Risk Assessment at Uncontrolled Shooting Sites

Sonoran Desert National Monument [1]

Abdullah Ashkanani
Kamran Khan
Shane Klotzman

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Roles

Shane Klotzman - Project Engineer

Kamran Khan - Project Lead

Abdullah Ashkanani - Project Engineer

Trash at Site [2]

Project Background

- Sites in question found on Bureau of Land Management lands
  - Sonoran Desert National Monument
    - Created by presidential proclamation (2001)
    - Cultural Resources: petroglyphs & national historic trails
- Preliminary Assessment & Site Inspection [CERCLA]
- Method of Contamination: Recreational Target Shooting
- Contaminants of Concern
  - Lead, Arsenic, Antimony, Copper, Zinc, Tin
- Human & Ecological Risk Assessment

Trash at Site [2]

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Stakeholders

- ➔ Bureau of Land Management
- ➔ Recreational Shooter
- ➔ Other Park Patrons
- ➔ Remediation Workers

Client

- ➔ Bureau Of Land Management: Matt Plis, Eric Zielske, Bill Harris

Technical Advisor

- ➔ Dr. Bridget Bero

Park Sign [2]

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

[2]

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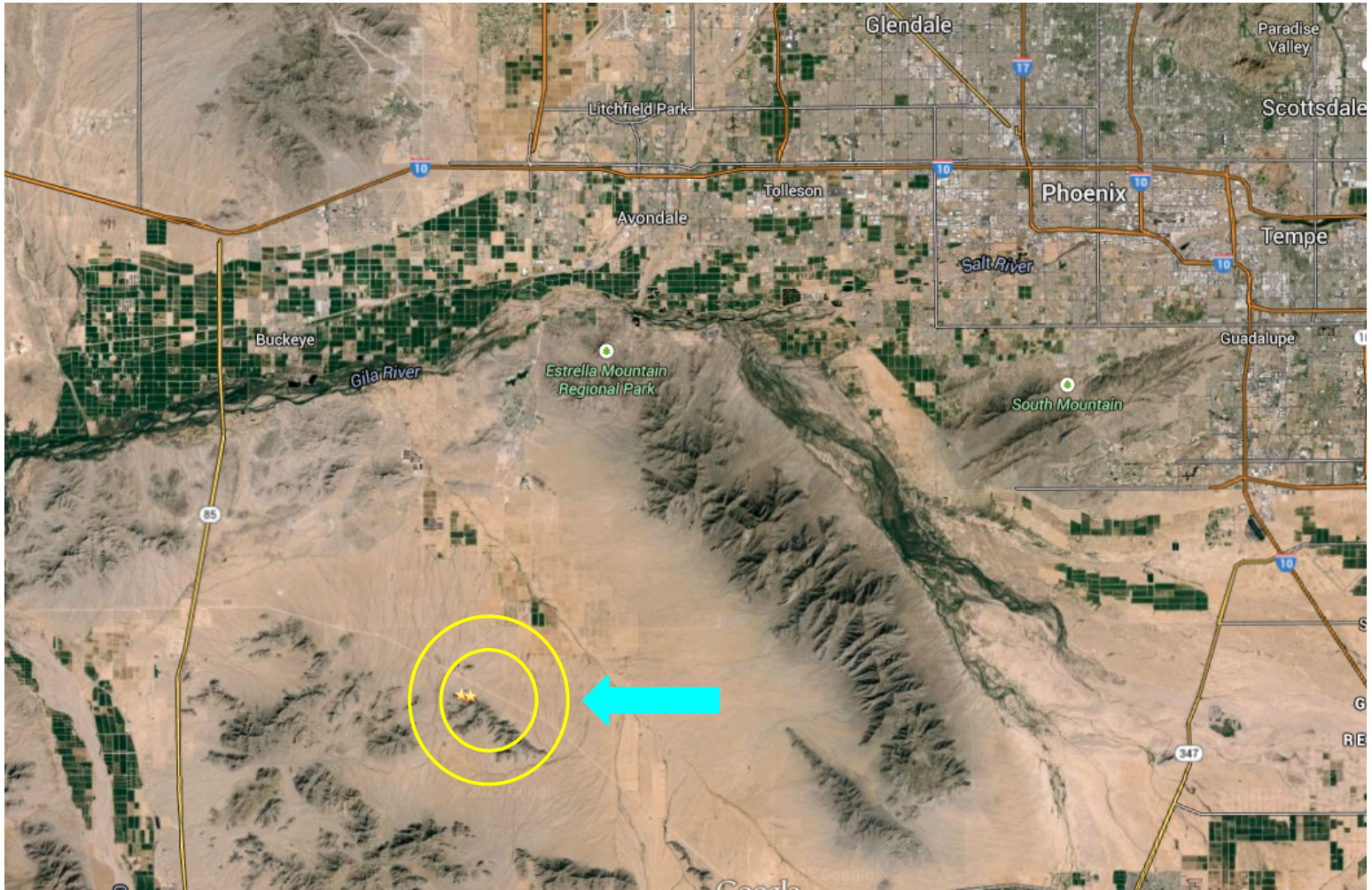
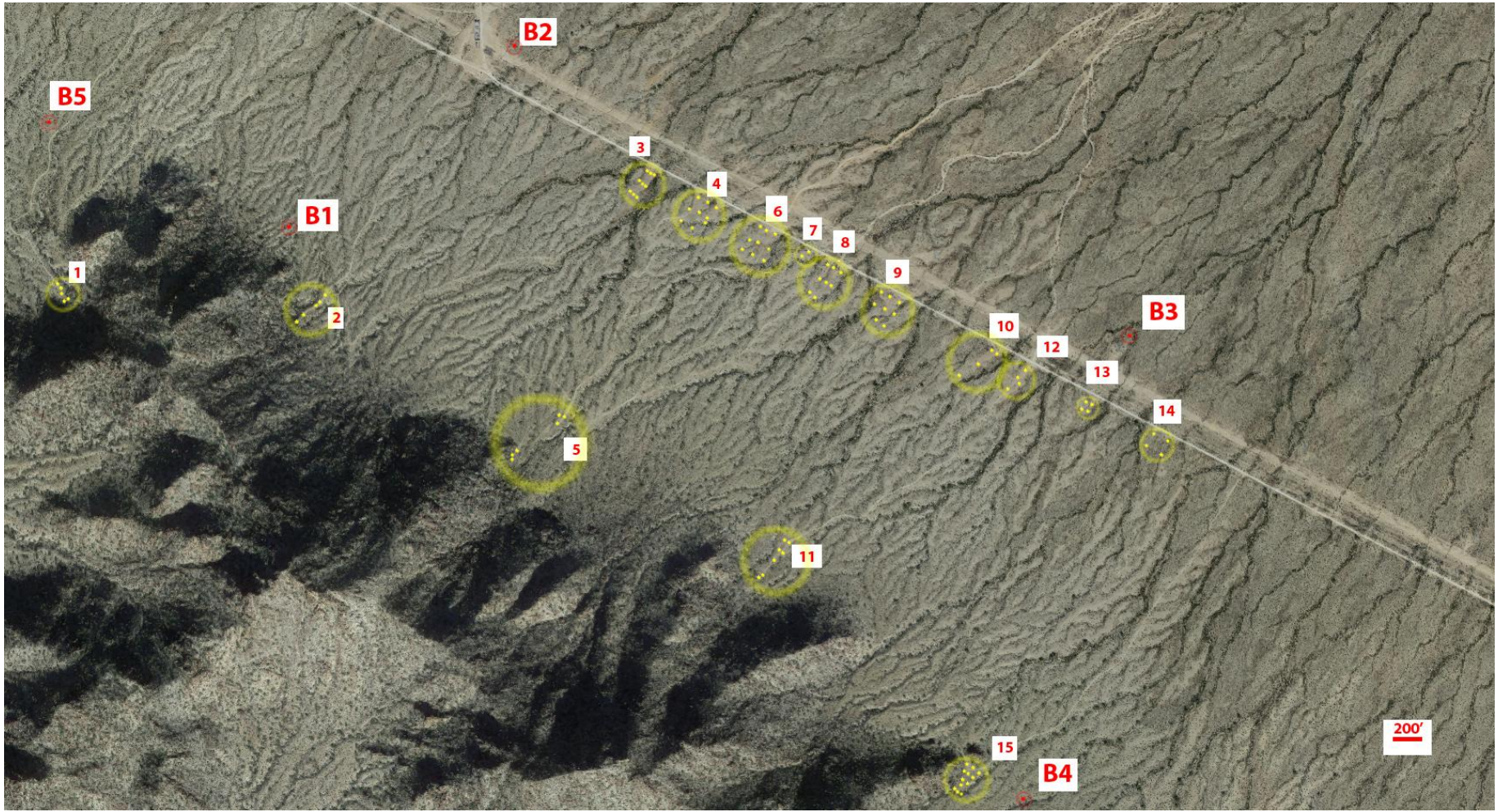
Site Overview



Site Overview



Field Work - Sample Collection

- ➔ Road Sites: Grid Approach
- ➔ Hill Sites: Hotspot & Grid Approach
- ➔ Soil of Interest: Surface Soil

Decontamination Procedure [2]

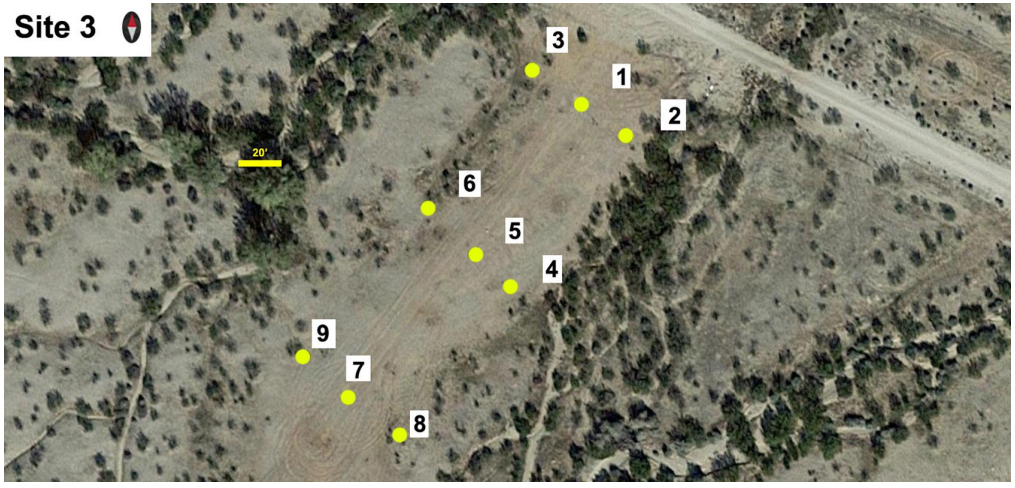
Sample Collection [2]

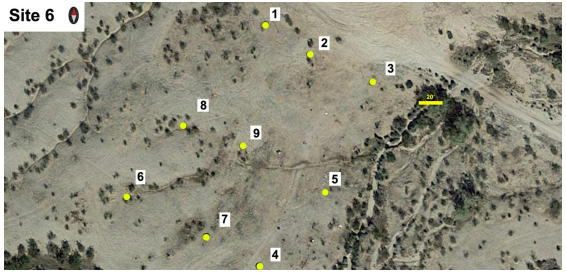
Sample Collection and Decontamination [2]

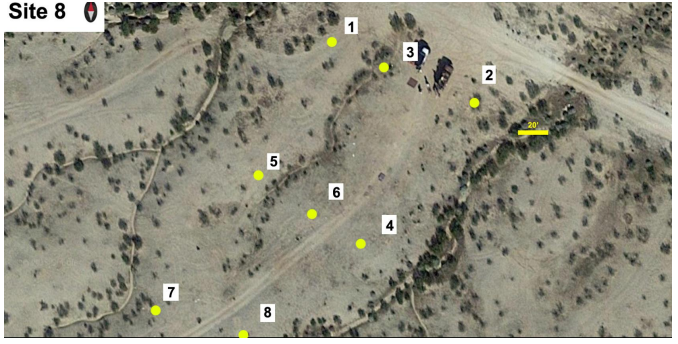
Sample Collection [2]

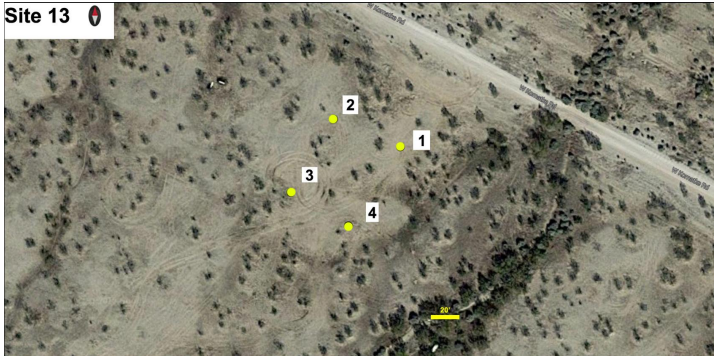
Sample Site [2]

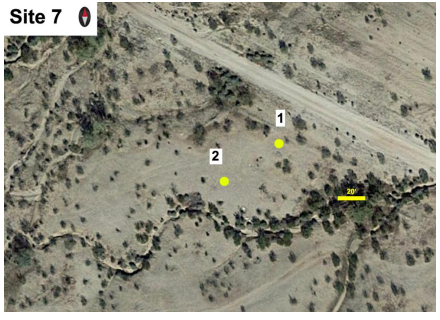
Road Sites


Site 3
3
1
2
6
5
4
9
7
8
20'


Site 6
1
2
3
8
9
6
5
7
4

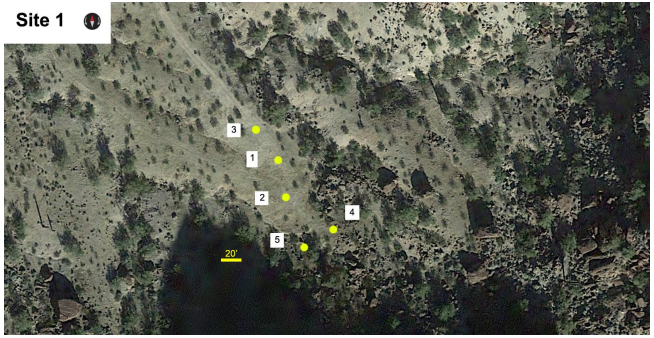

Site 8
1
3
2
5
6
4
7
8


Site 13
2
1
3
4

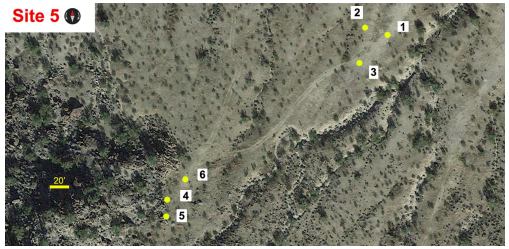

Site 7
1
2

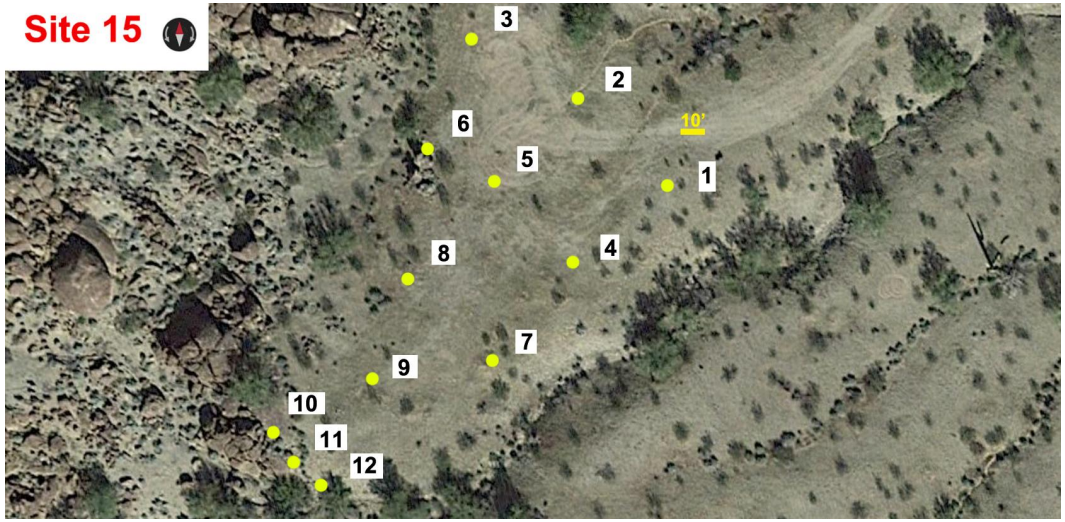

Site 14
2
1
3
4

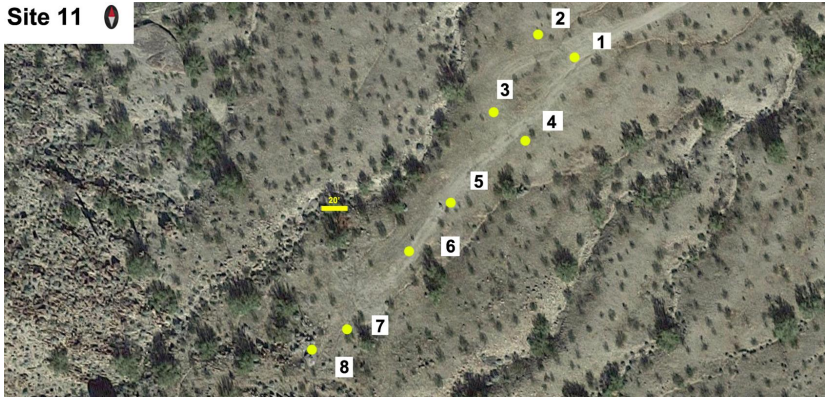
Hill Sites


Site 1
3
1
2
4
5
20'


Site 2
1
2
3
4
10'
5


Site 5
2
1
3
20'
6
4
5


Site 15
3
2
6
10'
5
1
8
4
7
9
10
11
12


Site 11
2
1
3
4
5
20'
6
7
8

Data Analysis

X-Ray Fluorescence

- ➔ 97 site samples and 5 background samples
- ➔ Grid method using an olympic average for each COC

Location	Contaminants of Concern (ppm)		
Site 15	Antimony	Arsenic	Lead
S15-1	ND	8	96
S15-2	ND	5	59
S15-3	ND	ND	309
S15-4	ND	5	215
S15-5	22	7	901
S15-6	77	12	4422
S15-7	ND	9	218
S15-8	ND	10	915
S15-9	ND	5	169
S15-10	52	ND	4466
S15-11	ND	7	64
S15-12	21	ND	455

Compound	Residential (ppm)	Non-Residential (ppm)
Antimony	21	410
Arsenic	10	10
Lead	400	800

Compound	Non-Detect Limit (ppm)
Antimony (Sb)	<20
Arsenic (As)	<5
Lead (Pb)	<5

XRF testing [3]

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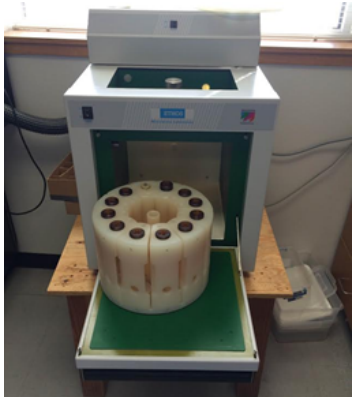
Data Analysis

Flame Atomic Absorption

- 33 samples tested
- EPA Method 3050B
  - 5g of sample
  - 10 mL of nitric acid
  - 2 mL of hydrogen peroxide
- Microwave Digester
  - Heat sample to 95 C
- Filter Samples



Digestion of Samples [3]

Filtration of Samples [3]

Flame Atomic Absorption [3]

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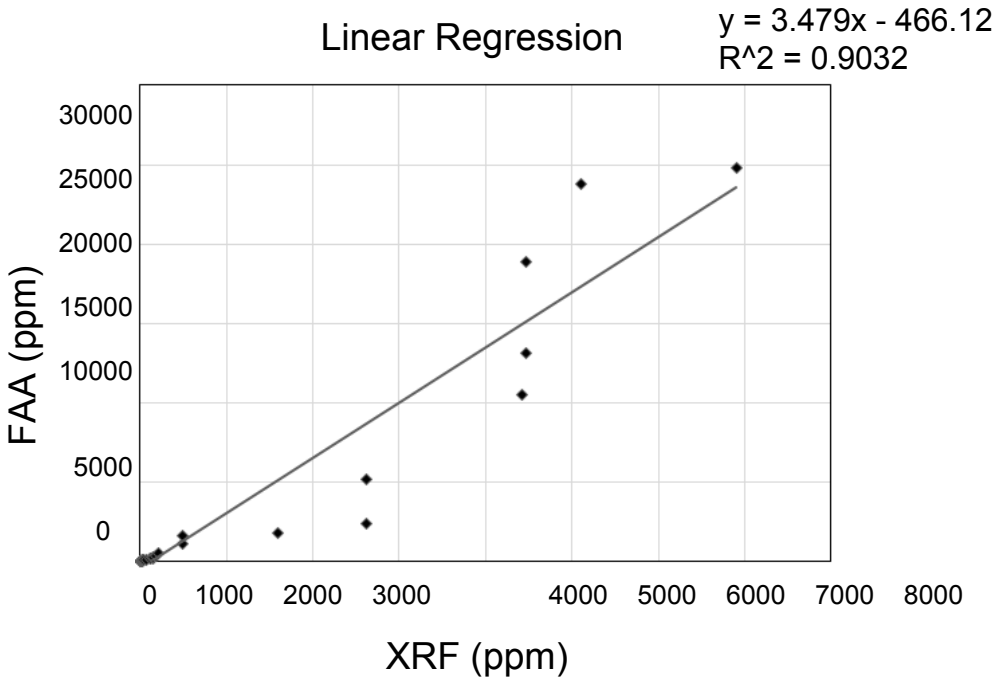
Data Analysis

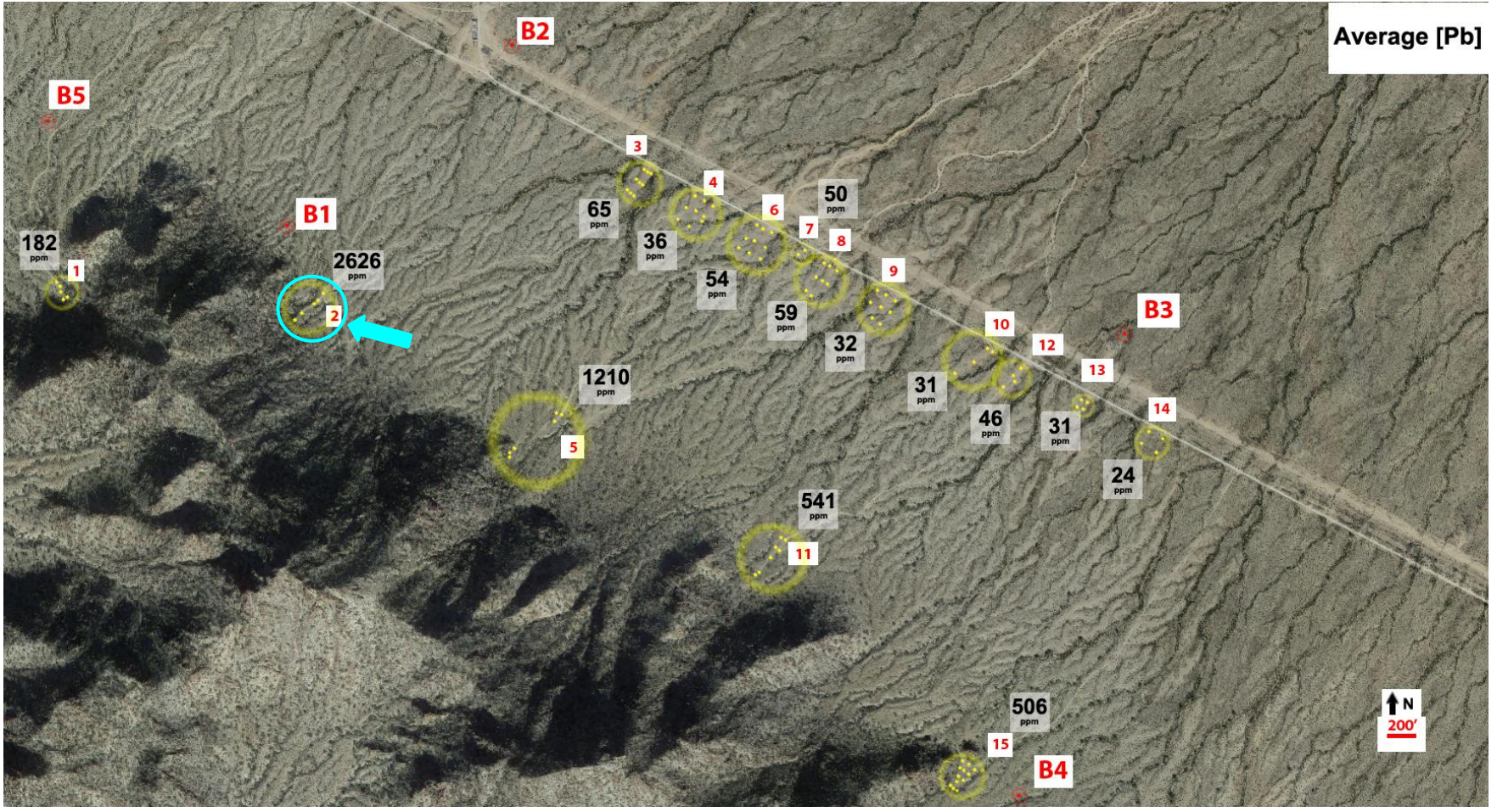
Data Correlation

Sample ID	FAA (ppm)	XRF (ppm)
B-1	53.1	42.1
B-2	16.8	20.7
B-3	16.0	20.7
B-4	14.9	20.0
B-5	13.9	17.6
1-3A	24.0	26.7
1-3B	28.9	26.7
1-4A	1584.6	488.4
1-4B	96.6	488.4
2-4A	2384.9	2621.1
2-4B	1819.5	2621.1
2-5	34088.3	22290.0
5-3	5186.0	1595.7
5-5	23790.2	6906.5
6-3	1083.3	183.0
6-9	74.8	36.7

Correlation		
	FAA	*XRF*
FAA	1	
XRF	0.88	1



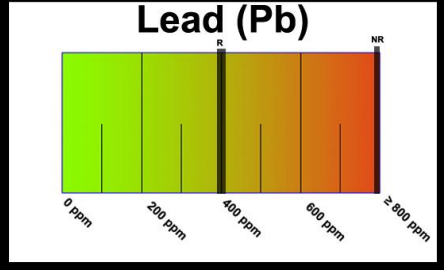
Results - Site 2



Results - Site 2 [Pb]

Location	Contaminants of Concern (ppm)					
Site 2	Sb *1	As *2	Cu	Pb	Sn *3	Zn
S2-1	ND	7.86	31.00	31.70	ND	84.29
S2-2	ND	ND	40.29	223.94	ND	71.00
S2-3	35.86	ND	84.86	888.88	ND	102.71
S2-4	60.14	ND	64.71	1272.69	ND	116.00
S2-5	299.29	36.29	372.57	10715.71	24.43	137.29

*1	the non-detect limit for Antimony is 19 (mg/kg)
*2	the non-detect limit for Arsenic is 4 (mg/kg)
*3	the non-detect limit for Tin is 19 (mg/kg)



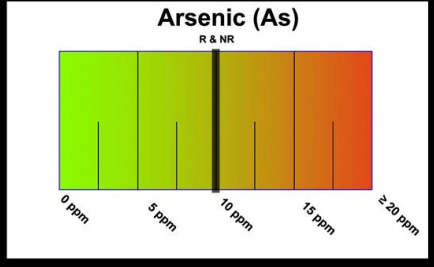
[1]

[1]

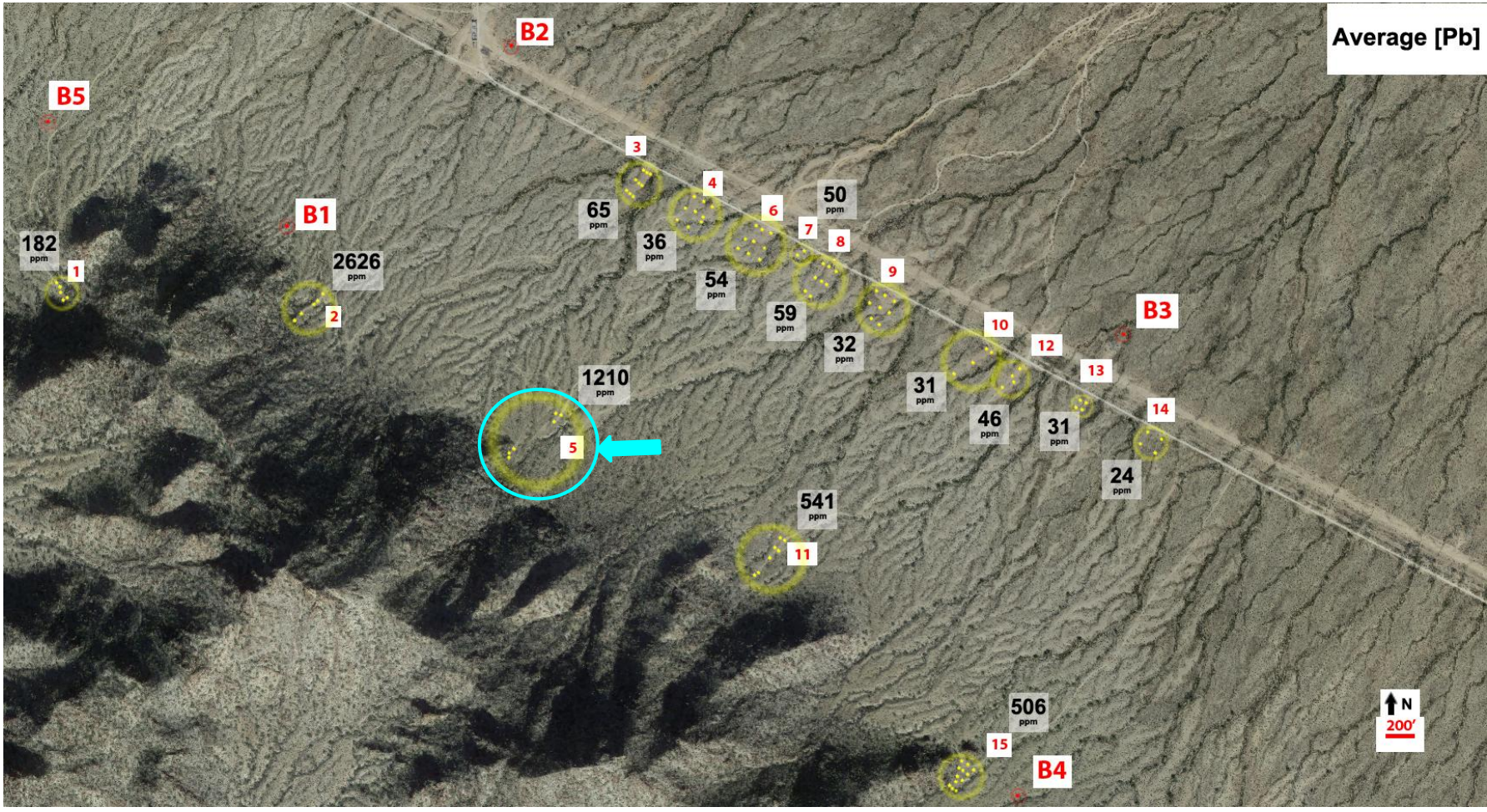
Results - Site 2 [As]

Location	Contaminants of Concern (ppm)					
Site 2	Sb*1	As*2	Cu	Pb	Sn*3	Zn
S2-1	ND	7.86	31.00	31.70	ND	84.29
S2-2	ND	ND	40.29	223.94	ND	71.00
S2-3	35.86	ND	84.86	888.88	ND	102.71
S2-4	60.14	ND	64.71	1272.69	ND	116.00
S2-5	299.29	36.29	372.57	10715.71	24.43	137.29

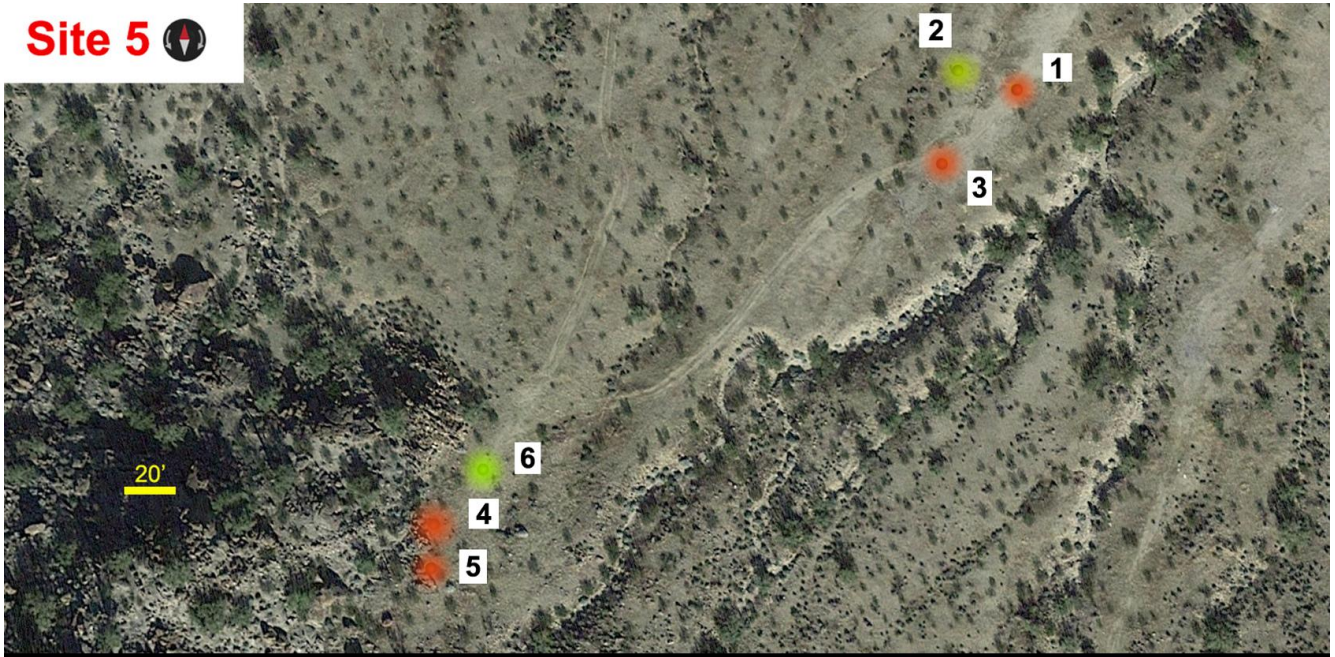
*1	the non-detect limit for Antimony is 19 (mg/kg)
*2	the non-detect limit for Arsenic is 4 (mg/kg)
*3	the non-detect limit for Tin is 19 (mg/kg)



Results - Site 5

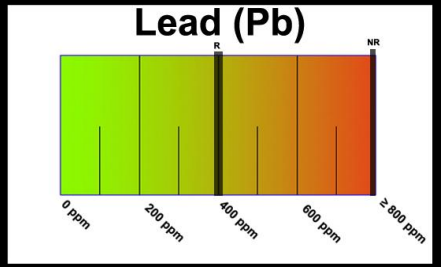


Results - Site 5 [Pb]

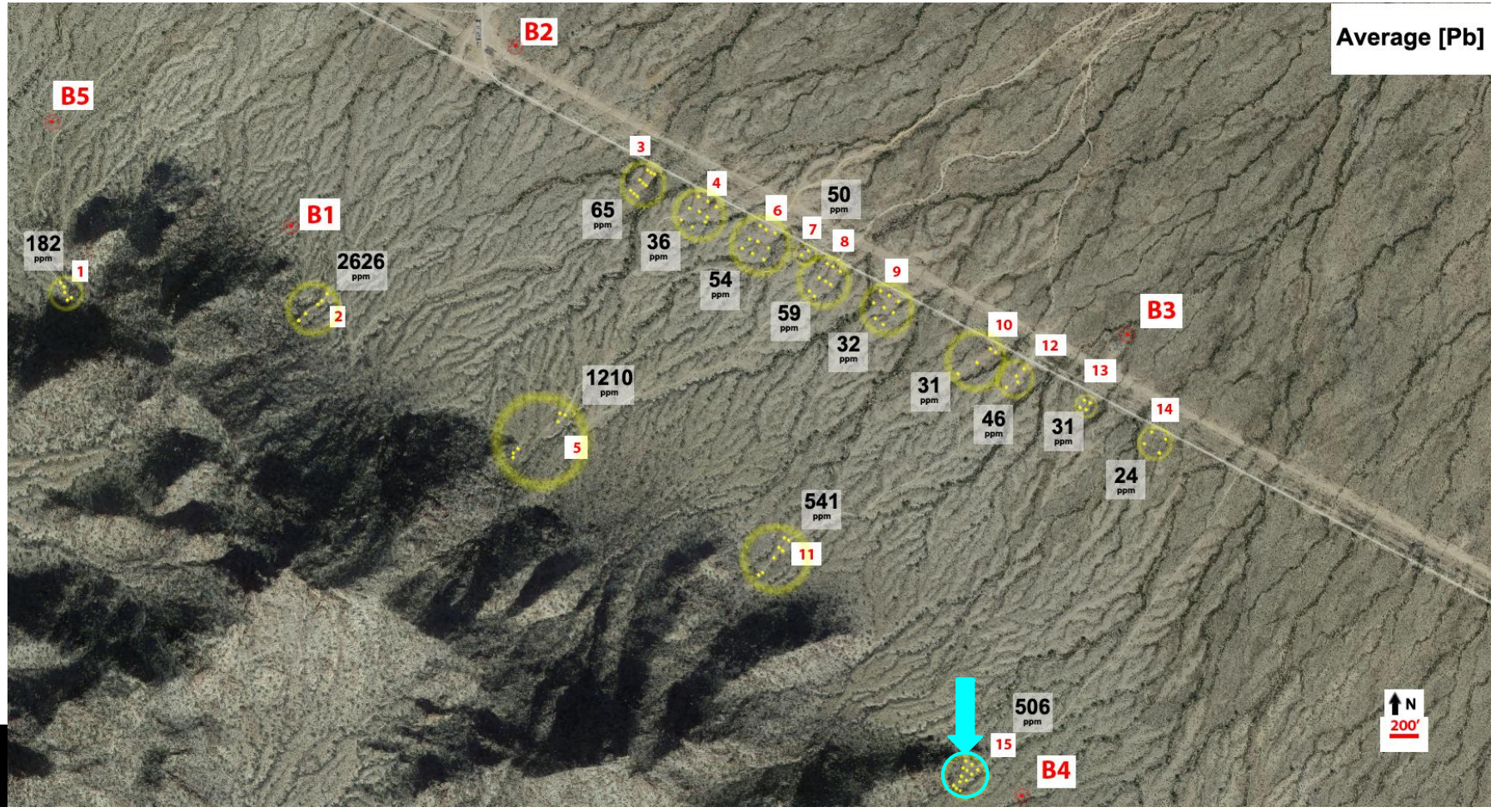


Location	Contaminants of Concern (ppm)					
Site 5	Sb *1	As *2	Cu	Pb	Sn *3	Zn
S5-1	20.67	ND	56.00	493.26	ND	78.17
S5-2	ND	ND	37.50	241.52	ND	65.17
S5-3	60.00	ND	60.33	780.36	ND	81.50
S5-4	89.00	ND	65.83	2314.04	ND	38.50
S5-5	132.83	ND	108.83	3330.09	34.50	99.50
S5-6	22.17	ND	28.33	105.17	ND	56.33

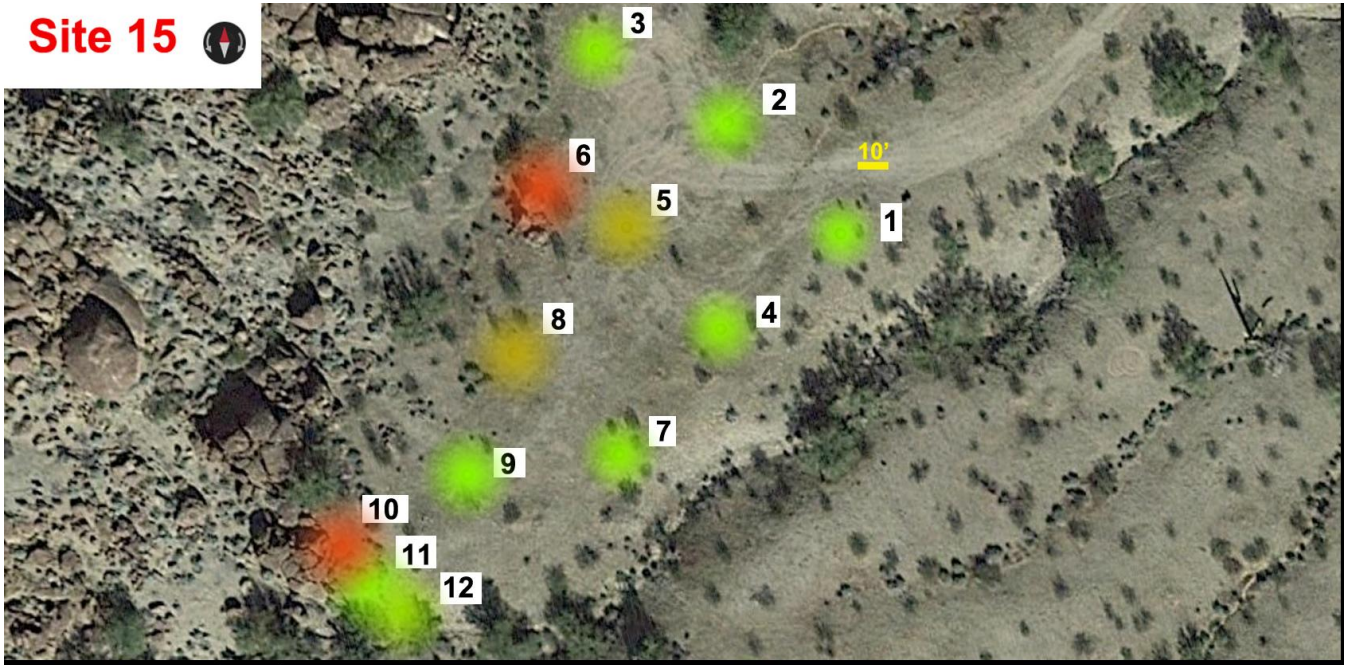
*1	the non-detect limit for Antimony is 19 (mg/kg)
*2	the non-detect limit for Arsenic is 4 (mg/kg)
*3	the non-detect limit for Tin is 19 (mg/kg)



Results - Site 15

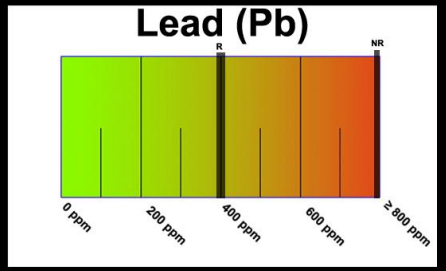


Results - Site 15 [Pb]



Location	Contaminants of Concern (ppm)					
Site 15	Sb*1	As*2	Cu	Pb	Sn*3	Zn
S15-1	ND	8.14	36.43	60.23	ND	71.00
S15-2	ND	4.86	35.71	42.60	ND	71.43
S15-3	ND	ND	37.57	162.83	ND	108.57
S15-4	ND	4.86	33.14	117.50	ND	71.71
S15-5	22.29	6.71	46.43	446.78	ND	113.57
S15-6	76.71	12.14	96.43	2137.28	ND	231.00
S15-7	ND	8.71	34.43	118.80	ND	69.00
S15-8	ND	10.00	49.43	453.50	ND	81.71
S15-9	ND	5.14	30.71	95.28	ND	69.00
S15-10	52.29	ND	106.57	2158.61	ND	104.57
S15-11	ND	6.71	34.57	44.80	ND	72.86
S15-12	20.57	ND	31.14	232.72	ND	73.29

*1	the non-detect limit for Antimony is 19 (mg/kg)
*2	the non-detect limit for Arsenic is 4 (mg/kg)
*3	the non-detect limit for Tin is 19 (mg/kg)



Results - Risk Assessment Scenarios

3 Different Risk Scenarios
- ➔ Adult volunteer worker
- ➔ Adult shooter
- ➔ Child

Mean = 64 ppm
90% “max” = 1237 ppm

What it looked at
- ➔ Soil ingestion rate
- ➔ Baseline blood lead level
- ➔ Exposure frequency

[4]

Results - Risk Assessment Scenarios

National Health And Nutrition Examination Survey Adult Risk Model

		Adult Shooter		Adult Volunteer	
	Units	90% max	Mean	90% max	Mean
Soil Lead Concentration	ppm	1237	64	1237	64
Exposure Frequency	days/yr	22	22	8	8
Averaging Time	days/yr	365	365	365	365
Blood Level Concentration	ug/dL	2.4	1.5	1.8	1.5

The Integrated Exposure Uptake Biokinetic Child Risk Model

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	1.291	2.795	1.5
1-2	2.045	3.992	1.7
2-3	2.053	4.158	1.6
3-4	2.063	4.156	1.5
4-5	1.538	3.639	1.3
5-6	1.387	3.628	1.1
6-7	1.312	3.659	1.0

Ecosystem - Fauna

- Rodents:
  - Cactus Mouse
  - Arizona Cotton Rat
- Raptors:
  - Horned Owl
  - Prairie Falcon
  - Common Barn Owl
- Bighorn Sheep
- Desert Tortoise
- Toxic Limit: 2-8 PPM

Cactus Mouse [5]

Horned Owl [6]

Bighorn Sheep [7]

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Ecosystem - Flora

- Cactus:
  - Saguaro
- Shrubs:
  - Bur Sage
- Sub Trees:
  - Ocotillo
  - Palo Verde
- Toxic Limit: 500-1000 PPM

Saguaro Cactus [8]

Bur Sage [9]

Palo Verde [10]

Ocotillo [11]

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Site Recommendation

- ➔ Further investigation of hill sites
- ➔ Further investigation of wash contamination
- ➔ Identification of other sites

Field Sampling [2]

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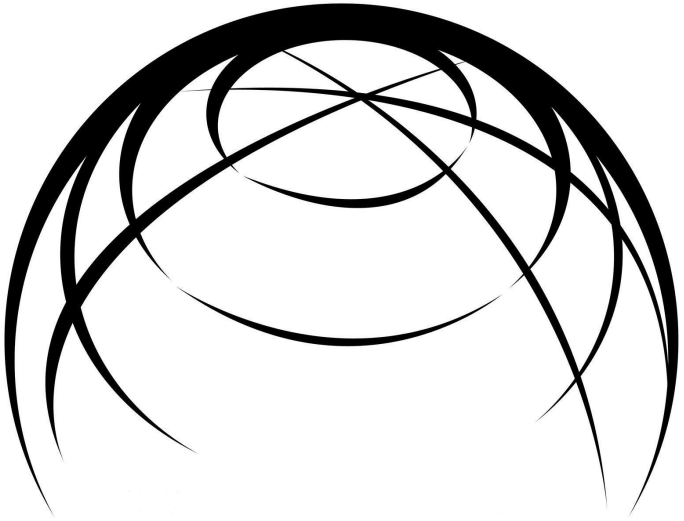
Broader Impacts

- ➔ Future site closures
- ➔ Investigation of other sites
- ➔ Increased restrictions at sites
- ➔ Promote site cleanup
- ➔ Improve shooter safety



[12]

Labor & Cost

Cost Categories	Classification	Hours	Rate $/hr	Cost
1.0 Personnel	SENG	128	100	$12,800.00
	ENG1	115	80	$9,200.00
	ENG2	107	80	$8,560.00
	LT	63	64	$4,032.00
2.0 Travel	Mileage	348	$.50/mi	$174.00
	Hotel	2 Rooms	$141	$282.00
	Food	5 People	$45/person	$225.00
3.0 Subcontract	Lab Work			$136.00
4.0 Total				$27,705.00

Acknowledgements

Technical Advisor: Dr. Bridget Bero

BLM Staff: Matt Plis, Eric Zielske, Bill Harris, Jason Frels

Lab Managers: Gerjen “Gary” Slim, Jeff Propster

Field Assistant: Alina-Maria Davidescu

References

[1] Picture by Kamran Khan December 2015

[2] BLM - Picture taken by Matt Pliss February 2015 (and logo)

[3] Picture by Shane Klotzman 2015

[4] EPA https://twitter.com/epa

[5] Mouse http://www.blairsociety.com/MC/LLMammals.html

[6] Owl

[7] Sheep

[8] Saguaro

[9] Bur Sage

[10] Palo Verde

[11] Ocotillo

[12] Globe

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