

Memorandum



Date: April 3, 2014

To: Environmental Monitoring and Restoration Division (EMRD) Staff

From: Wilbur Mayorga, P.E., Chief
EMRD-DERM

A handwritten signature in black ink, appearing to read "W. Mayorga", written over a horizontal line.

Subject: Miami-Dade County Anthropogenic Background Study

Contaminant concentrations attributable to natural processes or regional or subregional anthropogenic impacts are an important consideration for responsible parties and personnel involved in the restoration of contaminated sites. There are only a few studies targeting background soil concentrations at the national, state or local level. Often the data from national or state-wide studies cannot be directly applied at the county or subregional level. In 2011, the EMRD initiated a study to determine anthropogenic background concentrations of several contaminants (including inorganic chemicals which occur naturally) commonly encountered in soil at contaminated sites in Miami-Dade County. The anthropogenic background study is intended to complement the two studies, previously conducted by the Division, which evaluated naturally occurring background soil concentrations (DERM 2002 and 2004) and to assist responsible parties and environmental restoration contractors.

Between 2011 and February 2014, the EMRD sampled surficial soils at over 160 locations throughout the urban corridor (inside the 2015 UDB) of the county. The locations were selected to be representative of county-wide heterogeneity with respect to development history (older urban centers as well as newer suburban areas), land use (public buildings-libraries, residents and public parks), geology (coastal ridge versus low lying areas to the south and west, etc.). Samples were collected as composites, each consisting of 5 to 9 subsamples. Where feasible, samples were obtained from the 0-6 inch and the 6-24 inch intervals at each location. The samples were analyzed for fourteen inorganic chemicals and the carcinogenic polycyclic aromatic hydrocarbons (PAHs) represented by benzo(a)pyrene toxicity equivalents. In addition, 10% of the samples were analyzed for polychlorinated biphenyls (PCBs) as well as organochlorine pesticides.

The study results are presented in the attached tables and figures. The statistical descriptors evaluated include the Minimum Variance Unbiased Estimate (MVUE) and the 95% Upper Confidence Limit (95% UCL). In most cases the data is not normally distributed; therefore, the mean is provided for illustration only.

The results indicate arsenic as the most significant contaminant. To further assist data users, historical on-file data for muck soils/organic soils typical of western, southeast and south Miami-Dade County was reviewed and evaluated and summary statistics with respect to arsenic concentrations for these muck soils are also presented. Additionally for completeness, the data summary for the previously published naturally occurring background concentrations for the barrier islands (DERM 2004) is also presented.

If you have any questions concerning the above please contact me.

pc: Lee Hefty, DERM Director
Jose Gonzales P.E., Director's Office
DERM Division Chiefs

**Table 1: MIAMI-DADE COUNTY ANTHROPOGENIC BACKGROUND STUDY
SUMMARY STATISTICS**

Contaminants with no exceedence of residential Soils Cleanup Target Levels

	Al			Ba			Cd			Cr		
	0 - 6"	6 - 24"	0-2ft*	0 - 6"	6 - 24"	0-2ft*	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*
Number of Samples	148	140	140	153	140	140	148	141	141	150	140	140
Minimum	84	81.0	95.0	2.1	0.6	2.5	0.1	0.1	0.1	1.3	0.6	0.7
Maximum	9240	8780	8327	42.3	52.2	49.7	1.0	0.7	0.7	37.8	38.5	38.0
Mean	2320	2092	2129	11.6	8.6	9.3	0.3	0.1	0.2	12.0	9.6	10.2
MVUE	2372	2188	2179	11.6	8.6	9.2	0.3	0.1	0.2	12.1	9.9	10.4
95% UCL	2935	2548	2484	12.5	9.8	10.2	0.3	0.2	0.2	13.2	11.1	11.4

	Cu			Pb			Fe			Hg		
	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*
Number of Samples	143	140	140	152	141	141	147	141	141	145	139	139
Minimum	1.2	0.2	0.5	0.3	0.3	0.3	119	56	86	0.02	0.02	0.02
Maximum	32.5	29.6	33.8	129	141	133	10900	10100	7892	0.8	0.8	0.8
Mean	9.2	5.7	6.6	24.3	16.1	18.4	2446	2019	2125	0.3	0.4	0.4
MVUE	9.2	6.2	6.7	25	16	17.6	2499	2111	2176	0.4	0.4	0.4
95% UCL	10.3	7.7	7.7	33.2	20.1	21.5	3014	2447	2455	0.4	0.4	0.4

	Mn			Ni			Zn			Ag		
	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*	0-6"	6-24"	0-2 ft*
Number of Samples	140	139	139	142	139	139	140	138	138	148	136	136
Minimum	5.9	1	2.2	0.5	0.5	0.5	4	1	1.7	0.1	0.1	0.1
Maximum	243	196	206	8.9	5.9	5.9	168	154	143	5.1	5.1	5.1
Mean	15	31.6	36.3	2.1	1.9	1.9	37.2	21.6	25.5	1.0	0.9	1.0
MVUE	50.6	33.5	36.9	2.1	2	1.9	37.3	21.0	25.0	1.2	1.0	1.1
95% UCL	57.1	40.3	47.9	2.6	2.3	2.3	41.2	26.0	29.0	1.4	1.3	1.3

Concentrations in mg/kg

* weighted concentration

Outliers removed for data analysis

Data for Selenium not analyzed -94% of values below detection limit

PCB and Organochlorine pesticide data not analyzed statistically due to limited detections

**Table 2: MIAMI-DADE COUNTY ANTHROPOGENIC BACKGROUND STUDY
ARSENIC SUMMARY STATISTICS**

	Arsenic- County-Wide			Arsenic-North of SW 88 Street			Arsenic-South of SW 88Street		
	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*	0 - 6"	6 - 24"	0-2 ft*
Number of Samples	153	142	142	111	100	100	40	39	39
Minimum	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Maximum	27.3	14.5	16.2	24.8	10.0	13.7	27.3	14.5	16.2
Mean	3.9	2.6	2.9	3.3	1.9	2.2	5.9	4.2	4.7
MVUE	4.2	2.9	3.0	3.5	2.1	2.3	7	5	5.2
95% UCL	5.6	3.5	3.7	4.8	2.6	2.8	10.6	7.1	7.9

Concentrations in mg/kg

Outliers removed for data analysis

* Weighted Concentration

**Table 3: MIAMI-DADE COUNTY ANTHROPOGENIC BACKGROUND
BaPTE SUMMARY STATISTICS**

	BaPTE		
	0 - 6"	6 - 24"	0-2 ft*
Number of Samples	146	143	140
Minimum	0.01	0.01	0.01
Maximum	1.38	1.79	1.5
Mean	0.13	0.09	0.1
MVUE	0.14	0.07	0.11
95% UCL	0.2	0.13	0.13

Concentrations in mg/kg

Outliers removed for data analysis

* Weighted Concentration

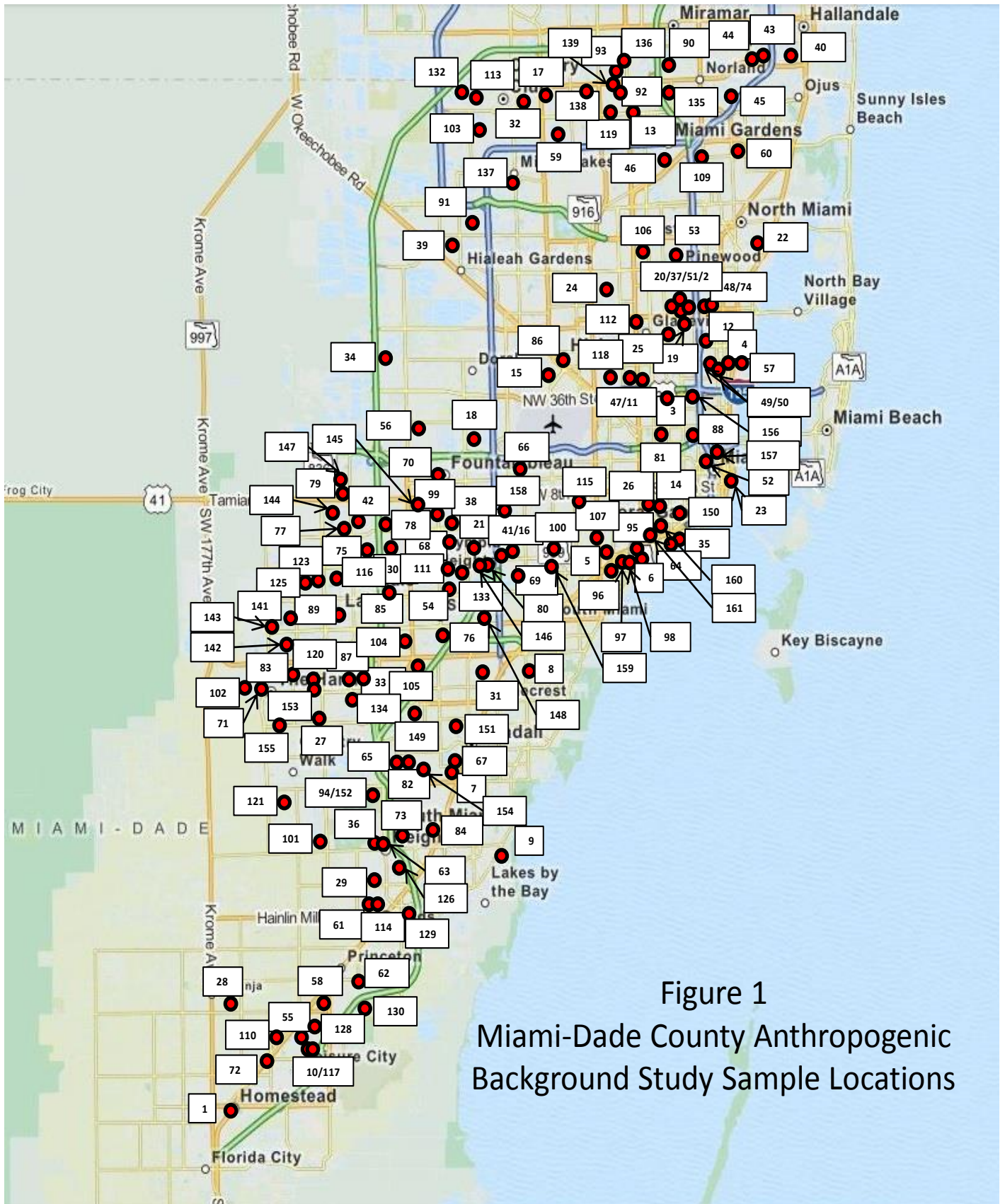
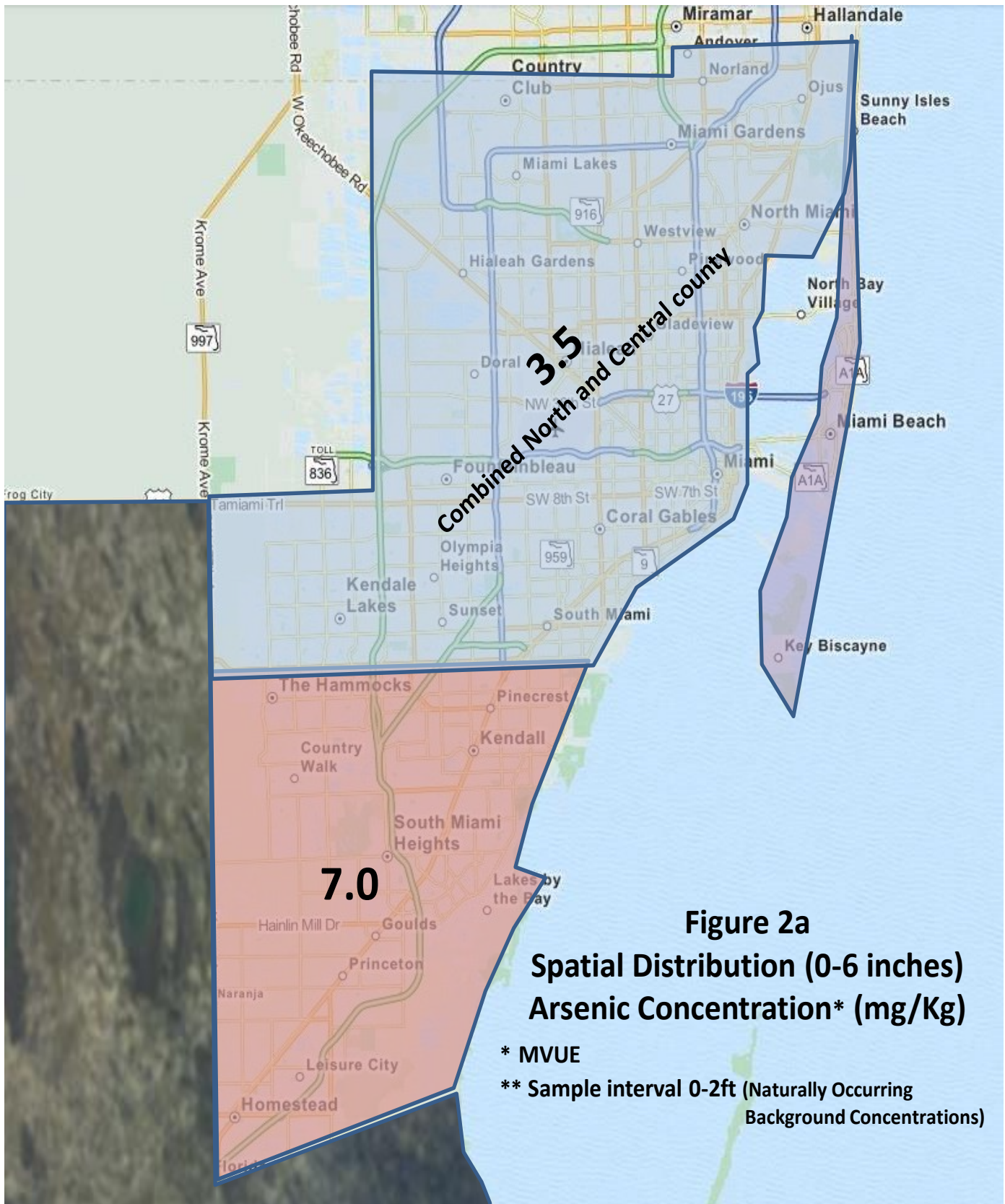
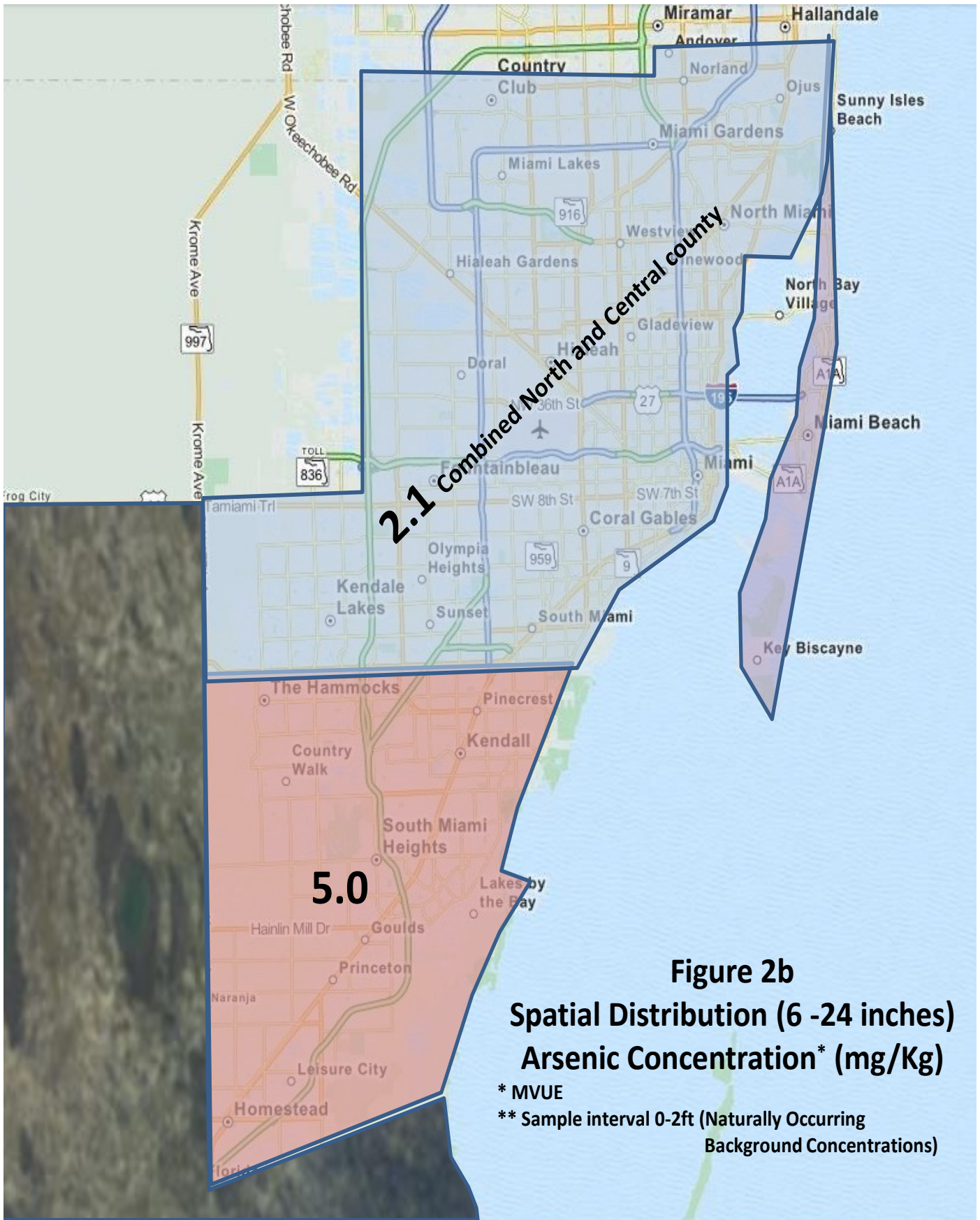


Figure 1
Miami-Dade County Anthropogenic
Background Study Sample Locations





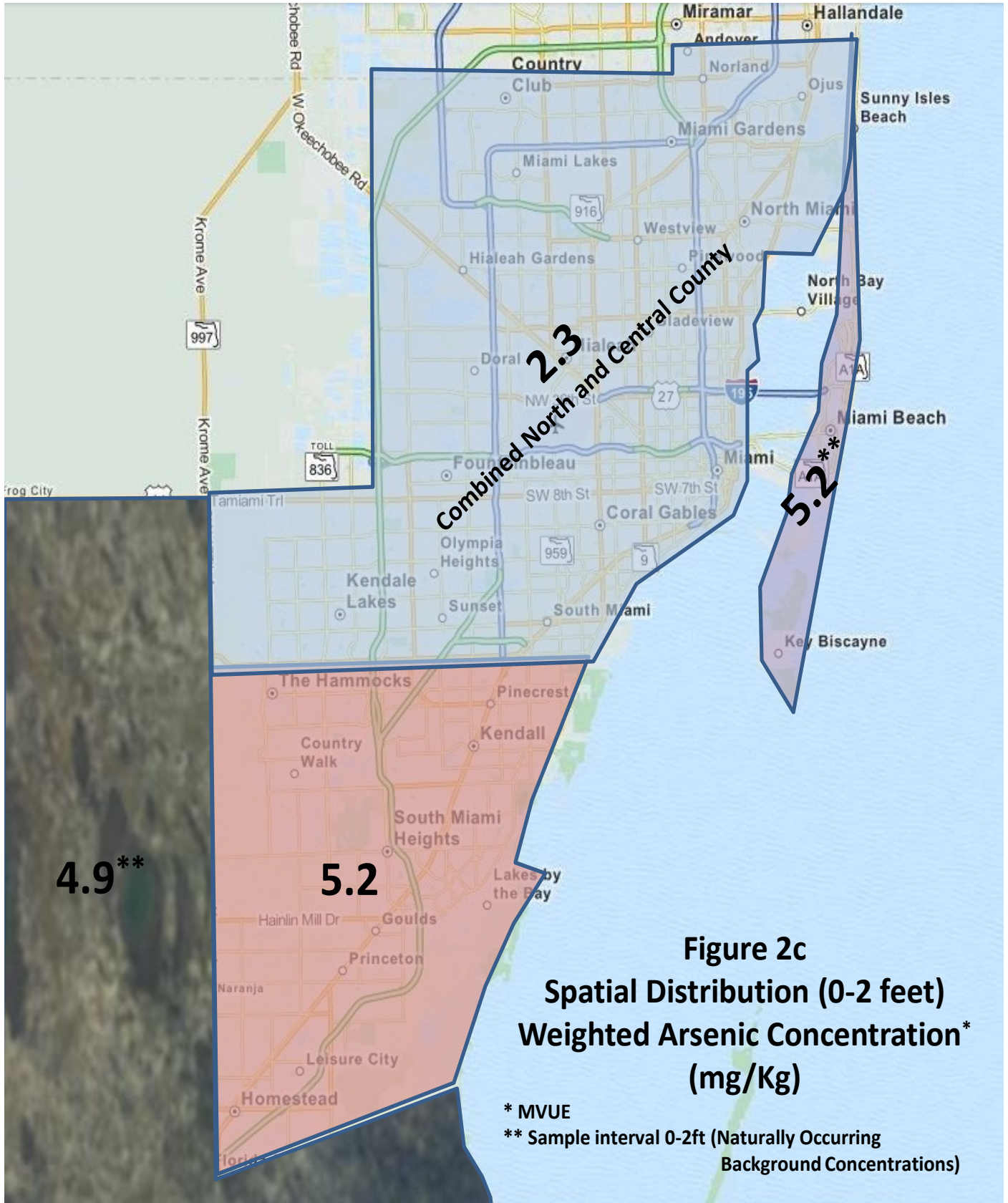


Table 5a: MIAMI-DADE COUNTY MUCK SOILS

	Arsenic (mg/kg)
	0 - 2ft
N	98
Minimum	0.7
Maximum	29
Mean	4.9
MVUE	4.9
95% UCL	5.5

Table 5b: BARRIER ISLANDS NATURALLY OCCURRING BACKGROUND CONCENTRATIONS (mg/kg)

Chemical Name	0-2 ft interval	
Arsenic	5.2	
Aluminum	798.7	
Cadmium	0.3	
Iron	2050.7	
Selenium**	<0.5	
Zinc	13.1	
Silver*	0.4	
	0-1 ft interval	1-2 ft interval
Barium	8.1	5.9
Chromium	7.9	5.7
Copper	5.4*	2.3*
Lead	15	5.2*
Mercury	0.054	0.026*
Nickel	1.08*	0.66*

* Represents censored data sets. The data from these populations were censored to fit a lognormal distribution

** The data for selenium were not analyzed statistically because all results were below the detection limit