

# *Assessing the Possible Impacts of Tacoma Smelter Plume Soil Lead Upon Ground Water*

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DEPARTMENT OF  
E C O L O G Y

# Ecology's Question to the SAB

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- ***Is it scientifically defensible to conclude that soil lead concentrations < 1,000 mg/kg are unlikely to significantly impact ground water?***
- SAB recommends that Ecology review ground water data from within the footprint of the Tacoma Smelter Plume (Nov-04 meeting).

# Today's Presentation

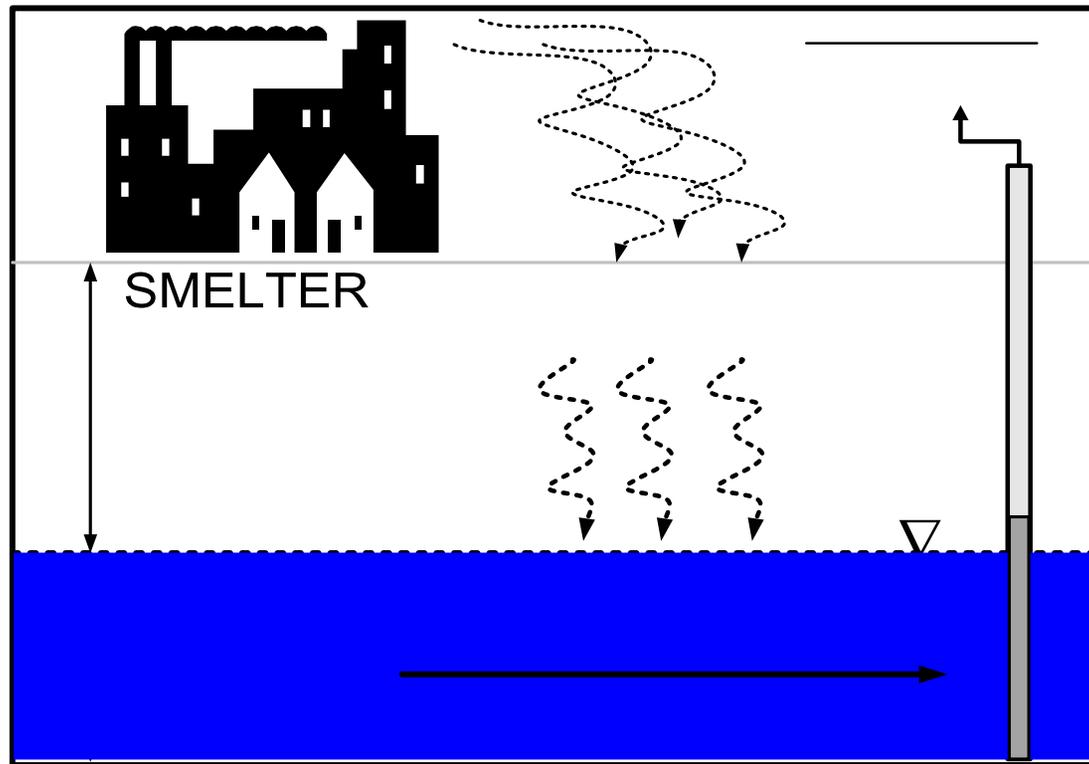
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- Soil lead data from the Tacoma Smelter Plume (TSP) “footprint”.
- Lead results for drinking water wells from within the TSP footprint.

# Conceptual Site Model

“Soil-Leaching-to-Ground Water” Exposure Pathway

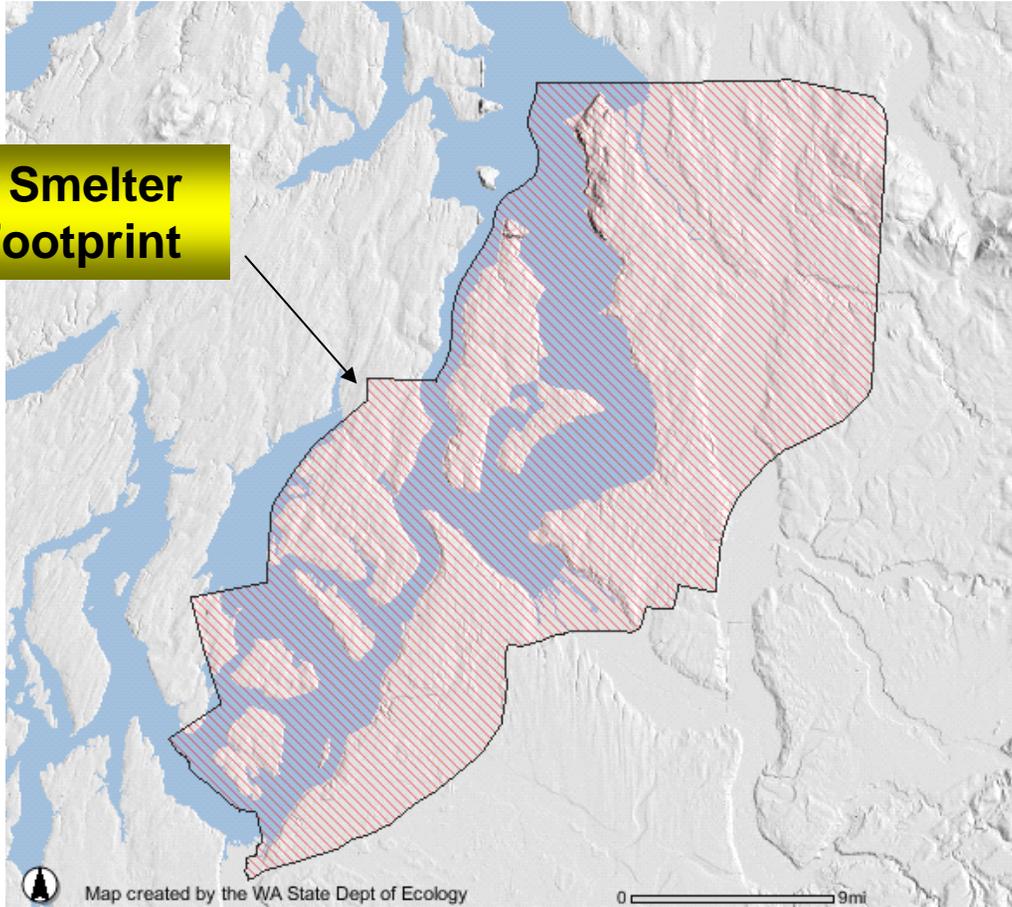
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# Tacoma Smelter Plume (TSP) Areawide Footprint Studies (1999 – Present)

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**Tacoma Smelter  
Plume Footprint**



# Tacoma Smelter Plume (TSP)

## Areawide Footprint Studies (1999 – Present)

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- Ten studies to date (1999 – Present).
- Soil samples collected in Thurston, Kitsap, Pierce and King Counties.
- Soil samples collected @ the following depths: 0-2,2-6,6-12,12-18 and 18-24 inches (~ 8,300 samples total).
- Analysis by GFAA, ICP-AES and ICP-MS for metals and trace elements (EPA 6020 and 7060).

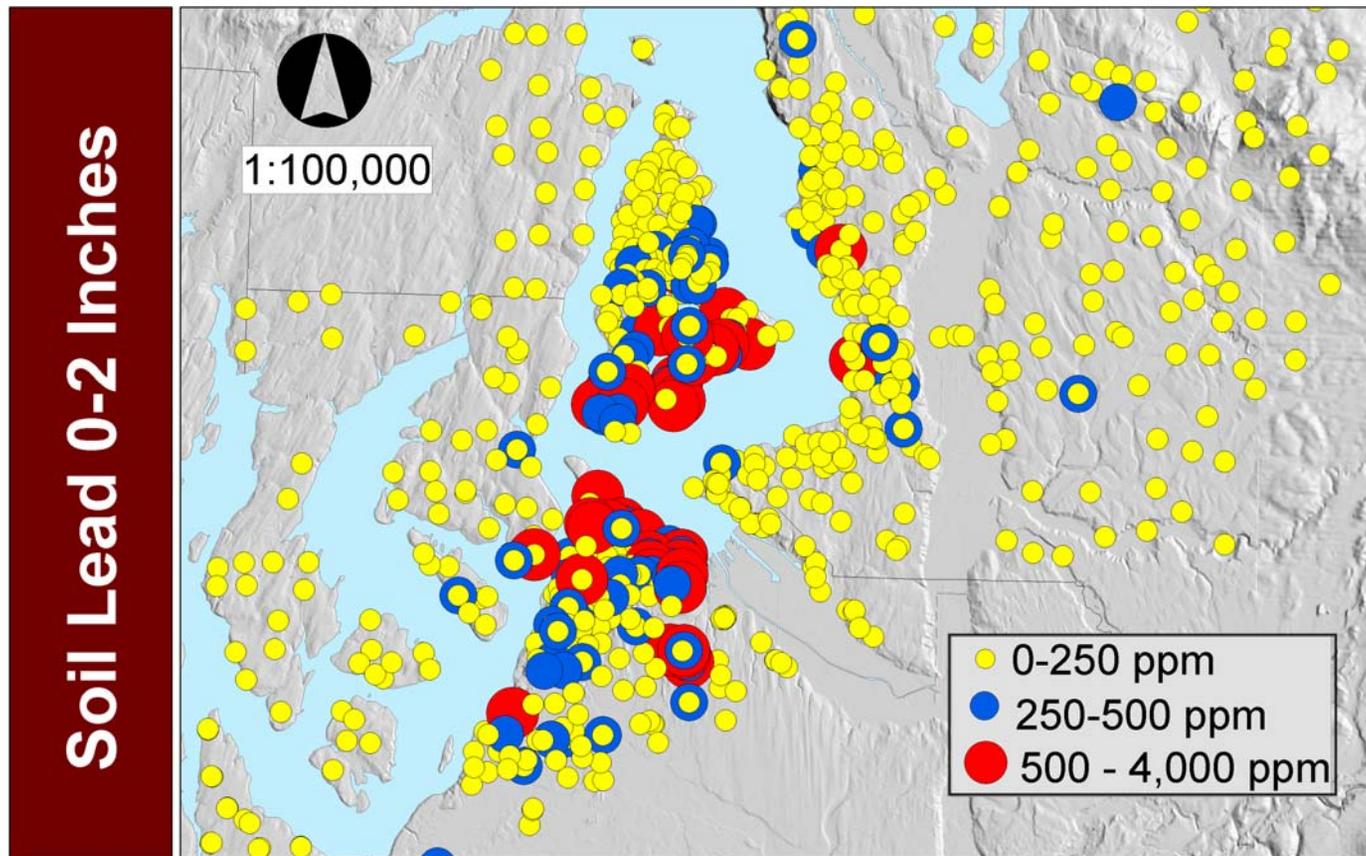
# Soil Lead Results by Depth (All Data)

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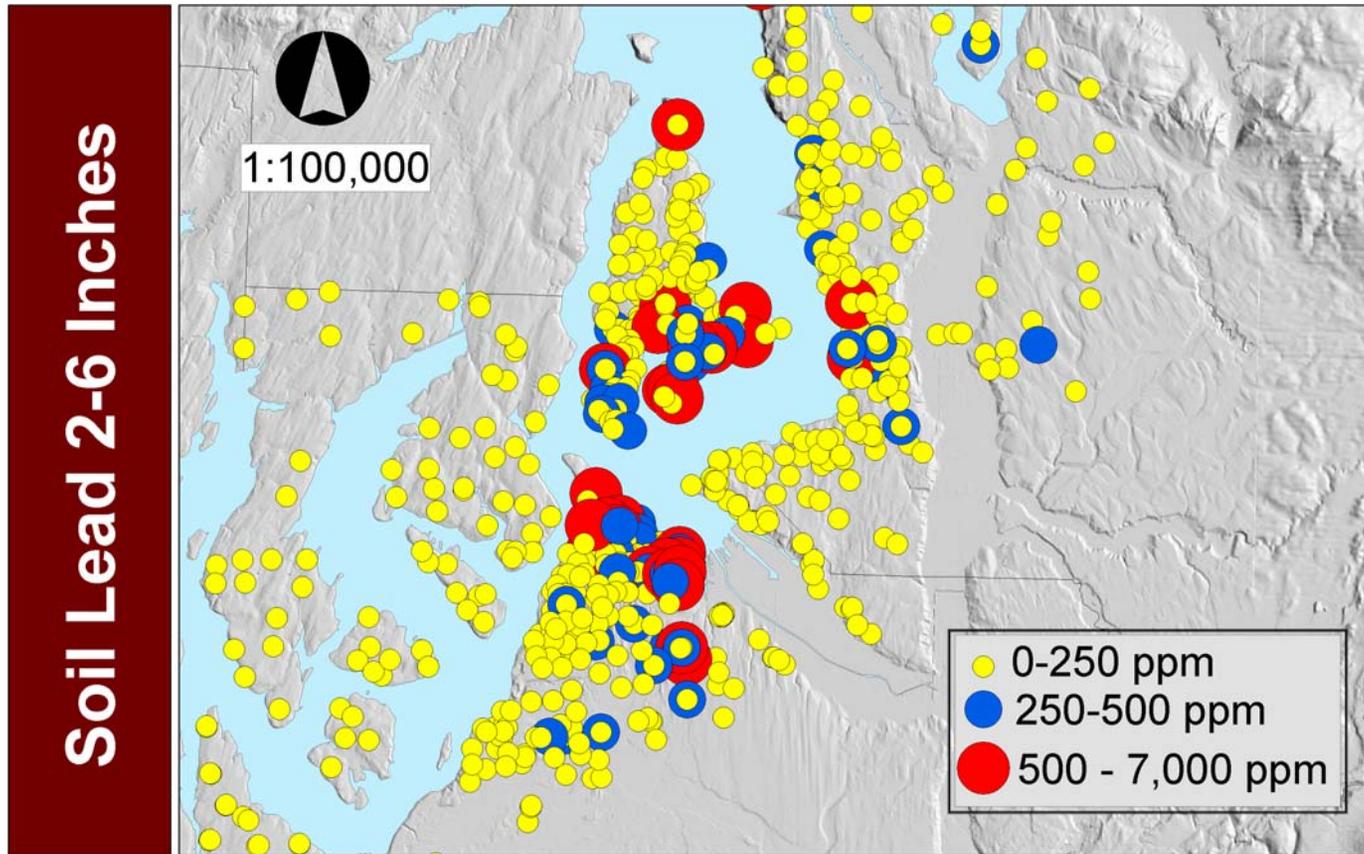
<b>Depth In.</b>	<b>n</b>	<b>Min (mg/kg)</b>	<b>1st Quartile (mg/kg)</b>	<b>Median (mg/kg)</b>	<b>3rd Quartile (mg/kg)</b>	<b>Maximum (mg/kg)</b>	<b>Stdev.</b>
<b>0-2</b>	3,964	0.89	16.0	32.3	75.6	4,000	142.37
<b>2-6</b>	3,636	1.30	12.0	24.8	55.0	6,700	154.90
<b>6-12</b>	514	1.80	10.0	20.0	42.0	790	80.43
<b>12-18</b>	153	5.40	9.2	14.0	27.0	150	20.50
<b>18-24</b>	89	5.70	8.1	14.0	27.5	290	35.67

- Statewide (WA) natural background for lead (90<sup>th</sup> percentile) = 17 ppm.
- Non-detect (ND) and “J”-Flagged (numerical estimate) values not included in data tabulation.

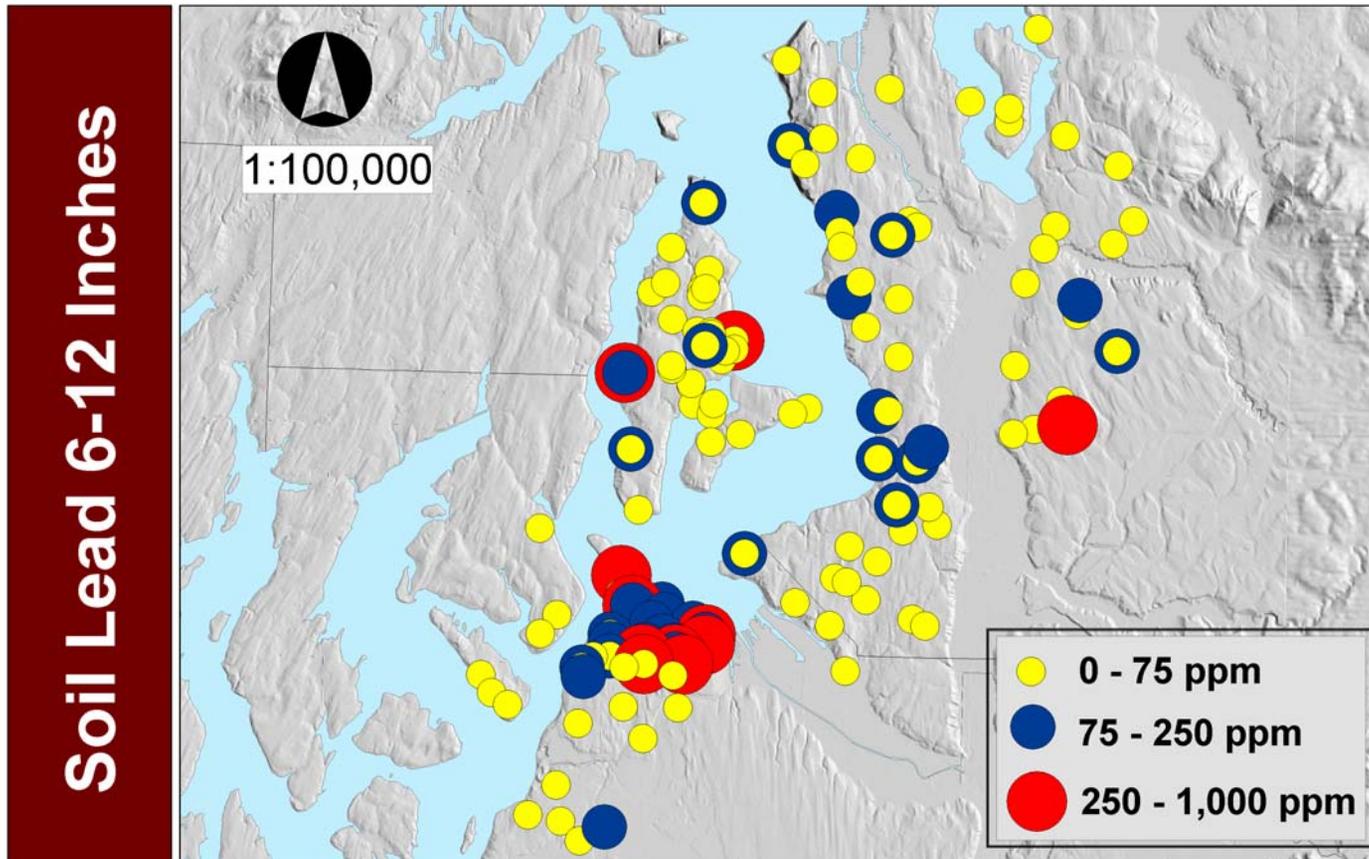
# Soil Lead (0-2 Inch Depth)



# Soil Lead (2-6 Inch Depth)

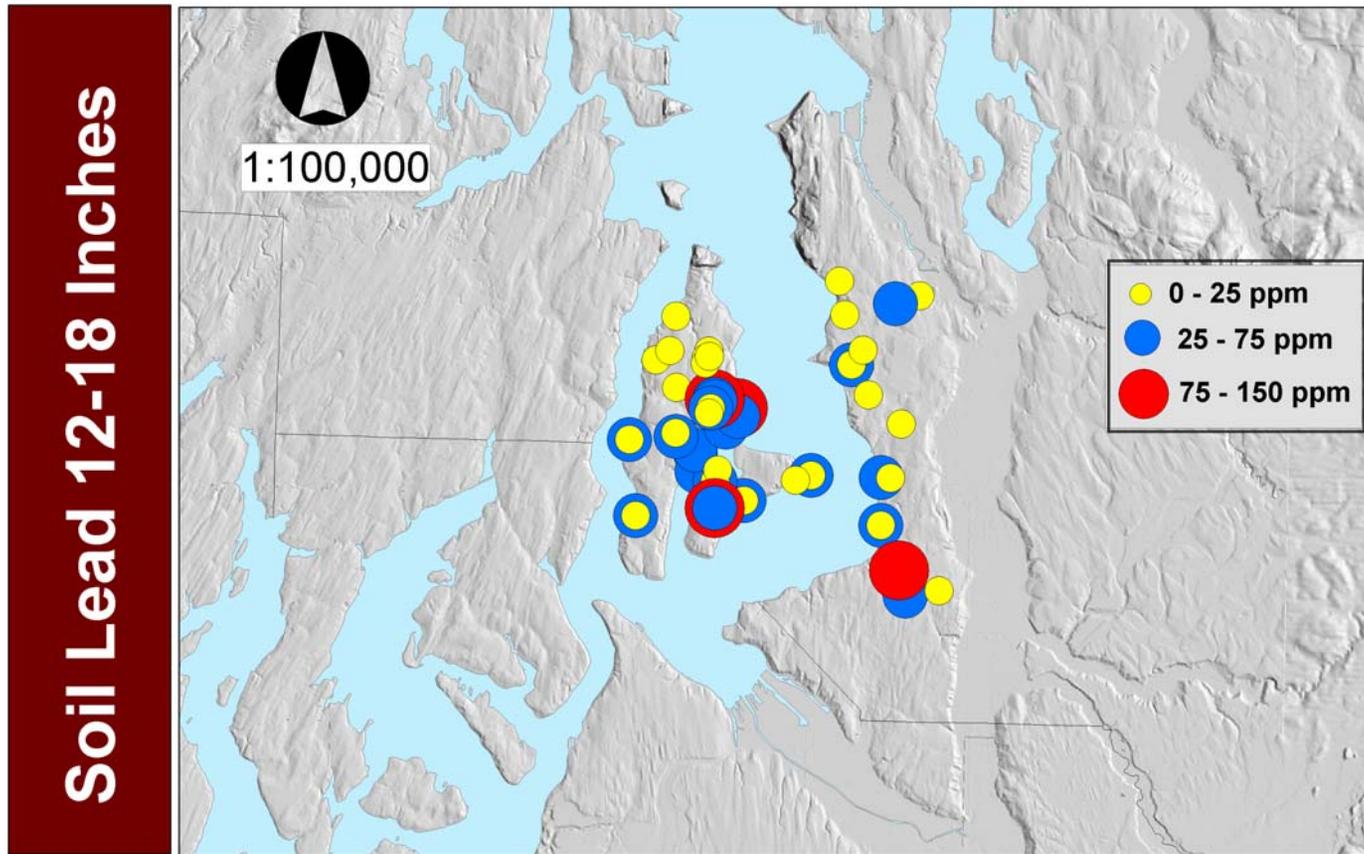


# Soil Lead (6-12 Inch Depth)



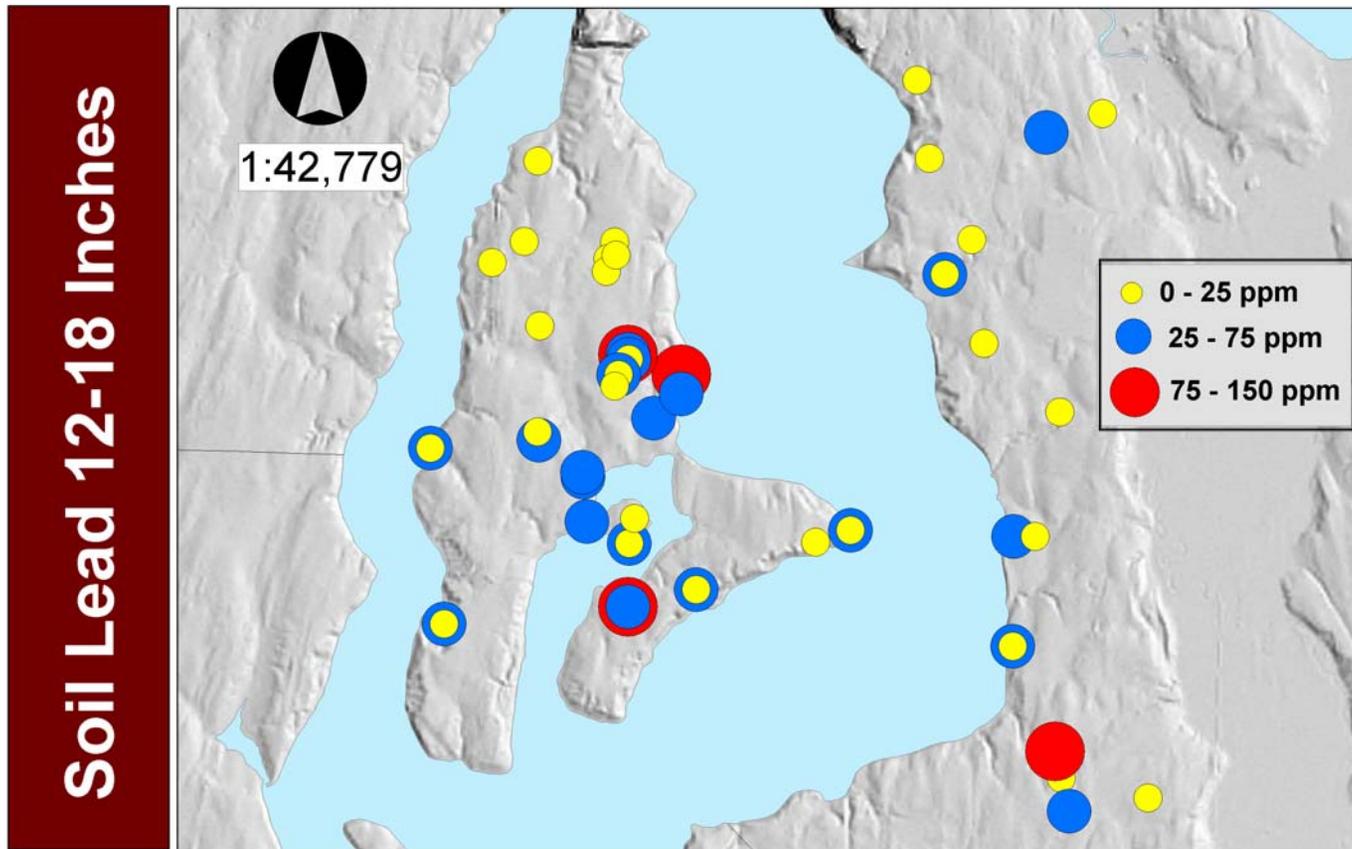
# Soil Lead (12-18 Inch Depth)

Scale = 1:100,000



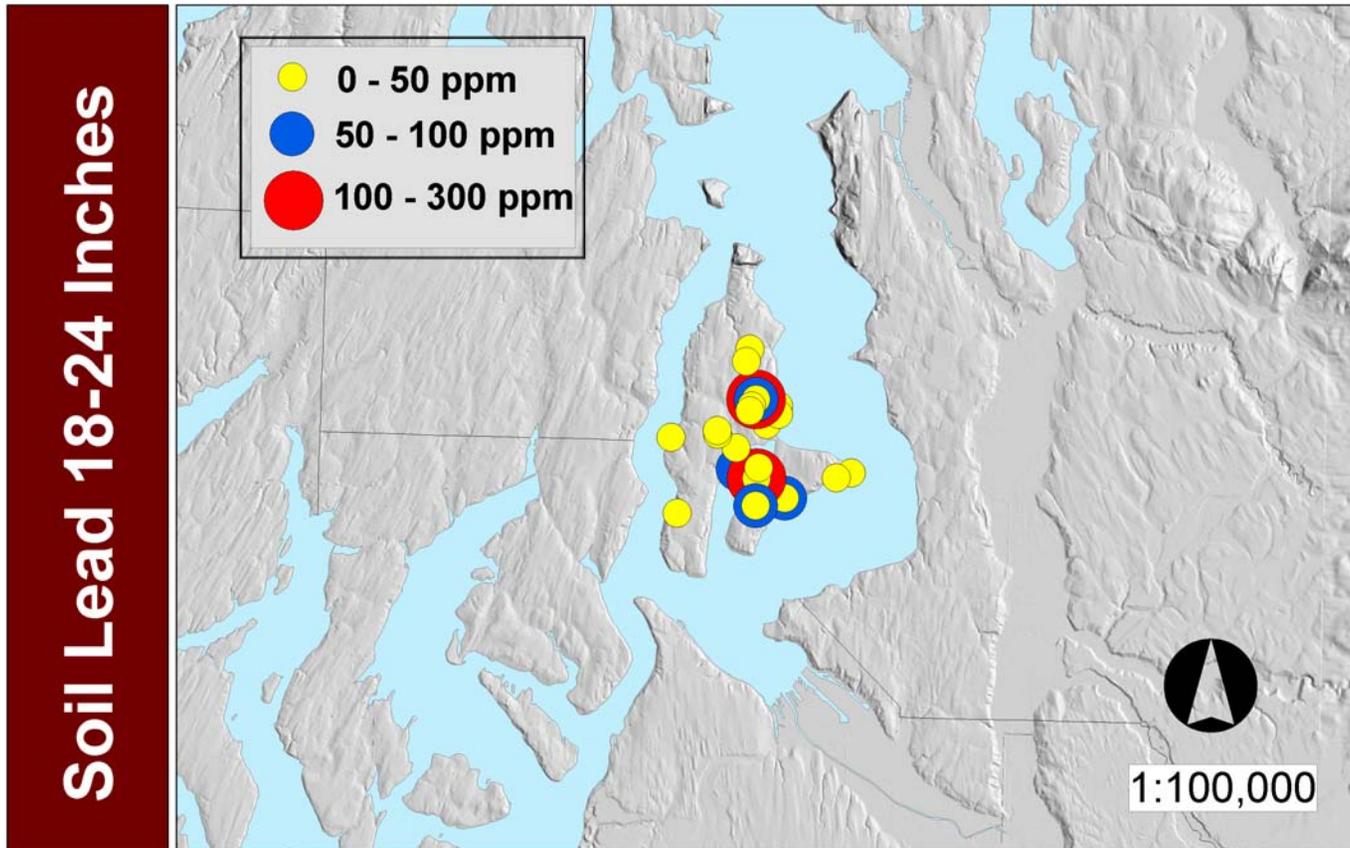
# Soil Lead (12-18 Inch Depth)

Scale = 1:42,000



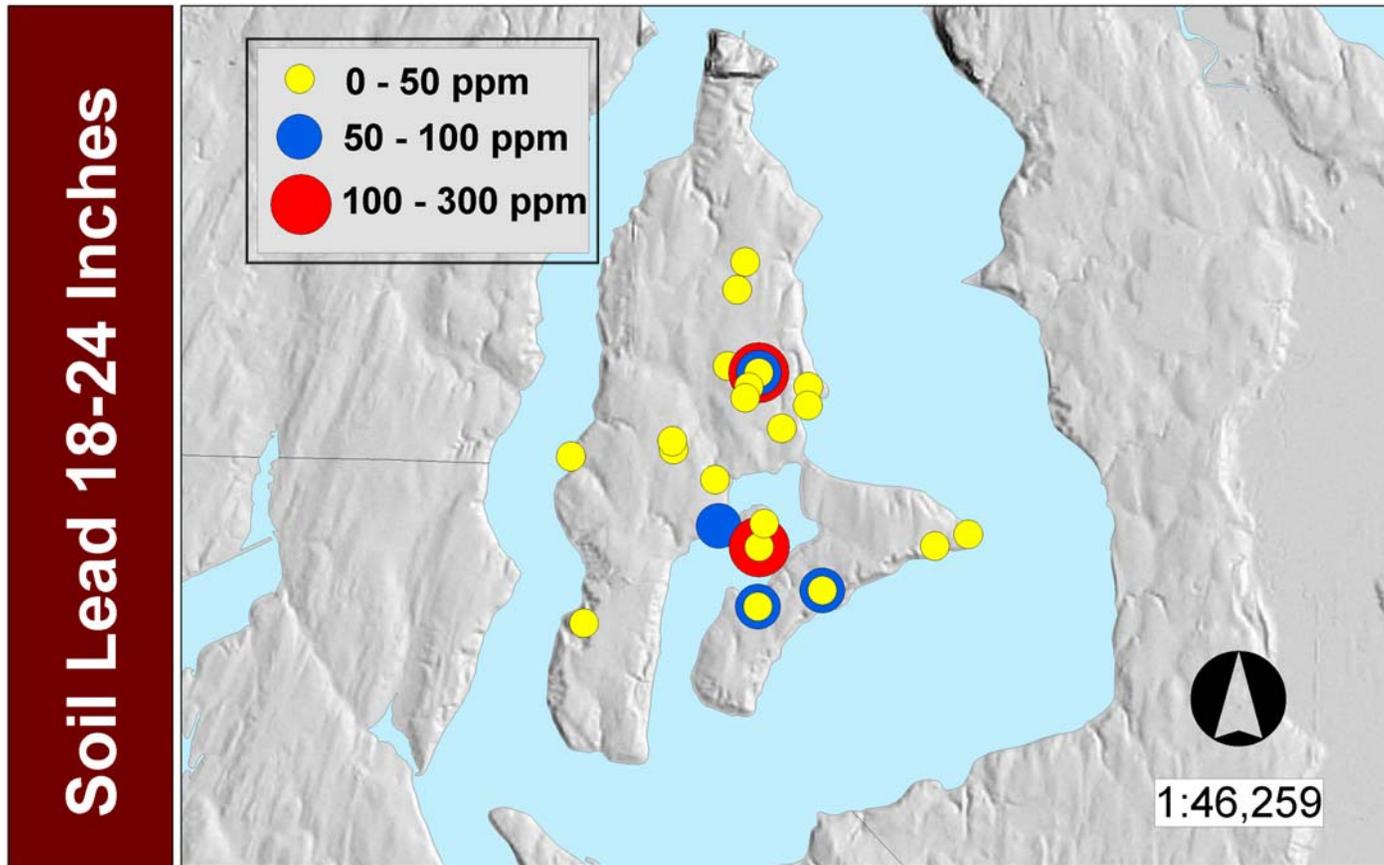
# Soil Lead (18-24 Inch Depth)

Scale = 1:100,000

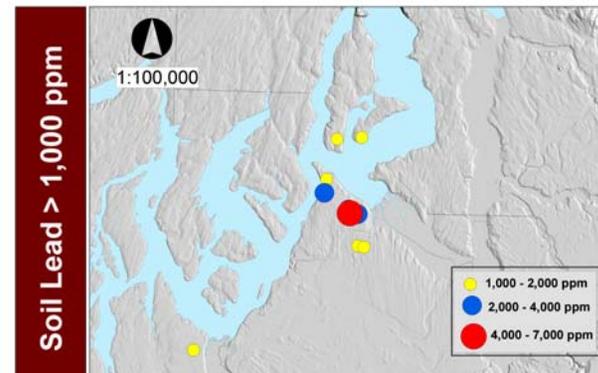
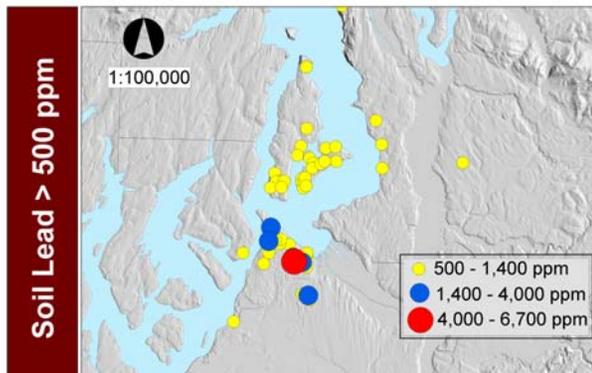
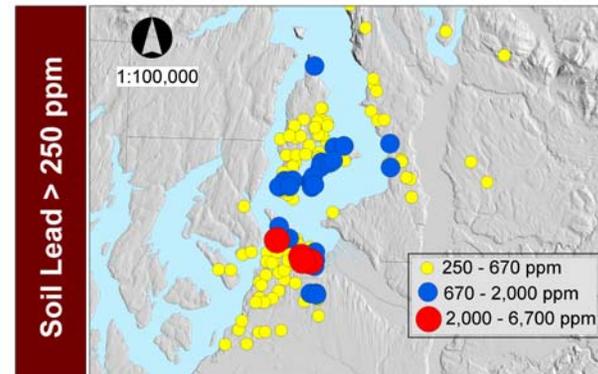
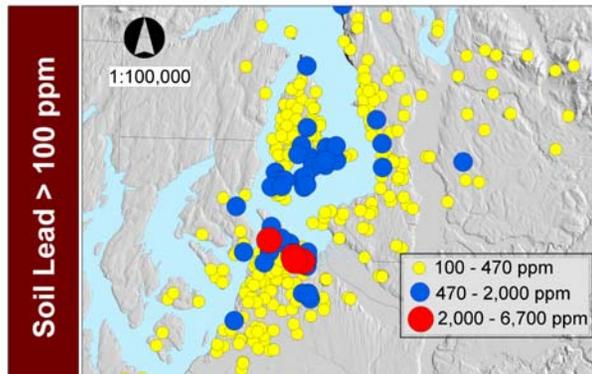


# Soil Lead (18-24 Inch Depth)

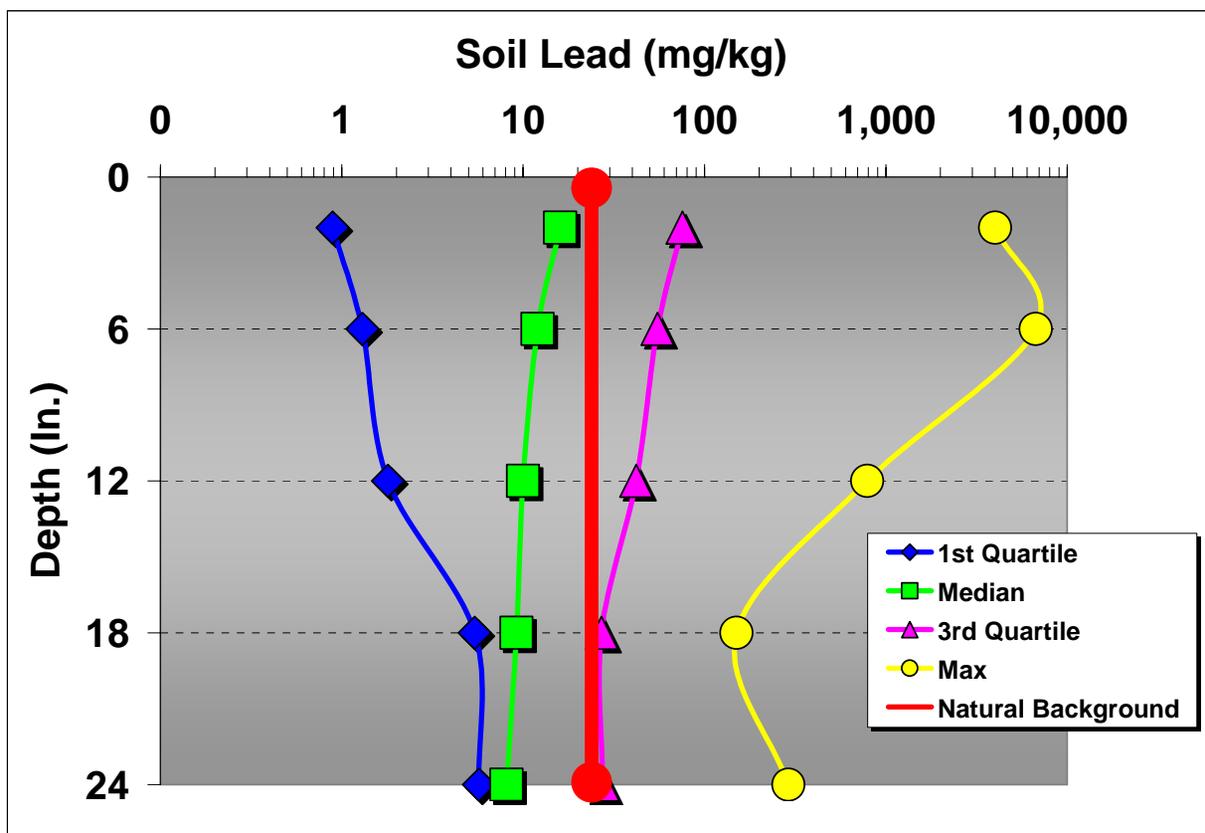
Scale = 1:46,000



# Soil Lead > 100, 250, 500, 1,000 ppm (All Depths)

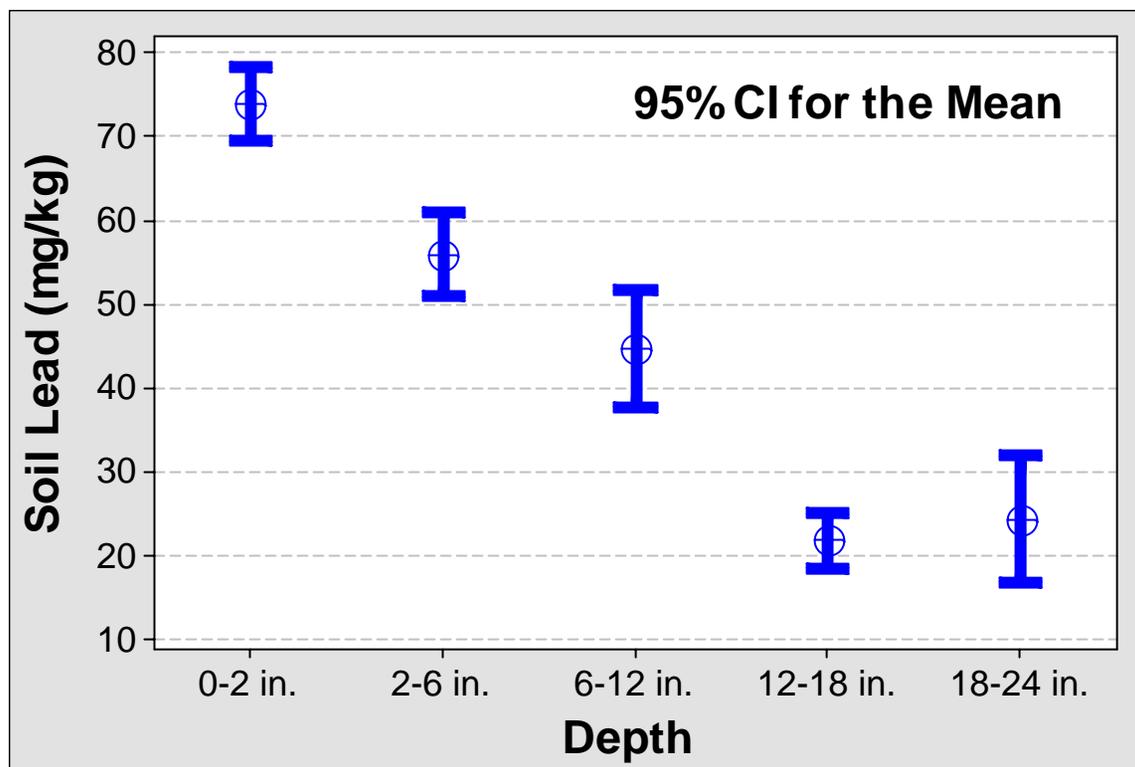


# Lead Concentration vs. Depth

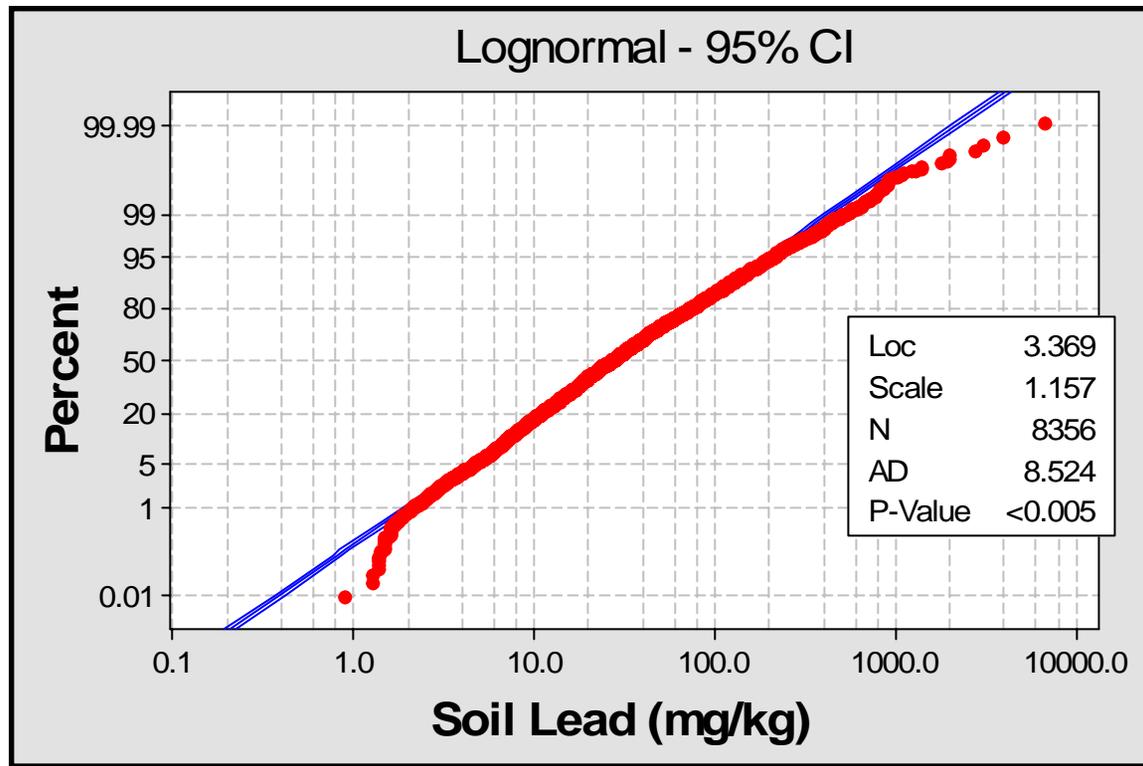


# Soil Lead Interval Plot

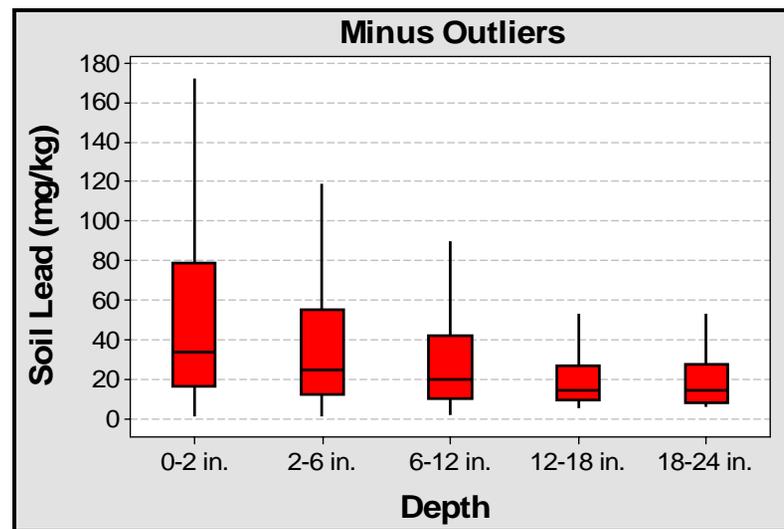
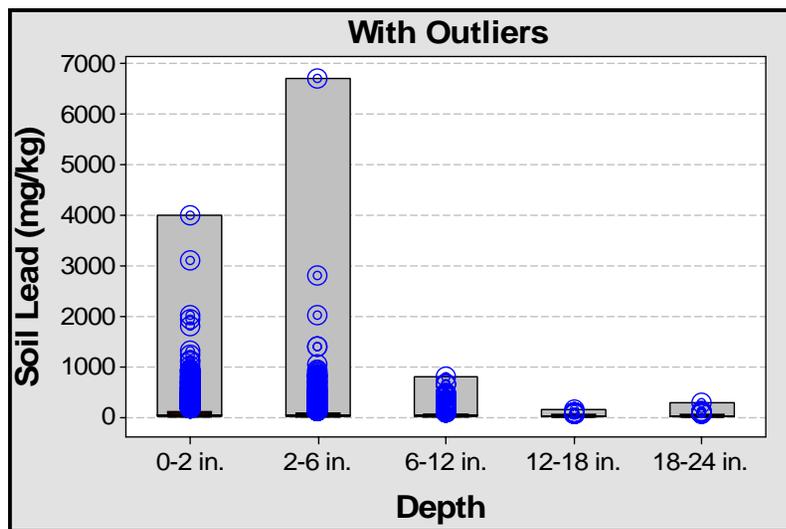
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# Soil Lead Probability Plot (All Data)



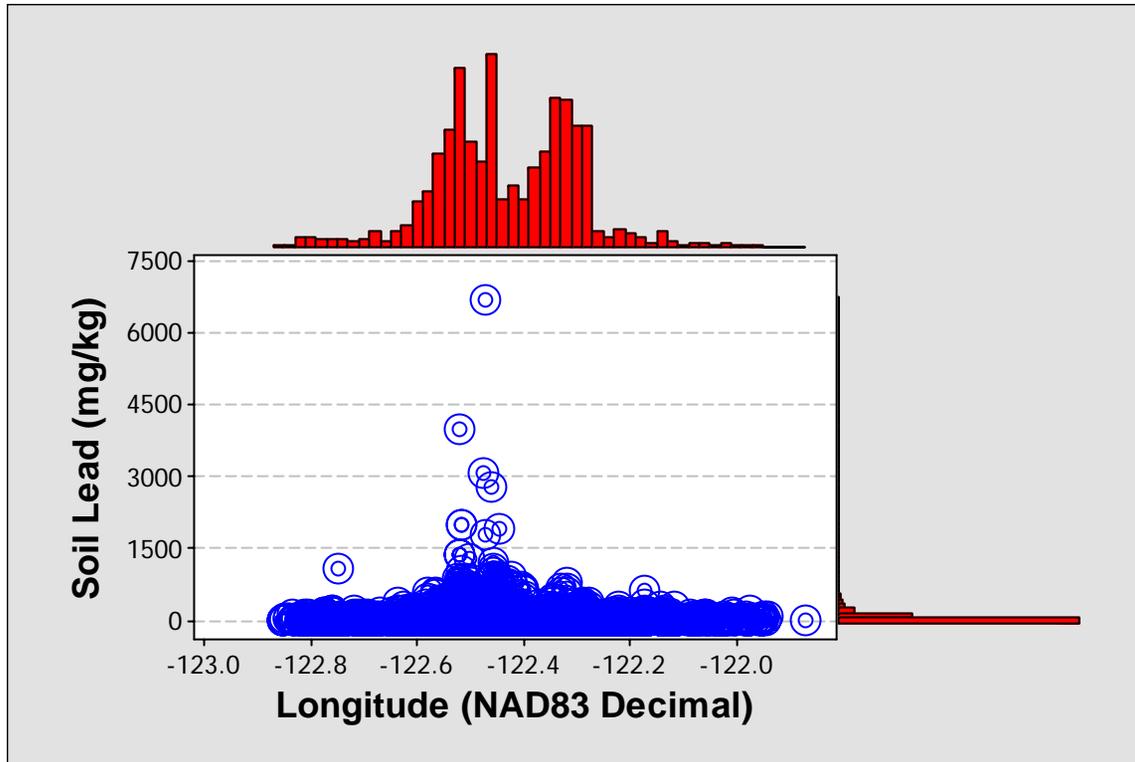
# Soil Lead Box Plots



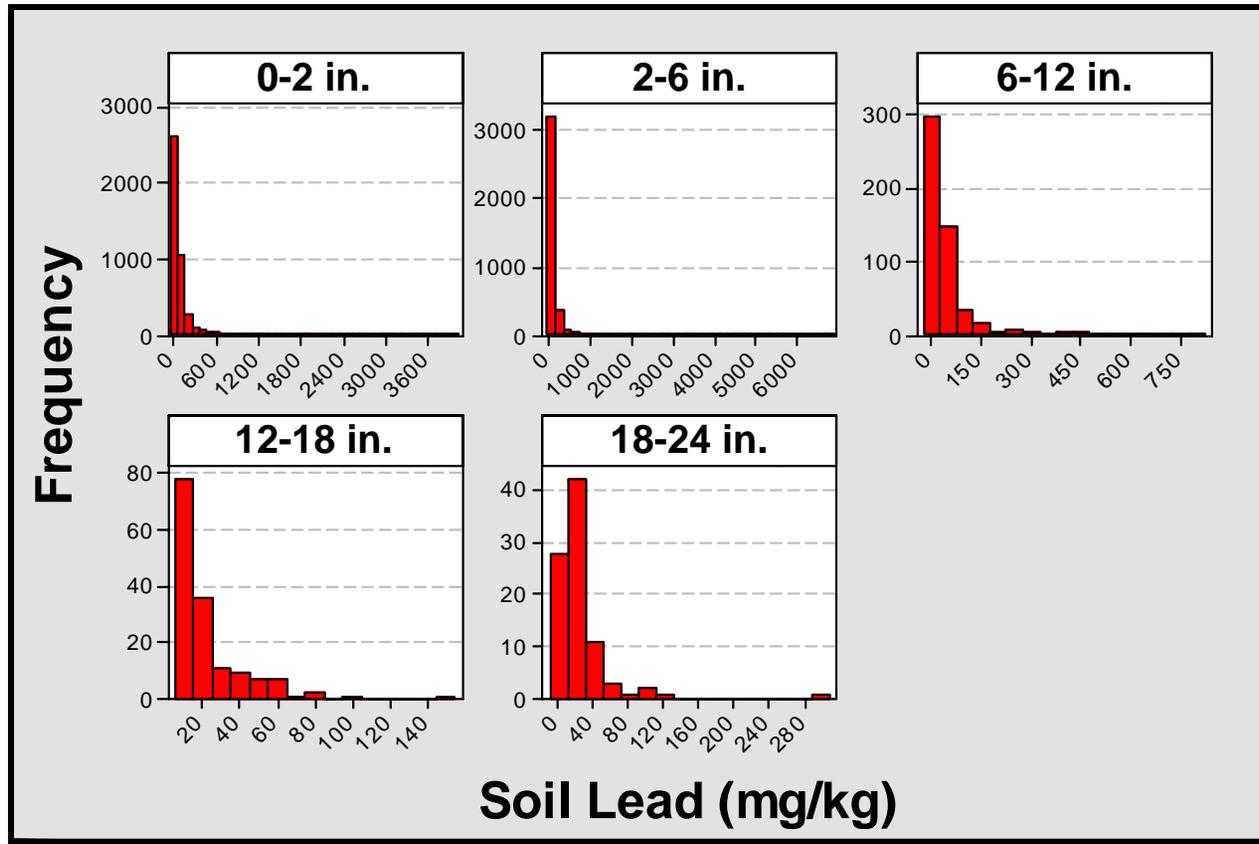
# Lead Concentration vs. Longitude

Asarco Tacoma Smelter = -122.49W, 47.29N

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# Soil Lead Histograms



# Tacoma Smelter Plume Data Results Summary

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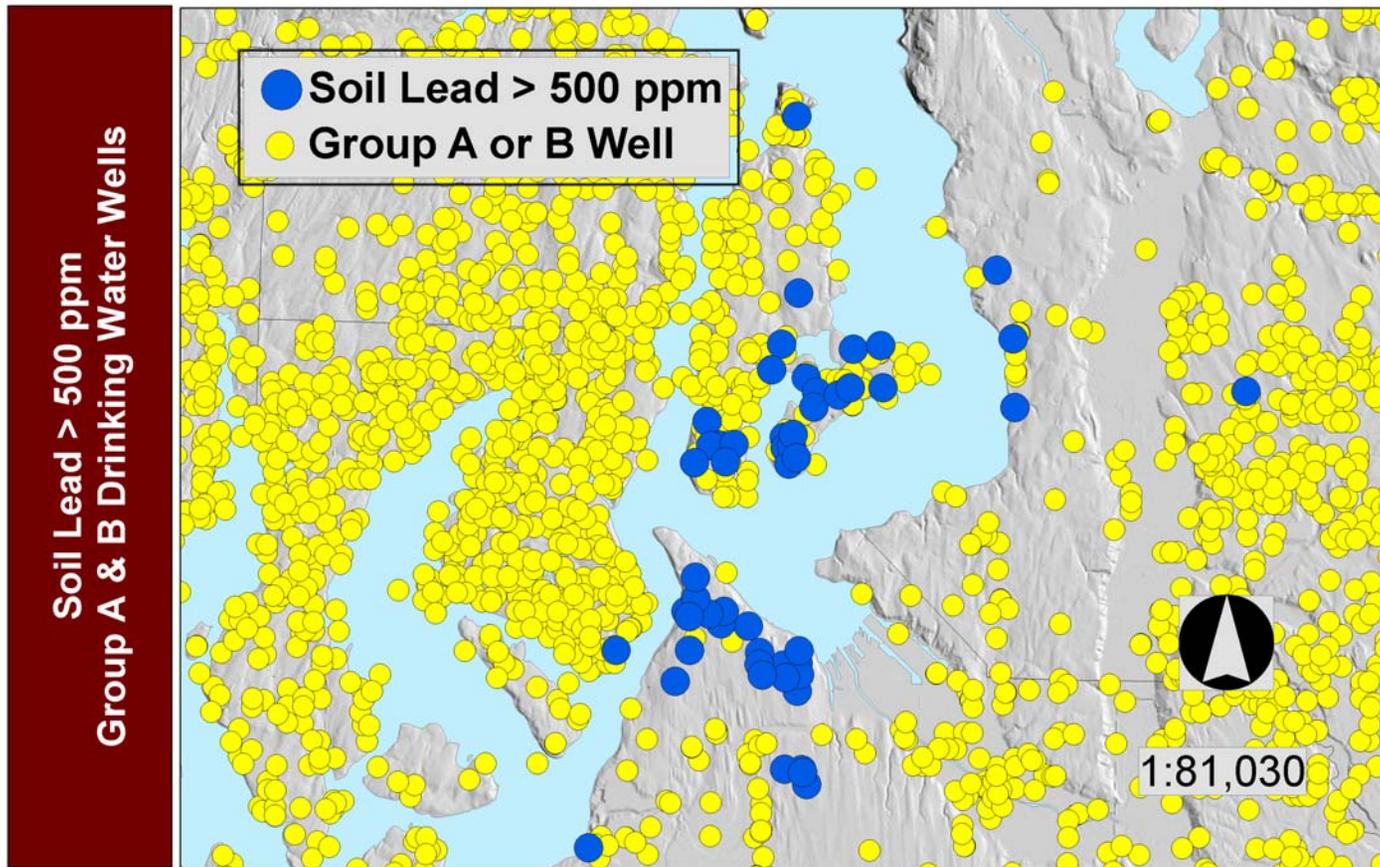
- 1.1% (n = 93) of all measured concentrations (n = 8,356) exceed the proposed action level of 500 ppm.
- If you compare 1<sup>st</sup> quartile, median, 3<sup>rd</sup> quartile and maximum concentrations, then the surficial soil (0-2 inches) concentrations are **2-14 X** higher than those at depth (18-24 inches).

# Has Lead Been Detected in Drinking Water?

No Record of Lead Detects in any Group A or B Well (1989-04, WDOH Drinking Water Data)

Group A Wells = You must analyze for inorganics once every 3-9 yrs

Group B Wells = You must analyze for inorganics ONLY upon system start-up.



# How Lead Gets Into Water

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- *“Lead in drinking water most often comes from water distribution lines or household plumbing rather than from the water system source. Lead from other sources can add to the effects of lead in water.”*

*Source: WA DOH Office of Drinking Water, Lead in Drinking Water Web Site.*

# Conclusions

## Tacoma Smelter Plume Soil Lead Data

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- Lead concentrations decreased with depth. Concentrations from 0-2 inches were ~ 2 X higher than concentrations @ 18-24 inches.
- Data limitations and uncertainty: 90% of all samples were obtained from 0-6 inch depth. Therefore, there is some uncertainty associated with the magnitude of changes in lead concentrations over depth.

# Discussion

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- Did this data help answer this question: is it scientifically defensible to conclude that soil lead concentrations  $< 1,000$  mg/kg are unlikely to significantly impact ground water?
- Are there other types of information that should be collected?
- Additional information (e.g. arsenic, etc.) on this subject will be presented at the next SAB meeting.