



Bombs to Biphenyls

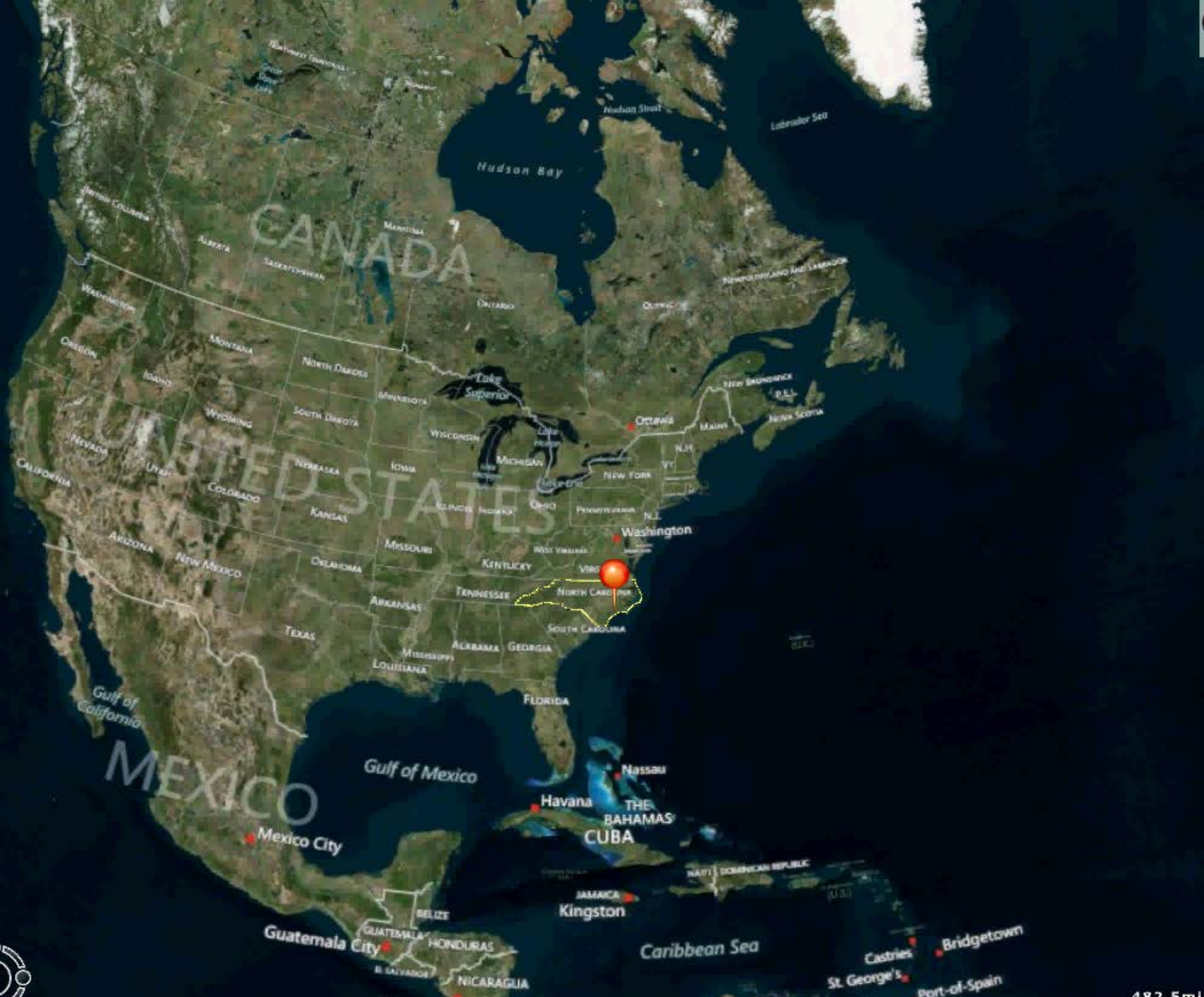
Removal and Remediation at the US17 Bypass
Project in Jacksonville, North Carolina

Cyrus Parker, LG, PE, NCDOT GeoEnvironmental

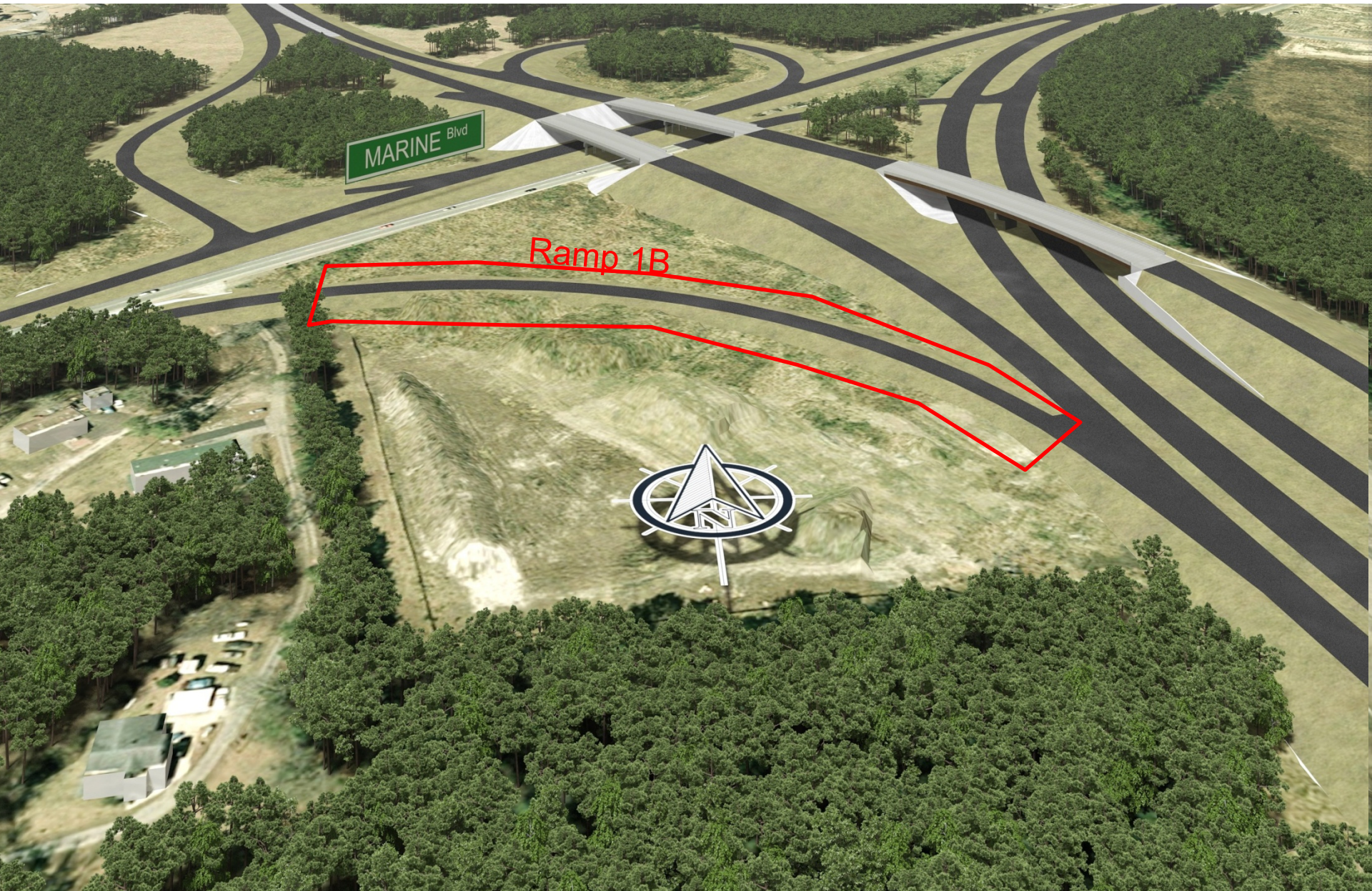
**Helen Corley, LG
Associate Hydrogeologist**

AMEC Environment & Infrastructure, Inc.
Charlotte, North Carolina

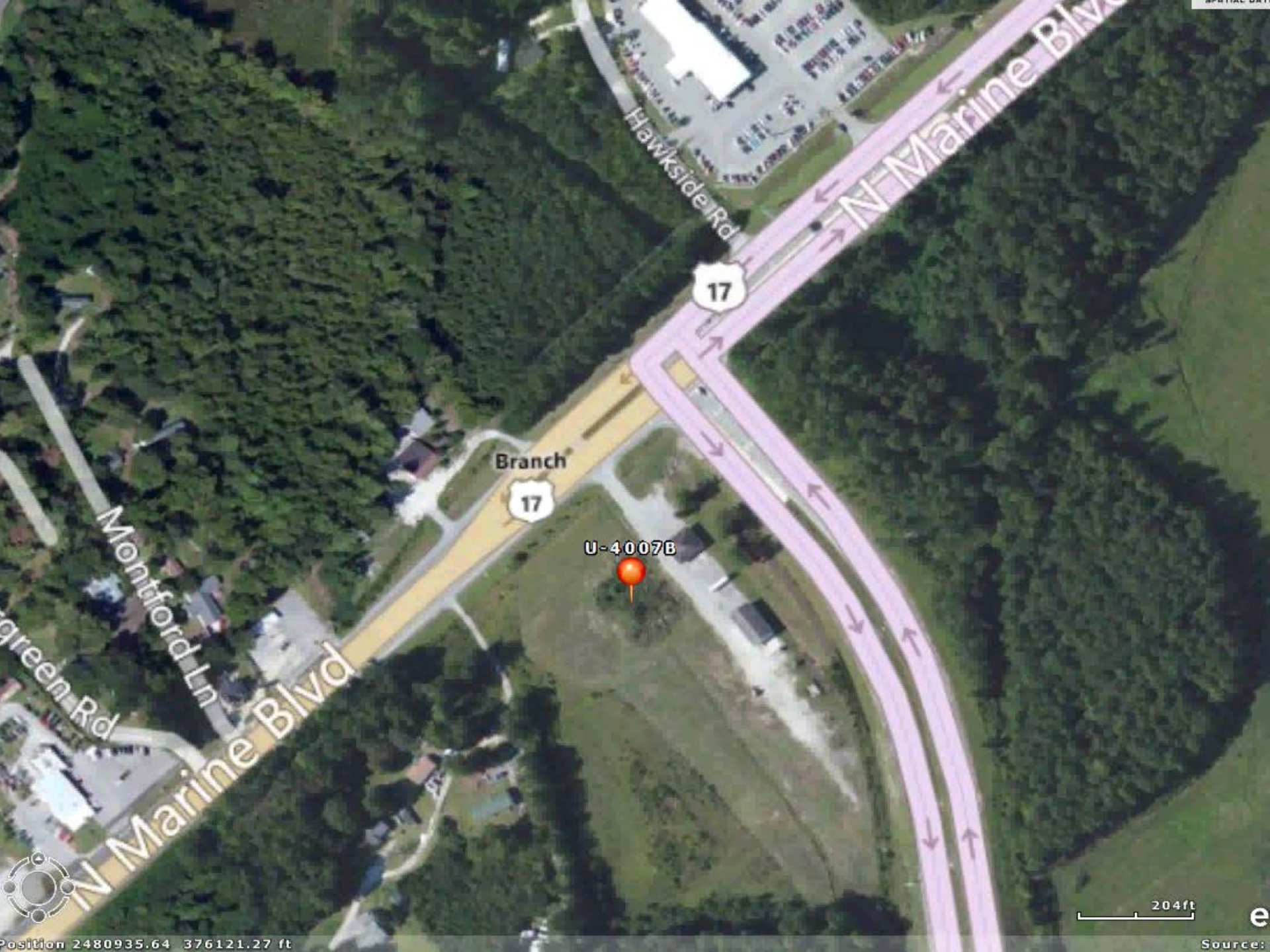
E-mail address: Helen.Corley@amec.com



U-4007B







U-4007B

Branch

N Marine Blvd

Hawkside Rd

N Marine Blvd

Green Rd

Montford Ln



204ft

Source

Position 2480935.64 376121.27 ft

2007

Marine Blvd



- High Resolution Metal Detection
 - Geonics® EM61 MK2 (EM61)
 - Hemisphere SF 101 differential GPS
 - Archer® data logger
- Walked pedestrian accessible areas ~ 10.5 acres
- Data collected on lines with 0.5 foot intervals
- Average line spacing of 5 feet



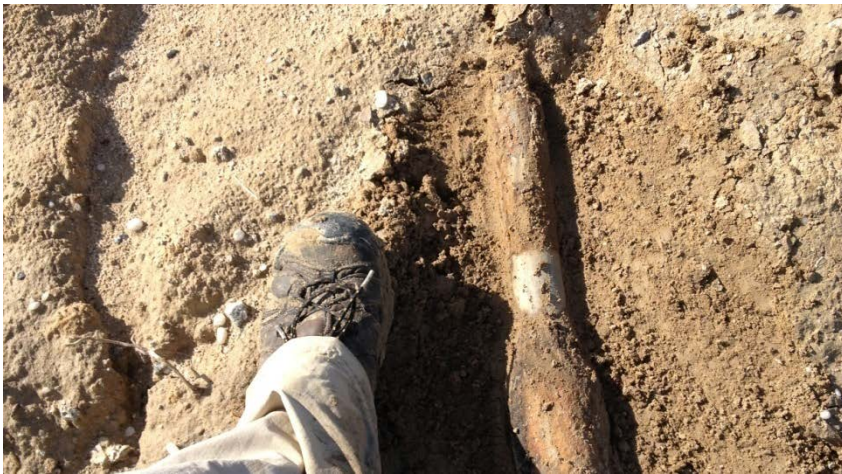
Digital Geophysical Mapping



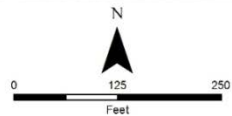
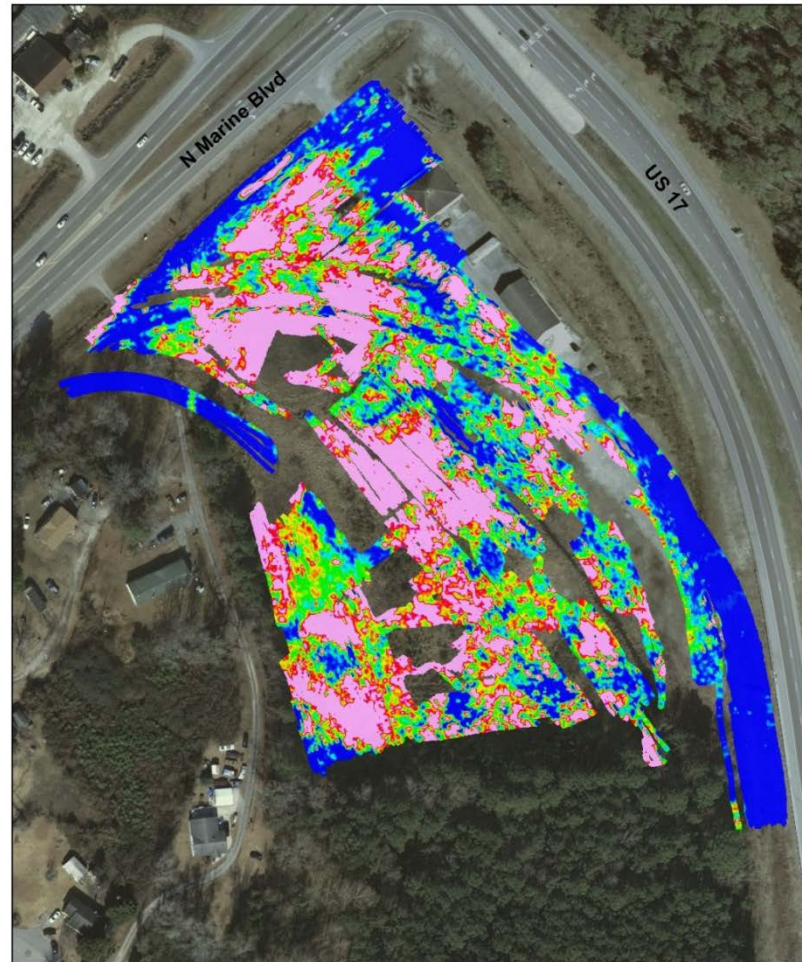
Photos of spent ordnance collected during DGM



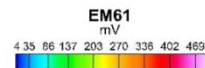
Photos of spent ordnance collected during DGM



Digital Geophysical Mapping Results

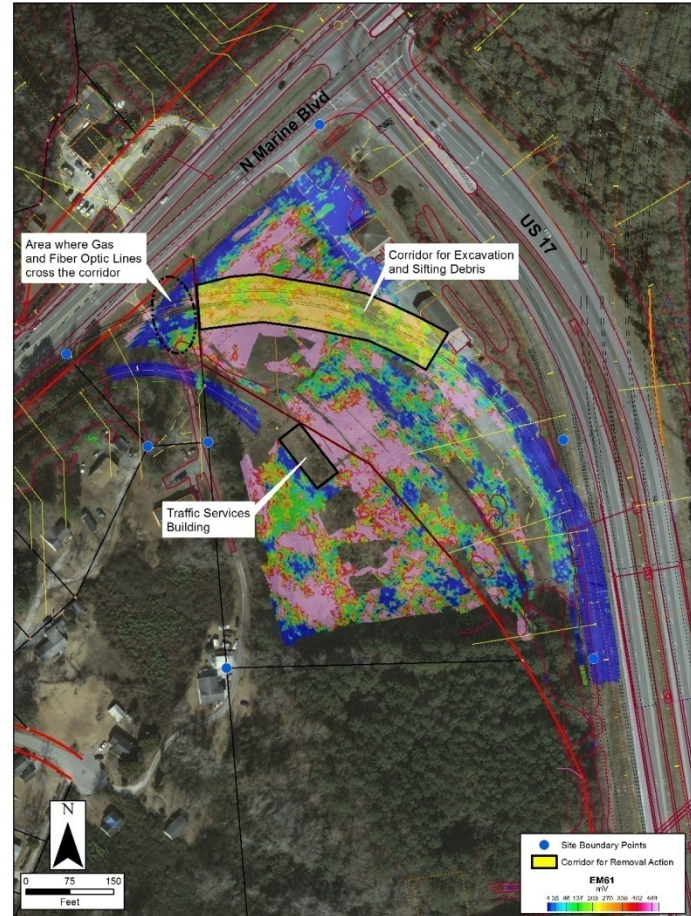


NCDOT
EM61 GEOPHYSICAL SURVEY
20120820



What are the options?

1. Excavate all the areas in pink
2. Excavate some of the areas in pink
3. Excavate between the slope stakes for the ramp construction area





OSHA

- Worker safety

USACOE
EP 75-1-2

- Munitions and Explosives of Concern during Hazardous, Radioactive and Construction Activities

Nine Person Field Team



Senior UXO
Supervisor

UXO Safety
Officer/Quality
Control Specialist

UXO Tech III – Team
Leader

UXO
Tech
II

UXO
Tech
II

UXO
Tech
II

UXO
Tech
I

UXO
Tech
I

UXO
Tech
I



Power Screen Warrior 800



Cultural & Munitions Debris



Could there be contamination?

Cracked Transformers observed

Battery casings observed

Odors Occasionally noted during Excavating

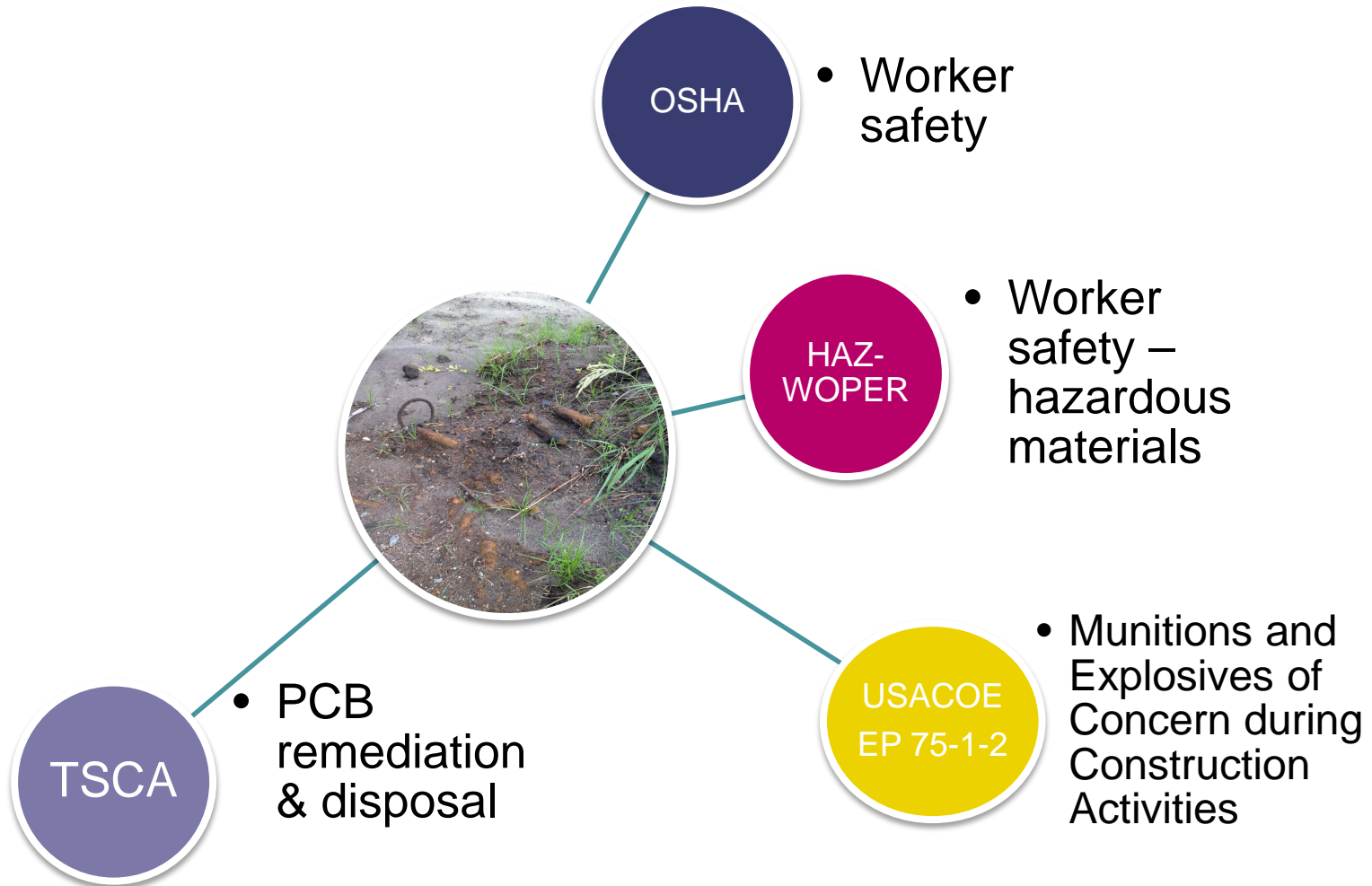
New Anecdotal Information

Collected a soil sample from four test pits (TP)

	Constituent	Units	TP-1	TP-2	TP-3	TP-4
Metals	Lead	mg/kg	4670*	2770**	412	71.8
	Aroclor-1242	µg/kg	1440	28600	654	2220
PCBs	Aroclor-1254	µg/kg	4600	15800	1690	2880
	Aroclor-1260	µg/kg	2480	6000	1510	1680

* TCLP Lead = 2.56 mg/L
 ** TCLP Lead = 78.7 mg/L





So how did contamination change scope?



Baseline Blood Samples & Respirator Fit

Tyvecs, Dust Monitoring, Personal Meters

Wipe Samples in Field Office & on Eqpt

Vehicle & Eqpt Decontamination

Soil Handling



Soil Handling



- Plastic
- Run-on
- Run-off
- Increased Sampling
- Wait for results

Variance Received

No in-
place
sampling
occurred

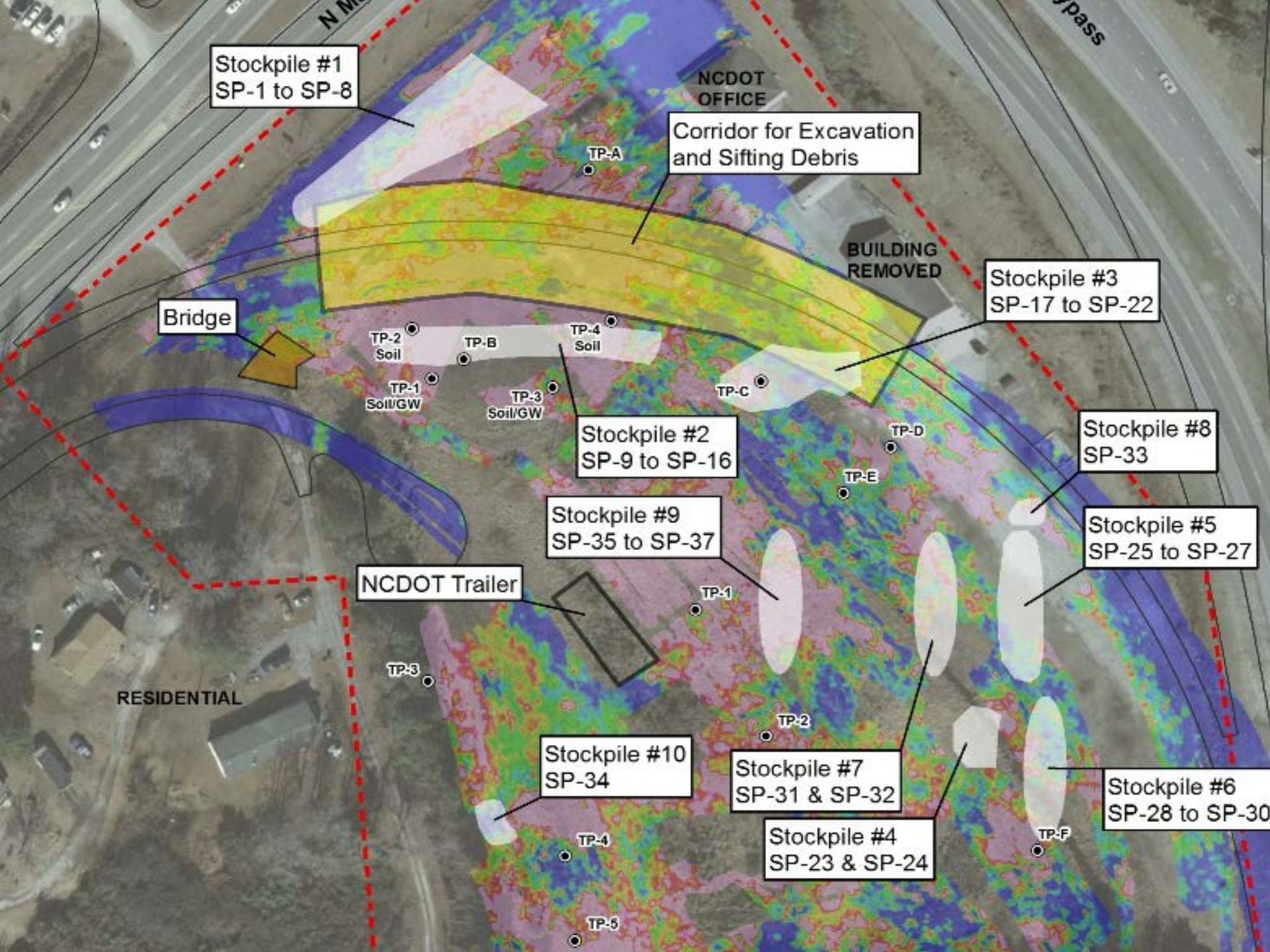
Characterization
for disposal
derived from
sifted soil

Collected 8
samples from
each 200 cubic
yards of
stockpile to be
composited



METHOD (units)	SAMPLE ID DATE COLLECTED	SP-18	SP-19	SP-20	SP-21	SP-22	SP-23	SP-24	SP-25	SP-26	SP-27	SP-28	SP-29	SP-30	SP-31	SP-32	SP-33	SP-34	SP-35	SP-36	SP-37	RCRA Regulatory Level ¹	
		10/17/12	10/17/12	10/17/12	10/17/12	10/17/12	10/19/12	10/19/12	11/5/12	11/5/12	11/5/12	11/12/12	11/12/12	11/12/12	11/12/12	11/12/12	11/12/12	11/26/12	11/26/12	11/26/12	11/26/12		11/26/12
		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
7471B	Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
6010C TCLP mg/L	Arsenic	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	5	
	Selenium	0.0706 J	0.0396 J	0.0402 J	<0.200	<0.200	<0.200	<0.200	0.0379 J	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	0.0294 J	<0.200	0.0763 J	0.0733 J	0.0511 J	1	
	Cadmium	0.0422 J	0.0534	0.0577	0.0567	0.0566	0.0182 J	<0.050	0.0618	0.0552	0.0589	0.105	0.150	0.151	0.198	0.224	0.154	0.0615	0.0979	0.105	0.106	1	
	Lead	0.251 J	0.304	0.572	0.372	0.427	0.248 J	0.122	1.15	0.687	0.505	0.496	0.655	0.827	0.737	0.838	0.407	0.142	0.326	0.202	0.273	5	
	Barium	0.731 J	0.767 J	0.84 J	0.742 J	0.714 J	0.295 J	0.267 J	0.527 J	0.501 J	0.522 J	0.926 J	1.15	1.15	1.05	1.22	0.968 J	0.443 J	0.850 J	0.927 J	0.948 J	100	
	Chromium	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.0403 J	0.0337 J	0.0436 J	<0.100	0.0215 J	0.0224 J	0.0152 J	0.0163 J	0.0196 J	0.0248 J	0.0300 J	0.0216 J	0.0186 J	5	
	Silver	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.0170 J	0.0498 J	0.0465 J	0.0415 J	0.0554 J	0.0523 J	0.0539 J	0.0469 J	0.0557 J	0.0282 J	0.0268 J	0.0285 J	0.0285 J	0.0301 J	5	
8082A µg/Kg	Aroclor-1242	<179	<179	<167	<173	<170	<37.4	<36.2				<285	<284	<615	<576	<591	<312	<319	<301	<323	<631		
	Aroclor-1248	700	671	810	828	975	34.7 J	201	553	903	563	809	1640	1550	2800	3340	1950	875	1160	1210	1420		
	Aroclor-1254	868	892	948	1010	915	46.8	323	610	1050	758	1160	1750	2540	4350	3530	3450	1590	1810	2380	2140		
	Aroclor-1260	480	500	548	453	382	19.3 J	110	389	1060	436	805	1070	2340	4180	2750	3260	701	1220	1800	1790		
	AROCLOR TOTALS	2,048	2,063	2,306	2,291	2,272	100.8	634	1,552	3,013	1,757	2,774	4,460	6,430	11,330	9,620	8,660	3,166	4,190	5,390	5,350	50 mg/kg	
8260B µg/Kg	Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
8270D µg/Kg	Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Benzo[a]anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Benzo[a]pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Benzo[b]fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Benzo[g,h,i]perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Benzo[k]fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Dibenz[a,h]anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	Indeno[1,2,3-cd]pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			





Stockpile #1
SP-1 to SP-8

NCDOT
OFFICE

Corridor for Excavation
and Sifting Debris

Stockpile #3
SP-17 to SP-22

Bridge

BUILDING
REMOVED

TP-2
Soil

TP-B

TP-4
Soil

TP-1
Soil/GW

TP-3
Soil/GW

TP-C

Stockpile #2
SP-9 to SP-16

TP-D

Stockpile #8
SP-33

TP-E

Stockpile #5
SP-25 to SP-27

Stockpile #9
SP-35 to SP-37

NCDOT Trailer

TP-1

RESIDENTIAL

TP-3

Stockpile #10
SP-34

Stockpile #7
SP-31 & SP-32

Stockpile #6
SP-28 to SP-30

Stockpile #4
SP-23 & SP-24

TP-4

TP-F

TP-5

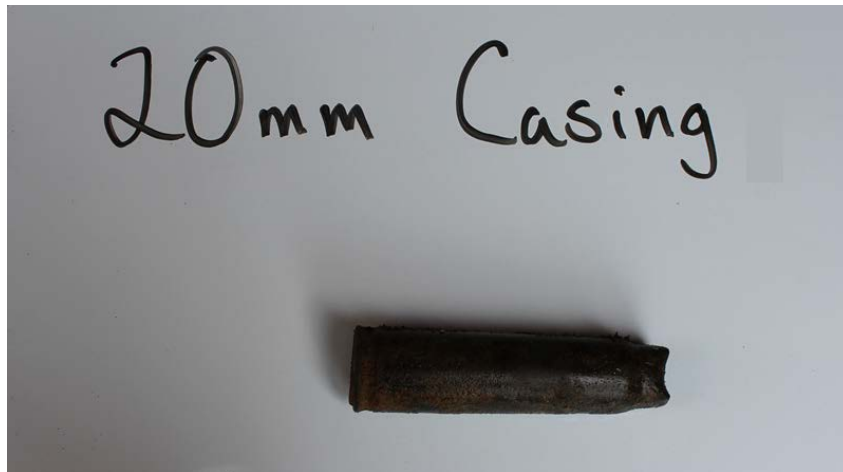
Challenge – LEAD STABILIZATION NEEDED

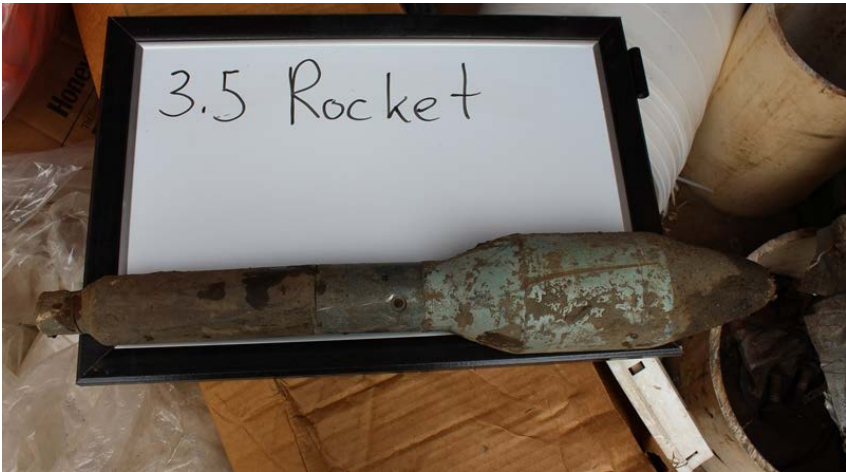
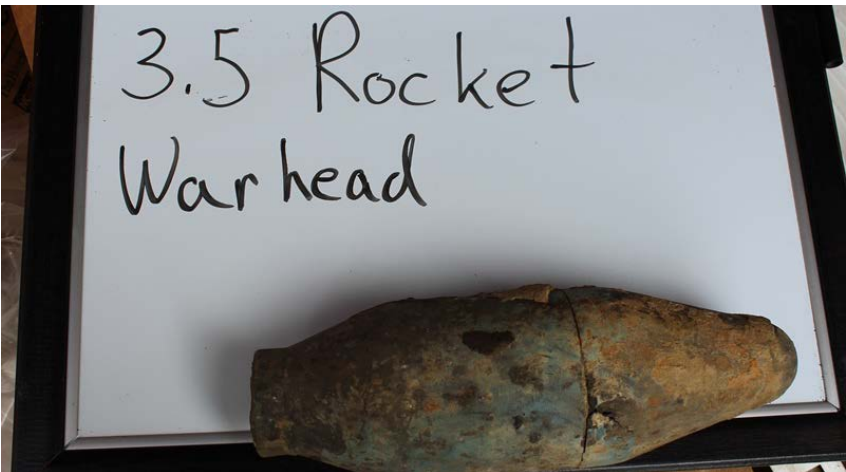
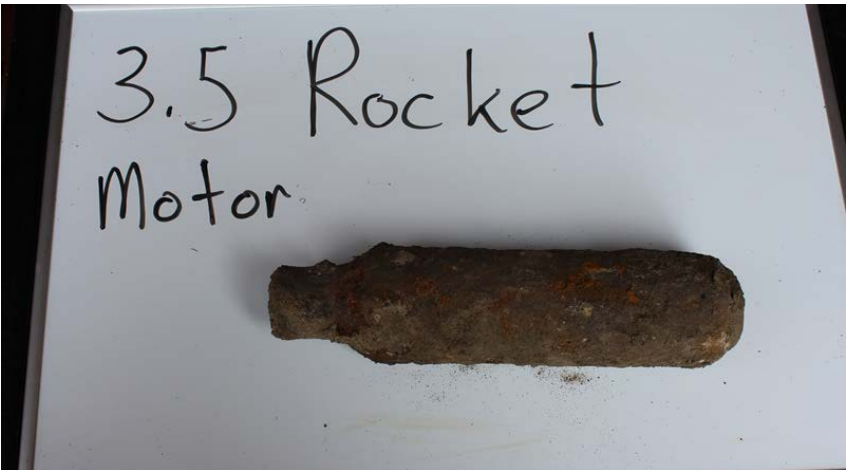
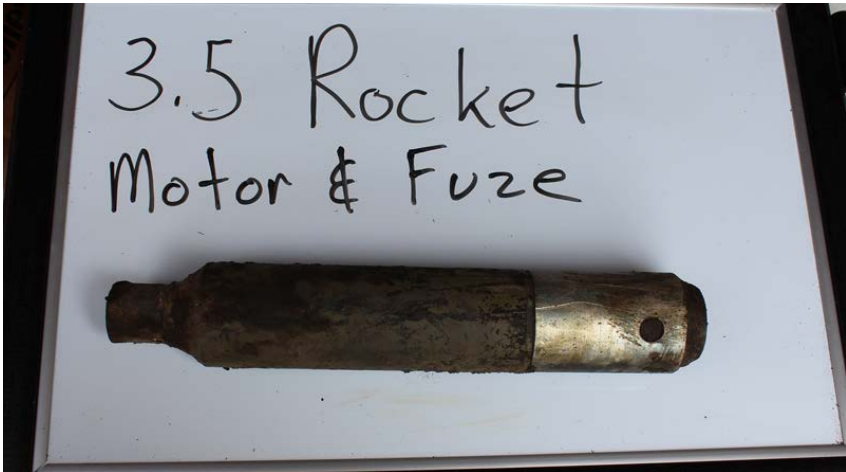


- 20 roll off bins were filled from stockpiles and transported to other part of the site
- Portland cement stabilization agent
- 22 tons soil in each roll off box

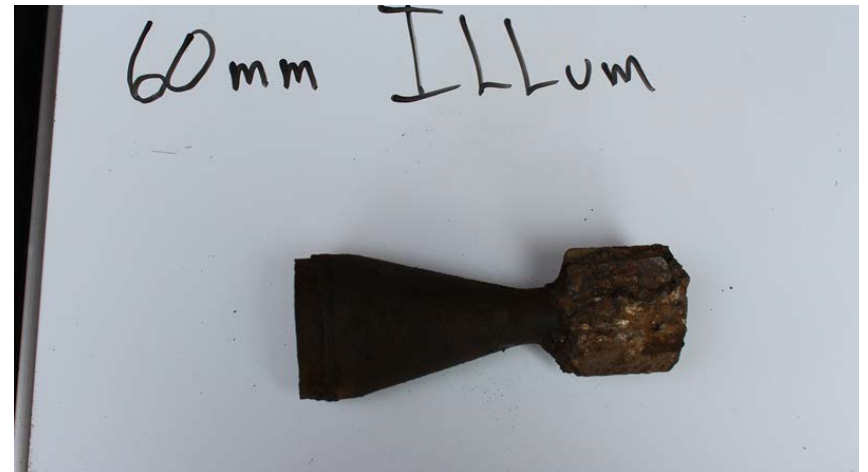
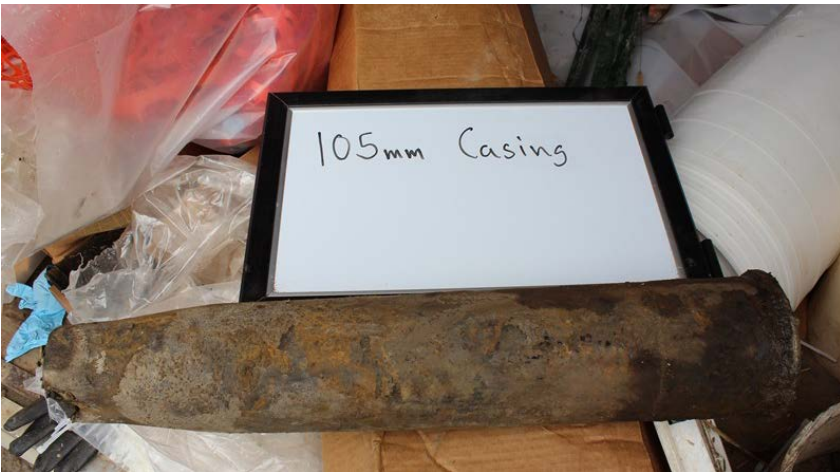
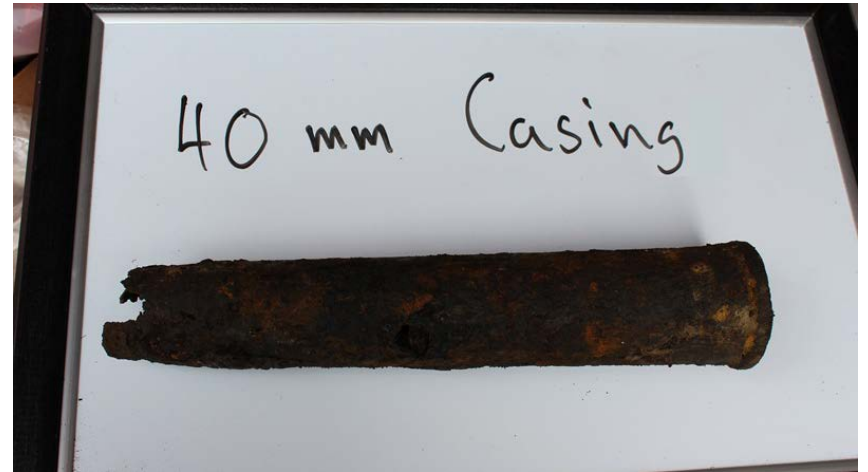
- Offsite disposal as hazardous \$430/ton
- Onsite stabilization on ground \$85/ton
- **Onsite stabilization in roll offs \$270/ton**







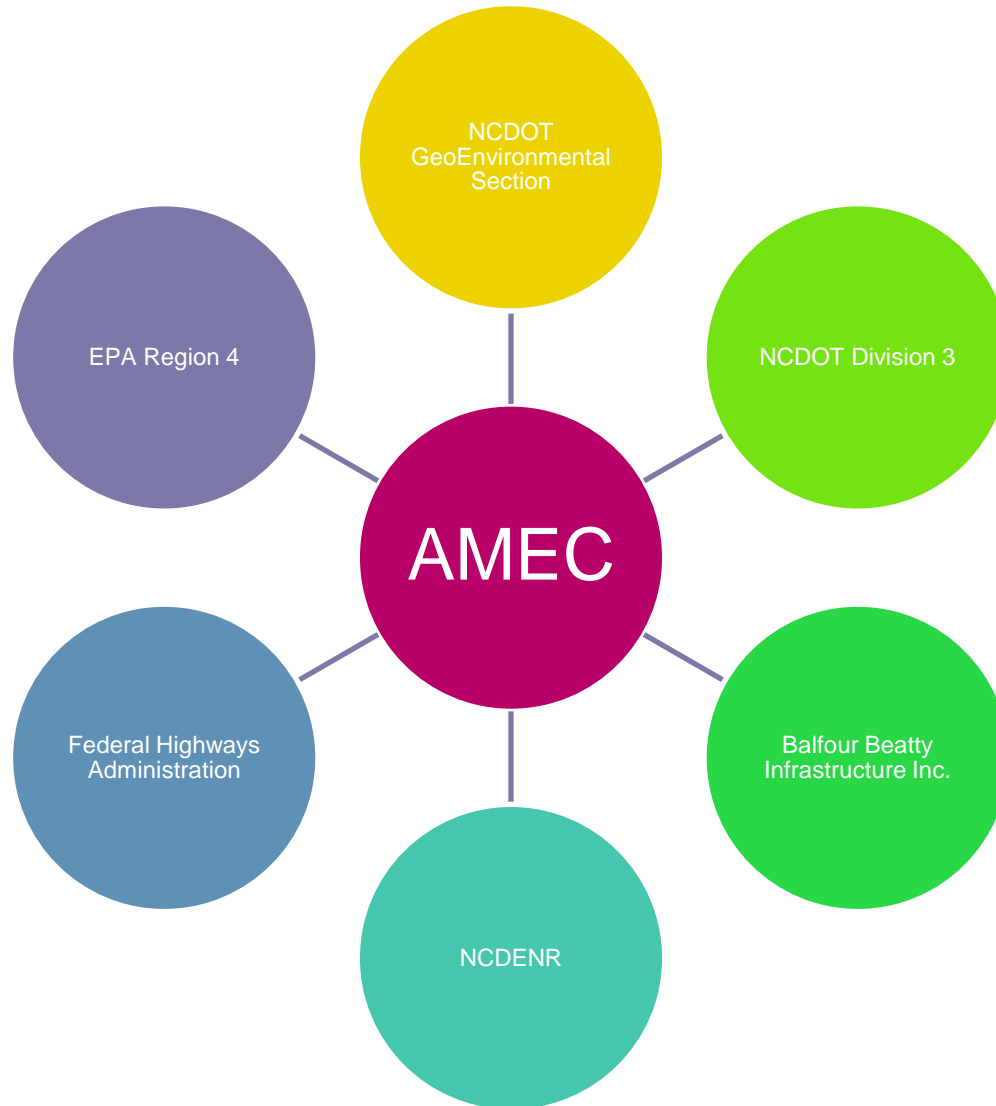






My personal favorite

Lots of Interested Parties





Challenge – Clay Clogs the Sifter



- Clay formed balls around ordnance
- Some soil piles had to be sifted more than once

Challenge - WEATHER



Ramp 1B



Questions & Discussion

