.687	1973372.602	375.462
52	5.5	~2.5	~2	726651.659	1973428.975	373.176
53	5.5	5	~2	726641.727	1973428.827	373.605
54	5.5	3	~3	726643.034	1973421.61	373.543
55	5	3.5	~3	726652.345	1973418.718	373.555
56	5	2.5	~2	726664.973	1973408.599	373.346
57	5	1	~2	726653.986	1973410.236	373.808
58	5	2	~2	726644.561	1973409.164	374.068
59	5	2	~2	726656.041	1973400.152	374.139
60	5	2.5	~2	726667.251	1973397.824	374.054
61	5	2.5	~2	726667.76	1973390.701	374.165
62	5.5	3.5	~3	726668.9	1973381.965	374.32
63	5.5	5	~5	726749.515	1973355.881	376.65
64	9	~5	~5	726669.869	1973363.855	375.085
65	5	~2.5	~3	726669.787	1973371.814	374.738
66	5	1	~2	726631.991	1973419.93	374.501
67	5	2	~2	726635.165	1973409.535	374.582
68	5	1	~2	726647.057	1973400.236	374.26
69	5	2	~2	726647.389	1973391.664	375.118
70	5	2.5	~2	726657.738	1973392.291	374.449
71	5	3.5	~3	726659.286	1973381.576	374.984
72	10	~5.5	~5	726661.286	1973364.629	375.575
73	5	~5	~4.5	726660.416	1973370.725	375.103
74	5	2.5	~2.5	726636.212	1973400.748	374.973
75	5	2.5	~2.5	726637.153	1973392.681	375.419
76	5	~2.5	~2.5	726639.234	1973381.81	376.026
77	5	~2.5	~2.5	726640.043	1973372.476	376.649
78	5	~2.5	~2.5	726650.167	1973372.616	375.857
79	5	4.5	~2.5	726649.384	1973381.627	375.573
80	~5	~2.5	2.5	726732.895	1973398.925	374.809
81	~5	~2.5	2.5	726711.458	1973393.834	374.669
82	~5	~2.5	2.5	726693.627	1973384.062	374.712
83	~5	~2.5	2.5	726692.779	1973391.709	374.194
84	~5	~2.5	~2.5	726683.889	1973375.678	374.405
85	~5	~2.5	~2.5	726660.458	1973406.338	373.409
86	~5	~2.5	~2.5	726659.699	1973425.168	373.36
87	~5	~2.5	~2.5	726648.326	1973415.642	373.292
88	~5	~2.5	~2.5	726633.705	1973428.254	374.287
89	~5	~2.5	~2.5	726632.681	1973387.185	375.56

Notes:
ft bgs - feet below ground surface
ft msl - feet above mean sea level
1. Tree locations surveyed by Stantec, Inc.

Figures



Map Location

Site Location Map

Former Lee Paving Asphalt Testing Site
NCDOT Priority Testing Site No. 6-48,
Pittsboro, NC

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

June 2013

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Figure 1-1

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LEGEND

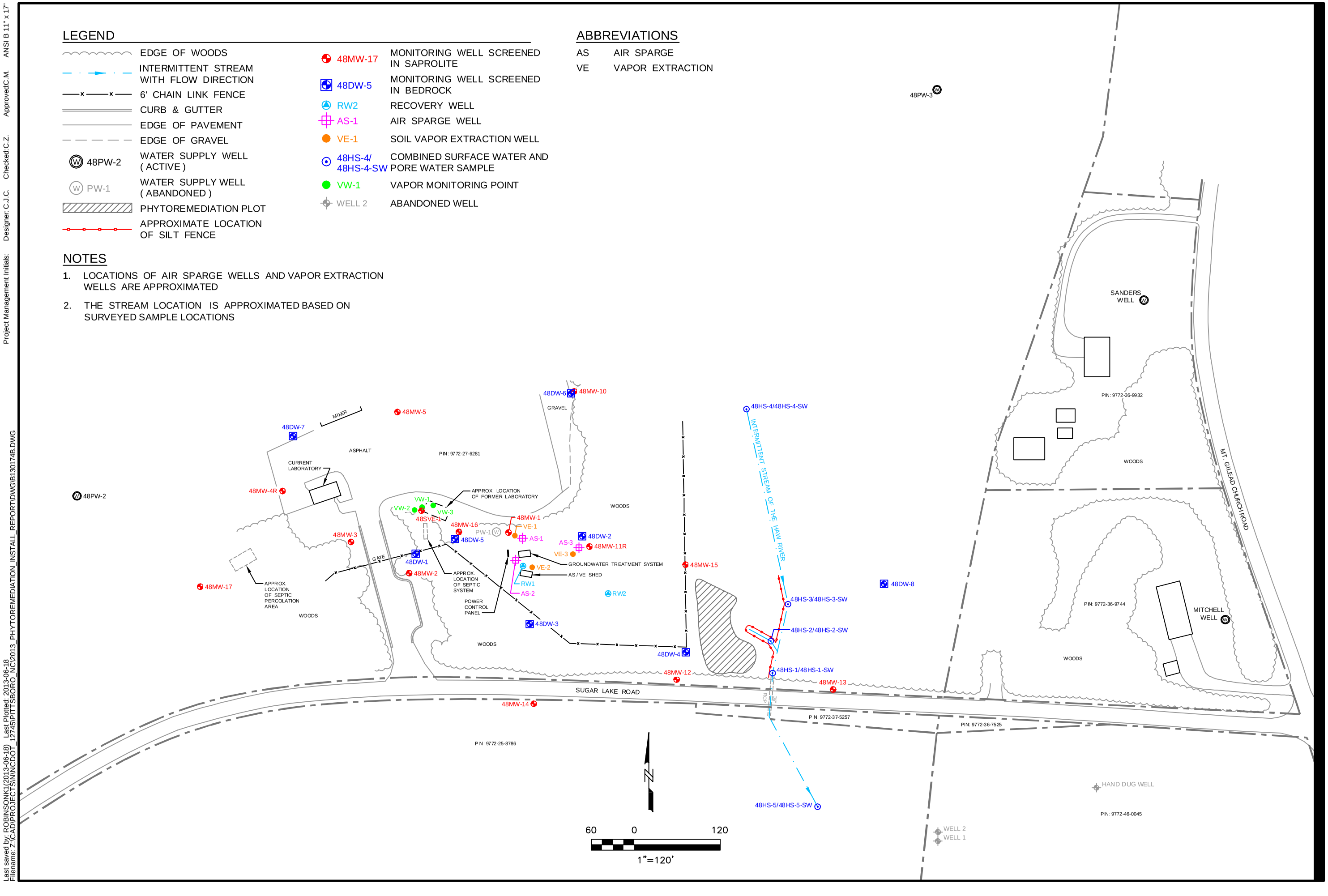
- EDGE OF WOODS
- INTERMITTENT STREAM WITH FLOW DIRECTION
- 6' CHAIN LINK FENCE
- CURB & GUTTER
- EDGE OF PAVEMENT
- EDGE OF GRAVEL
- 48PW-2 — WATER SUPPLY WELL (ACTIVE)
- PW-1 — WATER SUPPLY WELL (ABANDONED)
- PHYTOREMEDIATION PLOT
- APPROXIMATE LOCATION OF SILT FENCE
- 48MW-17 — MONITORING WELL SCREENED IN SAPROLITE
- 48DW-5 — MONITORING WELL SCREENED IN BEDROCK
- RW2 — RECOVERY WELL
- AS-1 — AIR SPARGE WELL
- VE-1 — SOIL VAPOR EXTRACTION WELL
- 48HS-4/ 48HS-4-SW — COMBINED SURFACE WATER AND PORE WATER SAMPLE
- VW-1 — VAPOR MONITORING POINT
- WELL 2 — ABANDONED WELL

ABBREVIATIONS

AS AIR SPARGE
VE VAPOR EXTRACTION

NOTES

1. LOCATIONS OF AIR SPARGE WELLS AND VAPOR EXTRACTION WELLS ARE APPROXIMATED
2. THE STREAM LOCATION IS APPROXIMATED BASED ON SURVEYED SAMPLE LOCATIONS



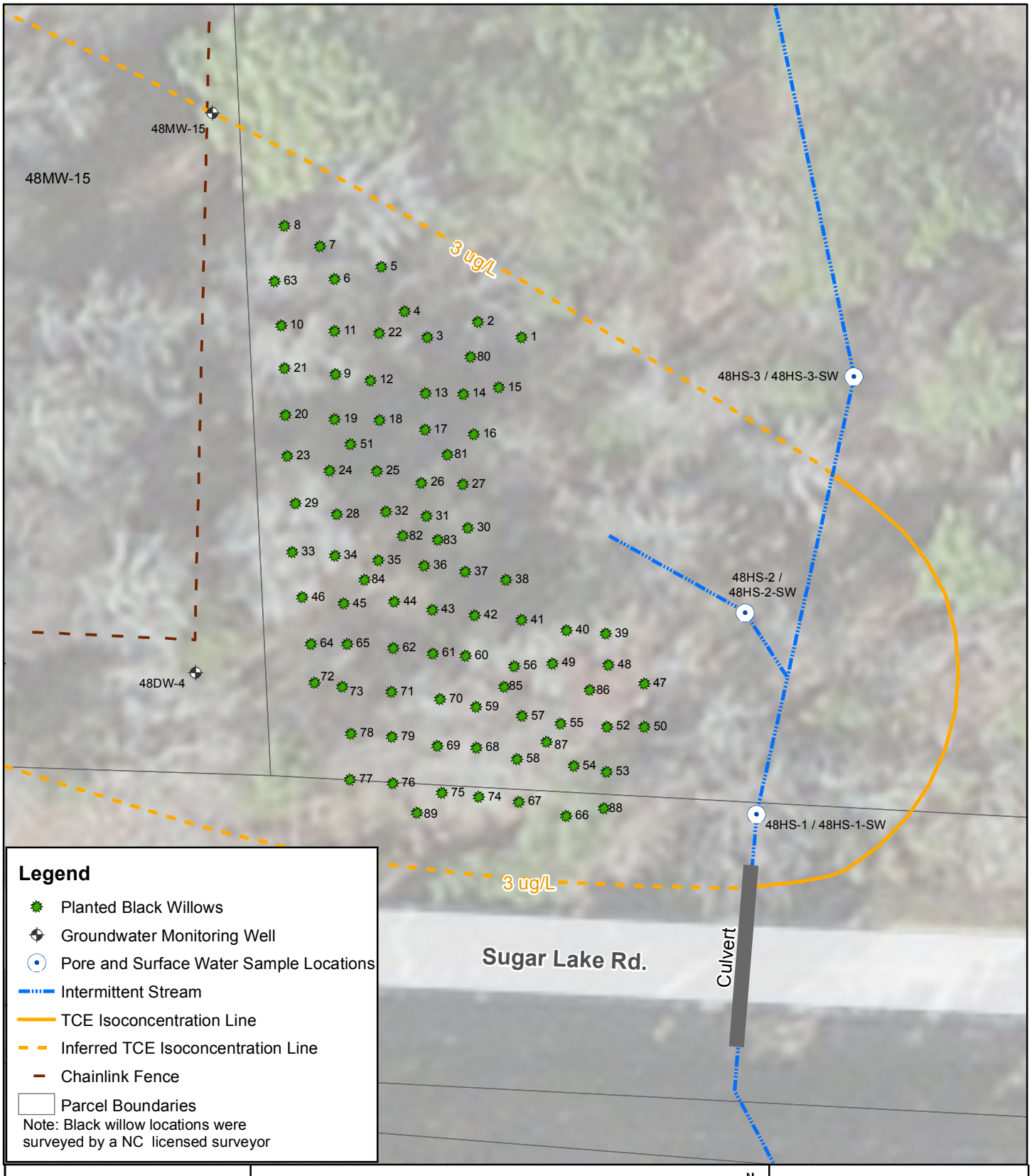
AECOM

Figure 1-2

SITE PLAN

Former Lee Paving Asphalt Testing Site
NCDOT Priority Testing Site No. 6-48
Pittsboro, North Carolina
Project No.: 60297531 Date: 2013-06-18

Path: Z:\GIS\Projects\N\NCDOT_12745\Pittsboro_12745_024\MXD\2013_03\WorkPlan_Phyto\Figure_3.mxd



Legend

- Planted Black Willows
- Groundwater Monitoring Well
- Pore and Surface Water Sample Locations
- Intermittent Stream
- TCE Isoconcentration Line
- Inferred TCE Isoconcentration Line
- Chainlink Fence
- Parcel Boundaries

Note: Black willow locations were surveyed by a NC licensed surveyor

Map Location

Phytoremediation Plot

Former Lee Paving Asphalt Testing Site
NCDOT Priority Testing Site No. 6-48,
Pittsboro, NC

0 15 30 60 Feet

1 inch = 30 feet

N

June 2013

60297531

Figure 2-1

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Appendix A. Phytoremediation System Installation

Appendix A: Phytoremediation System Installation

1. Site Preparation

2. Tree Removal

3. Sediment and Erosion Control: Silt Fencing

4. System Layout

5. Creation of Borehole

6. Creation of Borehole #2

7. Tree Installation

8. Tree Installation #2

About AECOM
AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 45,000 employees around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation, and collaborative technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments. A *Fortune 500* company, AECOM serves clients in more than 130 countries and has annual revenue in excess of $8.0 billion.

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