Enhanced Data Visualization and Analysis Approach at Former Industrial Site with Collocated Contamination

Advanced Data Visualization Techniques

Katie Elich

Woodard & Curran

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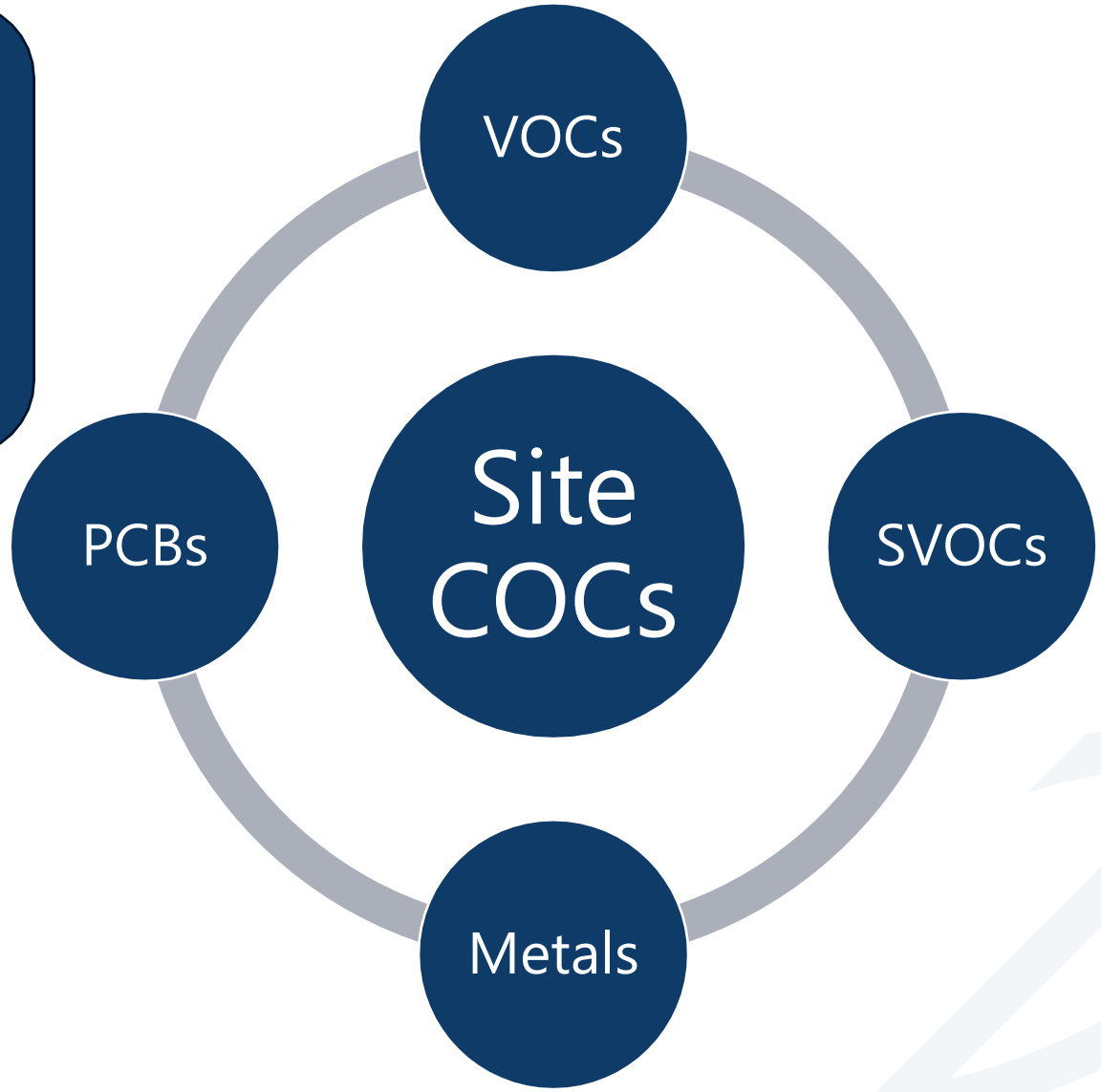
Site Setting

- Located in Brooklyn, NY, used for industrial purposes beginning in early 1900s
- Previous uses include steel manufacturing, lumberyard, marine canvas supply, iron works, vinyl stabilizers, plastic additives
- Surrounding area created through historical filling of waterfront in the late 1800s/early 1900s
- Heavily industrialized area, multiple remediation sites in the vicinity

Photo circa 1937, obtained from NYC Municipal Archives Collection

Contaminants of Concern (COCs)

COCs associated with historical Site operations



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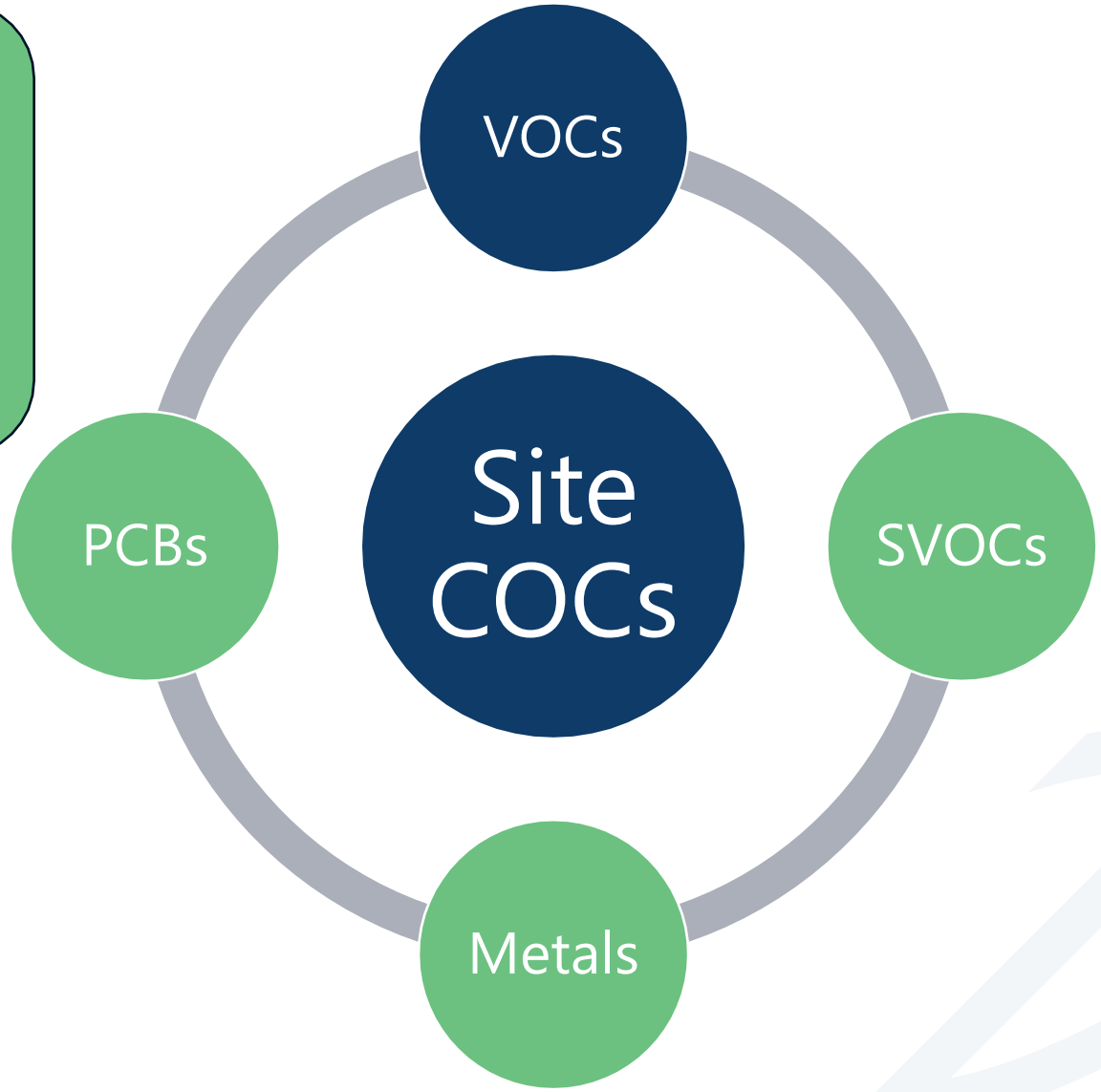
Contaminants of Concern (COCs)

COCs also associated with historical fill



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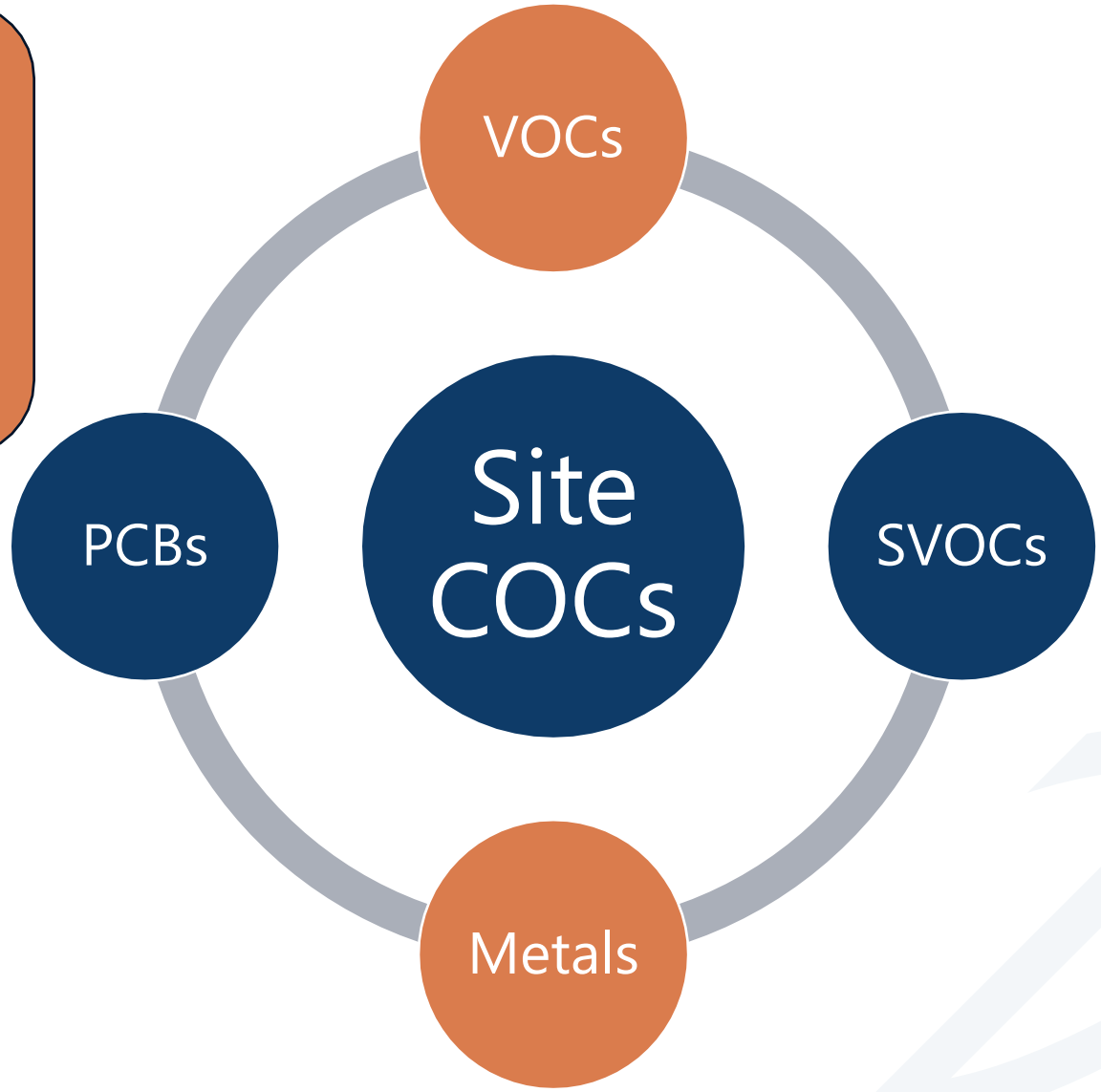
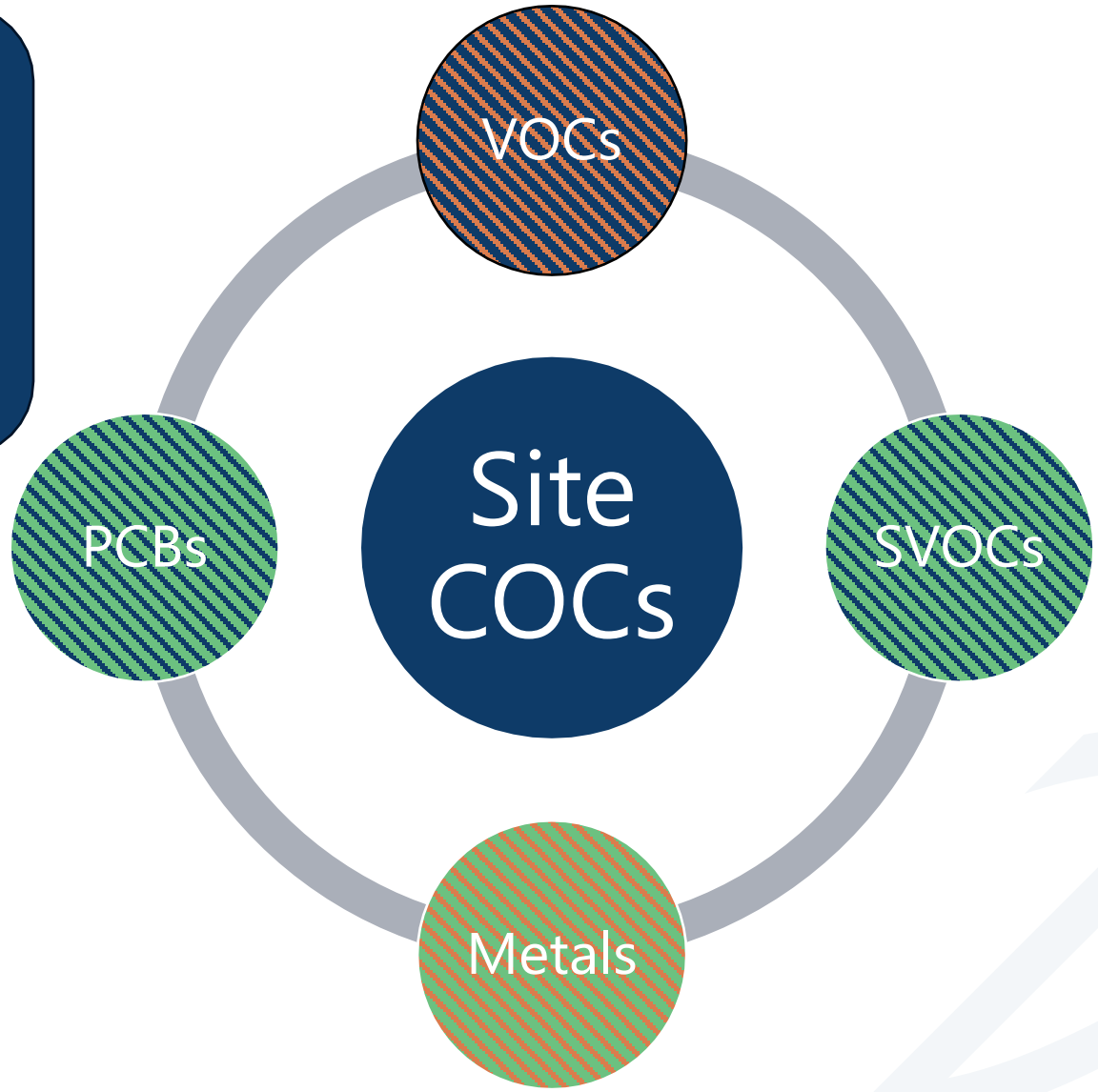
Contaminants of Concern (COCs)

COCs also associated with nearby remediation sites



Contaminants of Concern (COCs)

Goal: Determine nature and extent of COCs associated with **past Site operations only**



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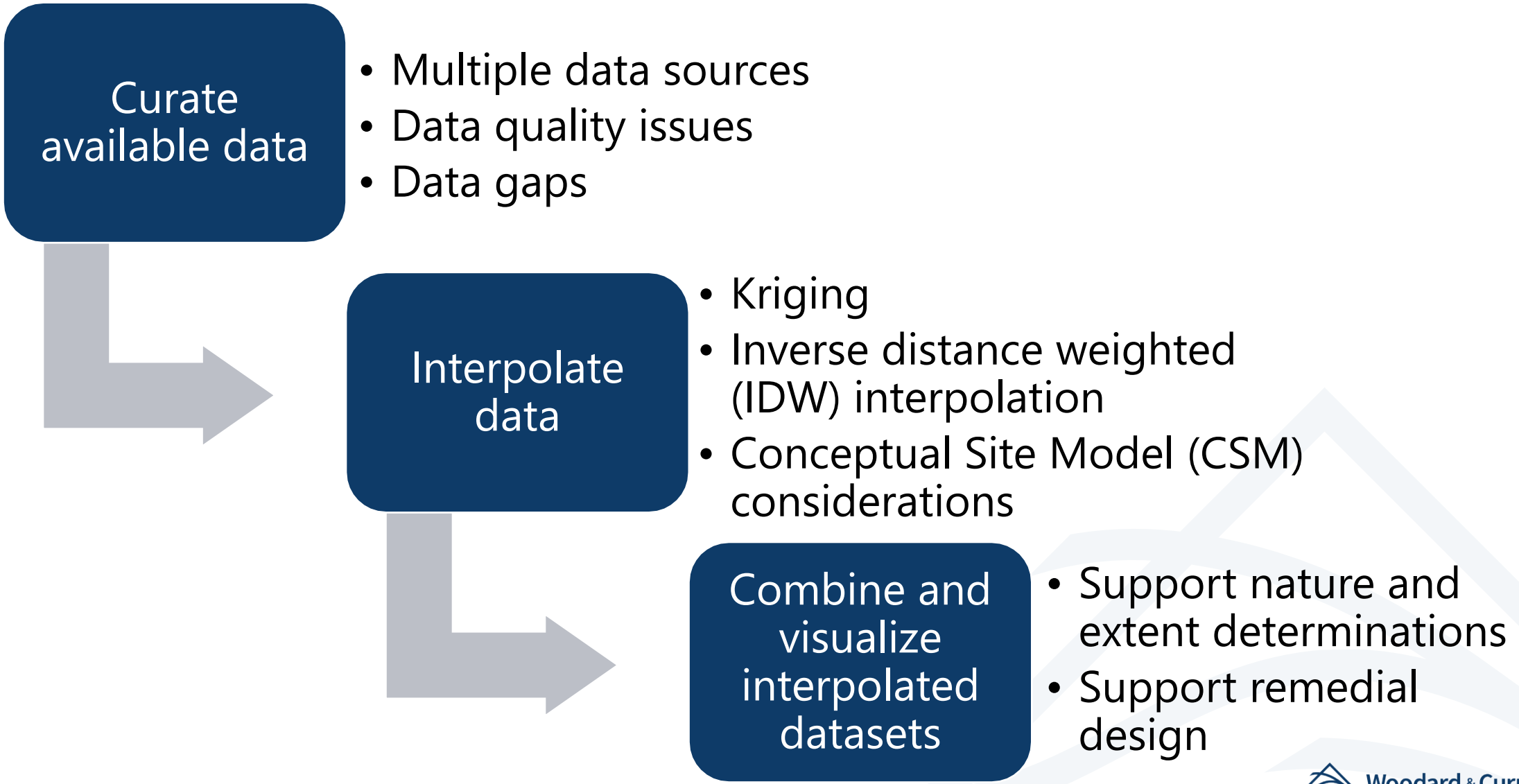
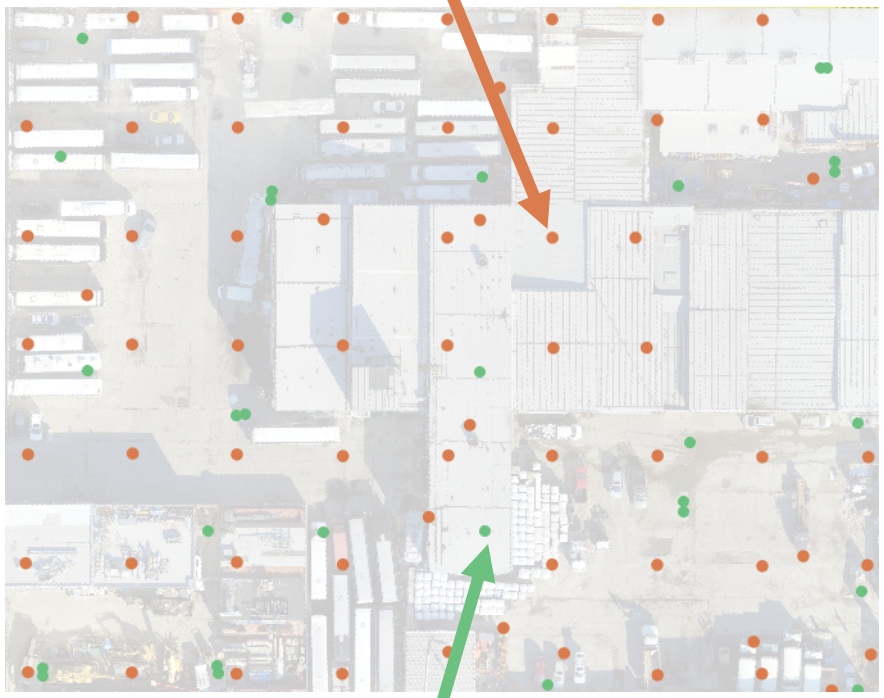
Proposed Approach



Step 1: Data Evaluation and Processing

Average Depth of 4-8 ft bgs



Average Depth of 32 ft bgs

Historical Investigations

- Data quality concerns
- Limited vertical extent
- Robust horizontal sampling grid

Recent Investigations

- Higher data quality
- Limited horizontal density
- Robust vertical delineation

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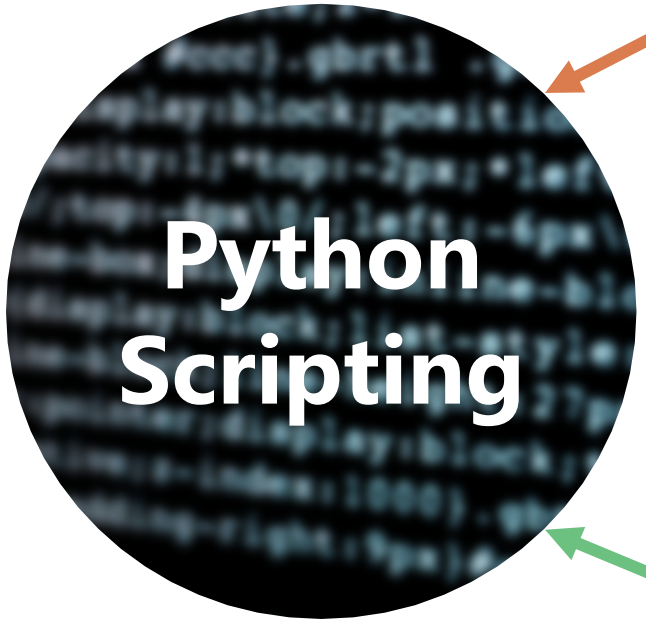
Step 1: Data Evaluation and Processing



Historical Investigations

- Data quality concerns
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Recent Investigations

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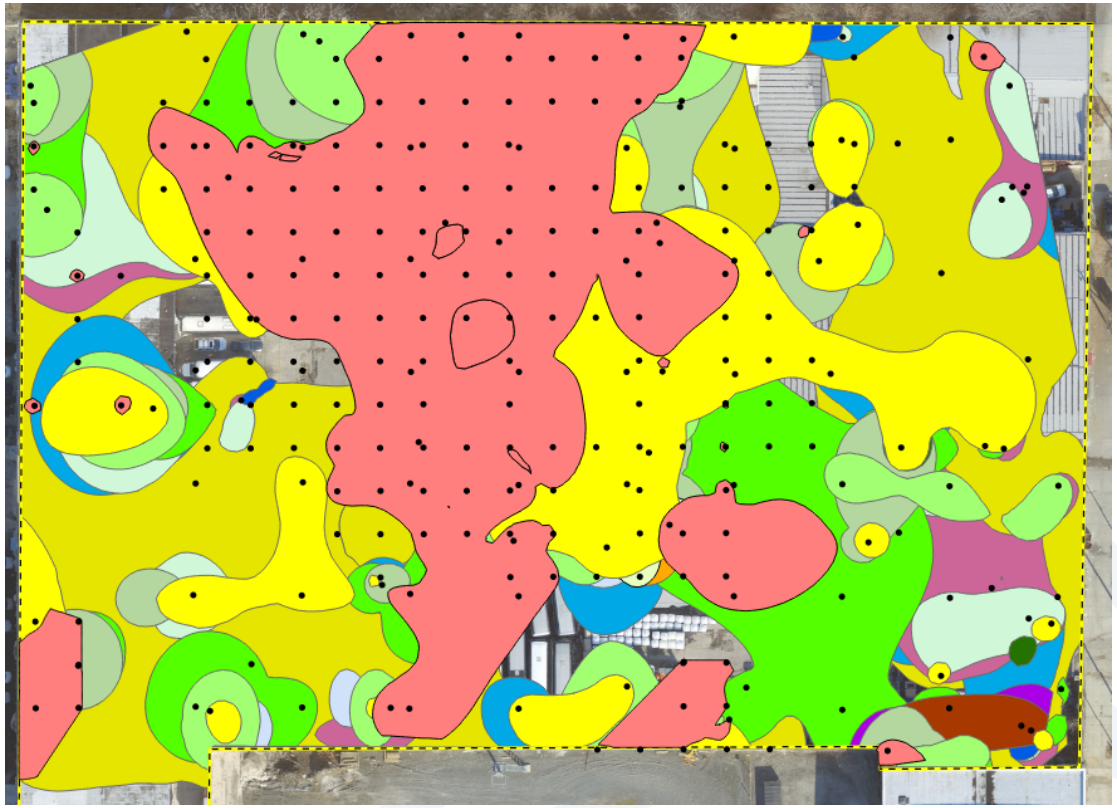
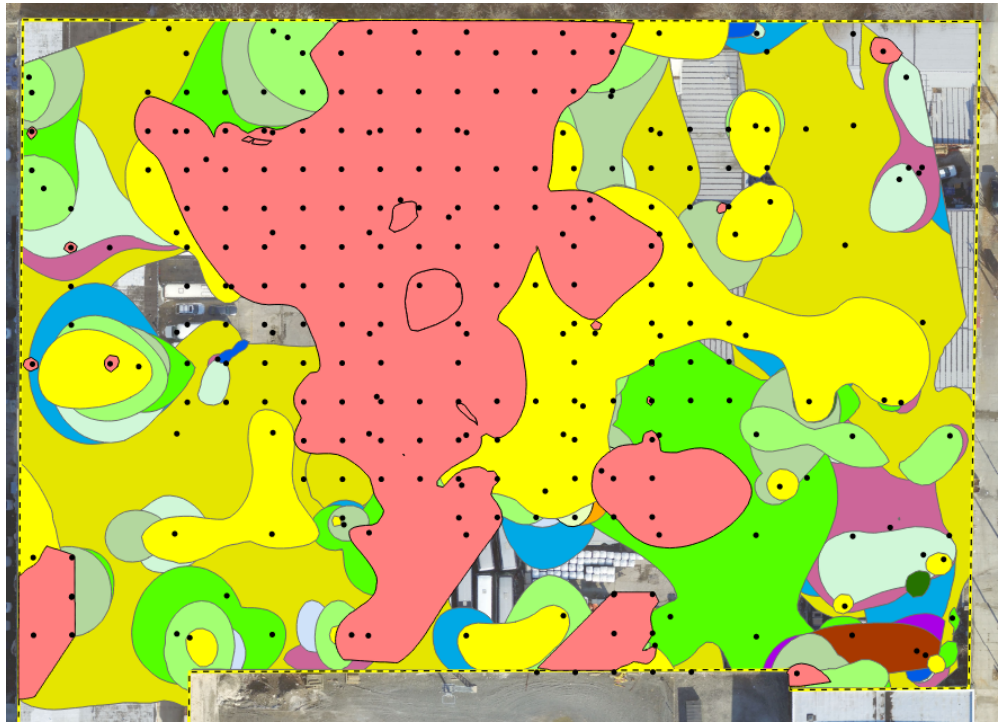
Step 2: Data Interpolation

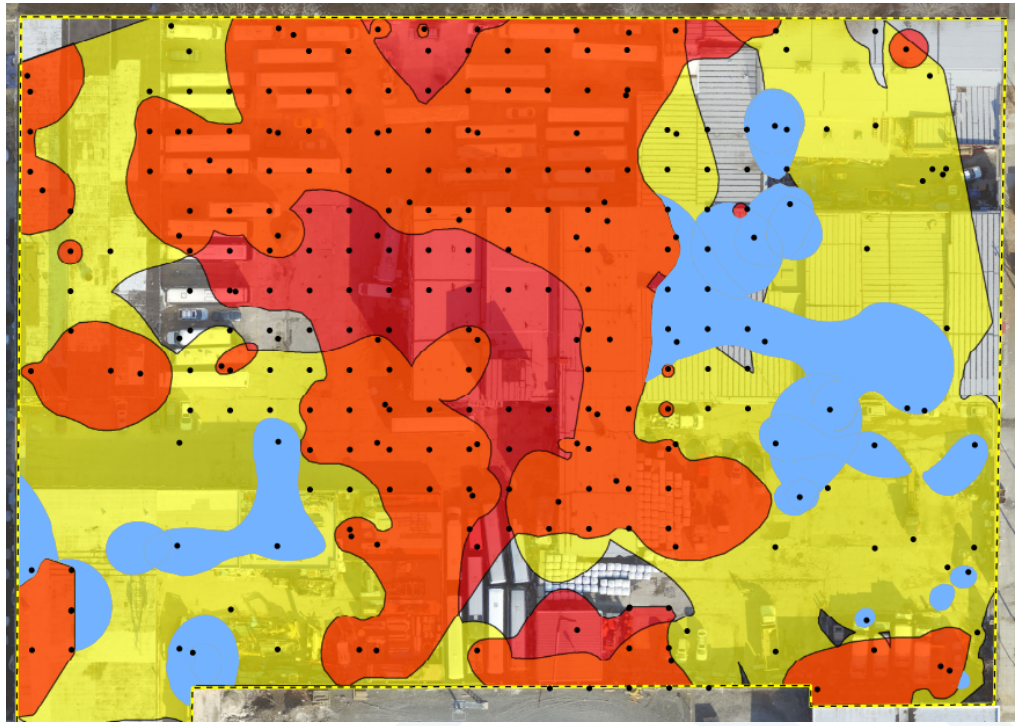
- Use of several interpolation methods
  - Kriging
  - IDW
  - Natural Neighbor
- CSM Considerations
  - Historical Fill Areas
  - Historical Roadways
  - Impacts from off-site properties

Overlay of interpolations of each individual Site COC



Step 3: Combine and Visualize Interpolated Data for Nature and Extent





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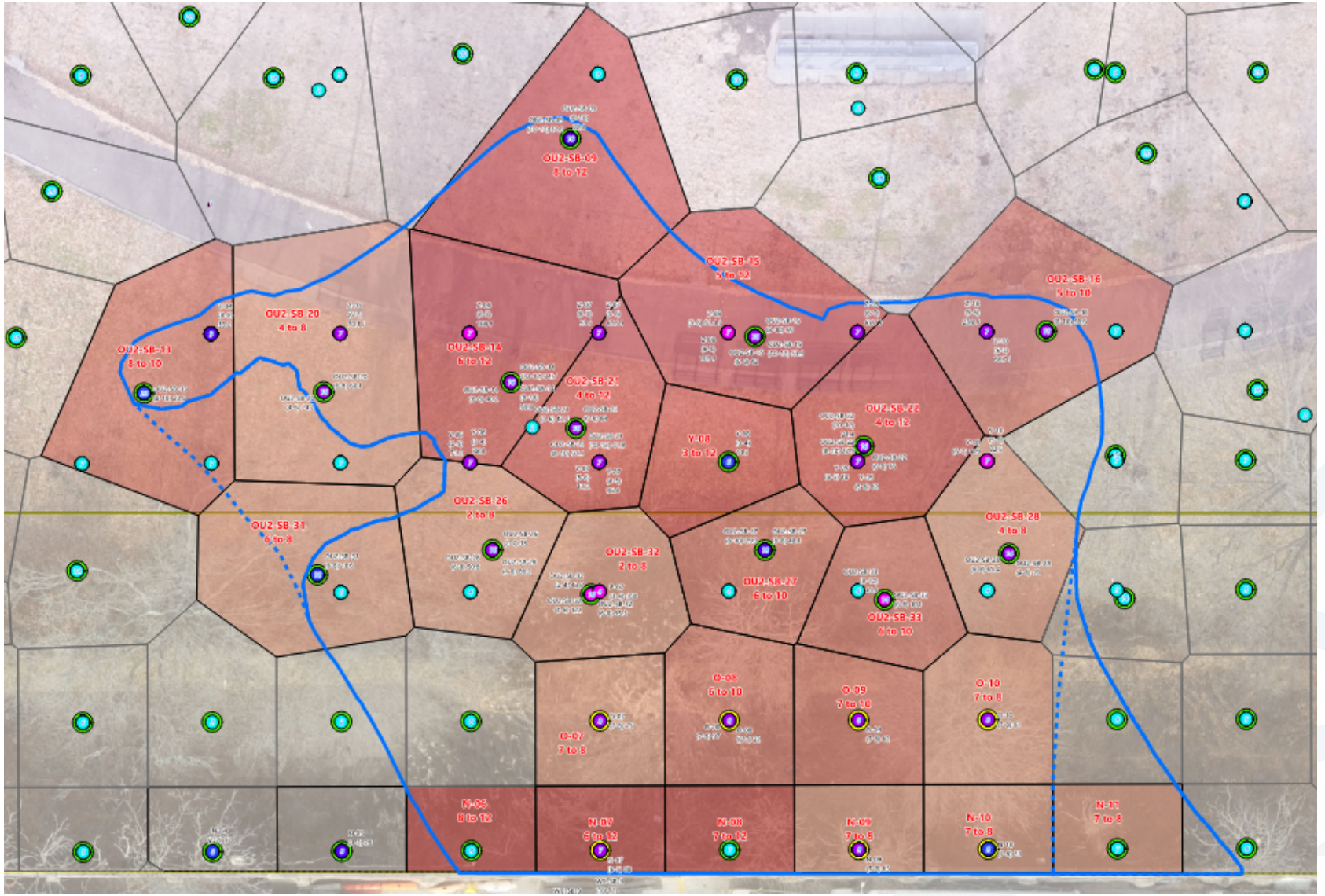
Step 3: Combine and Visualize Interpolated Data for Remedial Design – Thiessen Polygons and Kriging



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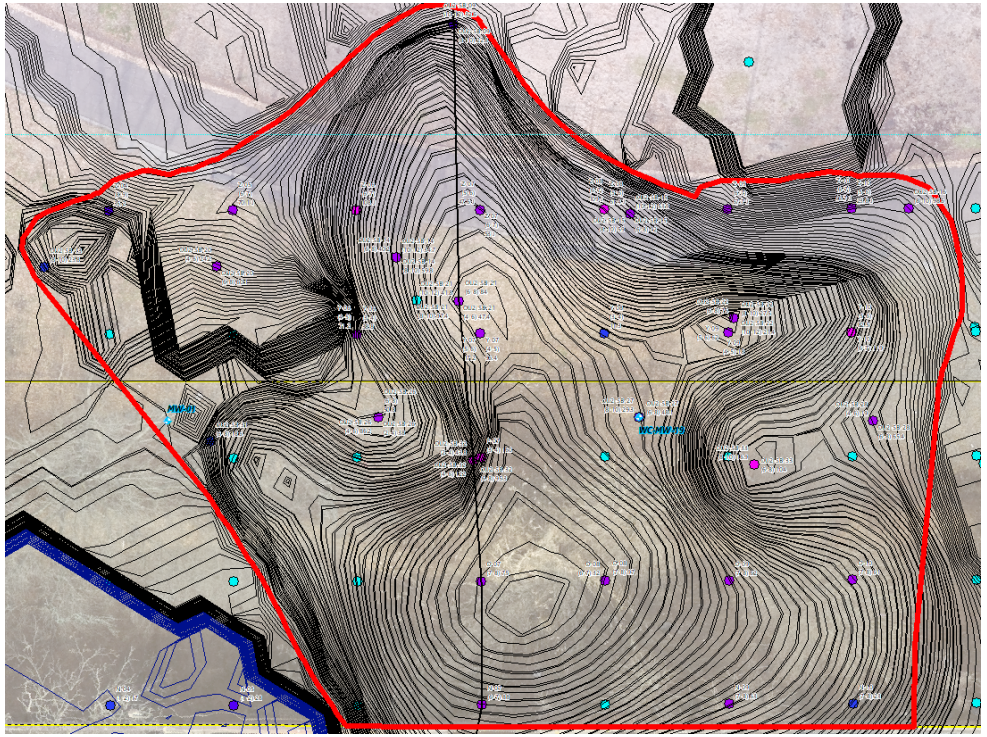
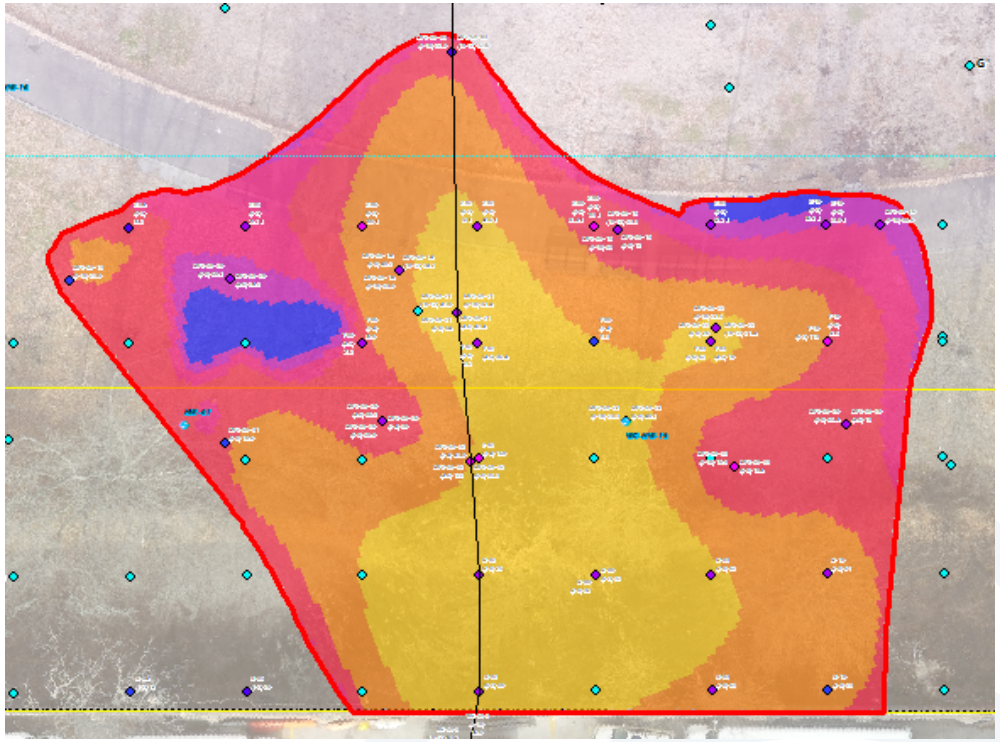
Step 3: Combine and Visualize Interpolated Data for Remedial Design – Vertical Extent

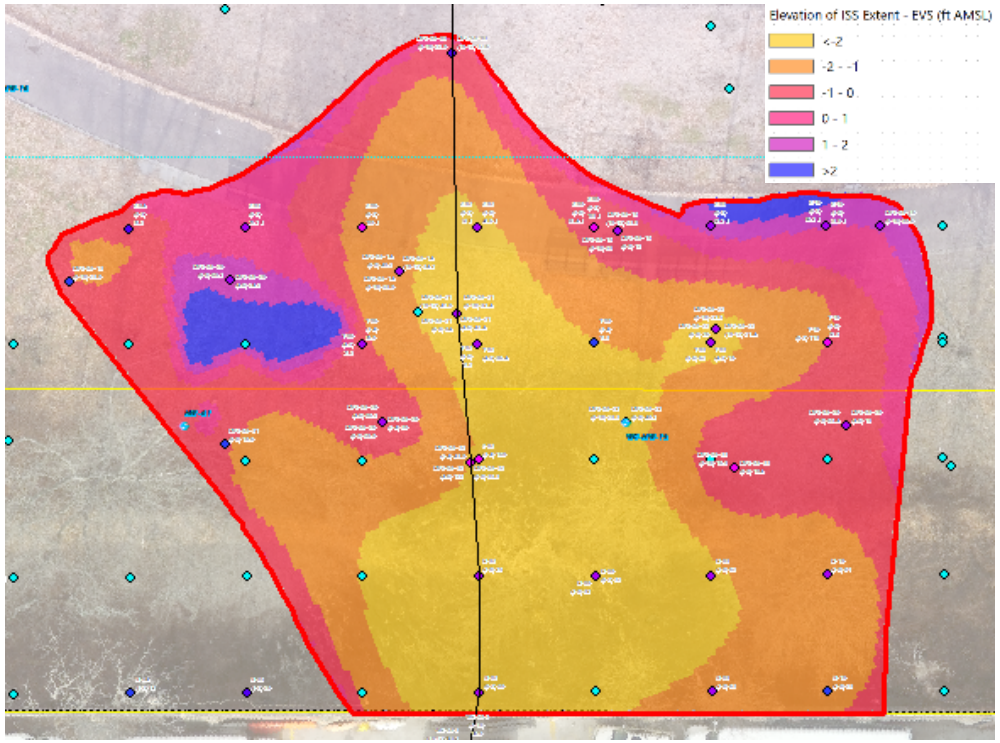
Exporting the plume/isopleth bottom elevation from EVS as contour lines

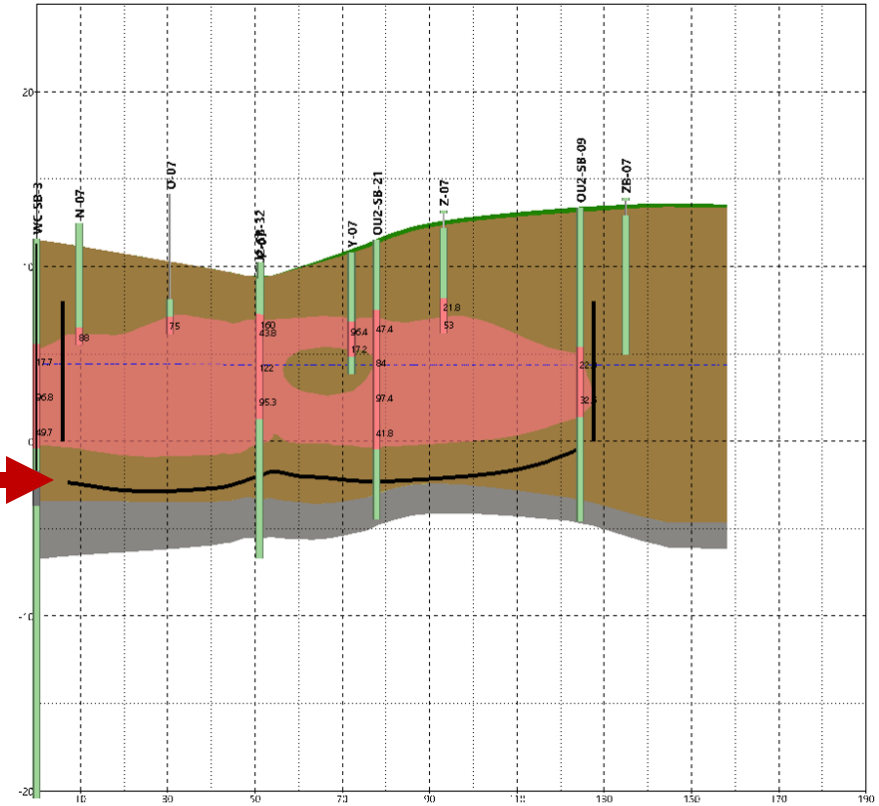




Determination of Vertical Extent - Kriging

Exporting the plume/isopleth bottom elevation from EVS as contour lines



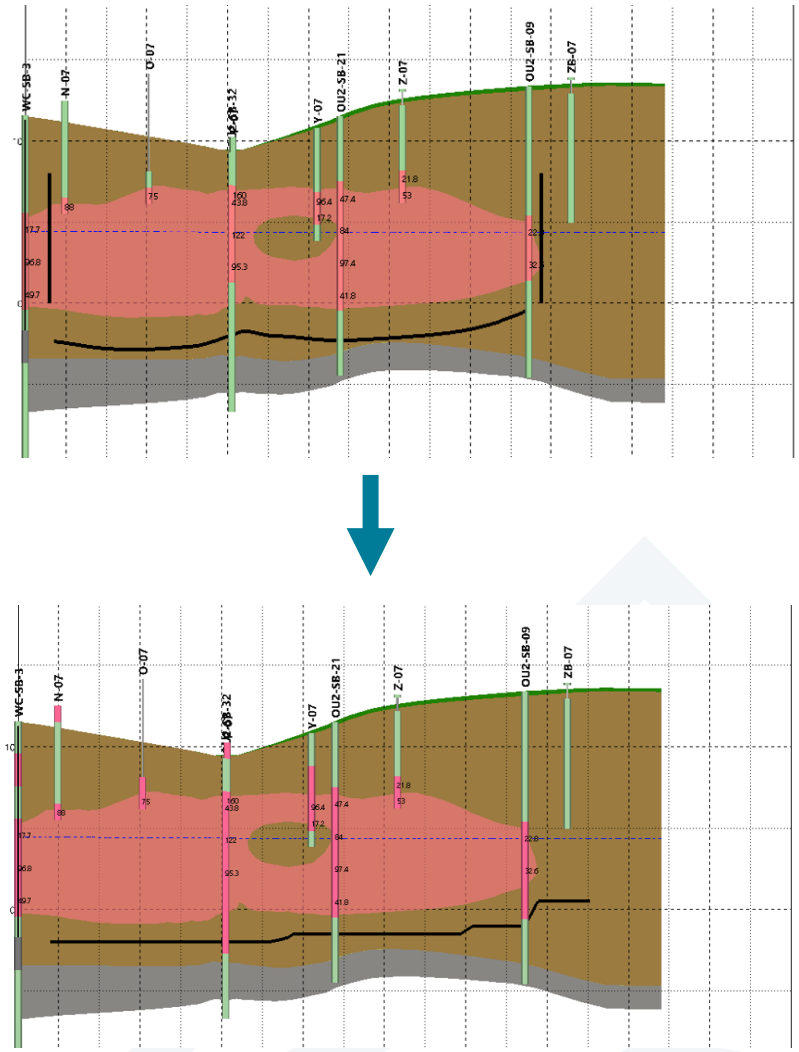


Determination of Vertical Extent - Kriging

Why is this significant?

We can leverage EVS kriging and export to our 2D design/plan drawings

- EVS has one of the **easiest to use kriging interfaces** of all of our third-party software, allowing us to more easily and confidently krige our data
- EVS will **interpolate actual concentration data** for export
- More robust **interpolation of areas with known data gaps**, with ability to also calculate the uncertainty in these areas
- Allows for **easy export of multiple options**



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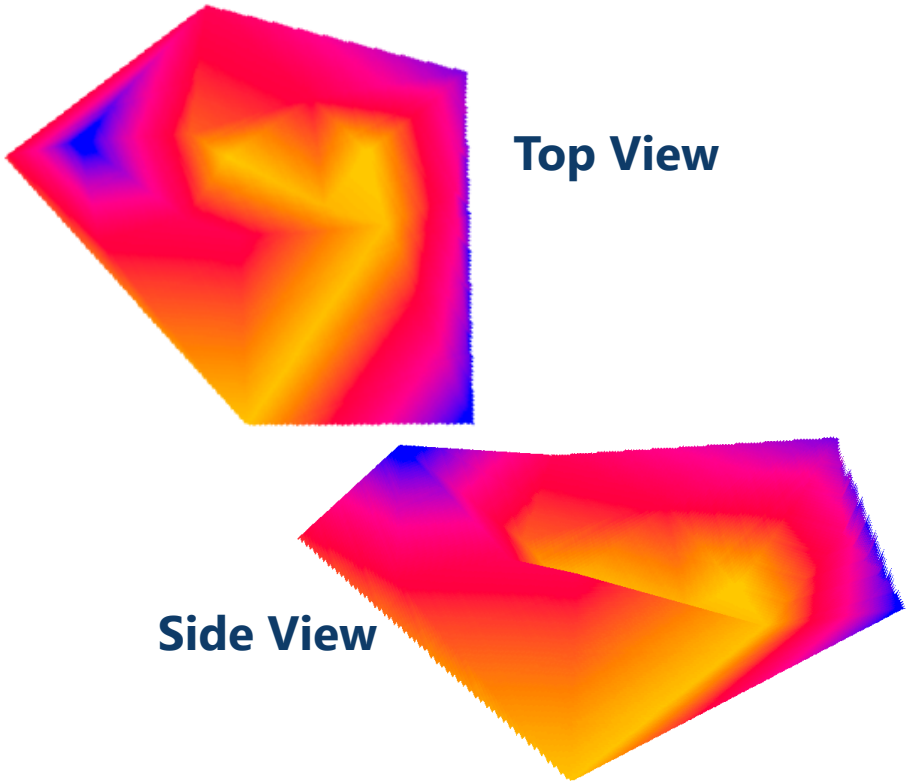
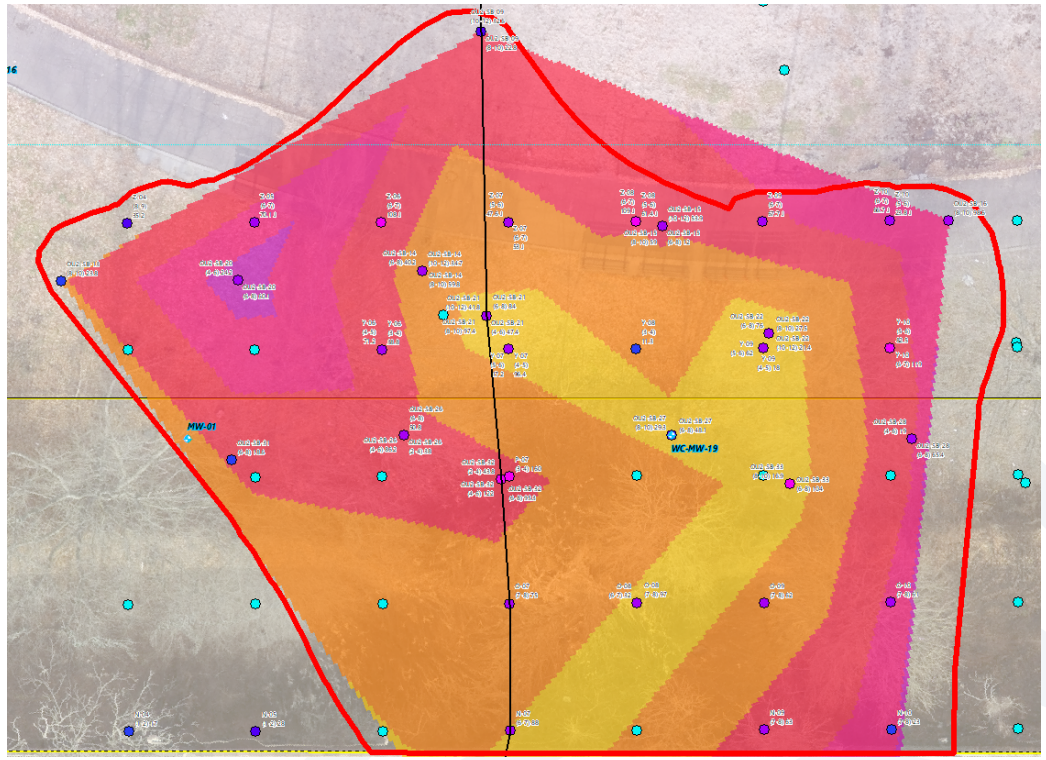
Determination of Vertical Extent - TIN

Using a Triangulated Irregular Network (TIN) to create a bottom surface in GIS and importing to EVS – represents the “draw a straight line” approach using **depth of exceedance data** instead of concentrations



Top View

Side View



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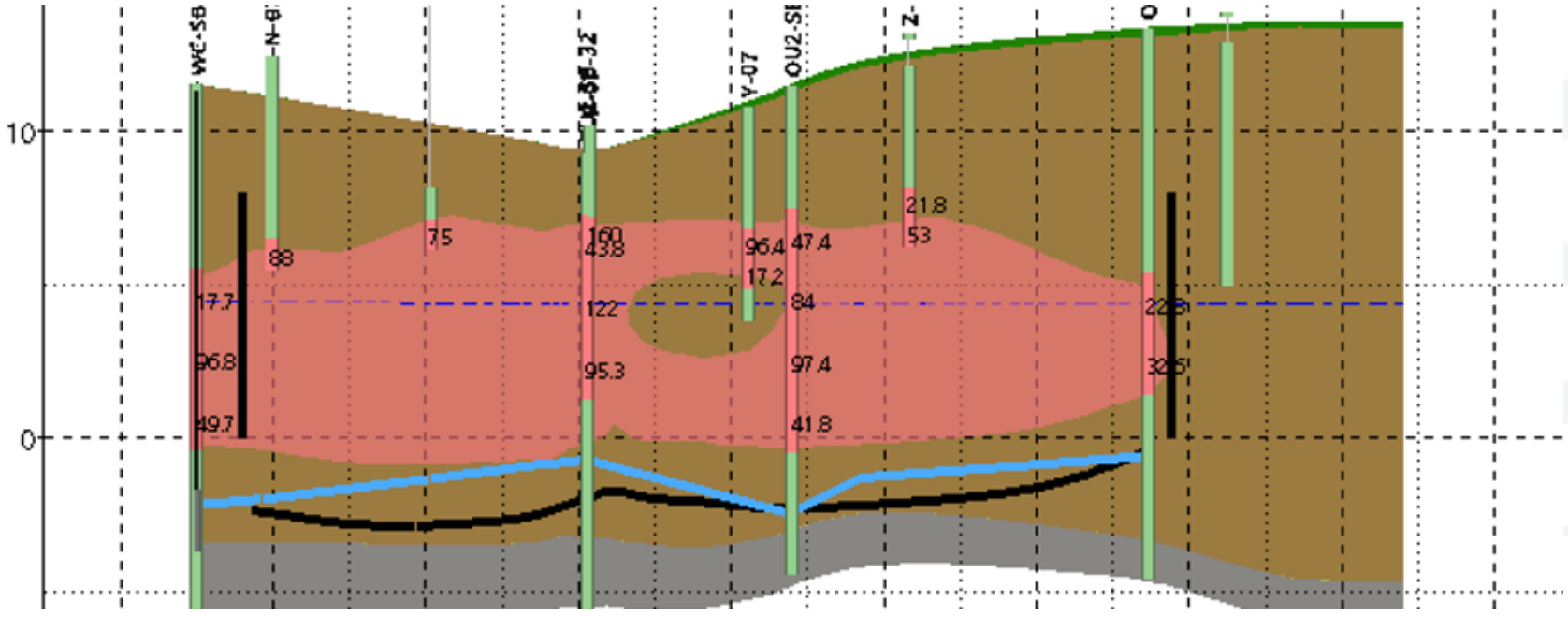
Determination of Vertical Extent - TIN

Why is this significant?

A TIN represents the "draw a straight line" approach, but in 3D instead of 2D

- **Easy to create** using the bottom elevation of contamination at each point (note we are **interpolating elevation** instead of concentration with this method)
- Use to compare design to more **traditional design approaches** (i.e., "go to the next clean point")
- 3D triangulated surface ensures **incorporation of all cross-sections**, not introducing bias based on an specific cross-section



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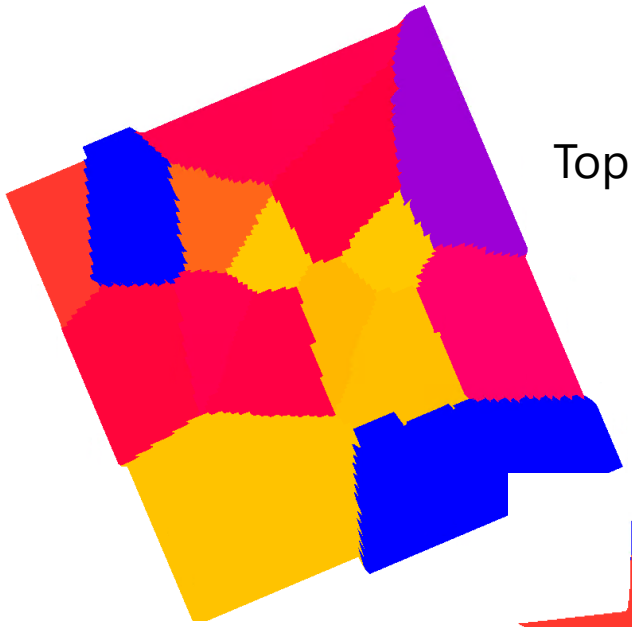
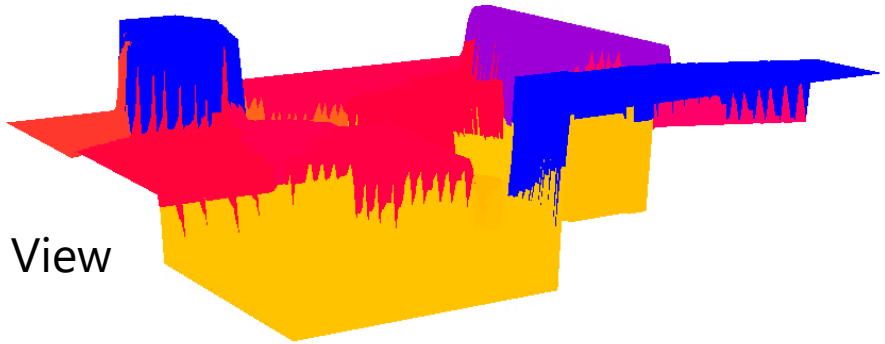
Determination of Vertical Extent – IDW/Thiessen Polygons

Using Inverse Distance Weighted (IDW) interpolation to create Thiessen Polygons representing the bottom extent of contamination

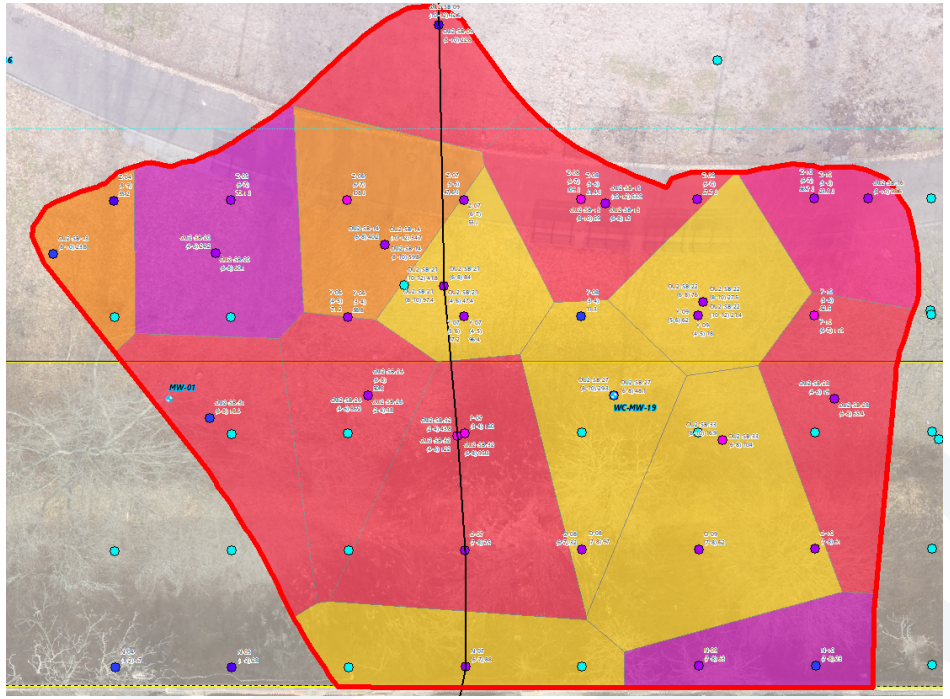
**Thiessen polygons are a type of IDW where only the nearest point is used for interpolation*



Top View



Side View



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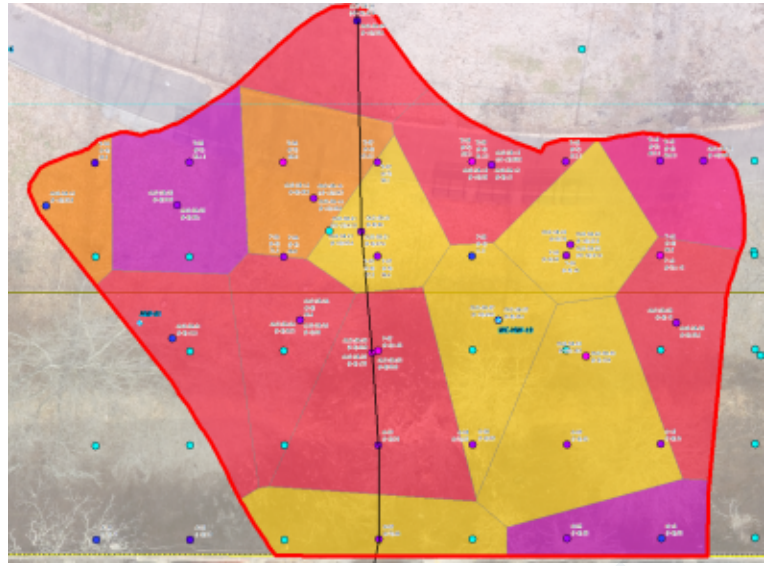
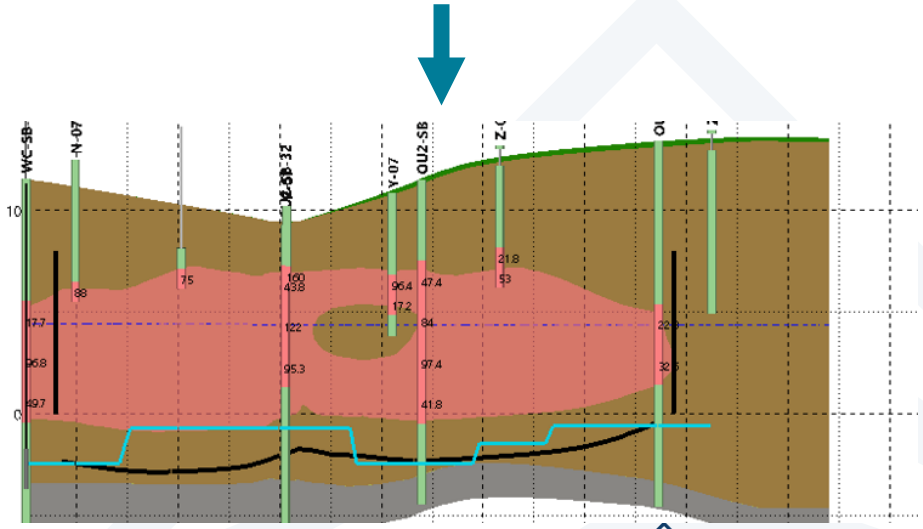
Determination of Vertical Extent – IDW Thiessen Polygons

Why is this significant?

Thiessen polygons can represent a more traditional approach of going halfway to the next point, but using EVS lets you easily apply to 3D instead of 2D

- **Easy to create** using the bottom elevation of contamination at each point (note we are **interpolating elevation** instead of concentration with this method)
- Can be compared to more **traditional design approaches** (i.e. "go halfway to the next point")
- 3D surface ensures you're **incorporating all cross-sections**, and not introducing bias based on a specific cross-section





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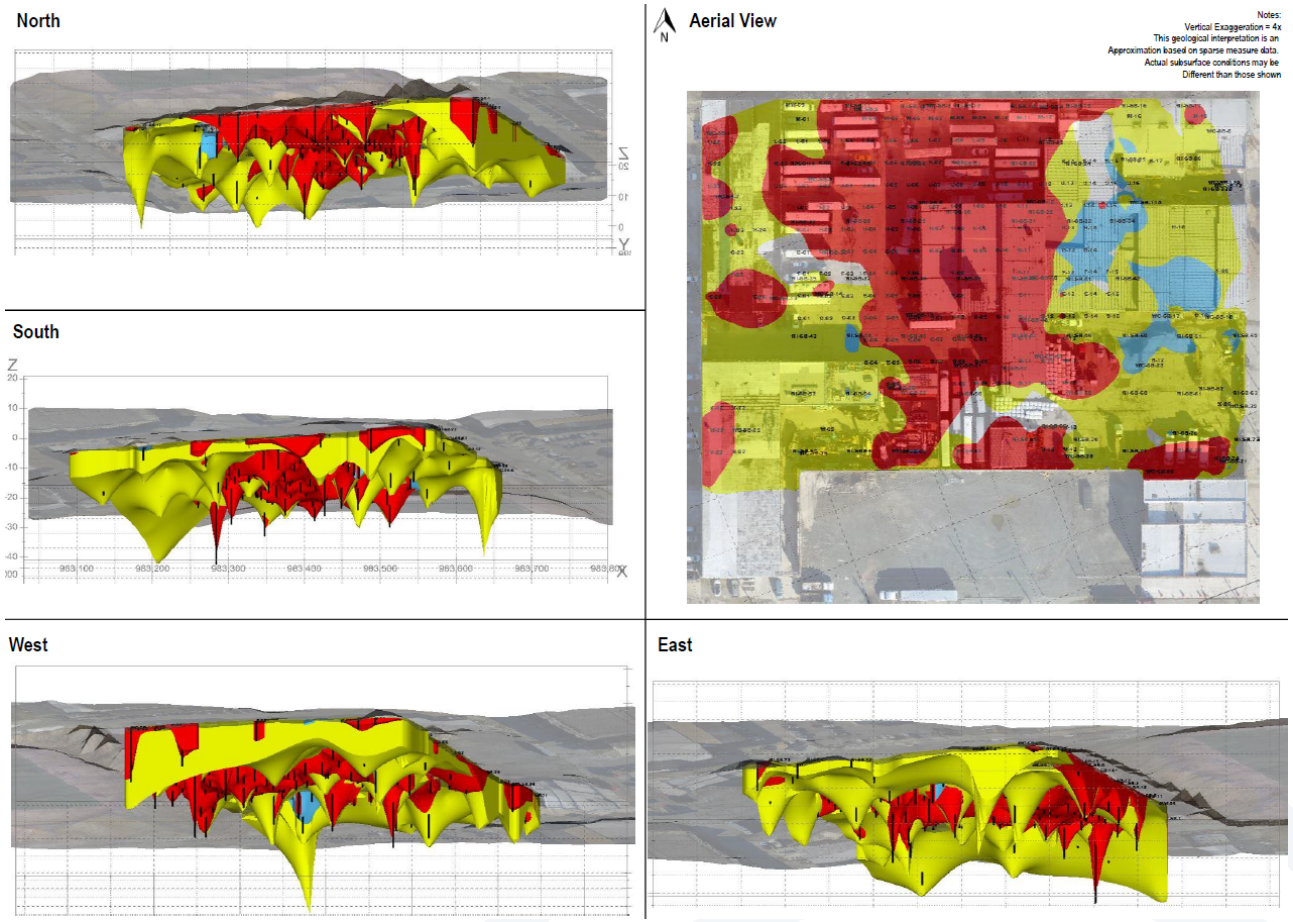
Project Benefits and Outcomes

- Regulatory Acceptance
  - EVS models were submitted as part of Remedial Investigation report directly to state agency
  - EVS models and GIS visualizations are being used to support remedial design discussions with state agency
- Client Benefits
  - More cost effective and defensible design
  - Eliminated need for additional investigation
- Public Health and Environment
  - More protective remedial design
  - More efficient remedy implementation



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Thank you!

Katie Elich

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kelich@woodardcurran.com