

Using Data Management and 3-Dimensional Data Visualization to Generate More Complete Conceptual Site Models and Streamline Site Closure

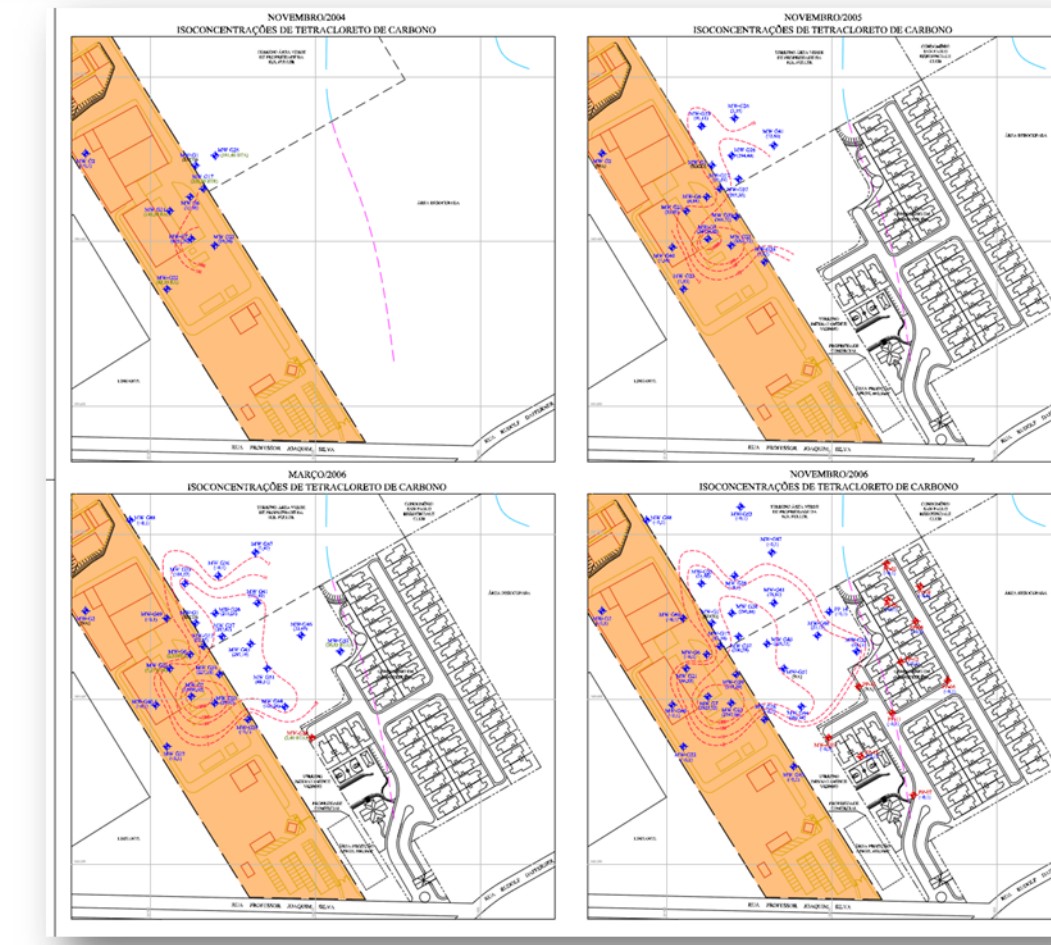
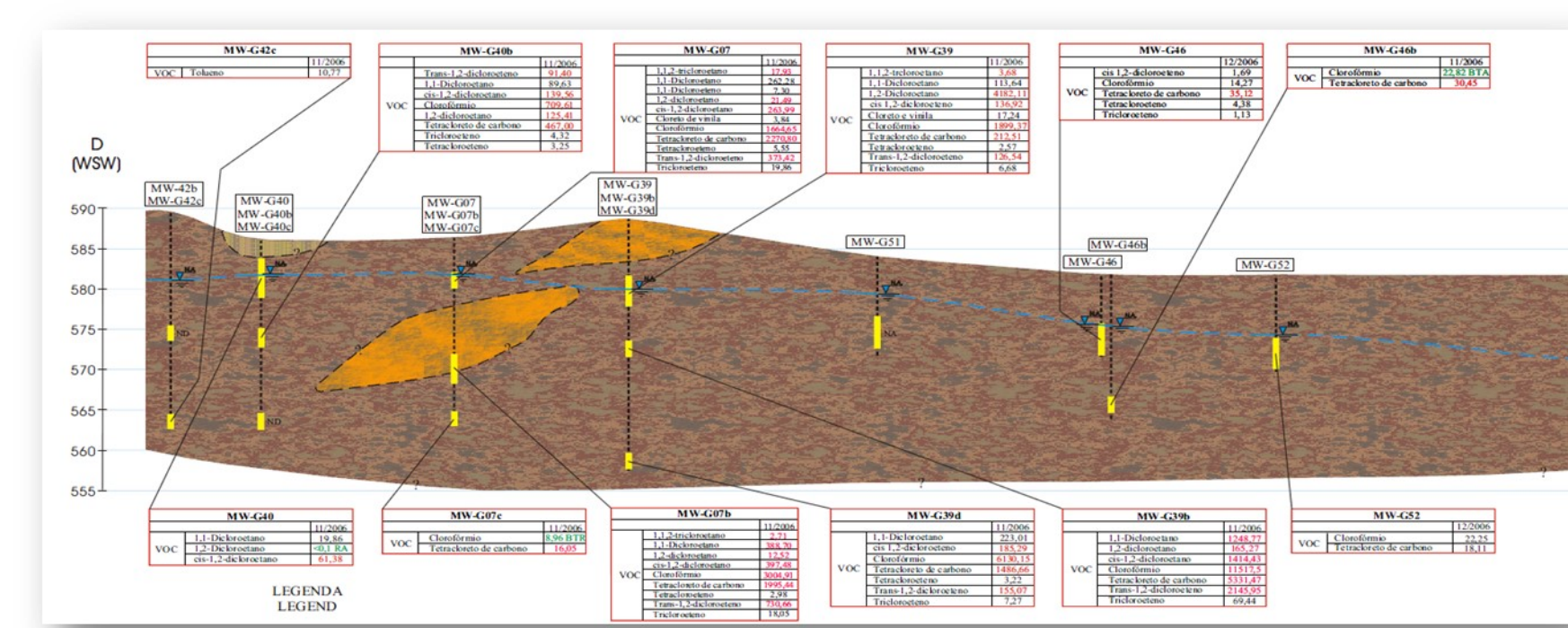
AUTHORS: JOSHUA ORRIS, ANTEA GROUP AND JASON RUF, S2C2 INC.

1 INTRODUCTION

Managing data and developing an accurate Conceptual Site Model (CSM) are critical challenges for complex environmental sites. Leveraging innovation through technology supports improvements in the development of more accurate and complete CSMs that are focused on tailoring the management of a client's environmental liability to their unique business needs.

Technical Management Challenges:

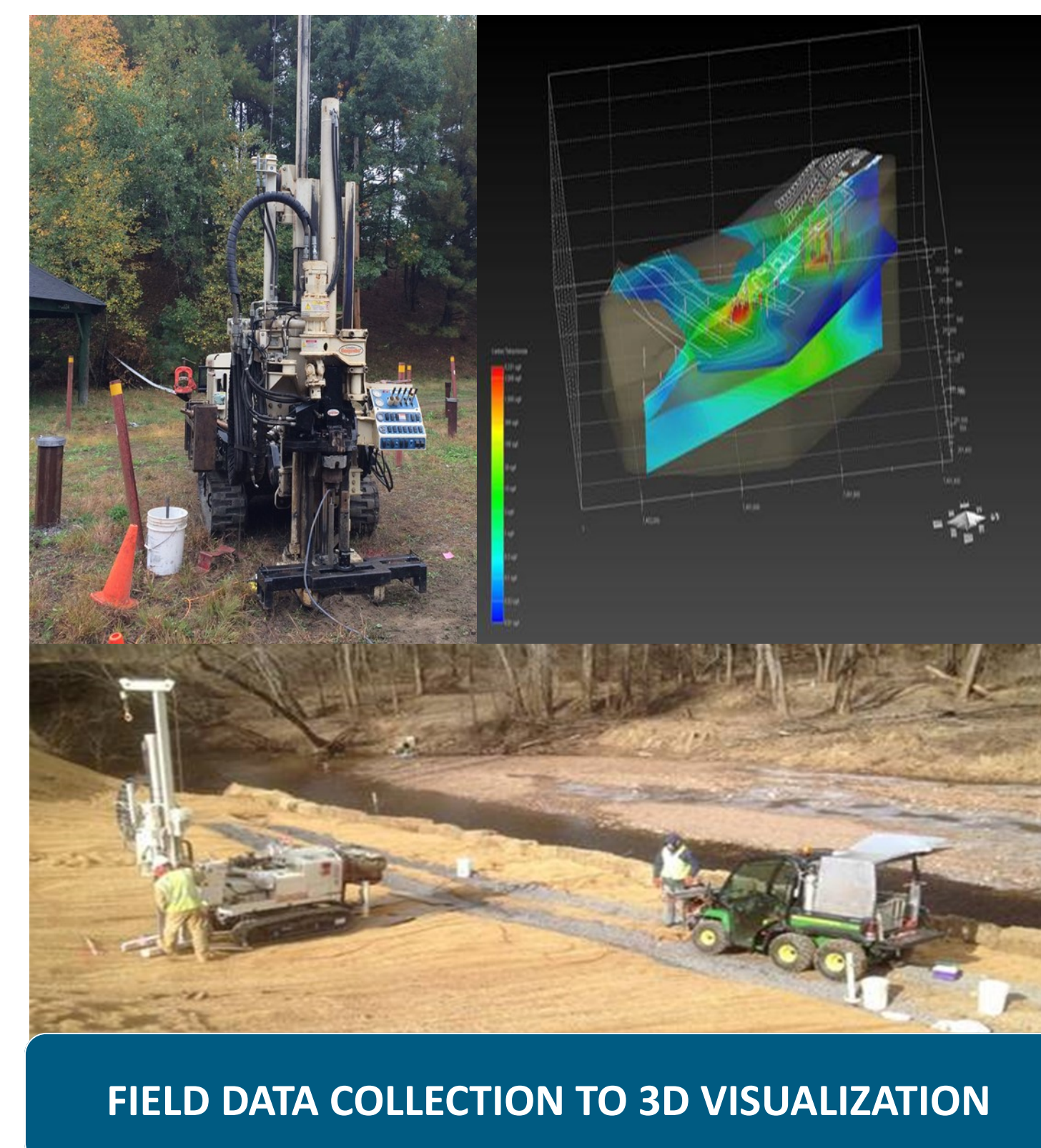
- Complex data sets over several years.
- Complex environmental systems.
- Varied site investigation methods.
- Performance inconsistency.
- Stakeholder engagement.
- Receptors & third-party potential impacts.
- Varied regulatory requirements for cleanup: numeric vs risk-based.



2 BUILDING THE CONCEPTUAL SITE MODEL

Goal: Build all Relevant Site Knowledge into the CSM

- Effective remedy selection, engineering design.
- Performance monitoring.
- Innovative investigation methods:
 - Direct sampling.
 - Mobile laboratories.
- Real estate—current & future land use.
- Source area evaluation.
- Contaminant distribution.
- Receptors.
- Regulatory drivers.
- Site investigation.
- Geology/hydrogeology.



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3 3D CONCEPTUAL SITE MODELS AS A BEST-MANAGEMENT PRACTICE

Provides a standardized solution process for the management and consistent representation of complex data sets leading to cost reductions of environmental liabilities in support of facilitating more informed **business decisions**.

Technical Data Tool for Data Analysis:

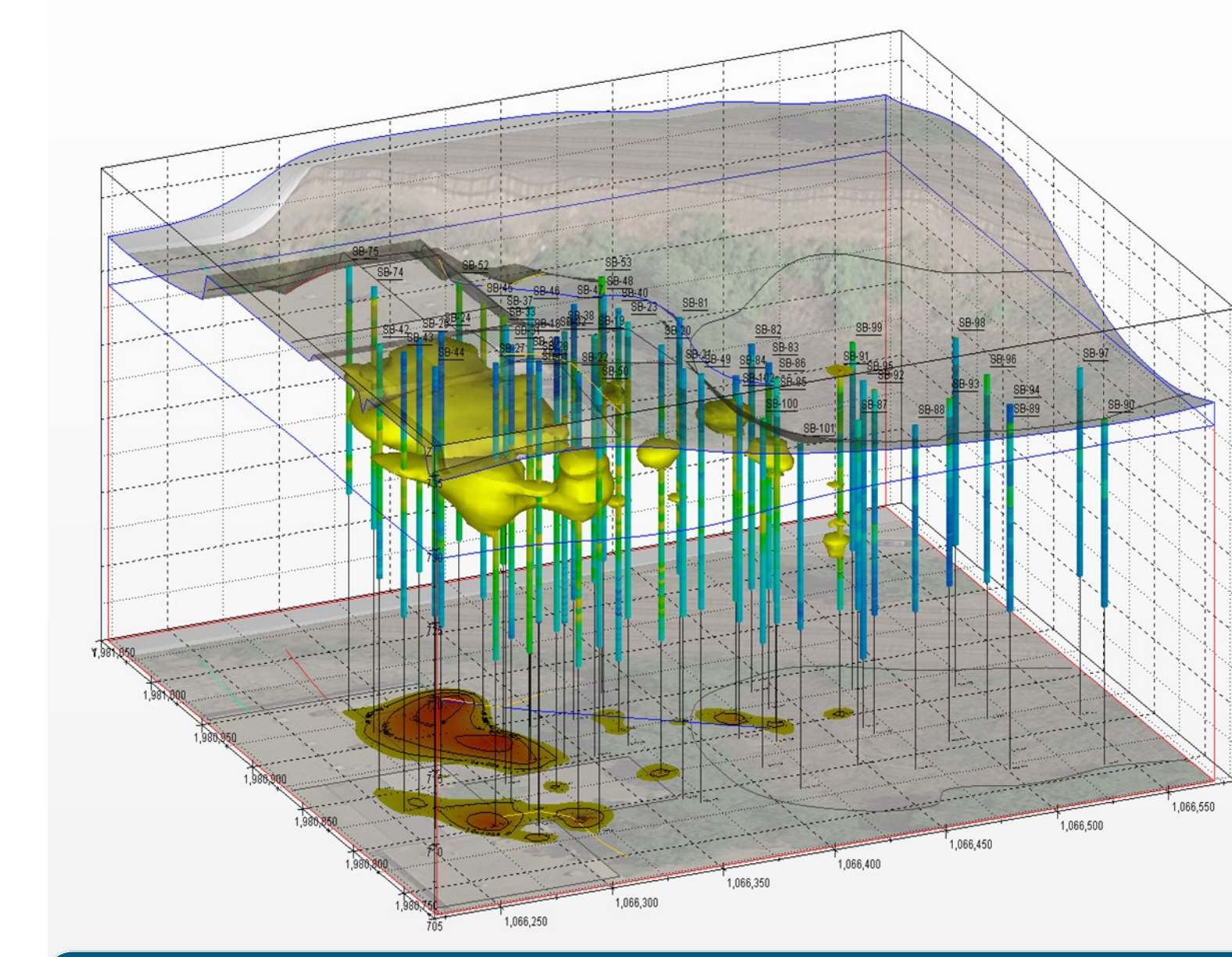
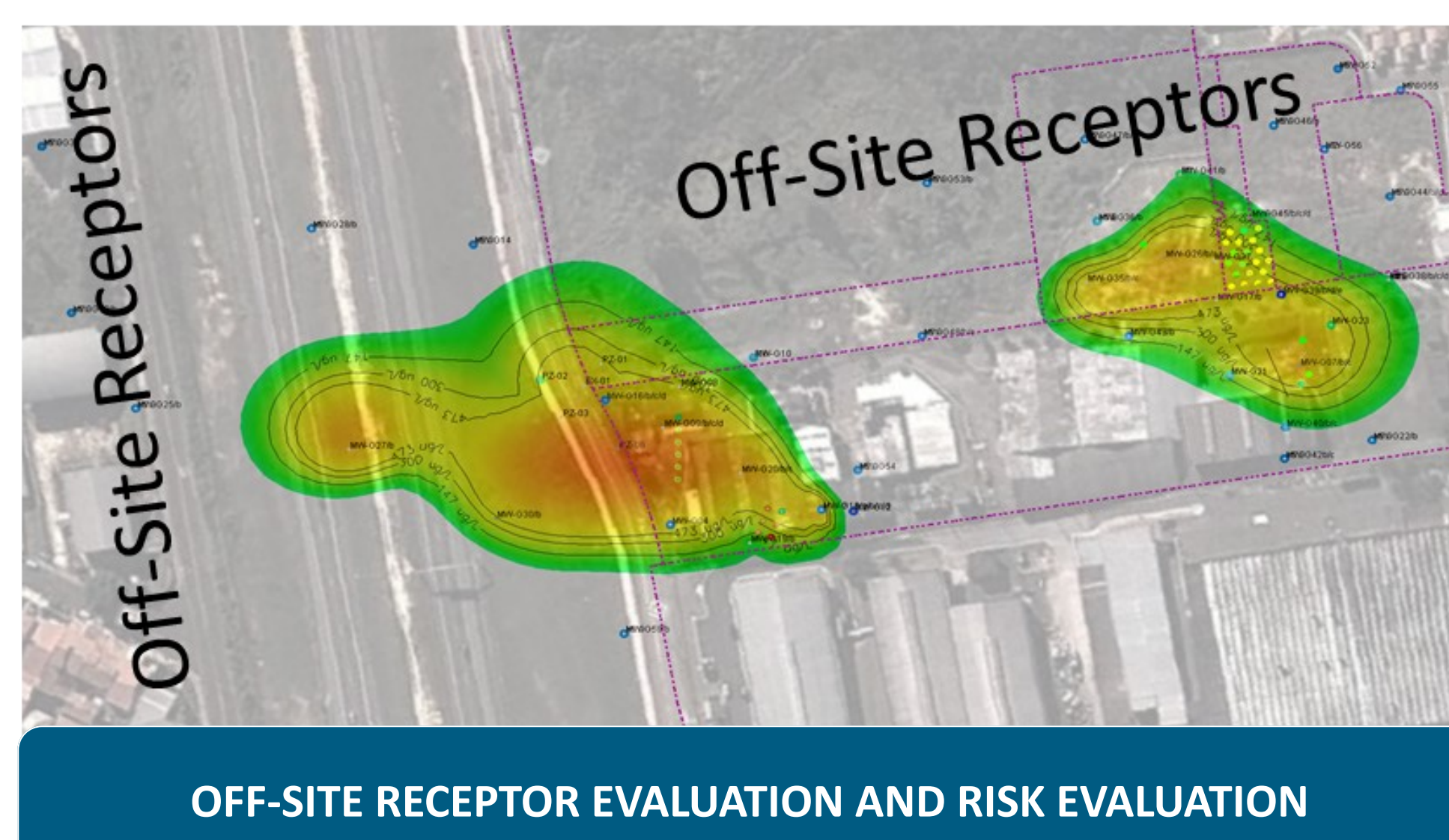
- Evaluate complex data sets.
- Evaluate chemical data in relationship to geologic data.
- Evaluate data gaps—statistically and visually.
- Assist in the design of more targeted investigations.
- Calculate mass and volume estimates for varying degrees of confidence.
- Evaluate potential remedial design options.
- Evaluate data sets over time: predictive model (simulations).

A Tool to Communicate Data Sets to All Stakeholders:

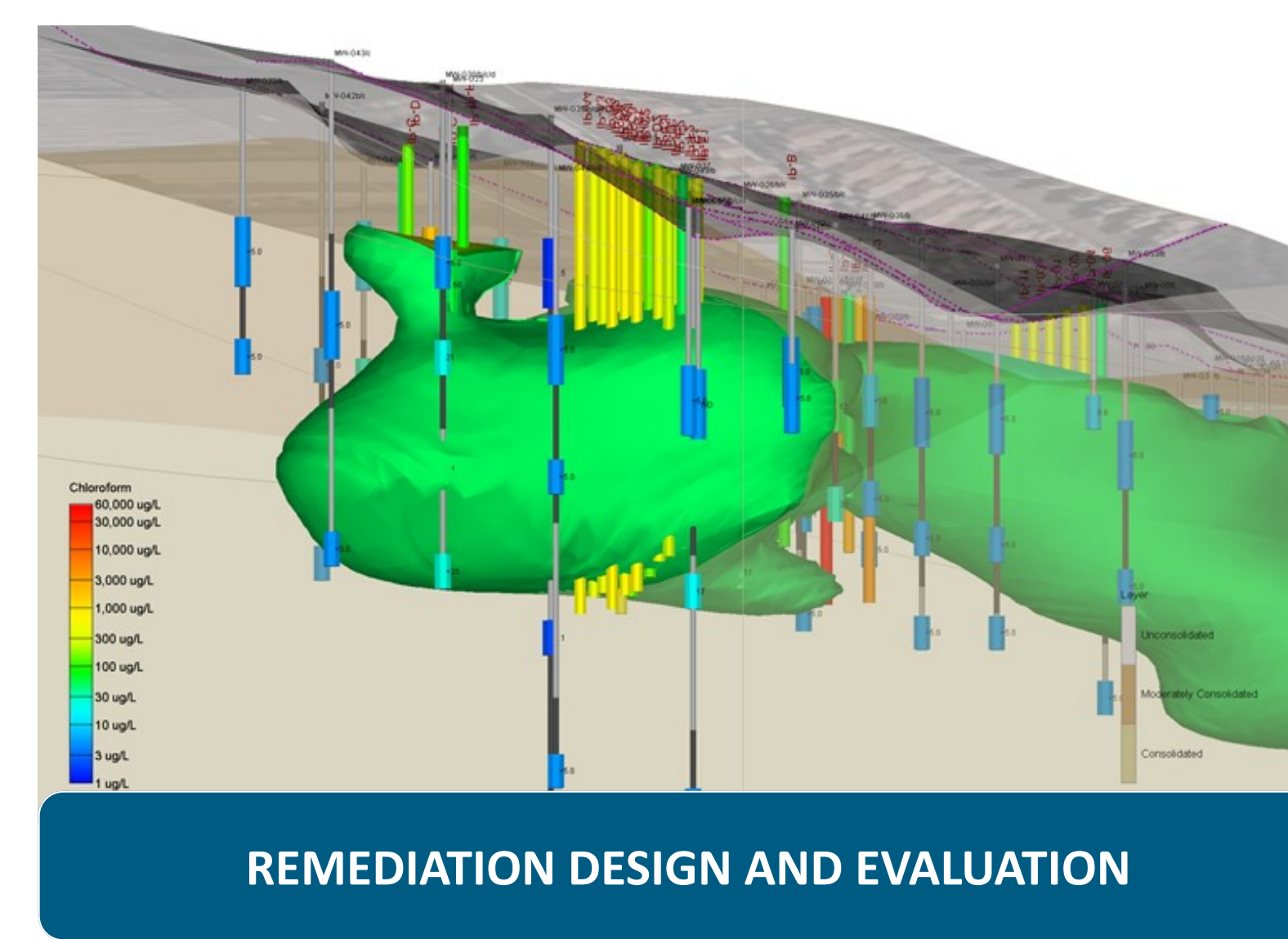
- Assists technical team present information to non-technical stakeholders.
- Global cultural barriers minimized by technology—data visualization.
- Facilitates collaborative discussions with regulators.
- Helps ownership team gain a better understanding of environmental drivers and risks.

A Tool to Reduce Lifecycle Costs (\$\$):

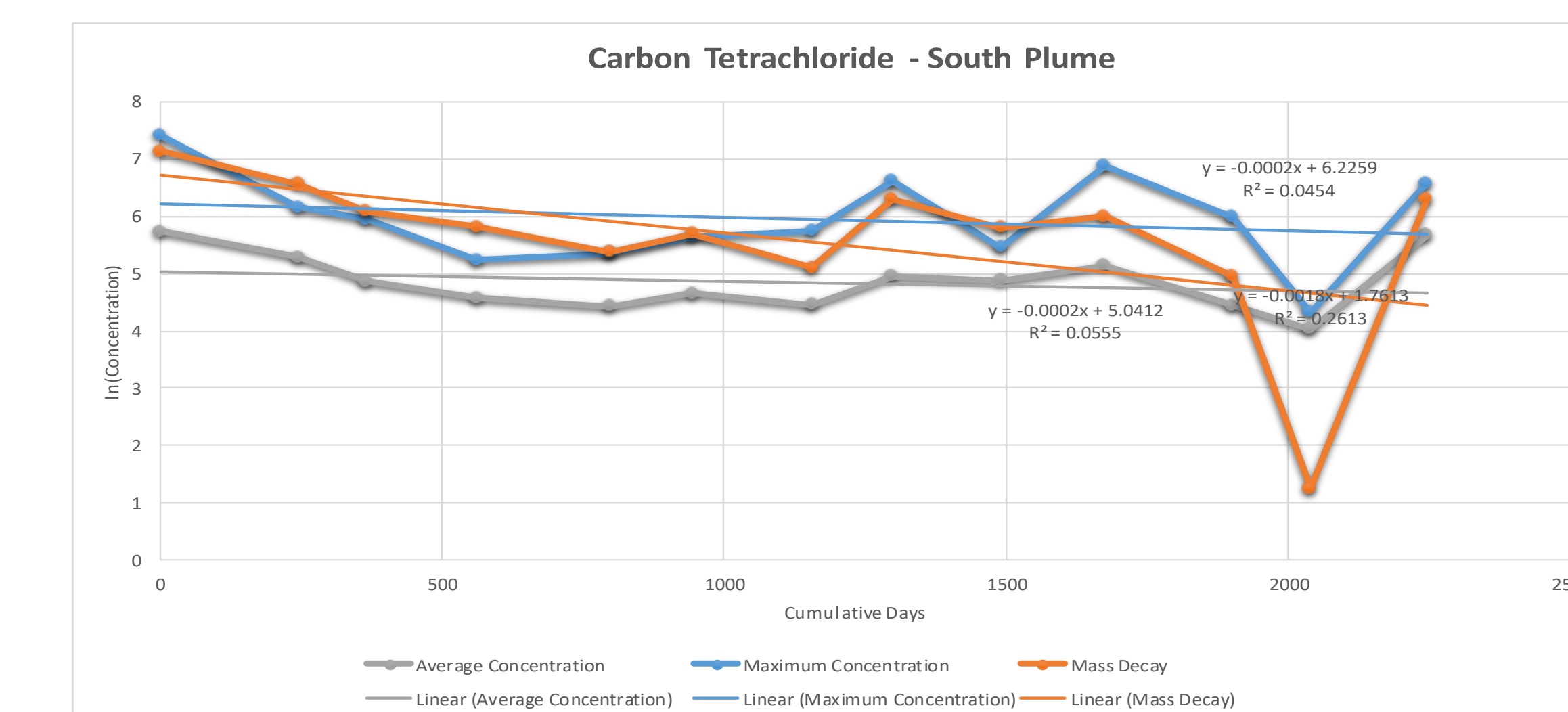
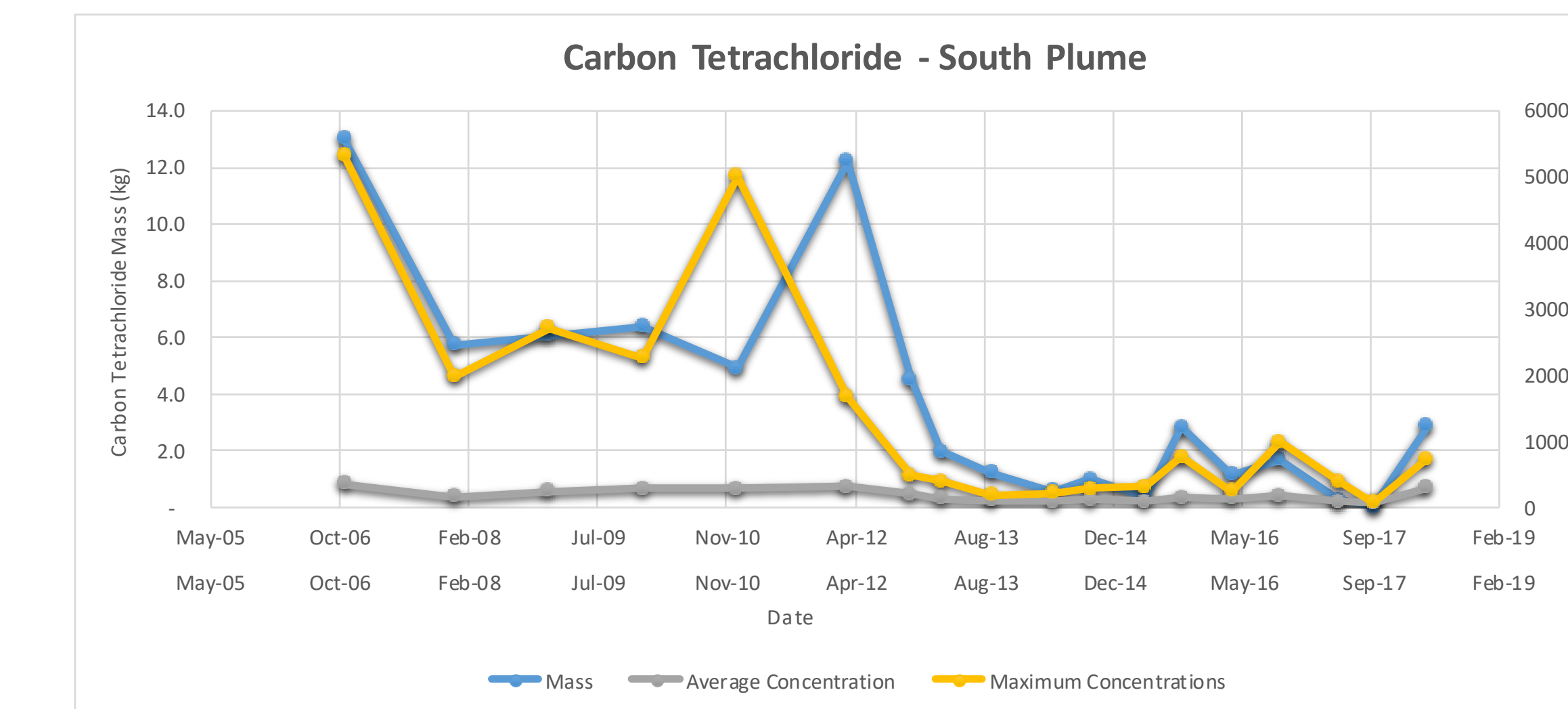
- Validation of strategies & investments for stakeholder influence.
- Enhanced corporate reserve cost modeling.
- Can assist with risk-based assessments and evaluate remedial design based prioritized to sensitive receptors.



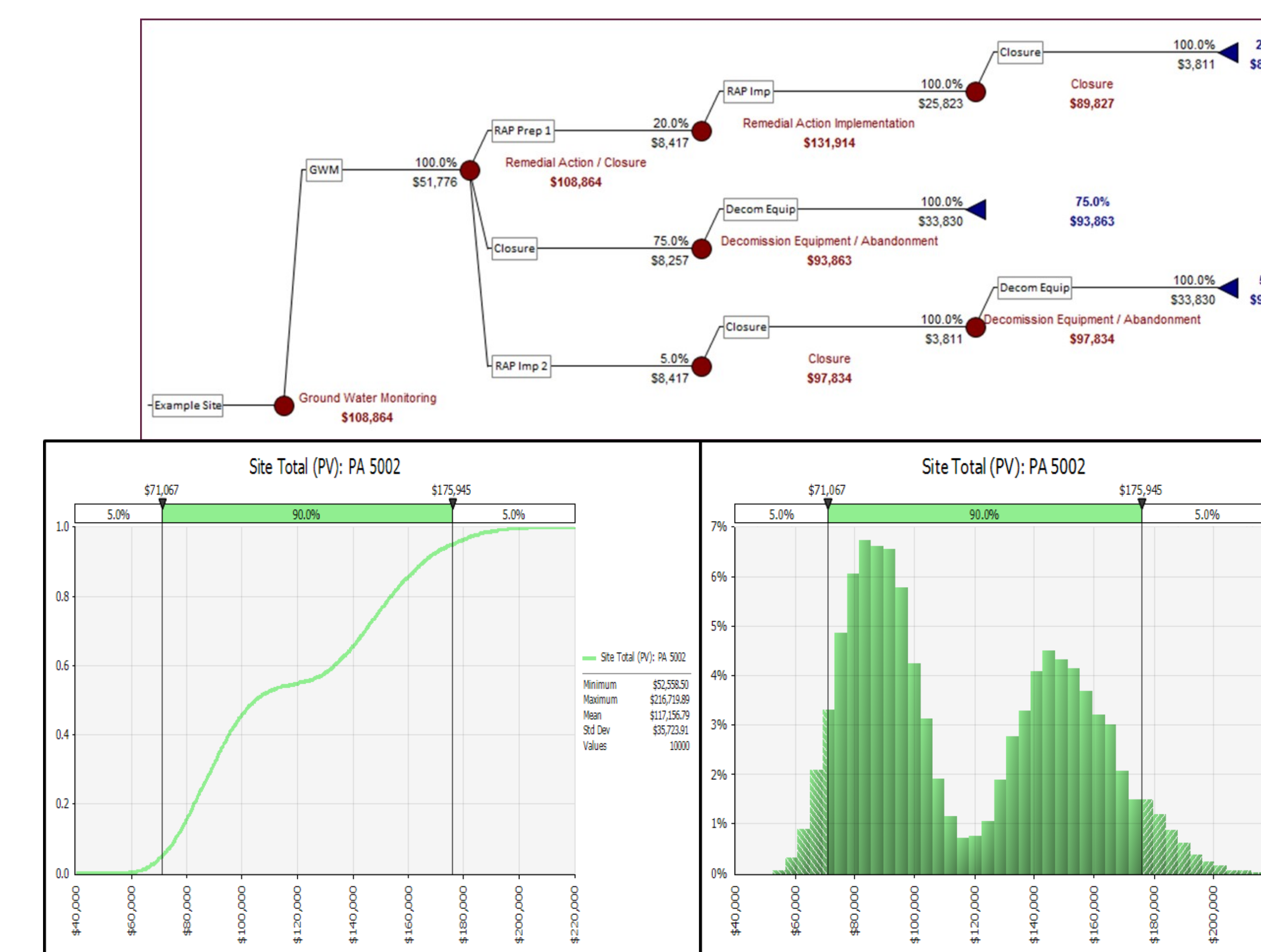
HRSC MIHPT DATA ANALYSIS



REMEDATION DESIGN AND EVALUATION



TIME SERIES AND DECAY ANALYSIS—
MASS, CONCENTRATION (AVERAGE & MAXIMUM)



CORPORATE RESERVE COST MODELING BASED ON 3D CSM

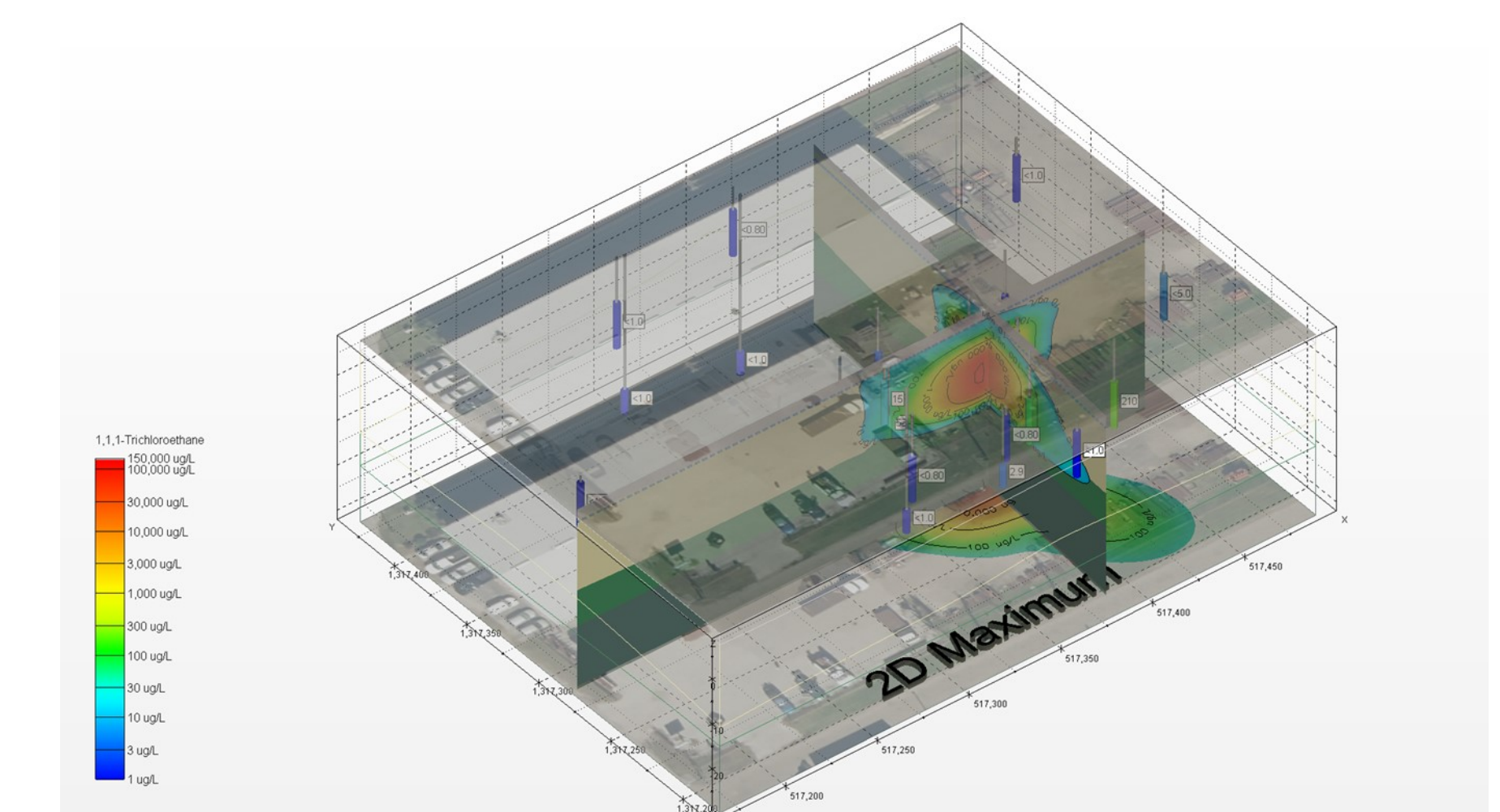


DATA VISUALIZATION IS THE CENTRAL COMMUNICATION AND TECHNICAL ANALYSIS TOOL

4 CASE STUDIES

CASE STUDY 1: 1.6-acre Former Manufacturing Facility—Tampa, FL

- 1992 – Original release date.
- Remediation strategies:
 - \$1.0 MM lifecycle cost-to-date.
 - IRM GW pump & treat.
 - Injection of ZVI/EVO.
- GW monitoring was \$50k @ 30-year lifecycle.
- 2015 Project Transition:
 - Implemented 3DVA, data management and CSM development.
 - HRSC MIP program was scoped but was deferred after 3DVA was completed.
 - 2017 obtained FDEP Closure NFA.
 - \$100K 2-year lifecycle.



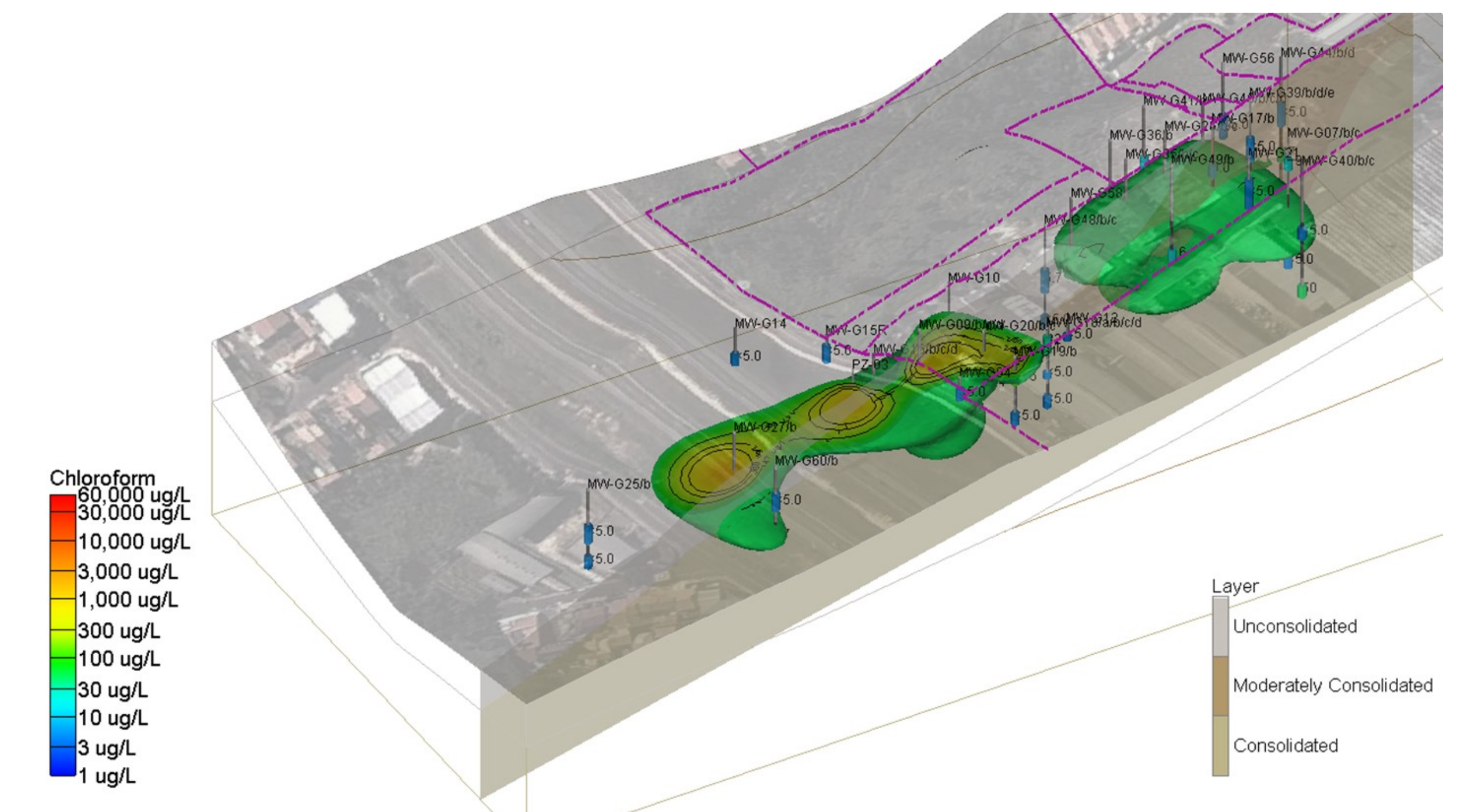
Click the QR Code or the Weblink to View 3D Data Visualization



<https://www.youtube.com/watch?v=all4LT25z2w&feature=youtu.be>

CASE STUDY 2: 12-acre Former Manufacturing Facility—Sorocaba, Brazil

- 2003—Original release date.
- Remediation strategy—Biostimulation system.
- GW monitoring \$200k annual @ 30-year lifecycle.
- \$2.0 MM lifecycle cost through 2011.
- Project transition 2011:
 - Implemented 3D Data Visualization and CSM Development.
 - \$50k – 3DVA/data management.
 - \$60k annual GW monitoring.
- 2 new source areas identified:
 - Hot melt sump.
 - Wastewater treatment plant (WWTP).
- Targeted remediation strategies implemented (2012 & 2014):
 - Chemical soil mixing.
 - Source area excavation.
 - Hot melt sump.
 - WWTP—demolition.
 - Permeable reactive barrier design & installation.
- 2017 site reached regulatory commercial closure levels.
- \$800k spent 2011-2017.



Click the QR Code or the Weblink to View 3D Data Visualization



<https://www.youtube.com/watch?v=QTaBqleNPPY&feature=youtu.be>