ENVIRONMENTAL CONSULTING GROUP

St.Germain · Collins

Dioxin Soil Cleanup Case Study: A Mix of Conventional Field and New Laboratory Techniques

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Introduction

Topics to Be Covered Today

- Utility Pole Contamination
- Soil Sampling Methods
- Dioxin Testing
- How to Fix a “Broken” Field Investigation
- Cost Considerations

Utility Pole Contamination

Utility poles treated to prevent decay

- Creosote
- Chromated Copper Arsenate (CCA)
- Pentachlorophenol (usually a diesel fuel solution) “Penta”
- Contaminants of concern PAHs, CCA metals,Penta
- (And Dioxin)

Pentachlorophenol

- Penta still used as utility pole preservative today.
- 36 million poles with Penta preservative in use in the US.

Dioxins

- Dioxin is an unavoidable byproduct of Penta manufacturing.
- EPA says 2,3,7,8-TCDD (most toxic dioxin) must be less than 1 ppb in Penta.
- Dioxin typically regulated using the Toxicity Equivalence Factor (TEF) approach.
- Summing the TEF-adjusted concentrations of detected dioxins gives Toxicity Equivalent (TEQ) value.

Dioxins

- Dioxin cleanup standards vary widely.
- Most based on future land use scenarios.
- Standards below are not completely comparable (land uses vary).

DIOXIN TEQ CLEANUP STANDARDS (NG/KG)

	ME	NH	VT	MA
“Residential”	10	1,000	4.5	20
“Industrial”	31	5,000	18	300

ng/kg (ppt) levels make cross-contamination a serious field concern

Site Description

- Utility pole storage site in northern New England since 1984.
- Two areas of storage:
  - Pole Yard
  - Stub Yard (broken poles)
- Both on bare soil.
- Thin fill soil on top of irregular bedrock surface.

Site Layout

Previous Work (by others)

- Sampling initially focused on Penta, PAHs, CCA—Penta became primary COC.
- 200 tons of Penta-contaminated soil removed (***stored on-site***) with clean confirmatory samples.
- So far, so good—Penta distribution made sense, easy to remove. But…
- Dioxin testing at request of State (oh-oh!).

Previous Work (by others)

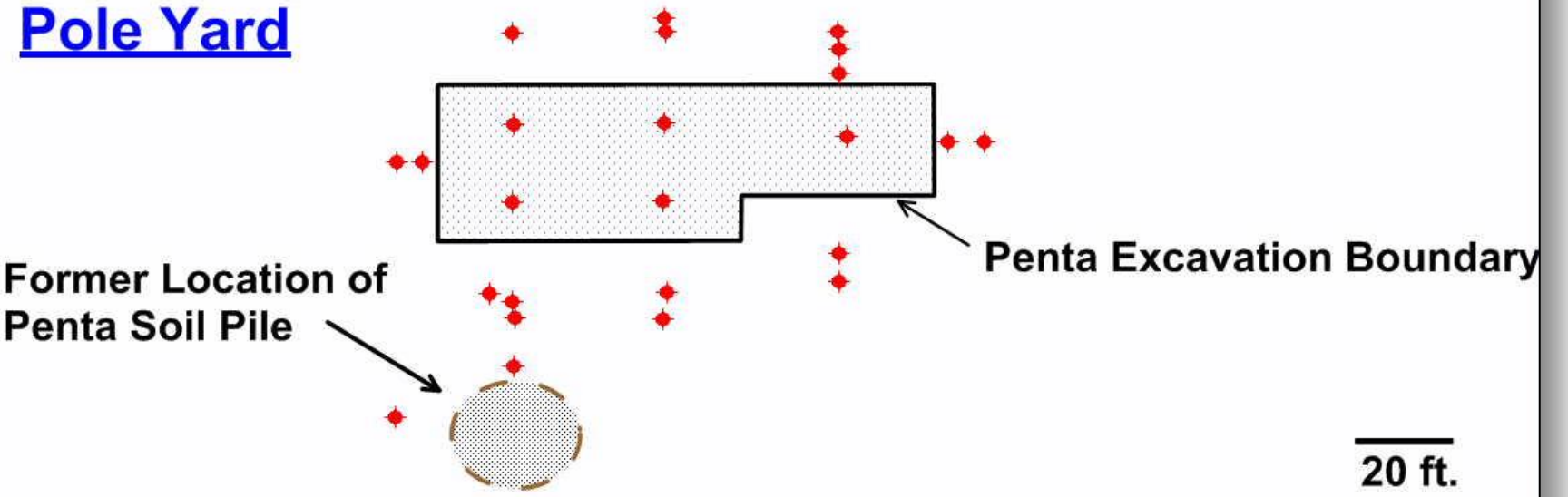
- 34 borings and 66 samples for dioxin later...

(Lab costs alone in the $35,000-$60,000 range using EPA Method 8290)

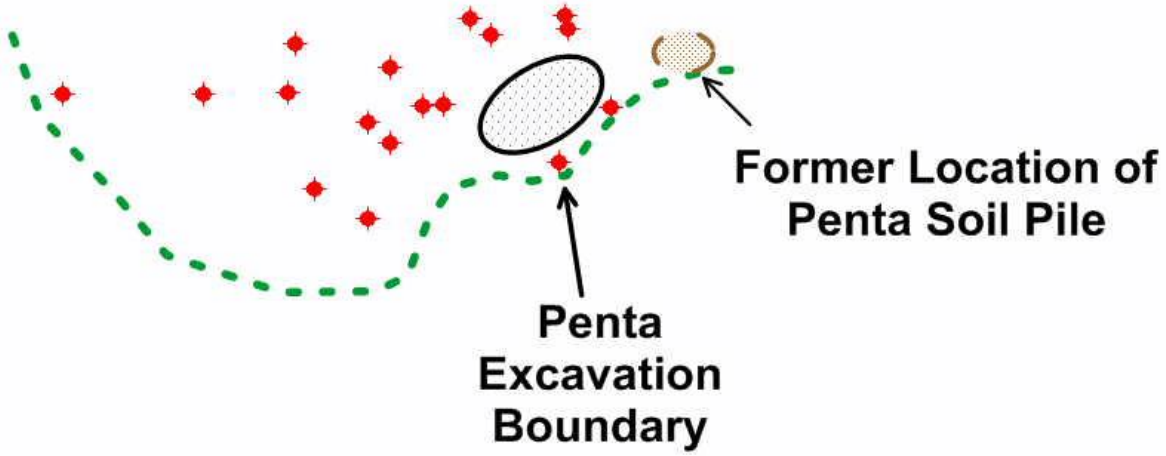
- Widespread exceedences of Residential standard (4.5 ng/kg).
- Extent of dioxin contamination still unclear because of:
  - No control for sample locations, often irregular.
  - Sample depth intervals inconsistent.
  - Cross contamination in the field.

DIOXIN SAMPLE LOCATIONS (BY OTHERS)

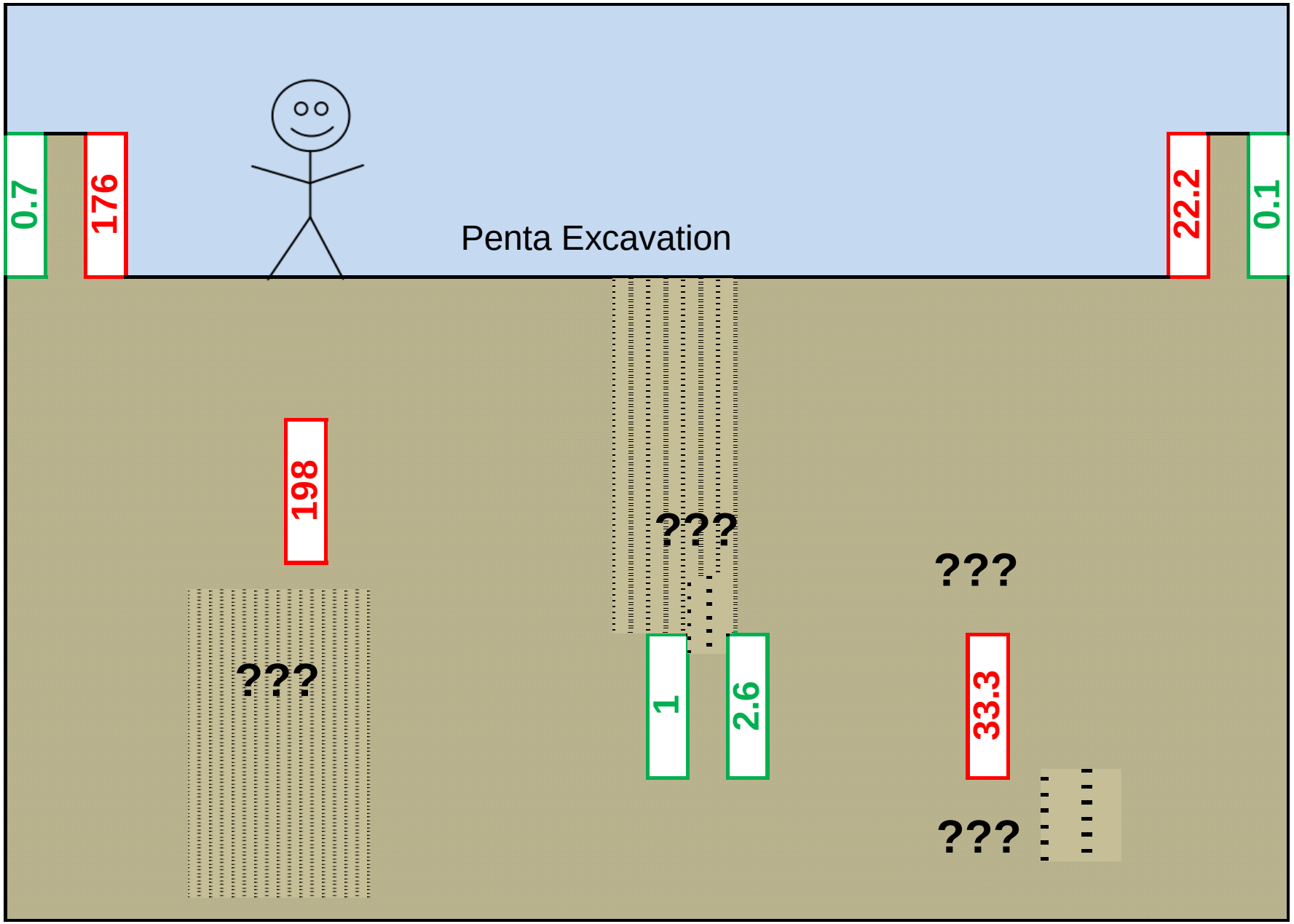
Pole Yard



Stub Yard



Schematic Cross Section



Previous Work (by others)

Soil Pile from Penta Excavation

Previous Work (by others)

Do the math--

Overbudget
Project Delays
+ Dioxin Extent Unclear
Unhappy Client $\Rightarrow$ New Consultant

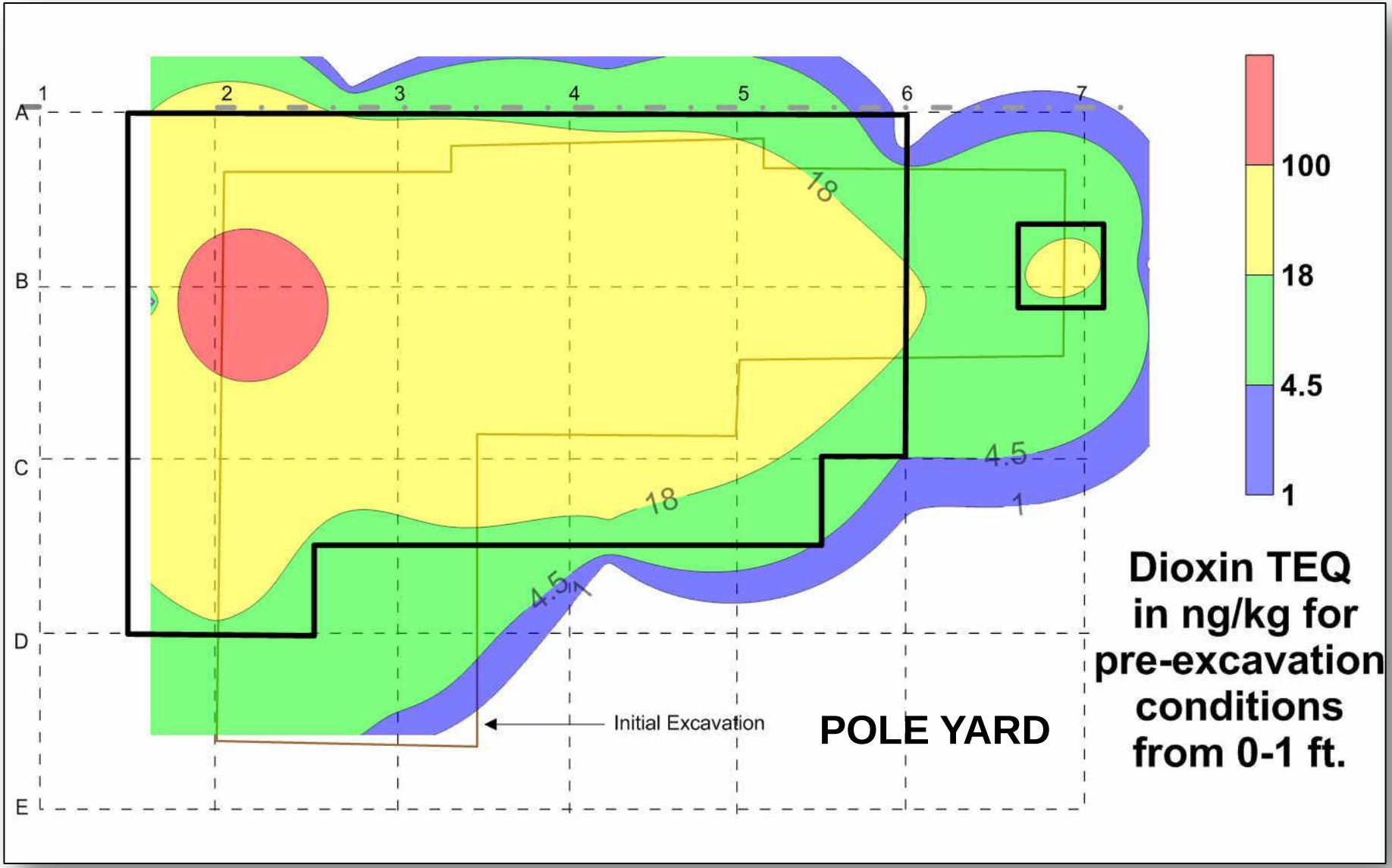
Our Sampling

- Past iterative approach for characterization too costly, time-consuming.
- 20’ grid tied into structures. Limited borings filled in gaps for characterization.
- Specific depth intervals, separate boreholes to minimize cross-contamination.
- 35 samples analyzed using EPA 4025M, 5 dups using EPA 8290.
- More on cost savings later.

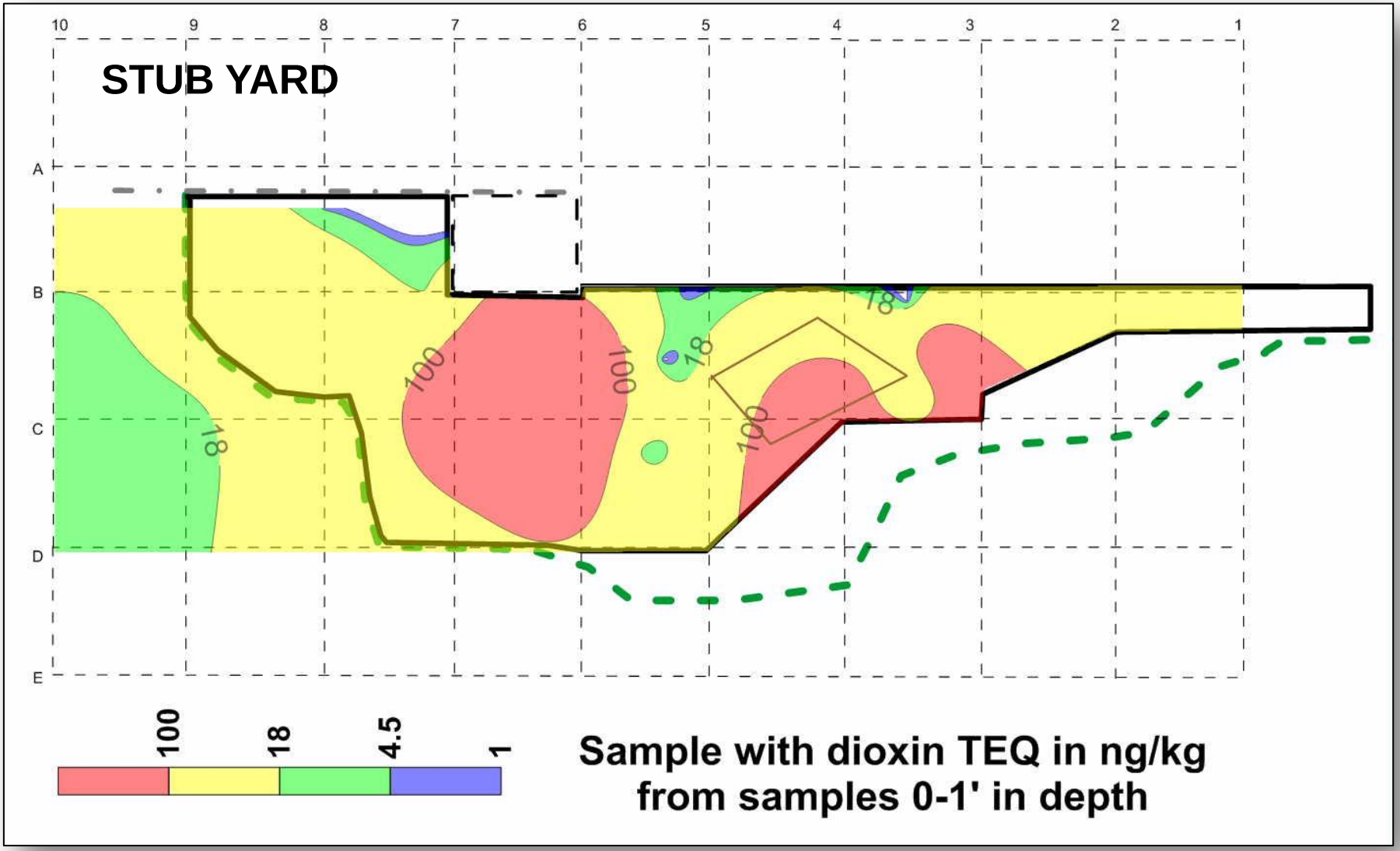
Data Analysis

- Contoured surface dioxin levels using Surfer for a visual understanding of its distribution.
- Used grids to select excavation boundaries, depths, and estimate volumes.
- **Did not worry about exact location of cleanup threshold boundary since confirmatory sampling would be completed.**

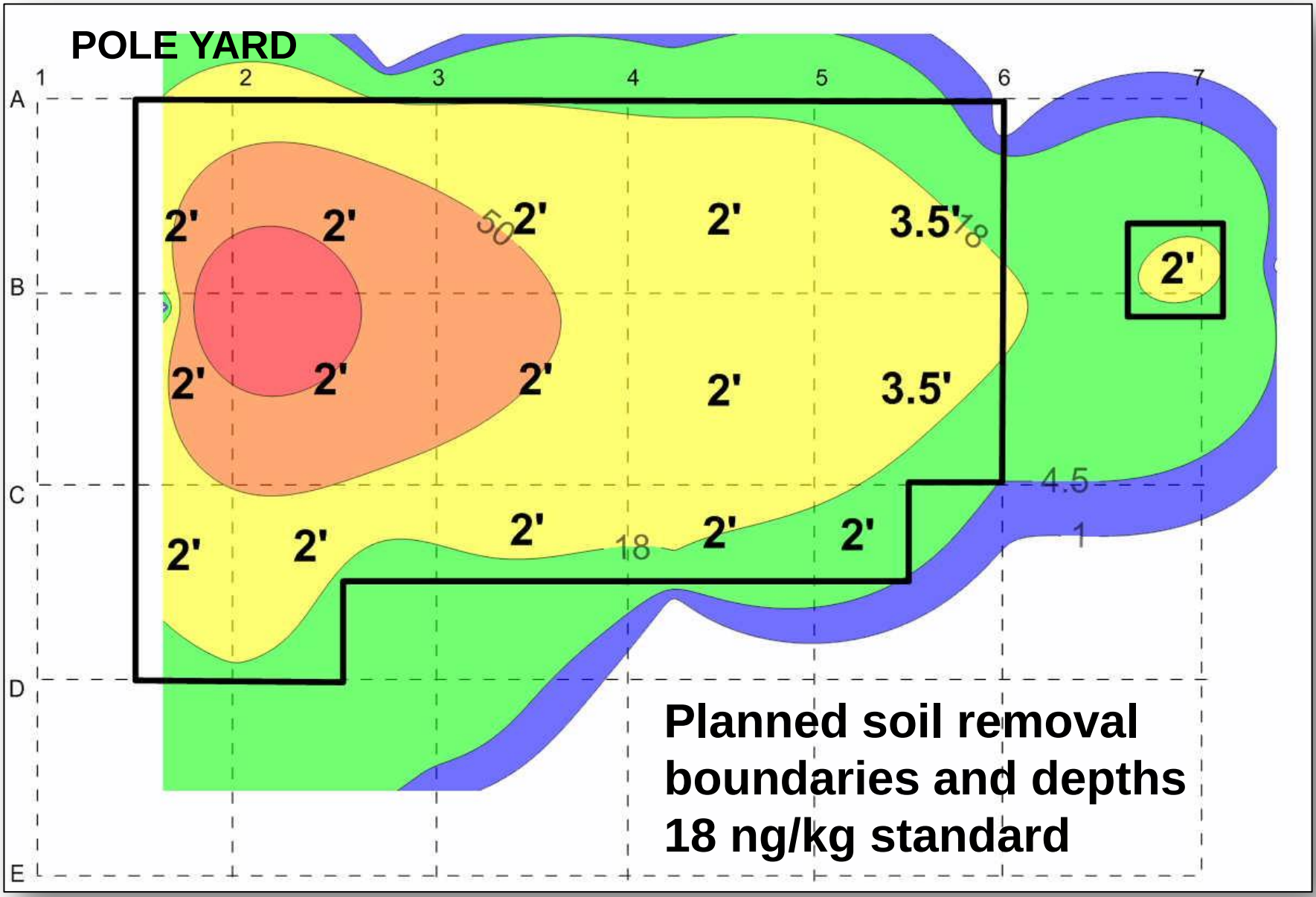
Results


1
2
3
4
5
6
7
A
B
C
D
E
18
4.5
18
4.5
1
100
18
4.5
1
Initial Excavation
POLE YARD
Dioxin TEQ in ng/kg for pre-excavation conditions from 0-1 ft.

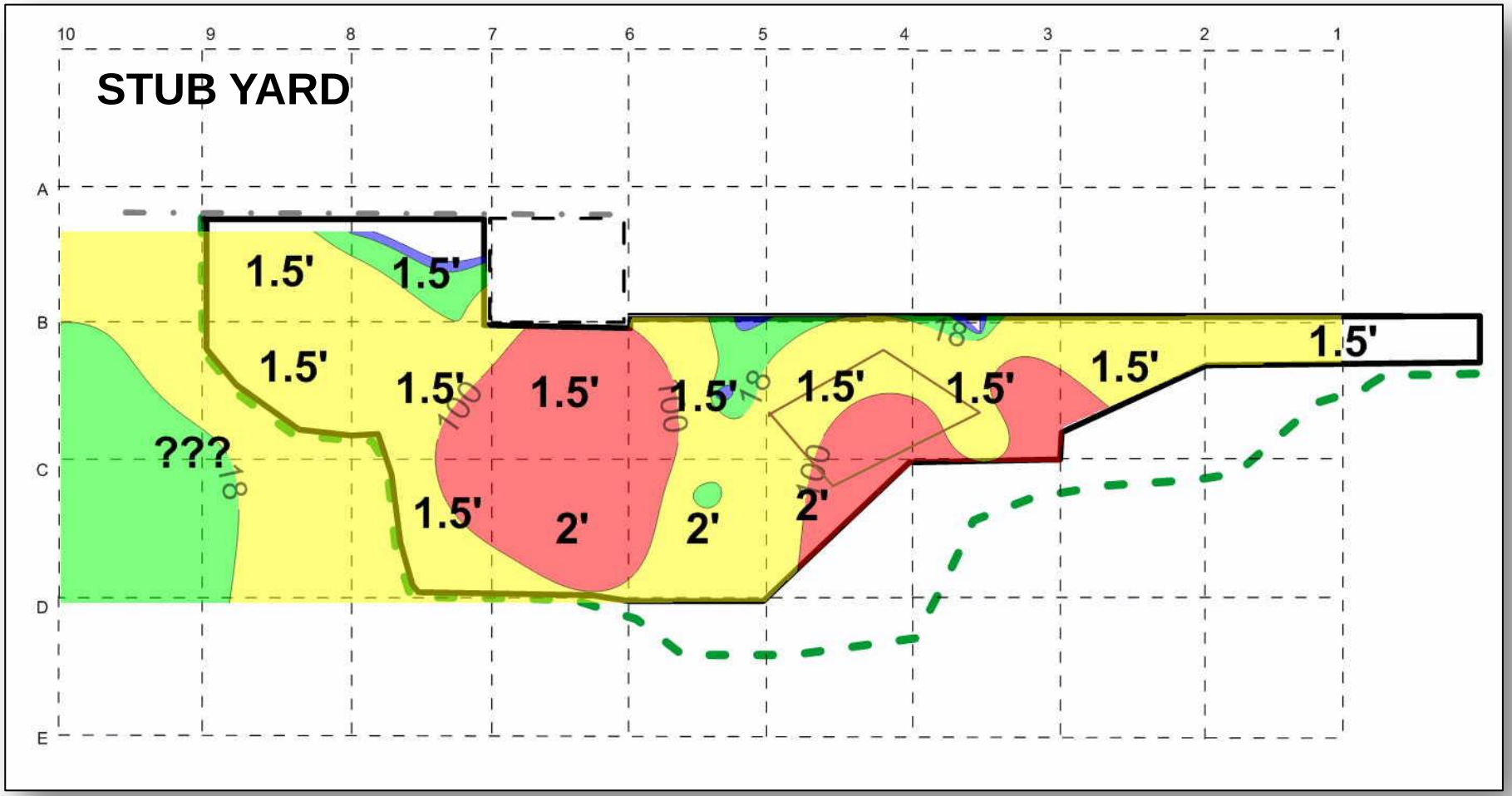
Results


STUB YARD
10
9
8
7
6
5
4
3
2
1
A
B
C
D
E
100
18
4.5
1
Sample with dioxin TEQ in ng/kg
from samples 0-1' in depth

Remediation Depths



Remediation

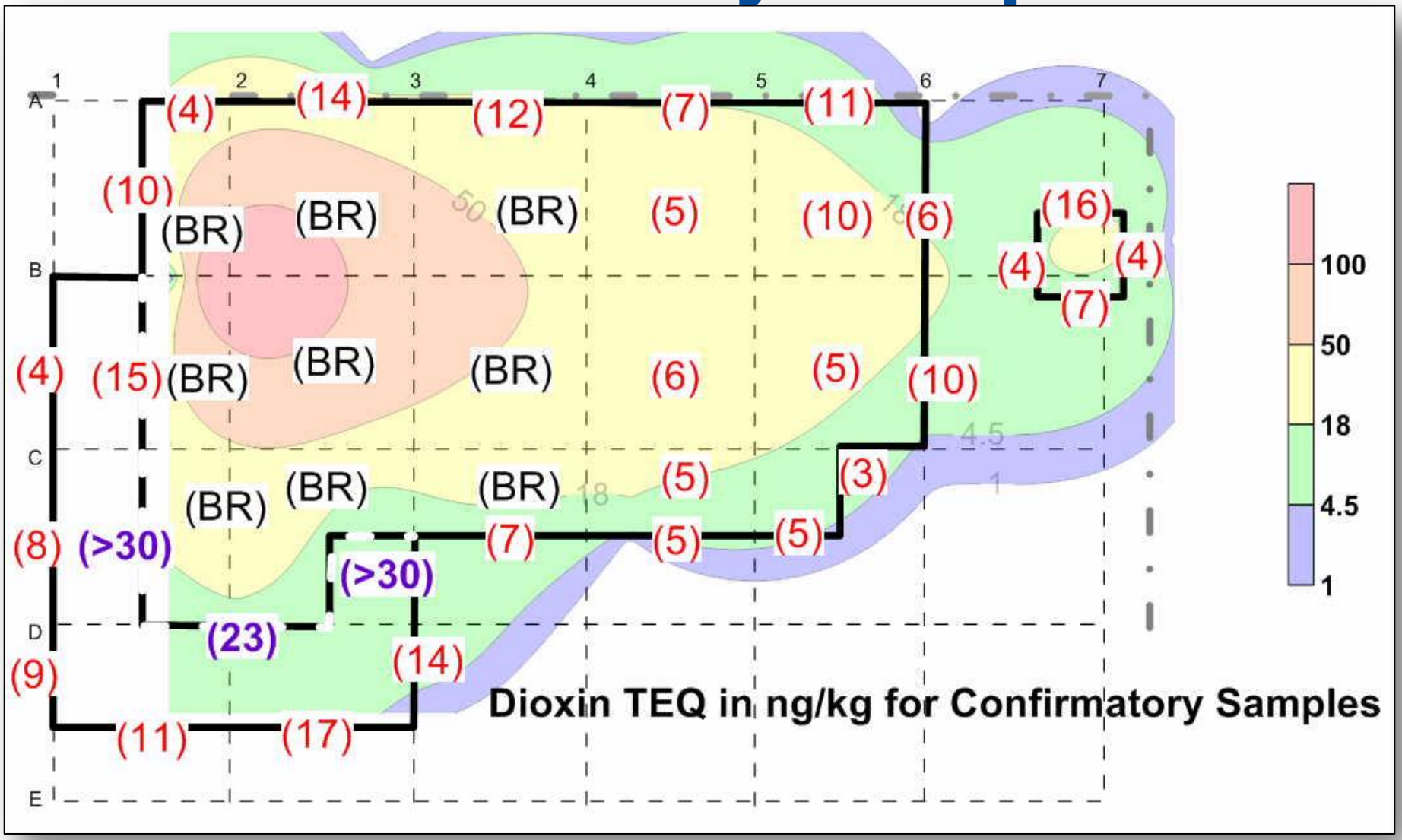


Planned soil removal boundaries and depths 18 ng/kg standard

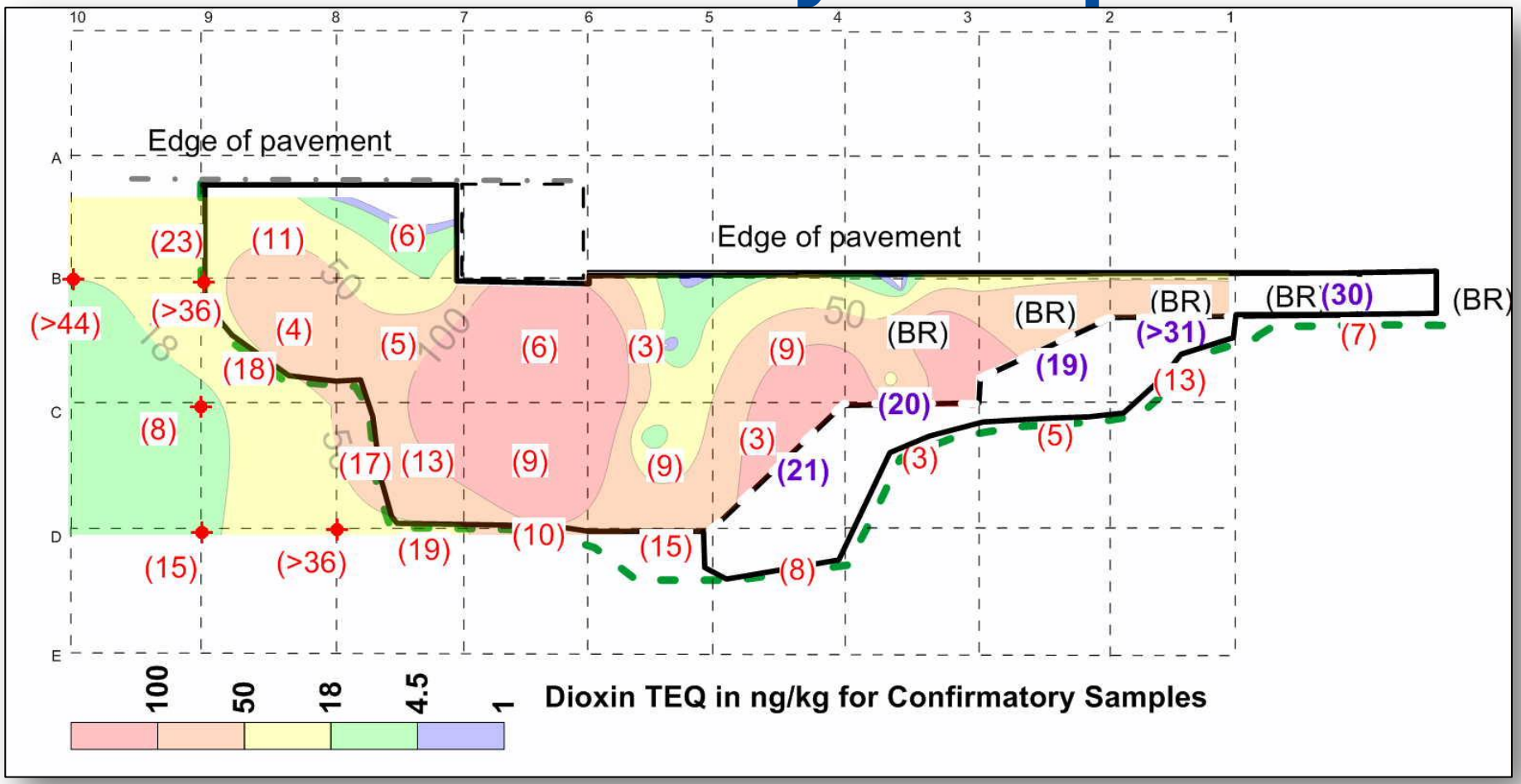
Remediation

- Industrial Standard (18 ng/kg) selected because 4.5 ng/kg would have significantly increased soil volume.
- Estimated 2,286 tons, 2,108 tons actual.
- Confirmatory sampling consisted of 3 to 5-grab composites for each 20’ x 20’ grid—62 samples in total.
- Both sidewalls and bottom sampled.
- Confirmatory sampling showed two areas that required additional excavation

Confirmatory Samples



Confirmatory Samples



Cost Considerations

Lab Method:	8290	8290	4025M
Approach:	Sample More	Dig More	Actual
Add. Site Char.	$27,000	$17,000	$13,000
Remediation & Confirmatory Sampling	$98,000	$85,000	$65,000
Soil Disposal	$150,000	$174,000	$150,000
TOTALS =	**$275,000**	**$276,000**	**$228,000**
		COST SAVINGS =	**18%**

Conclusions/Lessons

- Get your COCs right the first time.
- If Dioxin is a COC, be careful!
- Establish grid for characterization and confirmatory sampling.
- Consistency in sample depths.
- Explore new analytical methods.