

REMEDIAL INVESTIGATION SUMMARY REPORT

**Falls Dump
2731 Forbes Road
Gastonia, Gaston County, NC
ID No. NONCD0000808**

**Task No. 808SUM-1
State Contract No. N13001S
ESP Project No. E6-BN12.608.004**

Prepared for:

**North Carolina Department of Environment and Natural Resources
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July 28, 2015

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Table 1	Subsurface Landfill Gas Screening Results
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APPENDICES

Appendix A	Classification of the Unnamed Tributary
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ACRONYMS

µg/l	micrograms per liter
bgs	below ground surface
ft	feet
IHSB	Inactive Hazardous Sites Branch
LEL	.....	lower explosive limit
mg/kg	.....	milligrams per kilogram
mg/m ³	.....	milligrams per cubic meter
MSL	.....	mean sea level
NCAC	.....	North Carolina Administrative Code
NCDENR	.....	North Carolina Department of Environment and Natural Resources
NCDHHS	.....	North Carolina Department of Health and Human Services
PIN	.....	Parcel Identification Number
ppm	.....	parts per million
PSRG	.....	Preliminary Soil Remediation Goal
RI	.....	Remedial Investigation
SRG	.....	Soil Remediation Goal
SVOC	.....	semi-volatile organic compound
TCE	.....	trichloroethene
USEPA	.....	U.S. Environmental Protection Agency
USGS	.....	U.S. Geological Survey
VOC	.....	volatile organic compound

1.0 INTRODUCTION

This Remedial Investigation (RI) Summary Report for the Falls Dump (State ID # NONCD0000808) was prepared specifically for the use of the North Carolina Department of Environment and Natural Resources (NCDENR), Inactive Hazardous Sites Branch (IHSB), Pre-Regulatory Landfill Unit under ESP Associates, P.A.'s contract dated February 1, 2013, as defined in the scope of work authorized by NCDENR Task Order 808SUM-1. This RI Summary Report is based upon the findings of previous remedial investigations referenced in Section 6. Use of this document for other purposes or by other parties is at the sole risk of the user.

The Falls Dump (hereinafter referred to as the Site), which operated from the late 1950s to the late 1970s, is located at 2731 Forbes Road, Gastonia, Gaston County, North Carolina, within a residential area (see Figures 1 and 2). The majority of the Site is located in undeveloped woods (covered with brush, briars, Kudzu vines, and trees) on Parcel Identification Number [PIN] 3543-43-8083. The Site extends slightly onto four other parcels: PIN 3543-52-7385; PIN 3543-52-5954; PIN 3543-53-4043; and PIN 3543-53-3122. Mobile homes are located on the three parcels along Safeway Drive, and these parcels have landscaped lawns. Each mobile home property has a septic system believed to be located in the back yard.

The Site can be accessed from a dirt path at the end of Genes Ridge. Genes Ridge intersects with Forbes Road (see Figure 2).

The Site gently slopes from the southeast to the northwest, generally towards a drainage ditch (see Figure 2). Elevations across the Site range from approximately 770 to 745 feet above mean sea level (ft MSL). The drainage ditch is located approximately 330 to 360 ft northwest of the Site and generally flows in a northerly direction where it intersects the unnamed tributary. The unnamed tributary (located approximately 640 ft northwest of the Site) flows approximately 0.5 mile southwest, intersecting with an unnamed creek just north of Forbes Road. The unnamed creek flows approximately 1.5 miles south before entering Crowders Creek. Crowders Creek is a Class C stream (NCDENR, 2014a).

A separate and unrelated contaminated site, the Hemphill Road Trichloroethene (TCE) site (ID # NCO 002 374 445), is located to the northeast of the Site along Hemphill Road. The location of the Hemphill Road TCE site is shown on Figure 2. This site is a Superfund site being addressed by NCDENR and the U.S. Environmental Protection Agency (USEPA) Region 4 and consists of a TCE groundwater plume extending from the southeast parcel of the Hemphill Road TCE site downgradient to the northwest parcel and beyond toward the unnamed tributary. Elevated TCE concentrations have been documented to be present in the surface water of the unnamed tributary adjacent to the Hemphill Road TCE site.

2.0 GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

The Site is located in the Piedmont physiographic province within the Kings Mountain Geologic Belt. Geologic maps indicate the Site is underlain by high shoals granitic rock estimated to be Pennsylvanian to Permian in age (270 to 320 million years old). The rock suite is megacrystic to equigranular granite of the Butterfield Creek intrusive and Rocky Mount intrusive suite.

Based on surface topography, groundwater at the Site is anticipated to generally flow in a northwesterly direction toward the drainage ditch located to the northwest of the Site. Static groundwater levels range from approximately 4 ft below ground surface (bgs) at the northwestern extreme of the Site to approximately 33 ft bgs in the southeastern portion of the Site.

3.0 SENSITIVE ENVIRONMENTS

No documented sensitive environments were reported within 500 ft of the Site.

4.0 WASTE DISPOSAL AREA

Based on geophysical studies and subsurface soil borings, a single approximately 1.68-acre waste disposal area was identified (see Figure 2).

Surface debris within the Site boundary consists of concrete blocks, bricks, and metal/sheet metal.

Several isolated areas of surface debris beyond the boundary of the Site were noted on the Jean Falls Parker and Gene Falls properties. These areas are located northwest of the Site and along the southwestern perimeter of the Site on the Jean Falls Parker property, and in the central portion and southern corner of the Gene Falls property. The observed debris includes plastic, wood, metal, glass, fabric, concrete blocks, bricks, astro-turf, bubble wrap, plastic sheeting, and Styrofoam. These surface debris locations may represent random dumping activities since waste was not observed below the ground surface in these areas.

5.0 MEDIA CHARACTERIZATION

Soil, sediment, surface water, and groundwater samples (sampling locations shown on Figure 3) were collected from the Site for laboratory analysis of the following parameters: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), 15 selected metals (antimony, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc), ammonia, nitrate and sulfate. Additional soil, sediment, and surface water samples were collected for laboratory analysis of limited parameters as discussed in subsequent sections. Landfill gas samples were screened for oxygen, carbon dioxide, methane, mercury, hydrogen sulfide, and total VOCs using field instrumentation. Sample results for each media were screened against the latest applicable regulatory criteria as indicated in the subsequent sections.

5.1 Soil

The existing cover soil thickness was determined using soil borings and ranges from 0 ft to 7.5 ft, with about half of the Site having less than 2 ft of cover soil (see Figure 4). Soils at the Site area are primarily classified as fine sandy silt; lean clay with silt has also been observed. Very soft soils were noted along the southwestern edge of the Site during drilling activities.

5.1.1 Borings

Fifteen soil borings (B-9A, SB-1 through SB-5, GP-1/SB-1, SB-31, SB-32C, and SB-33 through SB-38) were advanced at the Site for the collection of soil samples (see Figure 3 for soil sampling locations). In addition, three soil borings (ASB-1 through ASB-3) were advanced at the Site for the collection of soil samples for asbestos analysis (see Figure 3 for asbestos sampling locations).

5.1.2 Sampling

Twenty-six soil samples from various depths within and around the perimeter of the Site were collected for laboratory analysis of the full suite of analytes listed above. In addition, 3 soil samples for hexavalent chromium analysis and 15 soil samples for asbestos analysis were collected from various depths within the Site boundary.

Soil analytical results were initially compared to the NCDENR IHSB Preliminary Soil Remediation Goals (PSRGs). If PSRGs were exceeded, the data were provided to the IHSB Superfund Section's Toxicologist for calculation of site-specific Soil Remediation Goals (SRGs). The following site-specific health-based SRGs were provided by the Superfund Section's Toxicologist:

- Arsenic – 22.5 milligrams per kilogram (mg/kg);
- Hexavalent chromium – 0.5 mg/kg;
- Lead – 400 mg/kg;
- Selenium – 78 mg/kg;
- Thallium – 0.8 mg/kg;
- Benzo(a)pyrene – 0.5 mg/kg; and
- Benzo(b)fluoranthene – 5 mg/kg.

Detected concentrations of lead and thallium in the soil samples that exceed the SRGs are presented on Figures 5a through 5c for several depth intervals: 0-5 ft bgs; 5-10 ft bgs; and 10-15 ft bgs. Estimated areas for each analyte exceeding SRGs at each depth interval are also

presented on Figures 5a through 5c. Asbestos was not detected in the analyzed soil samples. No hexavalent chromium was detected above the laboratory reporting limit in the analyzed soil samples.

Iron and manganese were detected in soil samples above PSRGs; however, the detections are thought to be associated with naturally-occurring conditions. Published regional maximum background levels in Gaston County soils (U.S. Geological Survey [USGS], 2014) are 77,410 mg/kg for iron and 2,197.64 mg/kg for manganese. All but two soil samples were below these regional background levels: iron at SB-38 (0-0.5); and manganese at SB-5 (14-15).

5.1.3 Sediments

Six sediment samples (SD-1, SD-1A, SD-2, SD-3, SD-4, and SD-5) were collected from locations along the unnamed tributary and the drainage ditch for laboratory analysis of the full suite of analytes listed above. In addition, 5 sediment samples (SD-1A, SD-2A, SD-3A, SD-4A, and SD-5A) were collected at locations along the unnamed tributary and drainage ditch for hexavalent chromium analysis, and 4 sediment samples (SD-1A, SD-1B, SD-1C, and SD-2A) were collected at locations along the unnamed tributary and drainage ditch for TCE analysis. Sediment sample locations are shown on Figure 3.

Sediment analytical results were compared to the site-specific health-based SRGs provided by the Superfund Section's Toxicologist (see Section 5.1.2). No analytes exceeded SRGs.

Iron detections in some sediment samples from the unnamed tributary exceeded the PSRG; however, the detected iron levels are thought to be associated with naturally-occurring conditions since they were below the background level. The published regional background level for iron in stream sediments is 20,000 mg/kg (NCDENR, 2014b).

Although referred to as sediment samples, the samples collected from the drainage ditch are more representative of soils than sediments because the drainage ditch is located on a hillside and only contains water during storm events. Iron and manganese in some sediment samples

from the drainage ditch exceeded PSRGs; however, the detected iron and manganese levels are thought to be associated with naturally-occurring conditions since they were below background levels (refer to published regional soil background levels provided in Section 5.1.2).

5.2 Waste

5.2.1 Types and Description

Waste types observed during the RI included wood/wood chips, burnt wood, stumps, shingles, brick, concrete/concrete blocks, asphalt, glass, Styrofoam™, plastic/plastic ribbons, duct tape, fibrous material, fabric, carpet, and metal/sheet metal. At the locations investigated, the waste ranges in thickness from approximately 0 ft (i.e., debris present on the surface only) to approximately 23 ft. The waste/residual soil interface (i.e., bottom of waste depth) ranges from approximately 0 ft bgs to 23.7 ft bgs, with many of the deeper locations occurring at the boundary of the Jean Falls Parker parcel and extending into the three Safeway Drive parcels. The waste depth exceeded 14.5 ft bgs at GP-2, B-10A, B-10B, B-9A, and B-9B (see locations on Figure 4).

5.2.2 Sampling

Waste samples were not collected for laboratory analysis. Sampling results for soils intermingled with the waste are presented in Section 5.1.2.

5.3 Water

5.3.1 Groundwater Monitoring Wells

Five temporary groundwater wells were installed along the Site perimeter (see Figure 3 for temporary groundwater well locations), and groundwater samples were collected. Sulfate concentrations that exceeded the 15A North Carolina Administrative Code (NCAC)

2L groundwater quality standards (a.k.a., 2L groundwater standards) in one well are presented on Figure 6.

5.3.2 Water Supply Wells

Water supply wells within 1,000 ft of the Site are located either topographically upgradient or side-gradient of the Site and thus were not sampled.

5.3.3 Surface Water

Four surface water samples (SW-1, SW-1A, SW-2, and SW-3, as shown on Figure 3) were collected at locations along the unnamed tributary and the drainage ditch for laboratory analysis of the full suite of analytes listed above. In addition, 4 surface water samples (SW-1A, SW-1B, SW-1C, and SW-2A, as shown on Figure 3) were collected at locations along the unnamed tributary and drainage ditch to confirm the presence of TCE. The only analyte in the surface water samples detected at concentrations exceeding the 15A NCAC 2B.0211 surface water standards (a.k.a., 2B surface water standards) was iron at one location in the drainage ditch (see Figure 6).

TCE was detected in the surface water of the unnamed tributary. Because the unnamed tributary ultimately flows into Crowders Creek, a Class C stream, the surface water sample results are compared to the lower of the 2B surface water standards for freshwater aquatic life and human health (NCDENR, 2014a). The TCE concentrations detected in the unnamed tributary are below the applicable 2B surface water standard of 30 micrograms per liter ($\mu\text{g/l}$). The Hemphill Road TCE site is believed to be the source of the detected TCE concentrations in the surface water of the unnamed tributary because the observed range of TCE concentrations upstream of the Site and adjacent to the Hemphill Road TCE site were notably higher (i.e., as high as 17 $\mu\text{g/l}$) (NCDENR, 2012).

5.3.4 Groundwater Flow Direction

Groundwater at the Site is anticipated to generally flow in a northwesterly direction toward the drainage ditch.

5.3.5 Naturally Occurring Organics

Arsenic, beryllium, chromium, iron, manganese, selenium, and nitrate were detected above 2L groundwater standards in one or more temporary groundwater wells at the Site; however, private well test results for Gaston County available from the North Carolina Department of Health and Human Services (NCDHHS) suggest that elevated concentrations of these inorganic constituents are likely due to naturally-occurring conditions. The following maximum concentrations have been measured in private wells elsewhere in Gaston County: arsenic at 232 µg/l; chromium at 30 µg/l; iron at 98,000 µg/l; manganese at 7,040 µg/l; selenium at 41 µg/l; and nitrate at 116,000 µg/l (NCDHHS, 2014).

5.4 Landfill Gas

Four subsurface landfill gas probes were installed within the Site boundary (see Figure 3 for gas probe locations). Each gas probe was field screened during between two and four separate events, and the detected results for methane, carbon dioxide, total VOCs, and mercury for each screening event are presented on Table 1. Hydrogen sulfide was not detected during subsurface landfill gas screening.

Mercury was detected at concentrations above the NCDENR IHSB Residential Vapor Intrusion Screening Limit for soil gas of 0.00209 milligrams per cubic meter (mg/m³) at all three locations screened in July 2013. Mercury was not detected in GP-1 (the only gas probe screened) during the March 2013 screening event, and landfill gases were not screened for mercury during the January 2014 and February 2014 screening events.

Methane was detected in only one of the gas probes (GP-2). The measured methane concentration at this location was low and was not confirmed during subsequent screening events. Carbon dioxide was detected in all four gas probes. Low levels of total VOCs were detected in all four gas probes the first time each was screened; however, total VOC detections were not confirmed during subsequent screening events.

The nearest structures to the Site are the three mobile homes, approximately 100 ft to the northeast, which are located on the small Site parcels along Safeway Drive. The mobile homes are built on crawl spaces, and each has a septic system in its back yard. Additional mobile homes built on crawl spaces and an enclosed shed built on a slab foundation (located to the southeast) are located greater than 100 ft away from the Site.

6.0 REFERENCES

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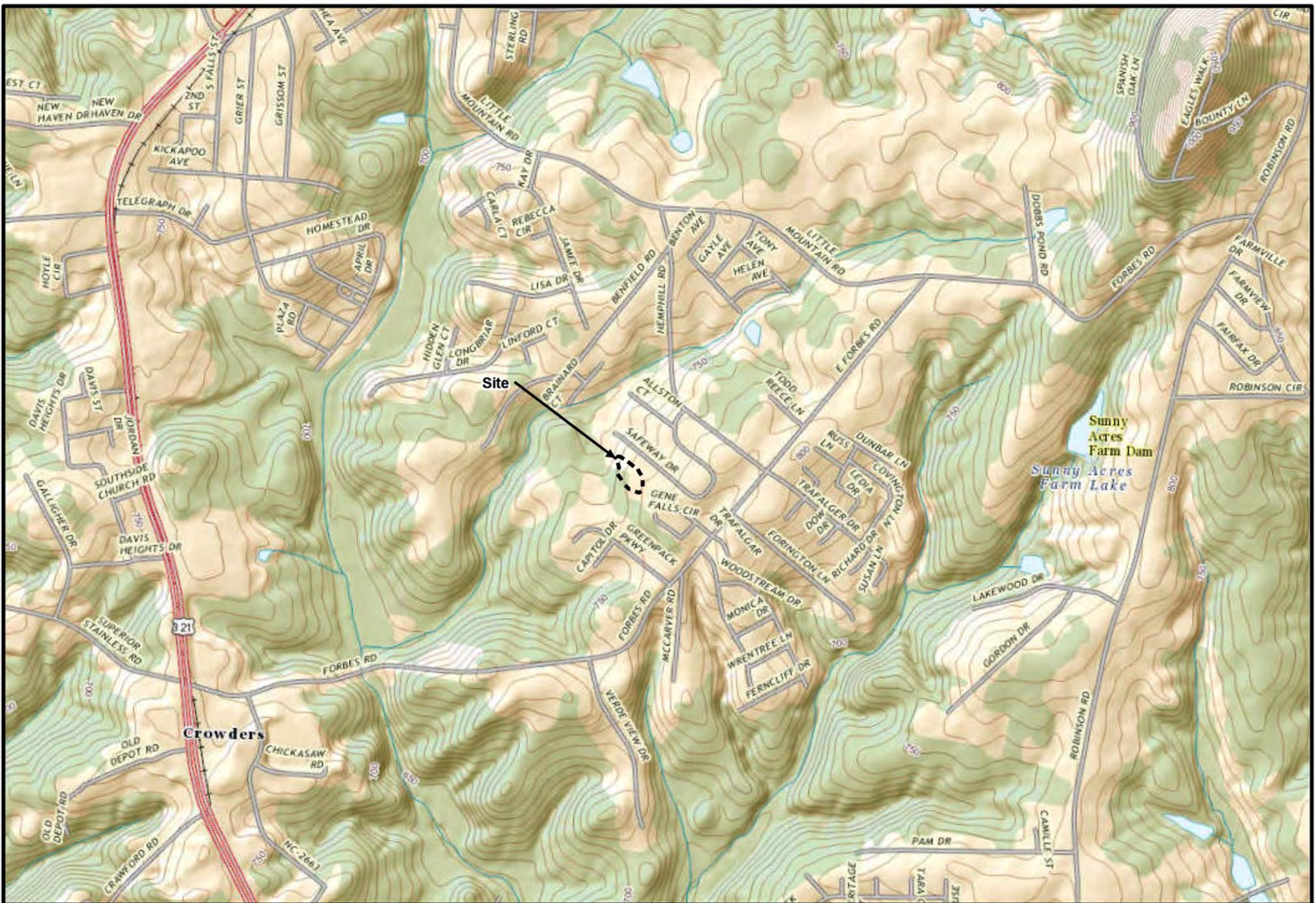
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FIGURES



Legend

--- Estimated Waste Disposal Area Perimeter

SHEET TITLE

Figure 1
 Site Location Map

Falls Dump
 NONCD0000808
 Gastonia, Gaston County, NC

Feet

0 337.5 675 1,350 2,025

* Source: USGS The National Map; National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrology Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data.

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DATE
 March 9, 2015

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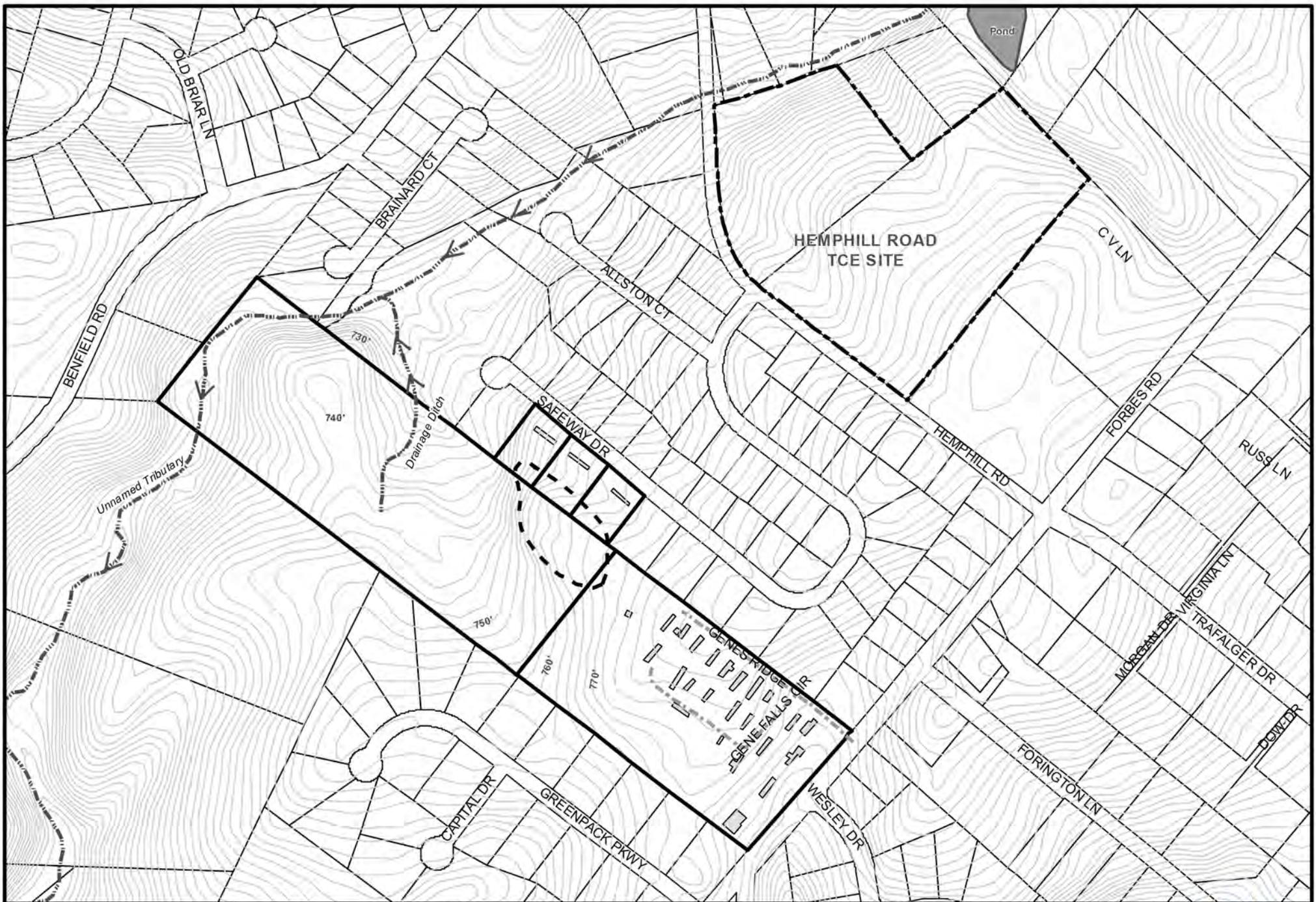
SCALE As Shown

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Minor Roads	Perennial Stream
Property Line	Topographic Contour (2ft)
Estimated Waste Disposal Area Perimeter	Parcel Line
Hemphill Road TCE Site	Existing Buildings On Site

SHEET TITLE

Figure 2
Site Map

Falls Dump
NONCD0000808
Gastonia, Gaston County, NC

0 95 190 380 570
Feet

* Source: Parcel and topographic information provided by Gaston County, NC GIS.

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DATE March 9, 2015

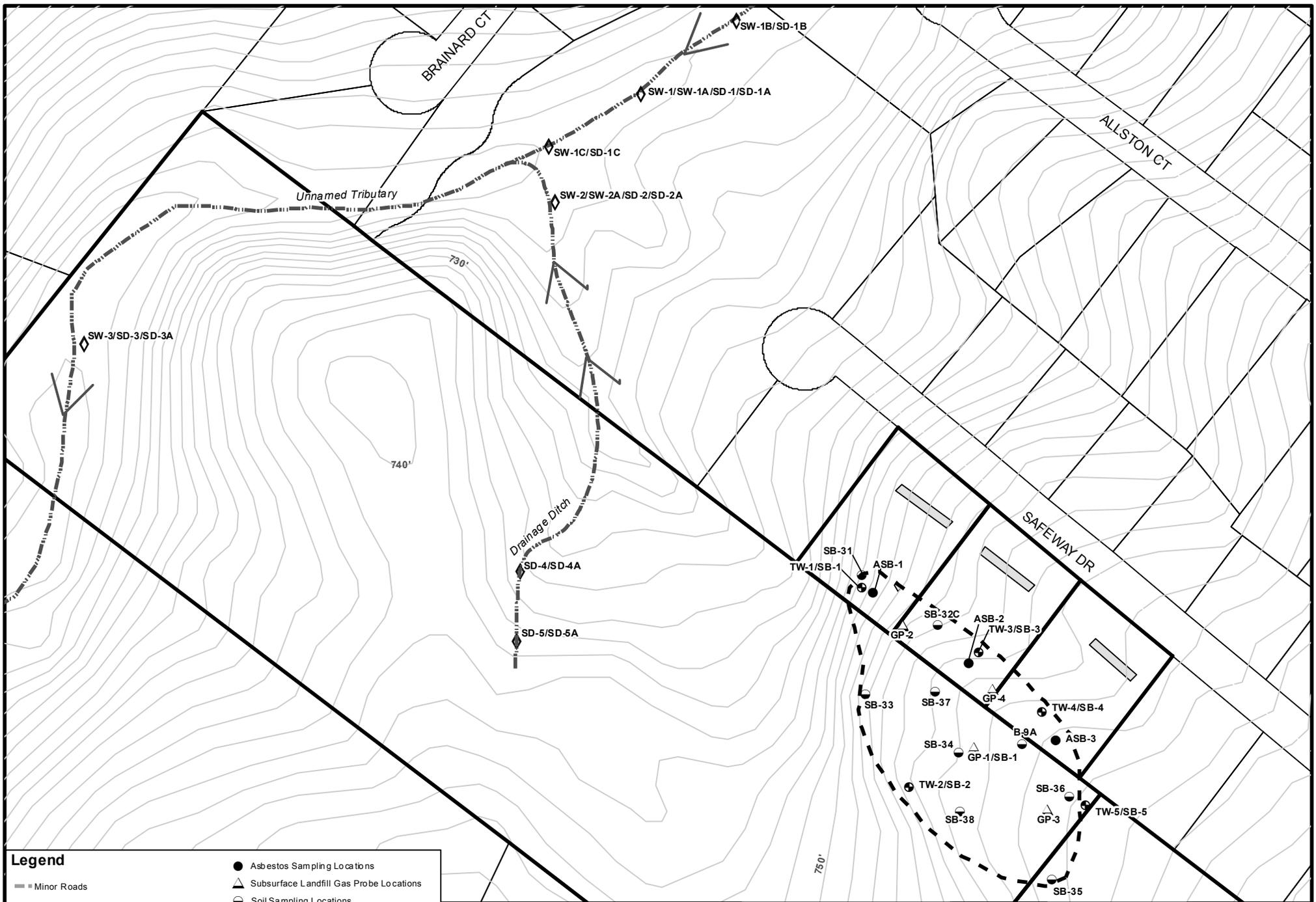
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Legend	
	Minor Roads
	Estimated Waste Disposal Area Perimeter
	Property Line
	Topographic Contour (2ft)
	Perennial Stream
	Hemphill Road TCE Site
	Asbestos Sampling Locations
	Subsurface Landfill Gas Probe Locations
	Soil Sampling Locations
	Surface Water/Sediment Sample Locations
	Temporary Groundwater Well Locations
	Parcel Line
	Existing Buildings On Site

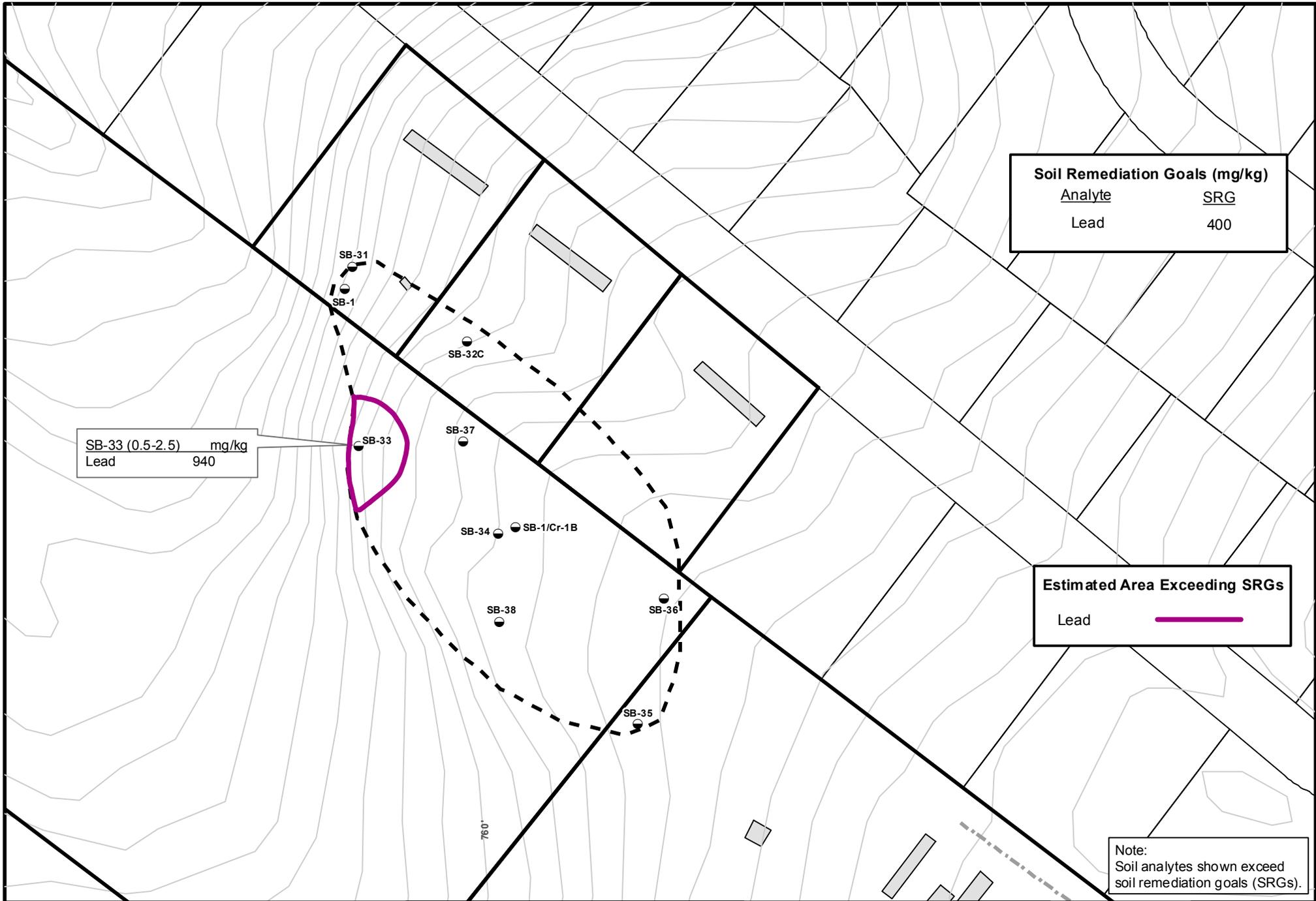
SHEET TITLE **Figure 3**
Investigation Sample Location Map
 Falls Dump
 NONCD0000808
 Gastonia, Gaston County, NC

0 37.5 75 150 225 Feet
 * Source: Parcel and topographic information provided by Gaston County, NC GIS.

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Soil Remediation Goals (mg/kg)	
Analyte	SRG
Lead	400

SB-33 (0.5-2.5) mg/kg
Lead 940

Estimated Area Exceeding SRGs
Lead

Note:
Soil analytes shown exceed soil remediation goals (SRGs).

Legend	
	Minor Roads
	Property Line
	Estimated Waste Disposal Area Perimeter
	Sampling Locations
	Topographic Contour (2ft)
	Parcel Line
	Existing Buildings On Site

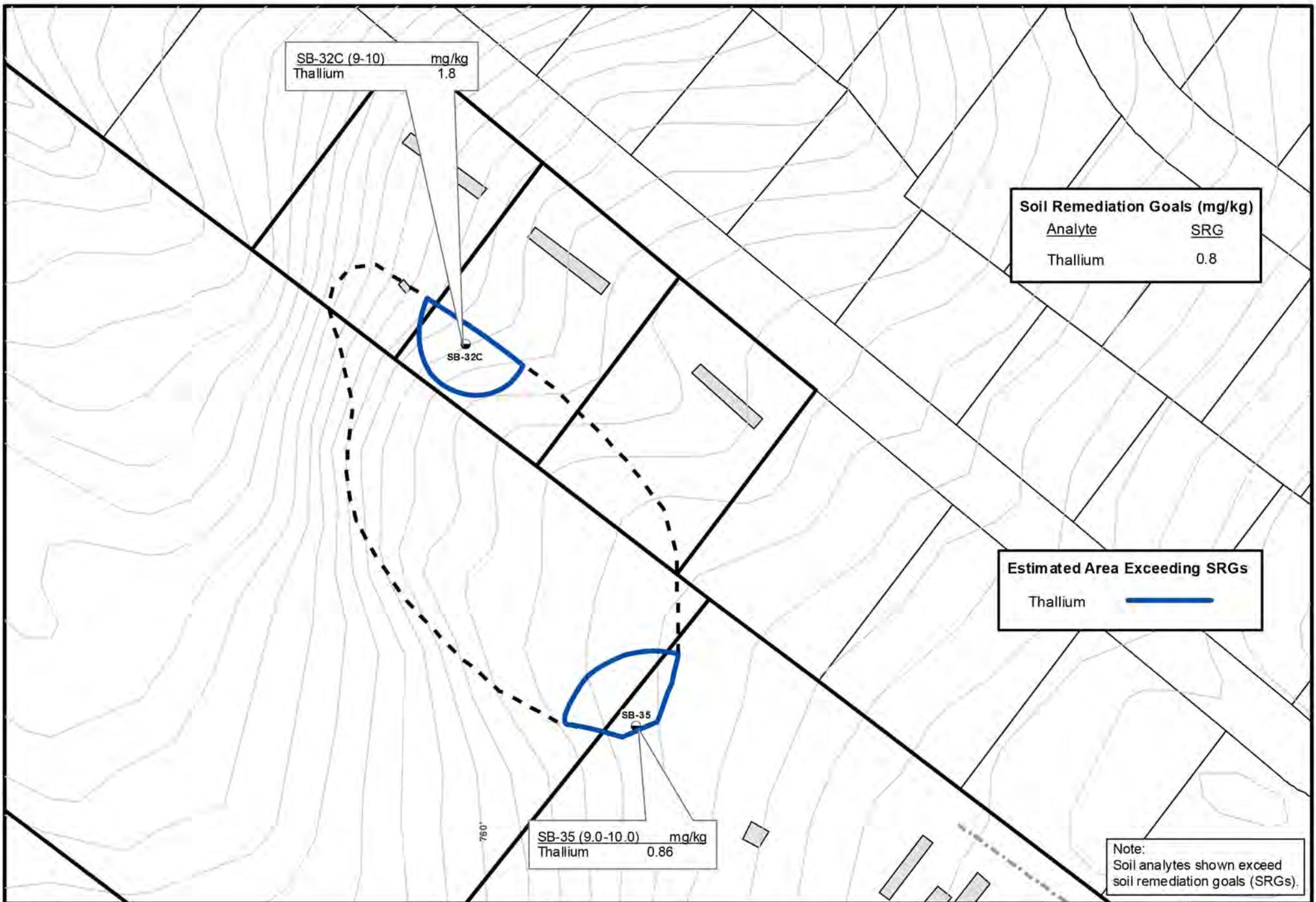
SHEET TITLE **Figure 5a**
Soil Concentration Contour Map – 0 to 5 ft bgs
Falls Dump
NONCD0000808
Gastonia, Gaston County, NC

0 25 50 100 150 Feet
* Source: Parcel and topographic information provided by Gaston County, NC GIS.

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SB-32C (9-10) mg/kg
Thallium 1.8

Soil Remediation Goals (mg/kg)	
Analyte	SRG
Thallium	0.8

Estimated Area Exceeding SRGs	
Thallium	

SB-35 (9.0-10.0) mg/kg
Thallium 0.86

Note:
Soil analytes shown exceed soil remediation goals (SRGs).

Legend

- Minor Roads
- Property Line
- Estimated Waste Disposal Area Perimeter
- Sampling Locations
- Topographic Contour (2ft)
- Parcel Line
- Existing Buildings On Site

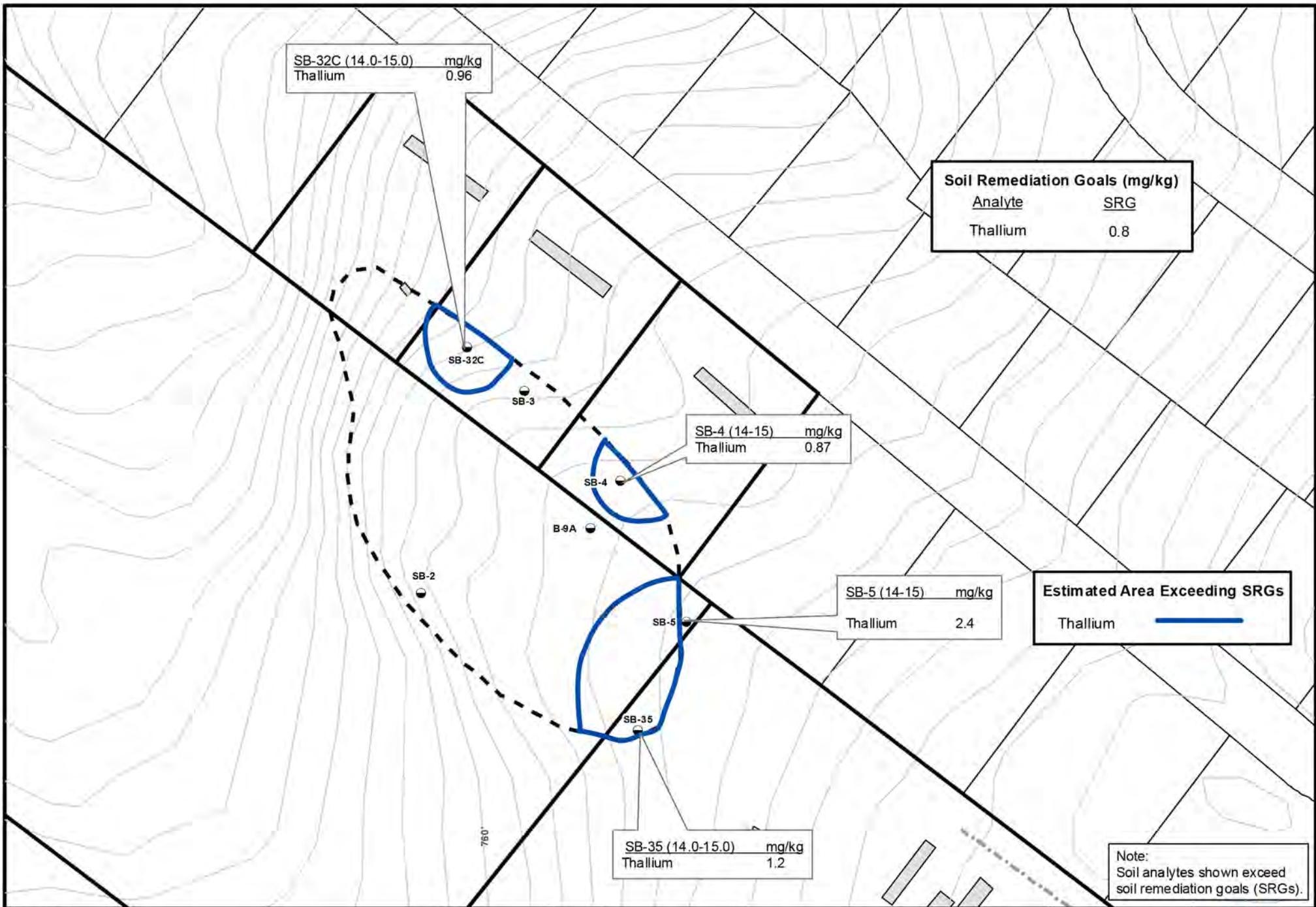
SHEET TITLE *Figure 5b*
Soil Concentration Contour Map – 5 to 10 ft bgs
Falls Dump
NONCD0000808
Gastonia, Gaston County, NC

0 25 50 100 150 Feet
*Source: Parcel and topographic information provided by Gaston County, NC GIS.

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SB-32C (14.0-15.0) mg/kg
Thallium 0.96

Soil Remediation Goals (mg/kg)	
Analyte	SRG
Thallium	0.8

SB-4 (14-15) mg/kg
Thallium 0.87

SB-5 (14-15) mg/kg
Thallium 2.4

Estimated Area Exceeding SRGs
Thallium ———

SB-35 (14.0-15.0) mg/kg
Thallium 1.2

Note:
Soil analytes shown exceed
soil remediation goals (SRGs).

Legend	
Minor Roads	Sampling Locations
Property Line	Topographic Contour (2ft)
Parcel Line	Existing Buildings On Site
Estimated Waste Disposal Area Perimeter	

SHEET TITLE *Figure 5c*
Soil Concentration Contour Map – 10 to 15 ft bgs
Falls Dump
NONCD0000808
Gastonia, Gaston County, NC

0 25 50 100 150 Feet
* Source: Parcel and topographic information provided by Gaston County, NC GIS.

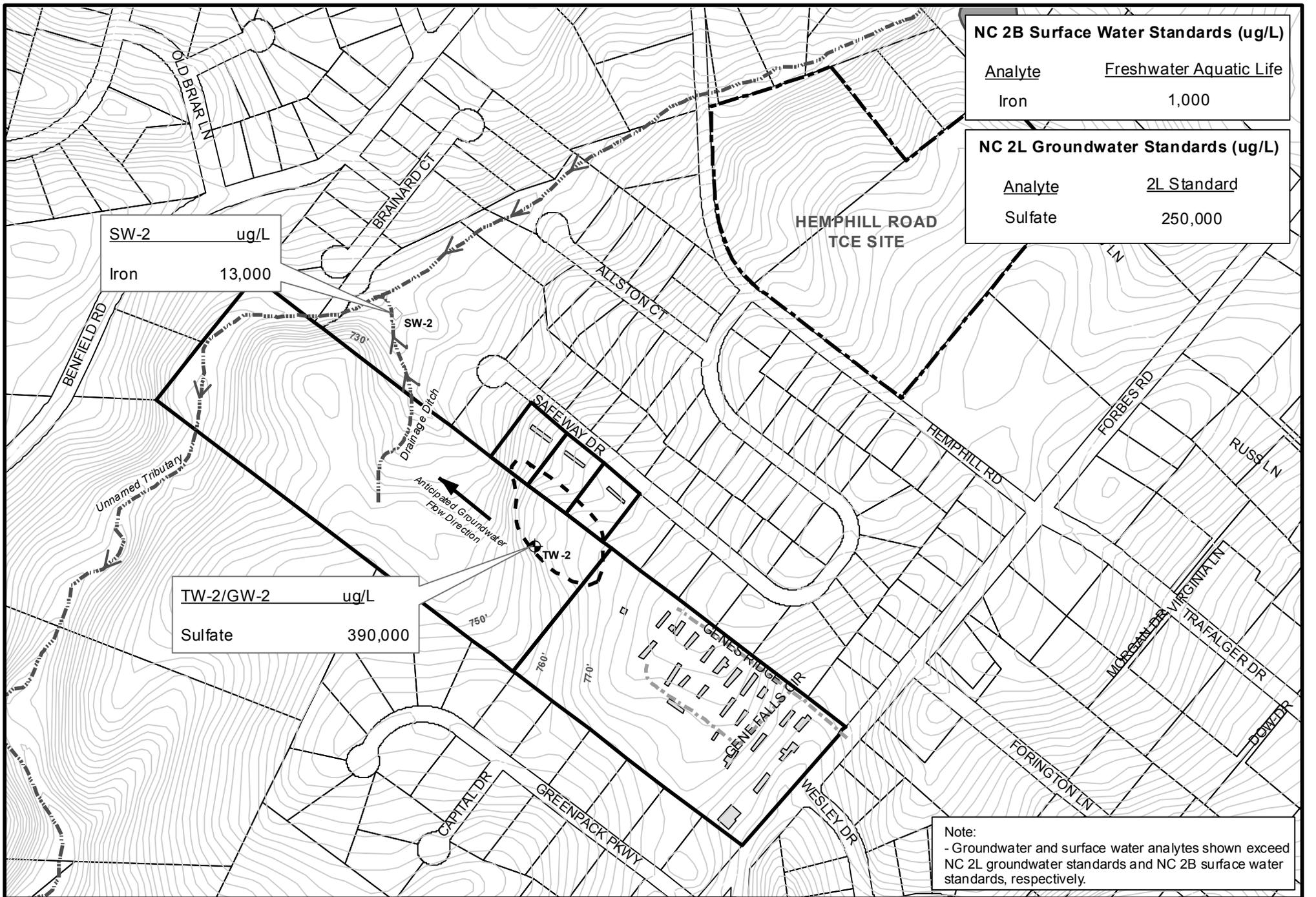
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NC 2B Surface Water Standards (ug/L)	
Analyte	Freshwater Aquatic Life
Iron	1,000

NC 2L Groundwater Standards (ug/L)	
Analyte	2L Standard
Sulfate	250,000



SW-2 ug/L
Iron 13,000

TW-2/GW-2 ug/L
Sulfate 390,000

HEMPHILL ROAD
TCE SITE

Note:
- Groundwater and surface water analytes shown exceed NC 2L groundwater standards and NC 2B surface water standards, respectively.

Legend	
	Minor Roads
	Estimated Waste Disposal Area Perimeter
	Property Line
	Perennial Stream
	Hemphill Road TCE Site
	Temporary Groundwater Well Locations
	Surface Water Sample Locations
	Parcel Line
	Existing Buildings On Site
	Topographic Contour (2ft)

SHEET TITLE
Figure 6
Groundwater and Surface Water Sampling Results
Falls Dump
NONCD0000808
Gastonia, Gaston County, NC

0 95 190 380 570 Feet
* Source: Parcel and topographic information provided by Gaston County, NC GIS.

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TABLES

Table 1
Subsurface Landfill Gas Screening Results
Falls Dump

Gas Probe ID	Date Screened	Methane		Carbon Dioxide	Total VOCs	Mercury
		(% by volume)	(% LEL)	(% by volume)	(ppm)	(mg/m ³)
GP-1	3/8/2013	0	0	12.2	1	0
	7/2/2013	0	0	16.6	0	0.037
	1/9/2014	0	0	8.7	0	--
	2/10/2014	0	0	9.2	0	--
GP-2	7/2/2013	0.6	12	9.1	2.2	0.022
	1/9/2014	0	0	8.6	0	--
	2/10/2014	0	0	0	0	--
GP-3	7/2/2013	0	0	4.8	2.2	0.006
	1/9/2014	0	0	0.2	0	--
	2/10/2014	0	0	0	0	--
GP-4	1/9/2014	0	0	6.2	2.8	--
	2/10/2014	0	0	3.4	0	--

Bold values exceed the NCDENR IHSB Residential Vapor Screening Limit for mercury in soil gas of 0.00209 mg/m³.

-- - Reading not collected.

IHSB - Inactive Hazardous Sites Branch.

LEL - Lower explosive limit.

mg/m³ - Milligrams per cubic meter.

NCDENR - North Carolina Department of Environment and Natural Resources

ppm - Parts per million.

VOC - Volatile organic compound.

APPENDIX A
CLASSIFICATION OF THE UNNAMED TRIBUTARY

Nora Zirps

From: Brower, Connie <connie.brower@ncdenr.gov>
Sent: Friday, July 11, 2014 2:42 PM
To: Nora Zirps
Cc: Kountis, Elizabeth
Subject: RE: surface water classification and criteria selection

Nora -

Thanks to Betsy Kountis – she has provided to me that the site is discharging to an unnamed tributary to Crowder Crk. Crowder Crk is a Class C water. The applicable standards would be the lower of either the human health column or the aquatic life column in the link provided on Thursday. If you have questions, please feel free to call. I will be here today until ~ 4 or a bit after, and will be happy to help.

PS – As this is a Class C stream – there is no applicable standard for manganese.

Have a great weekend –

Connie

From: Nora Zirps [mailto:nzirps@espassociates.com]
Sent: Thursday, July 10, 2014 9:12 AM
To: Brower, Connie
Subject: RE: surface water classification and criteria selection

Thank you Connie. Is there anything else I can provide to make the location search easier?

From: Brower, Connie [mailto:connie.brower@ncdenr.gov]
Sent: Thursday, July 10, 2014 9:08 AM
To: Nora Zirps
Subject: RE: surface water classification and criteria selection

<http://portal.ncdenr.org/web/wq/code-and-rules>

In the above link, see 15A NCAC 02B for the regulations and http://portal.ncdenr.org/c/document_library/get_file?uuid=dfc89f23-a372-4782-b3b0-60e6884b1696&groupId=38364 for the summary table of chemicals.

We do not currently have a dedicated GIS person - so it may take me a bit of time to get the proper classification for you. I will get it as soon as is possible.

Connie

From: Nora Zirps [mailto:nzirps@espassociates.com]
Sent: Thursday, July 10, 2014 8:51 AM
To: Brower, Connie
Subject: RE: surface water classification and criteria selection

Connie,

I was also hoping you could provide the link for the current surface water criteria. Thanks.

Nora

From: Nora Zirps
Sent: Wednesday, July 09, 2014 5:20 PM
To: 'Brower, Connie'
Subject: surface water classification and criteria selection

Connie,

We are currently supporting the Pre-regulatory Landfill Unit assessing Falls Dump in Gastonia. There is a stream adjacent to the site as shown in the attached drawing. Can you provide information on the stream classification and the appropriate surface water criteria to consider when evaluating surface water sample results. Manganese was found in one of the samples and I see there is an (LD). What would we use for a criteria?

Below are several coordinates (NAD83) to assist in locating the stream:

Points to Include	State Plane (meters) - N	State Plane (meters) -E
SW-1A	162658.252	409963.353
SW-1A	162658.252	409963.353
SW-1B	162650.168	409979.196
SW-1C	162639.055	409929.767

Thanks for your help!

Nora

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