LithoStratigraphic & GMS Modeling Projects

(USACOE Groundwater Modeling System)

Bruce Phillips - Portage Environmental
Steve Hampson – UK KRCEE
Dr. Chandramouli Viswanathan – UK Civil Engineering
Josh Sexton – UK-Geological Sciences
Dr. John Volpe - KRCEE

LithoStratigraphic & GMS Modeling Projects

Objectives

- Identify and Test Modeling Programs for PGDP Data & Lithostratigraphic Visualization (Sexton,2006)
  - Golden Software Rockware & Surfer
  - ARCGIS/ARCMAP
- Evaluate USACOE Groundwater Modeling System (GMS) for use of Groundwater Modeling and Lithologic Database at PGDP
  - Grids, Tins, Solids, Contouring and Cross-Section Modeling
  - Presentation
- Evaluate Other Visualization and Modeling Programs for interoperability with DWGIS
  - Grids, Tins, Solids, Contouring and Cross-Section Modeling
  - Presentation

LithoStratigraphic & GMS Modeling Projects

CTECH EVS

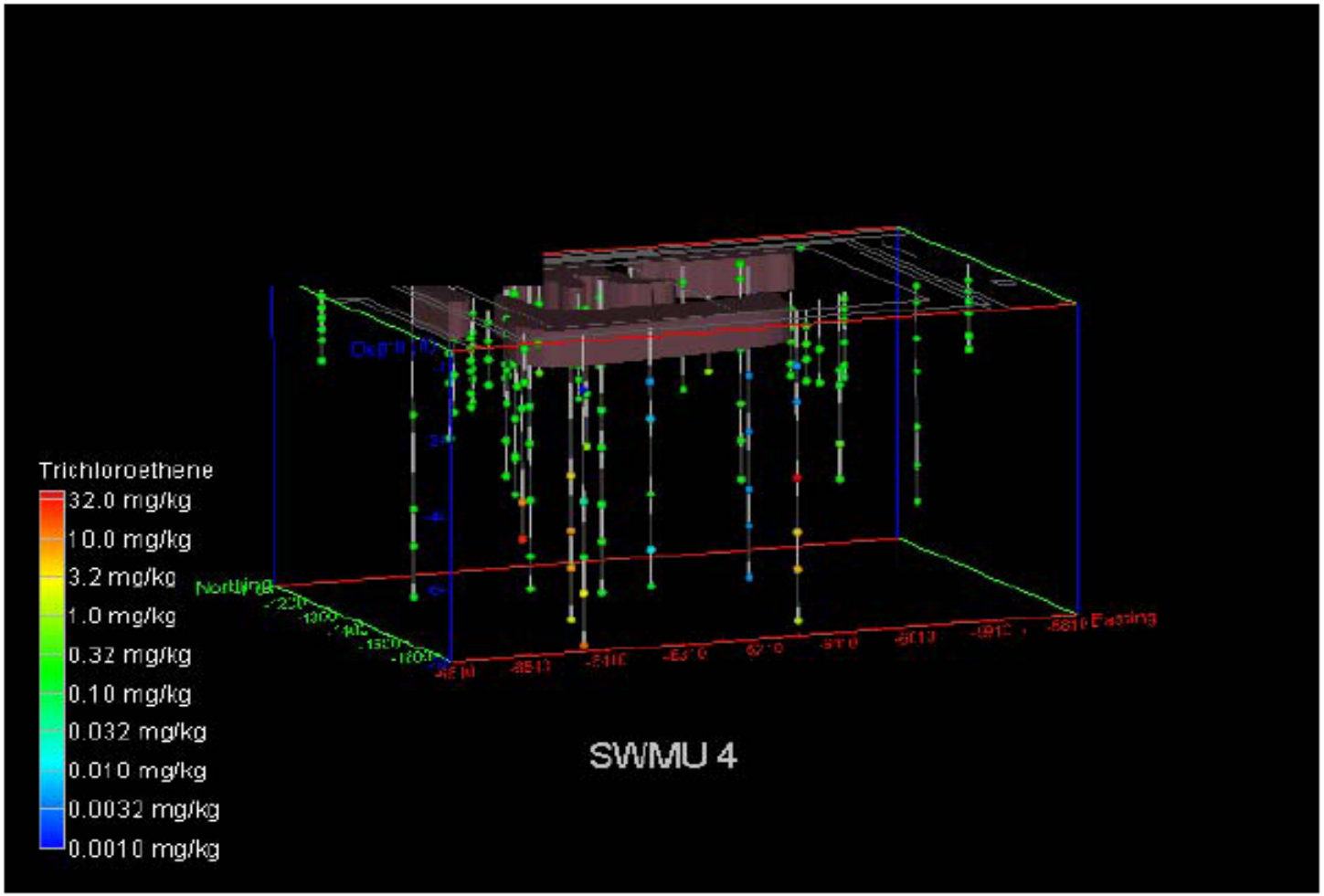
CTECH Development Corporation

CDM

Tracy Brindley/Kevil, Kentucky

Adam Locke/State College, Pennsylvania

LithoStratigraphic & GMS Modeling Projects
SWMU 4
Trichloroethylene Soil Sampling Results



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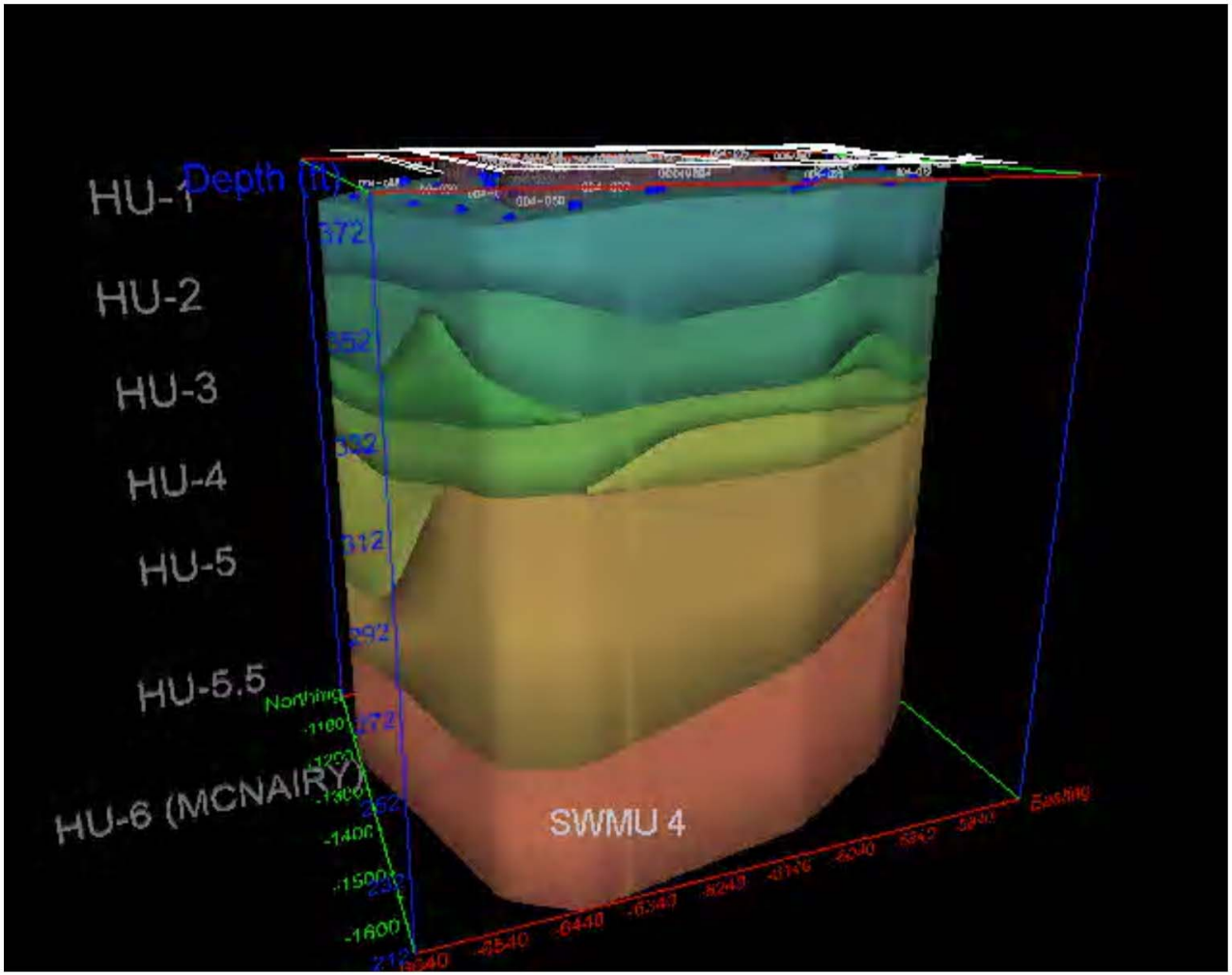
SWMU 4

Lithology Distribution



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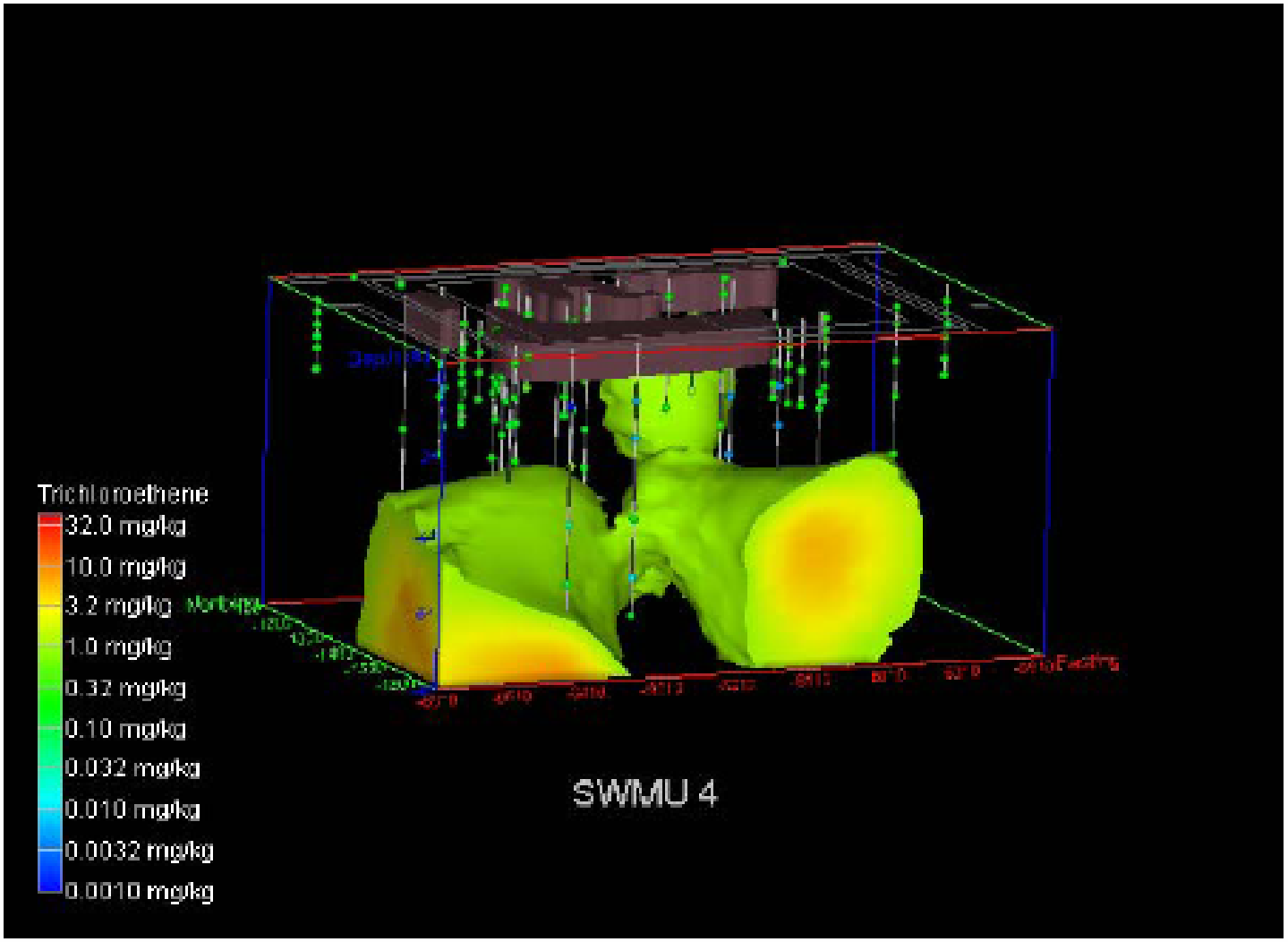
SWMU 4

Trichloroethylene Soil Sampling Results - Solids



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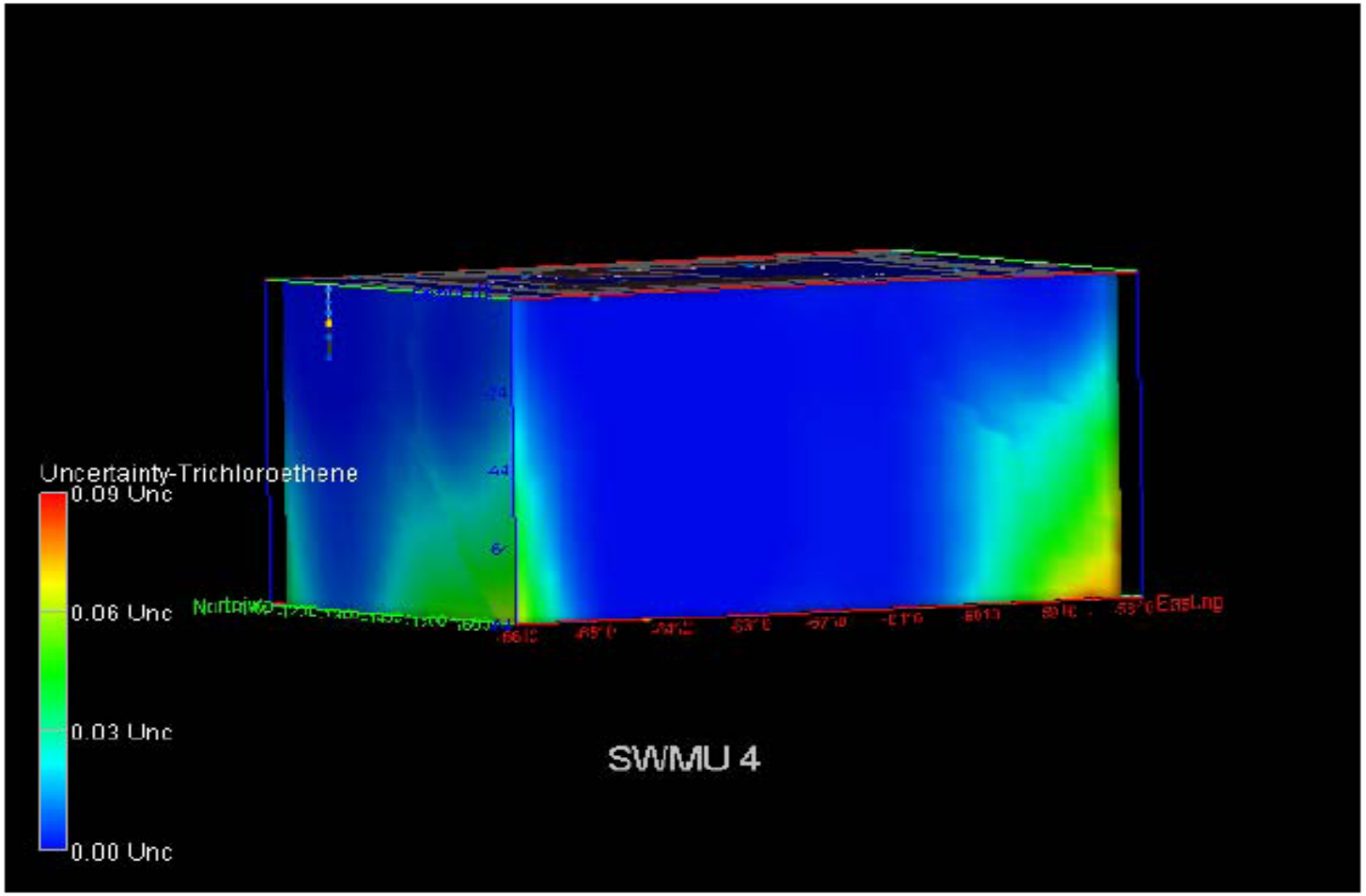
SWMU 4

Trichloroethylene Soil Sampling Results – Uncertainty Plot



Surfer 7.0
Golden Software

Josh Sexton/UK-Geological Science, 2005
Steve Hampson/UK-KRCEE, 2006-7

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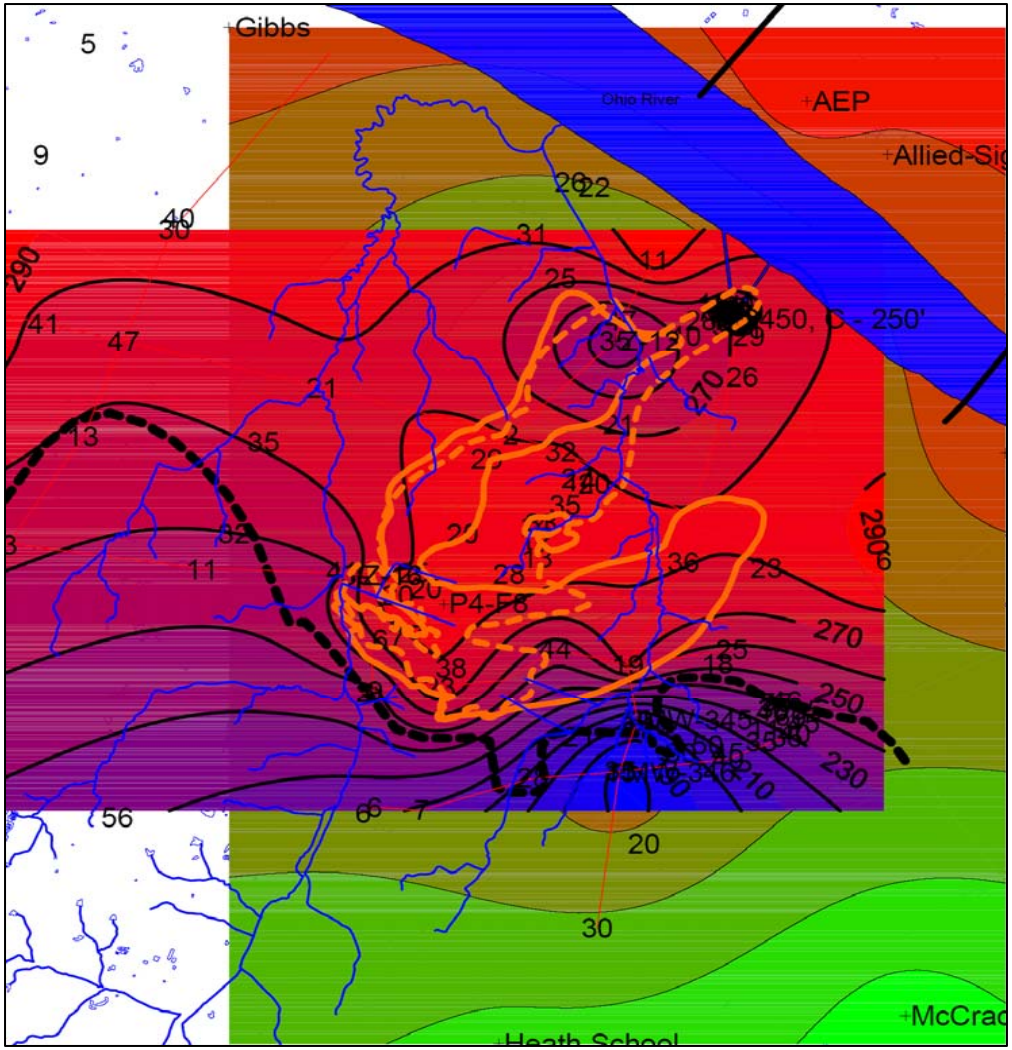
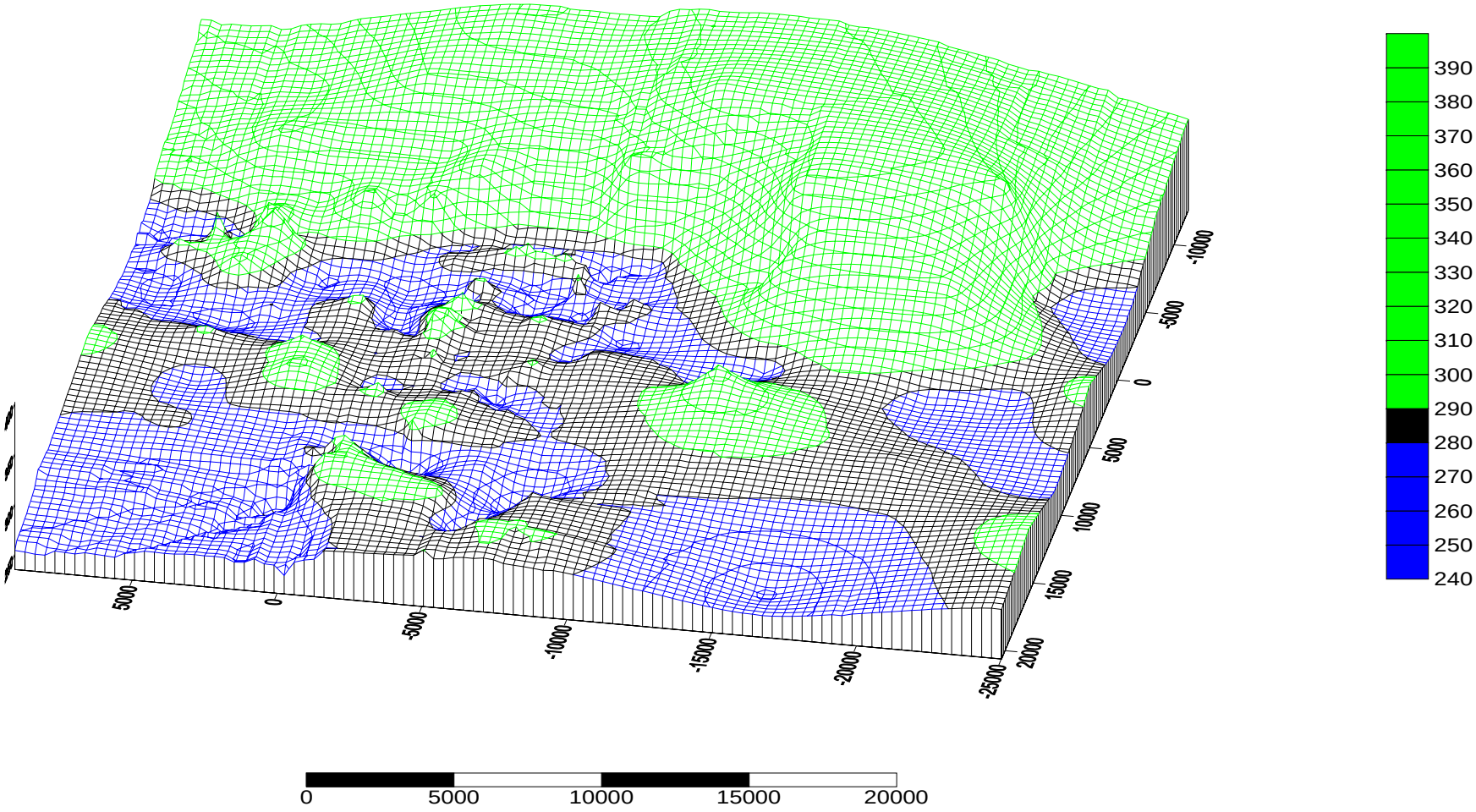
Surfer Generated Contour Plots (Red-Blue Figure = Base LCD)



LithoStratigraphic & GMS Modeling Projects

Surfer Wireframe (5 mins from xls file)



KRCEE

SADA

Dr. John Volpe, KRCEE
Dr. Rich Bonczek (SAIC)

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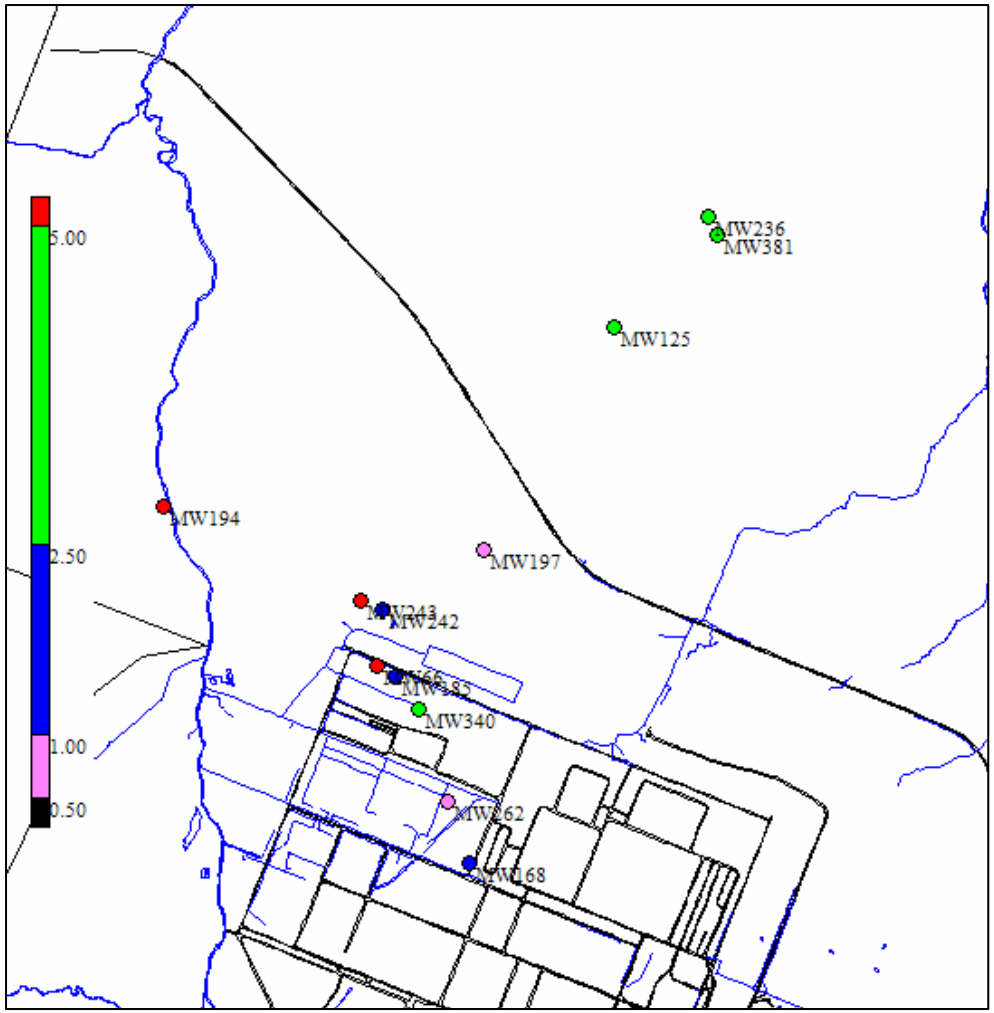
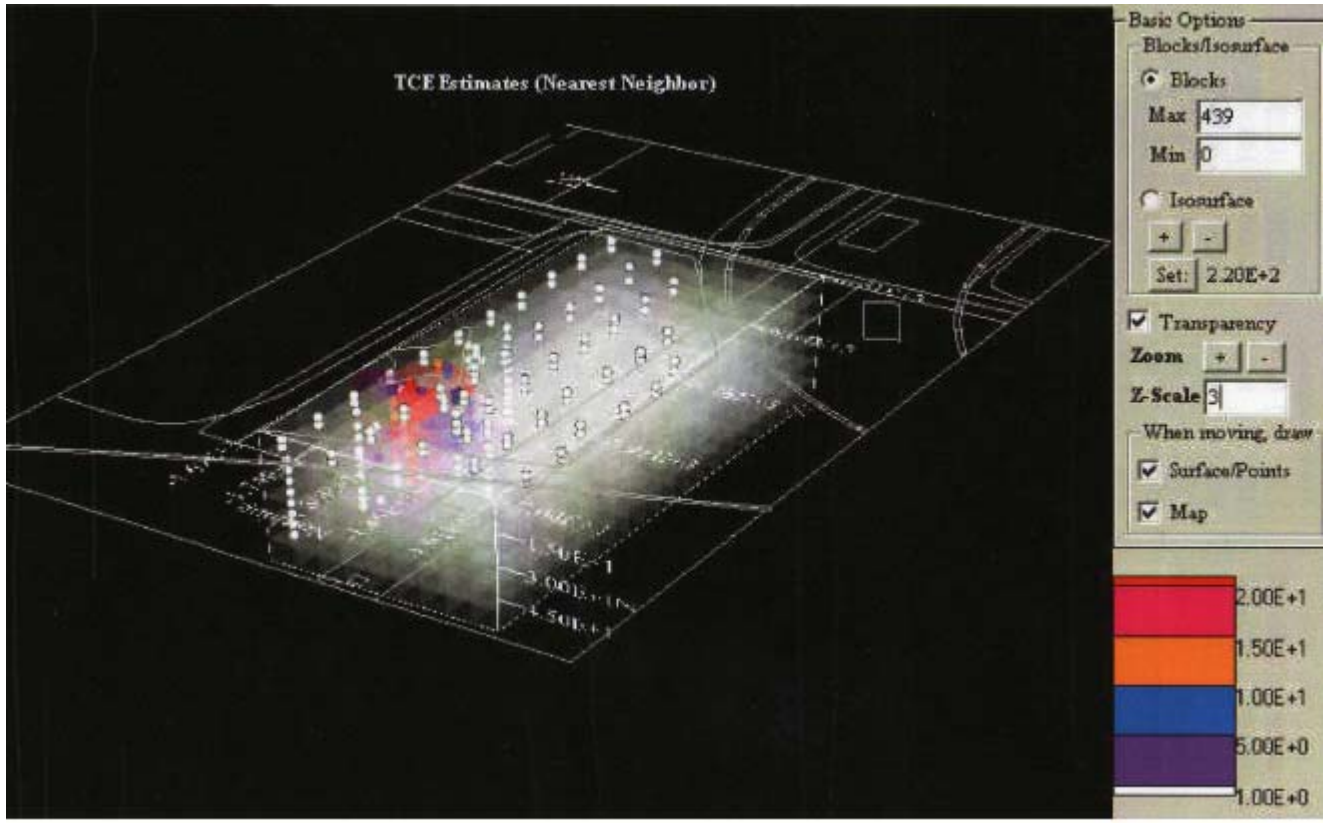


LithoStratigraphic & GMS Modeling Projects



GMS 6.0

Brigham Young University

PGDP Preview Work by USACOE Waterways Station

Recent PGDP Work

Bruce Phillips, Portage
Steve Hampson, KRCEE
Dr. Chandramouli Viswanathan

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Surfer Wireframe (5 mins from xls file)

Stratigraphic Boreholes		
Unit	**Note**	**# Borings**
Base of Upper Continental Deposits	**(Top LCD)**	**567**
Base of Lower Continental Deposits	**(Top McNairy Fmn.)**	**440**
Top of McNairy Levings Member		**22**
Bottom of McNairy Levings Member		**10**
Bottom of McNairy Formation	**(Top Rubble Zone)**	**10**
Bottom of Rubble Zone	**(Top Miss. Limestone)**	**8**

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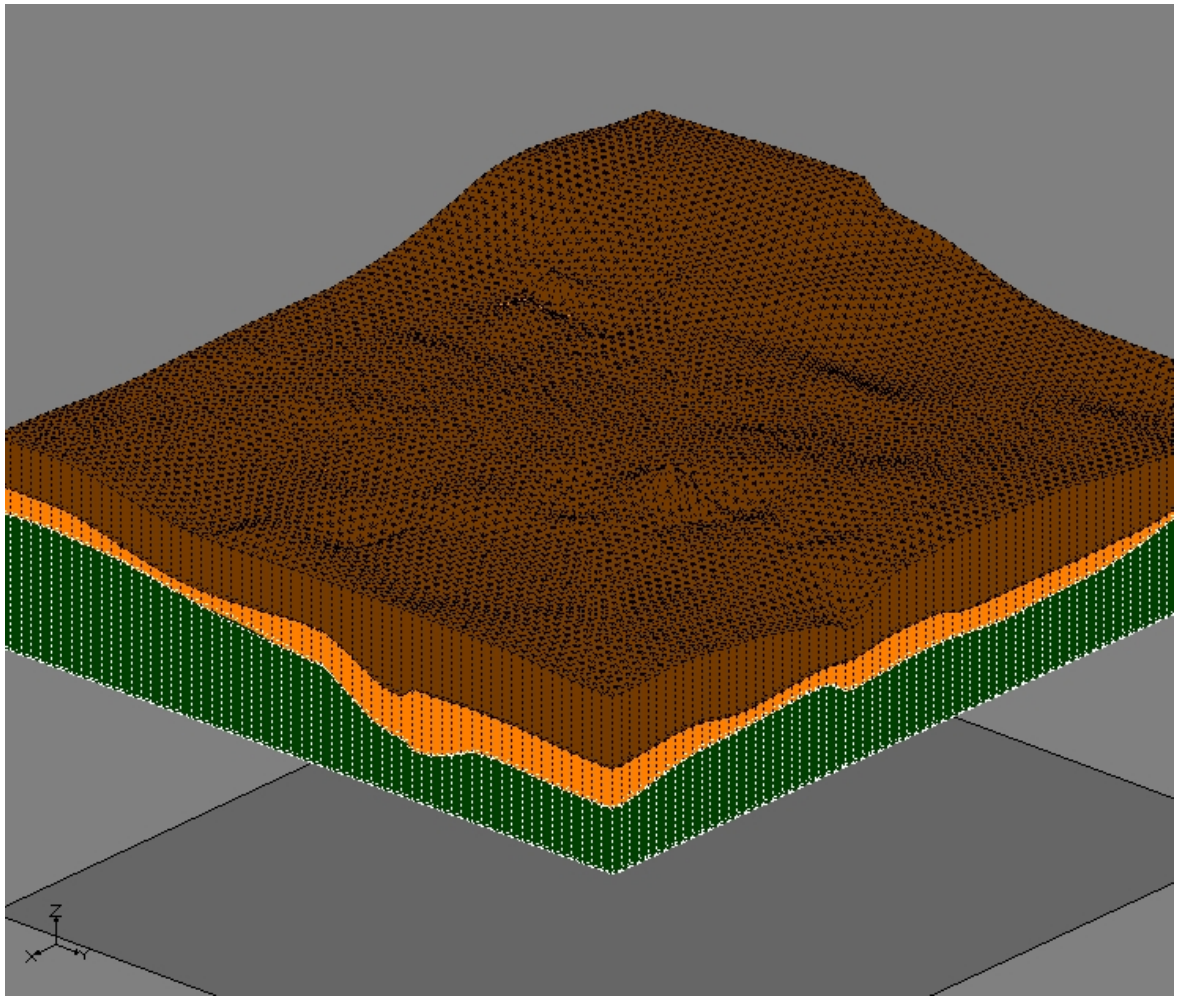
Solids Model for McNairy, LCD, UCD



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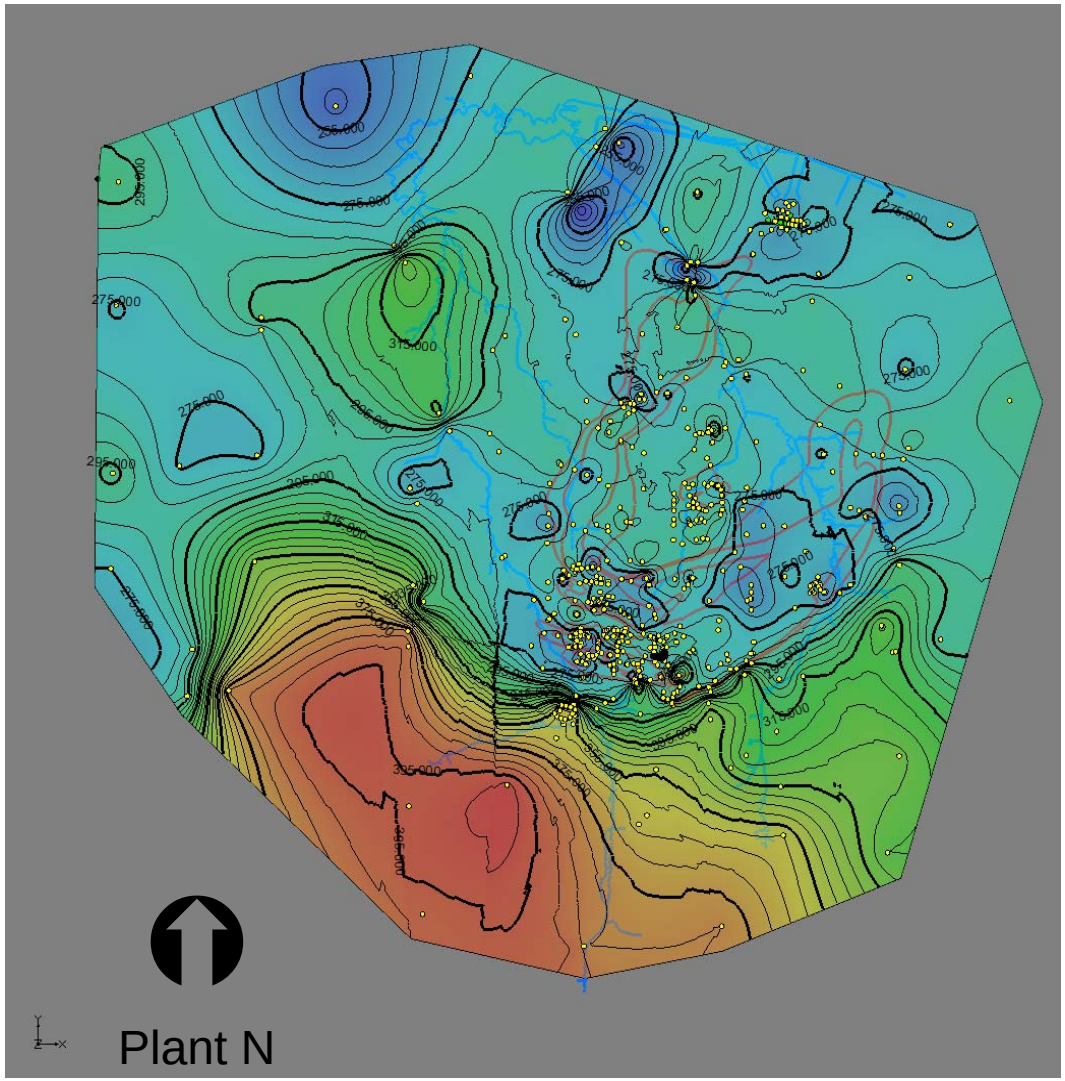
Base of LCD 3-D Contour Plan View

Dark Blue = Low Elevation, Red – Highest



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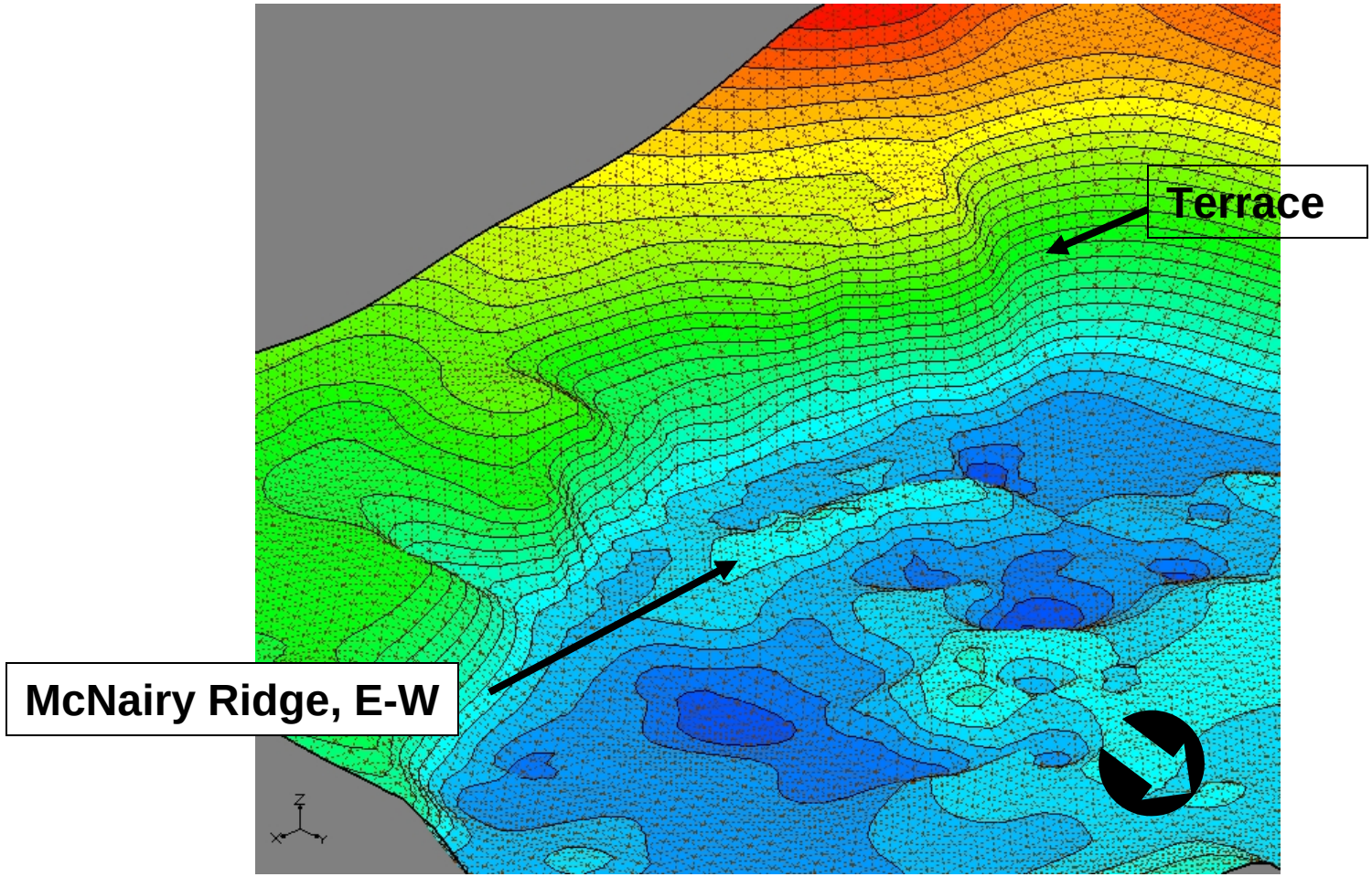
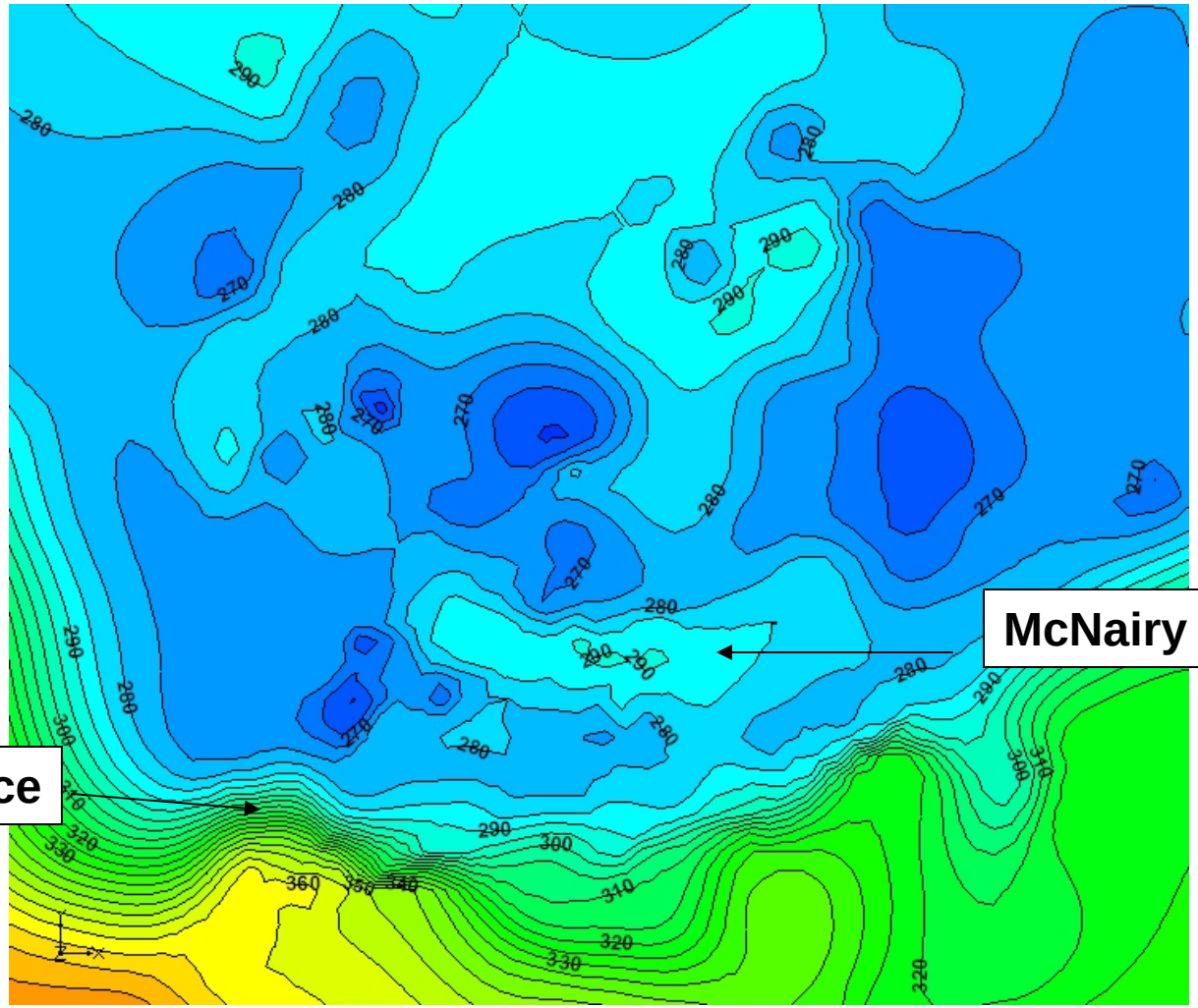
(Terrace & McNairy Ridge Under PGDP from ENE; VE=20x)



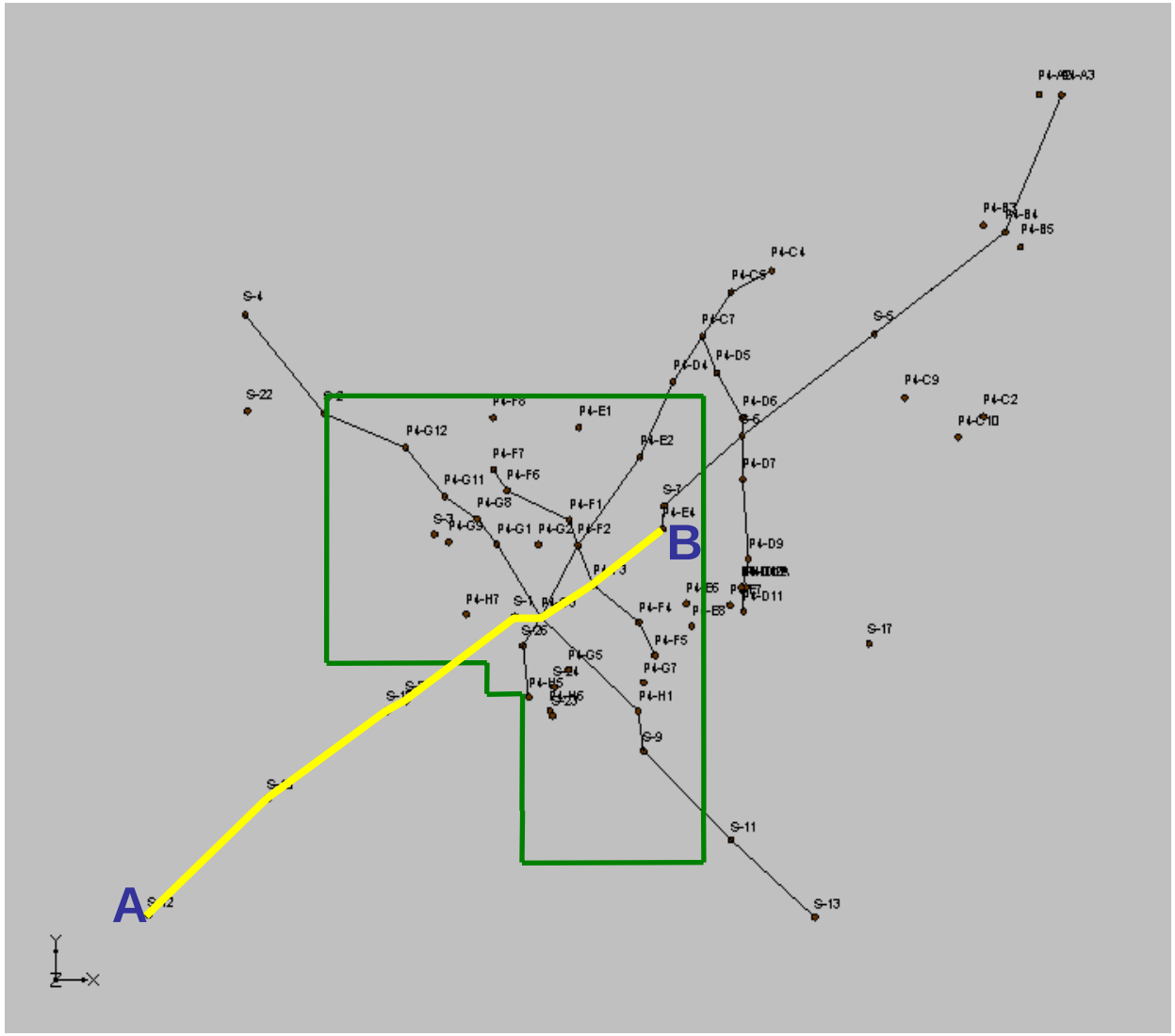
LithoStratigraphic & GMS Modeling Projects

Top of McNairy/Porters Creek Clay

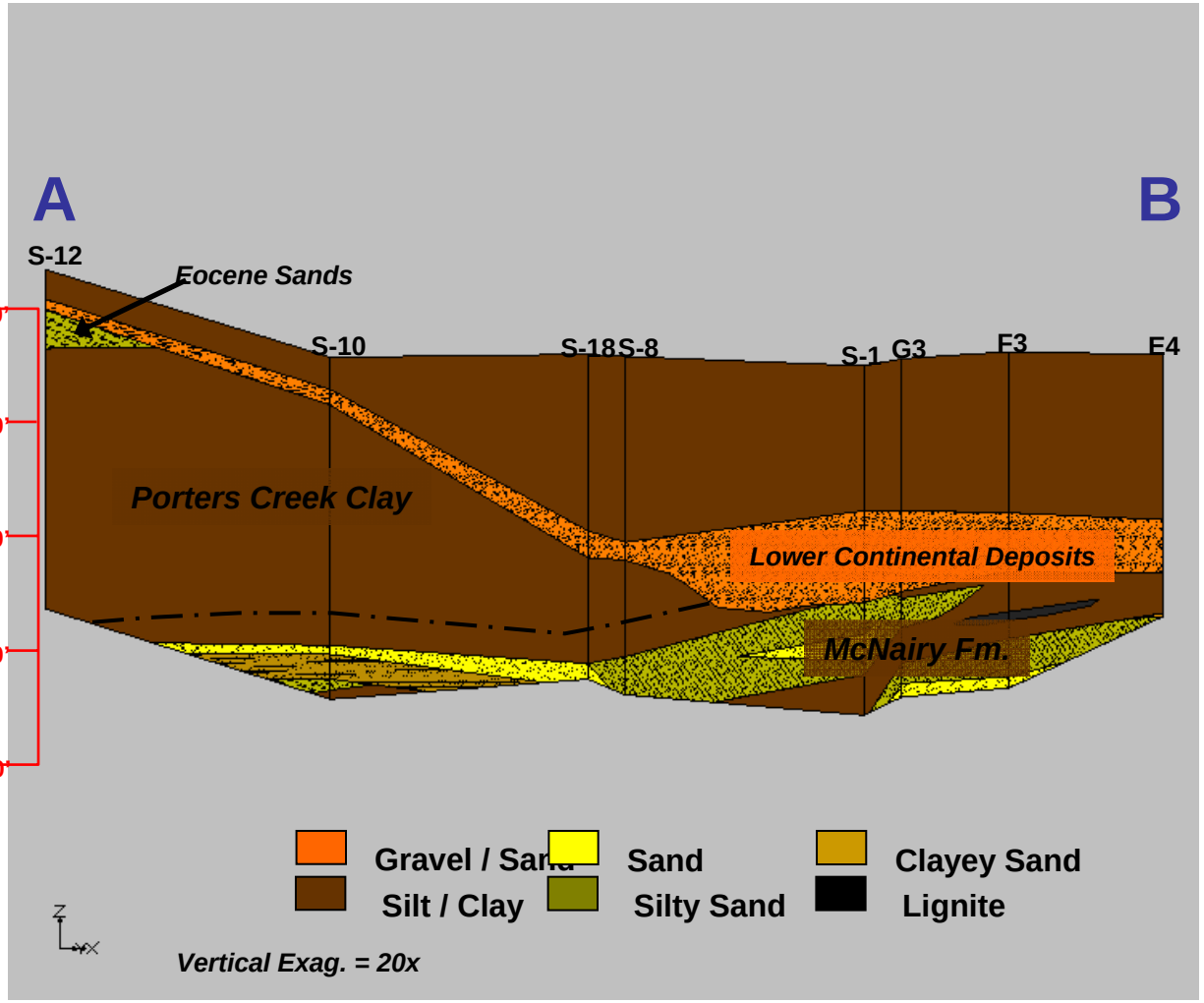
Dark Blue = Low Elevation, Red – Highest



LithoStratigraphic & GMS Modeling Projects
Plant Cross-section A-B

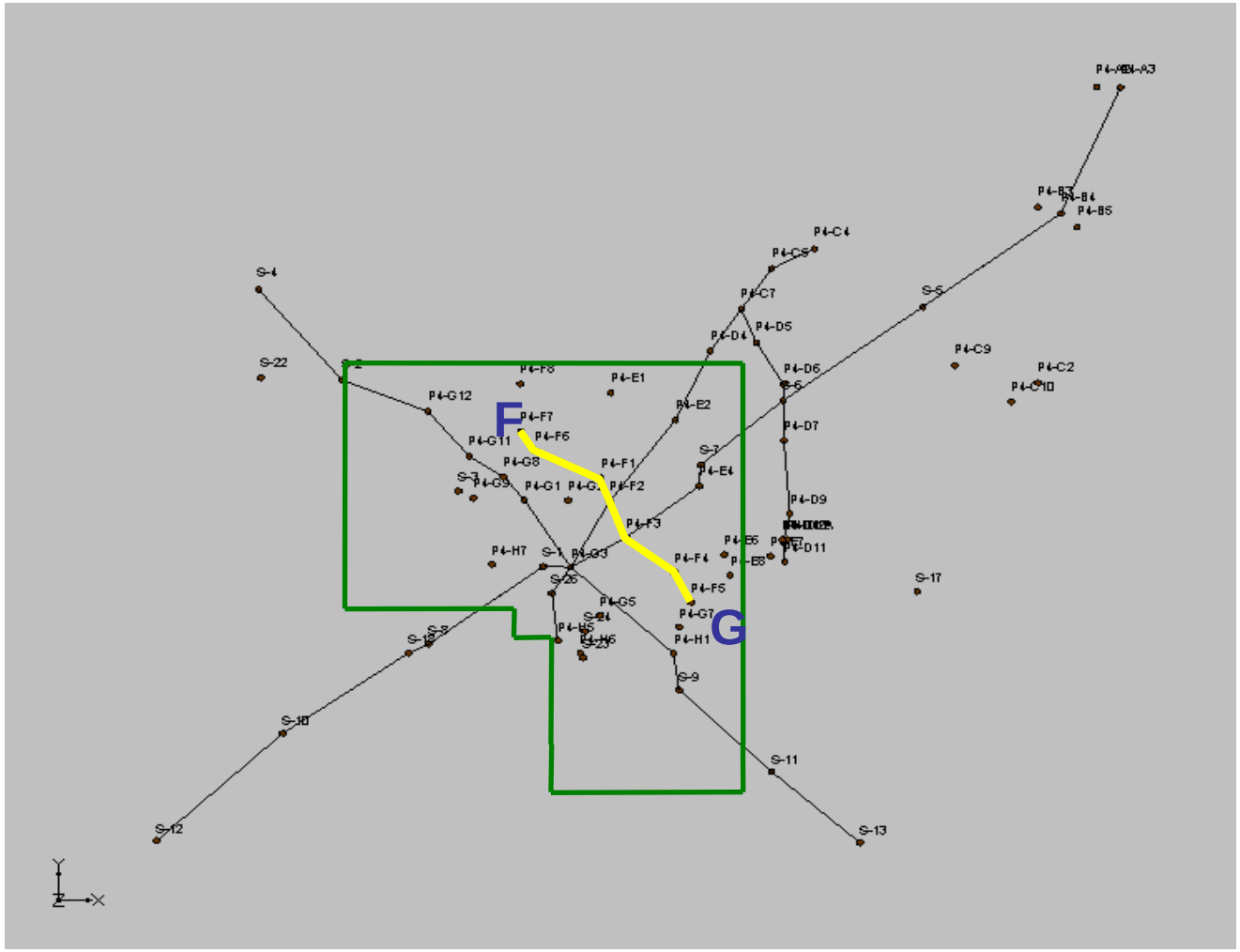


LithoStratigraphic & GMS Modeling Projects
Plant Cross-section A-B



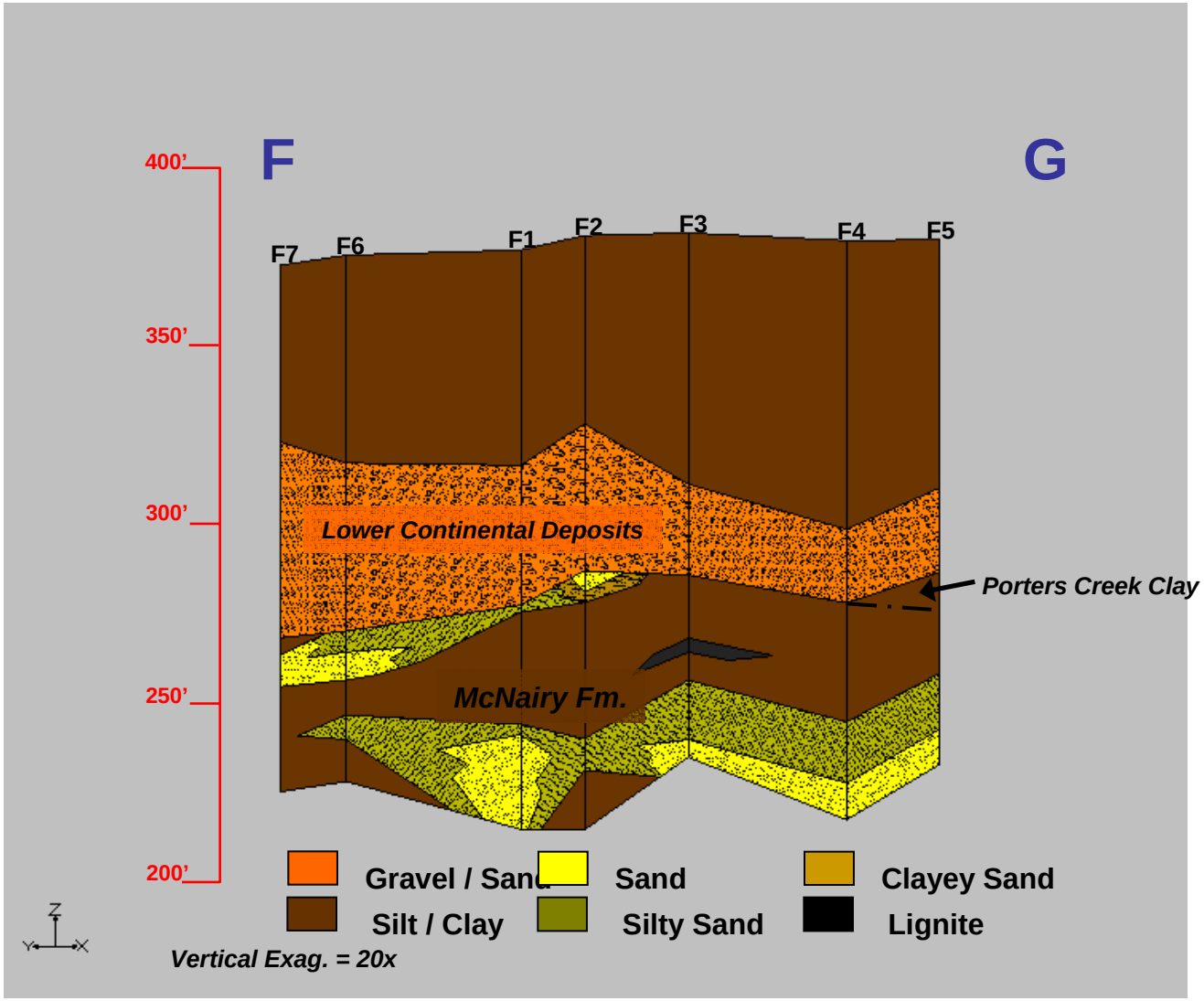
LithoStratigraphic & GMS Modeling Projects

Cross Section F - G



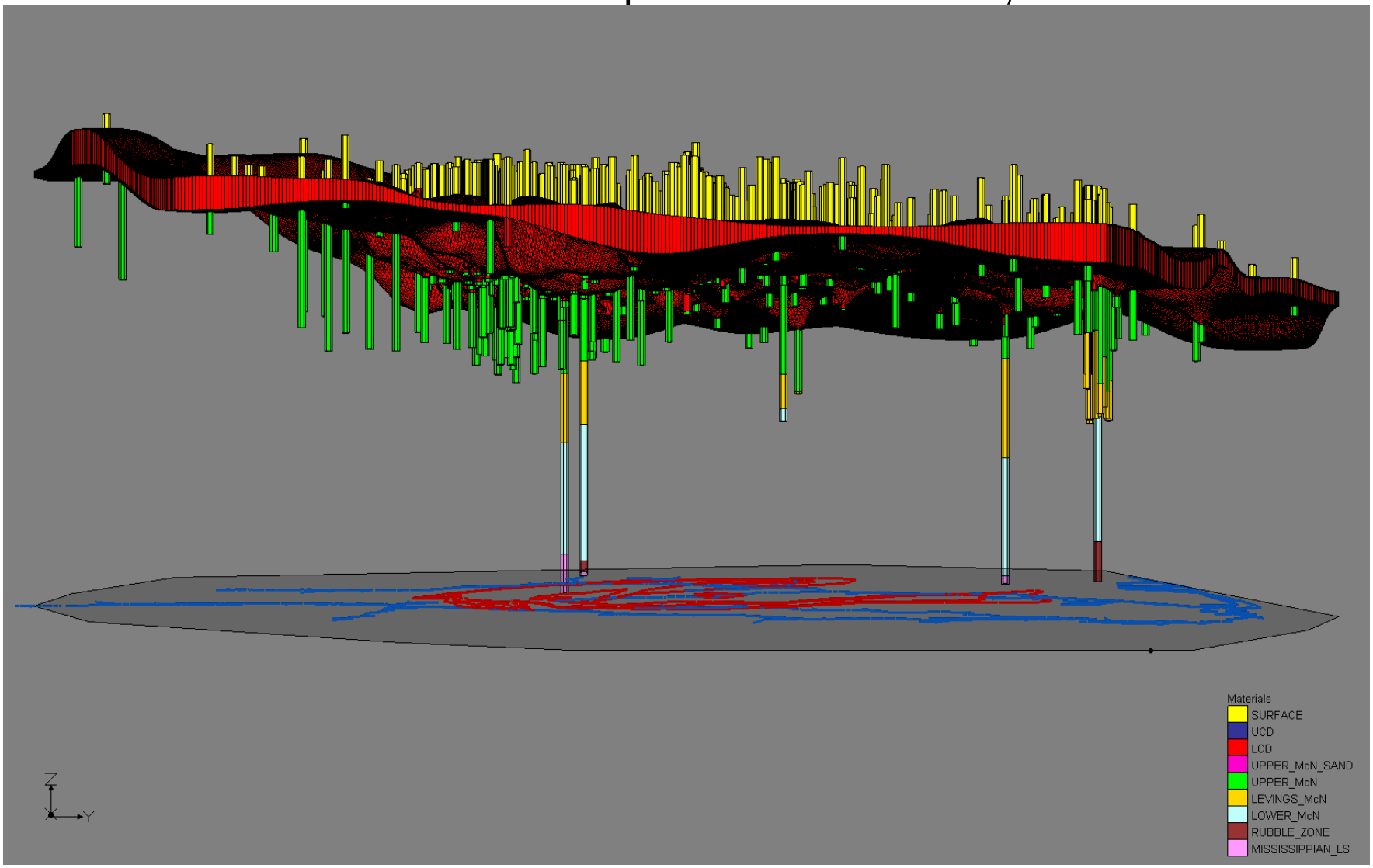
LithoStratigraphic & GMS Modeling Projects

Cross Section F - G

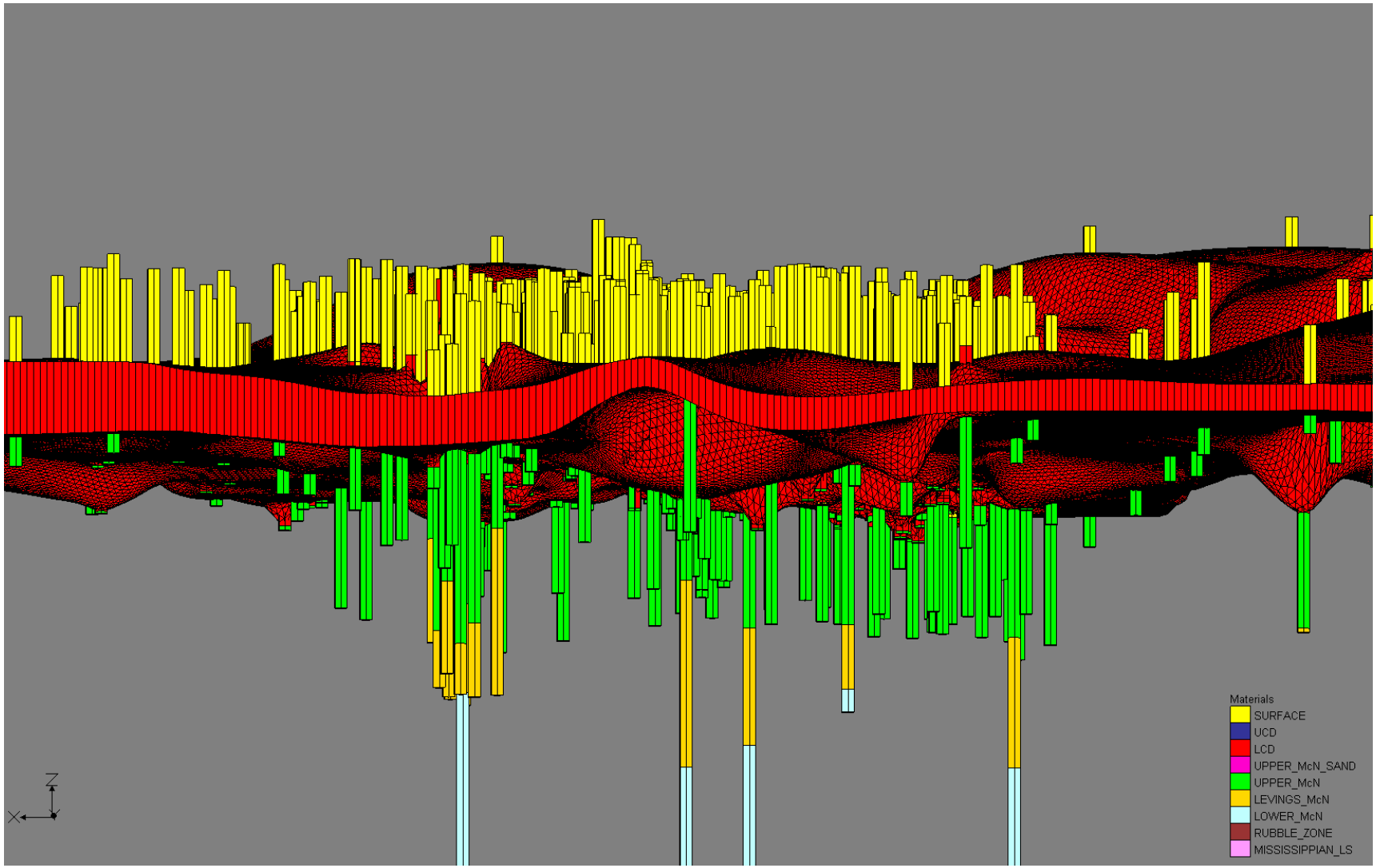


LithoStratigraphic & GMS Modeling Projects

Lower Continental Deposit Solid from East, VE=30x



LithoStratigraphic & GMS Modeling Projects
LCD solid from North, VE=30x



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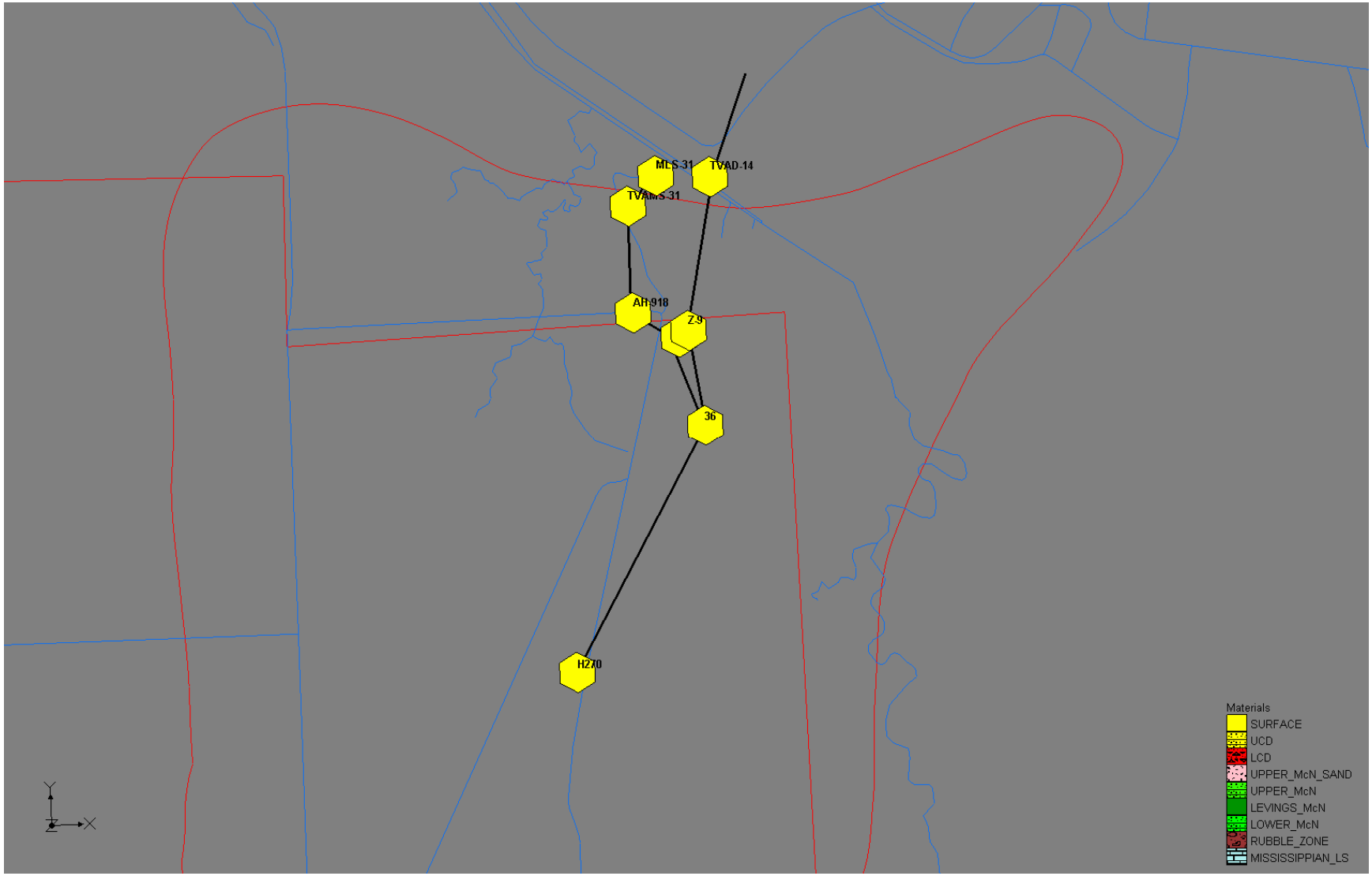
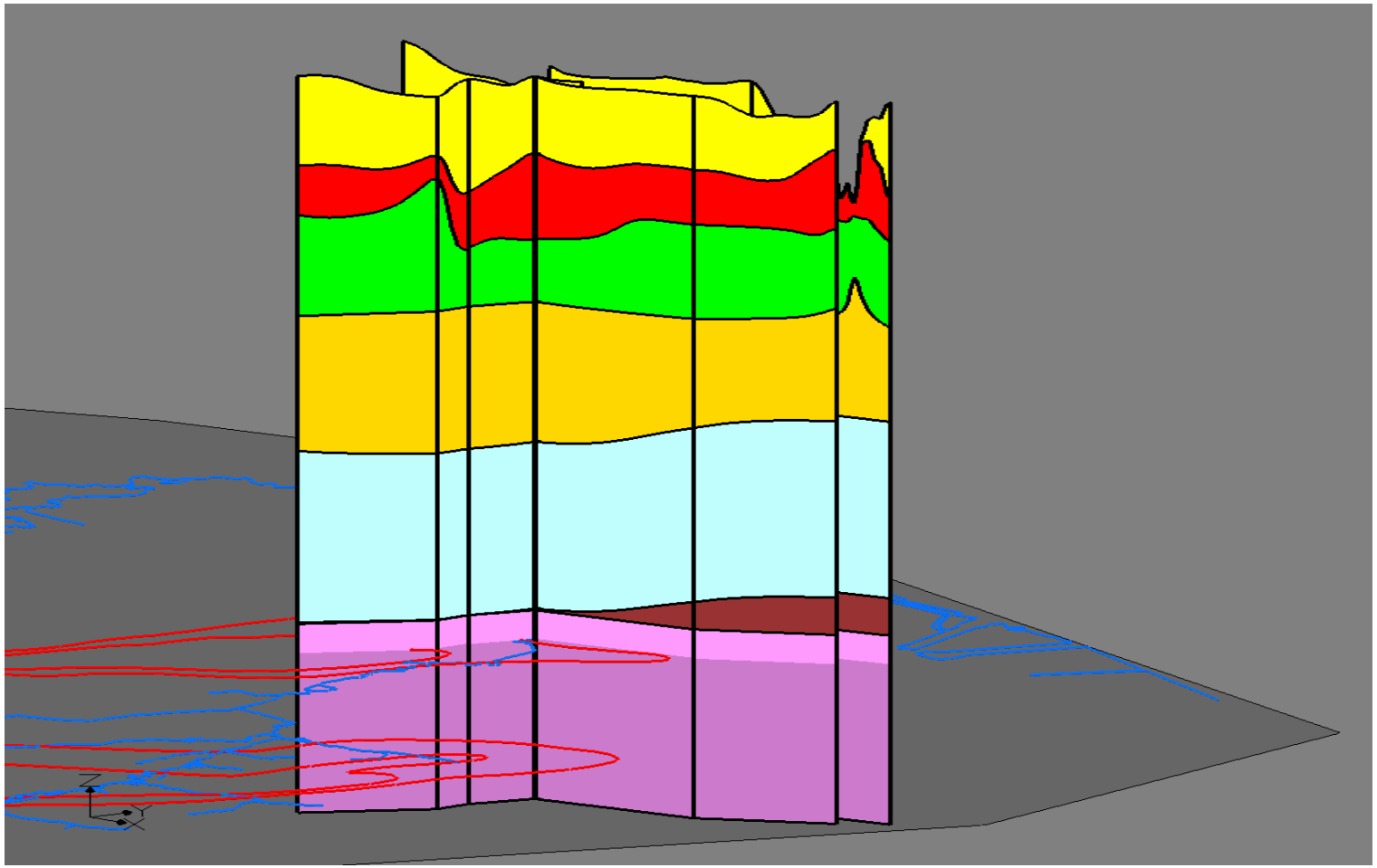
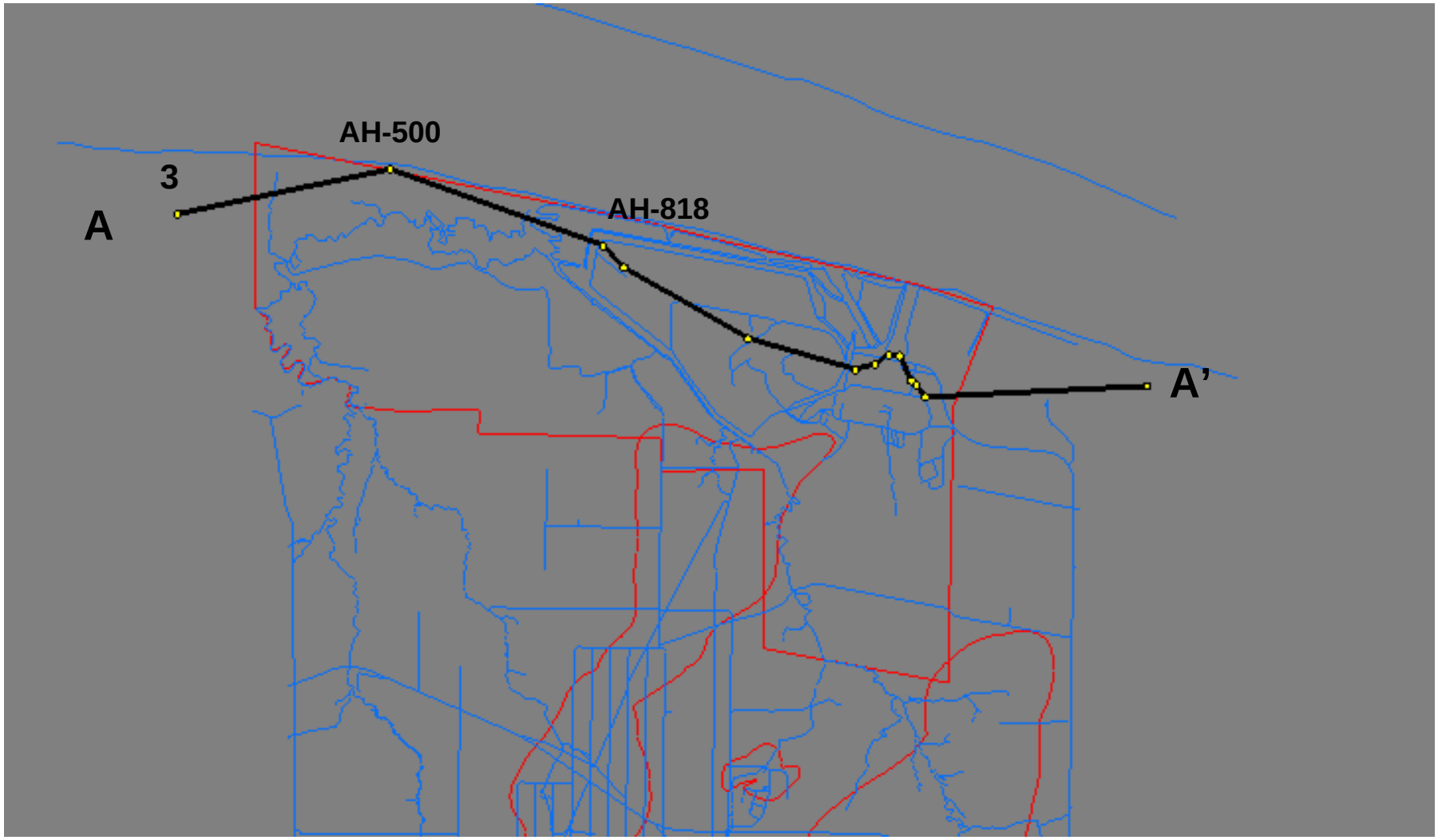
LithoStratigraphic & GMS Modeling Projects



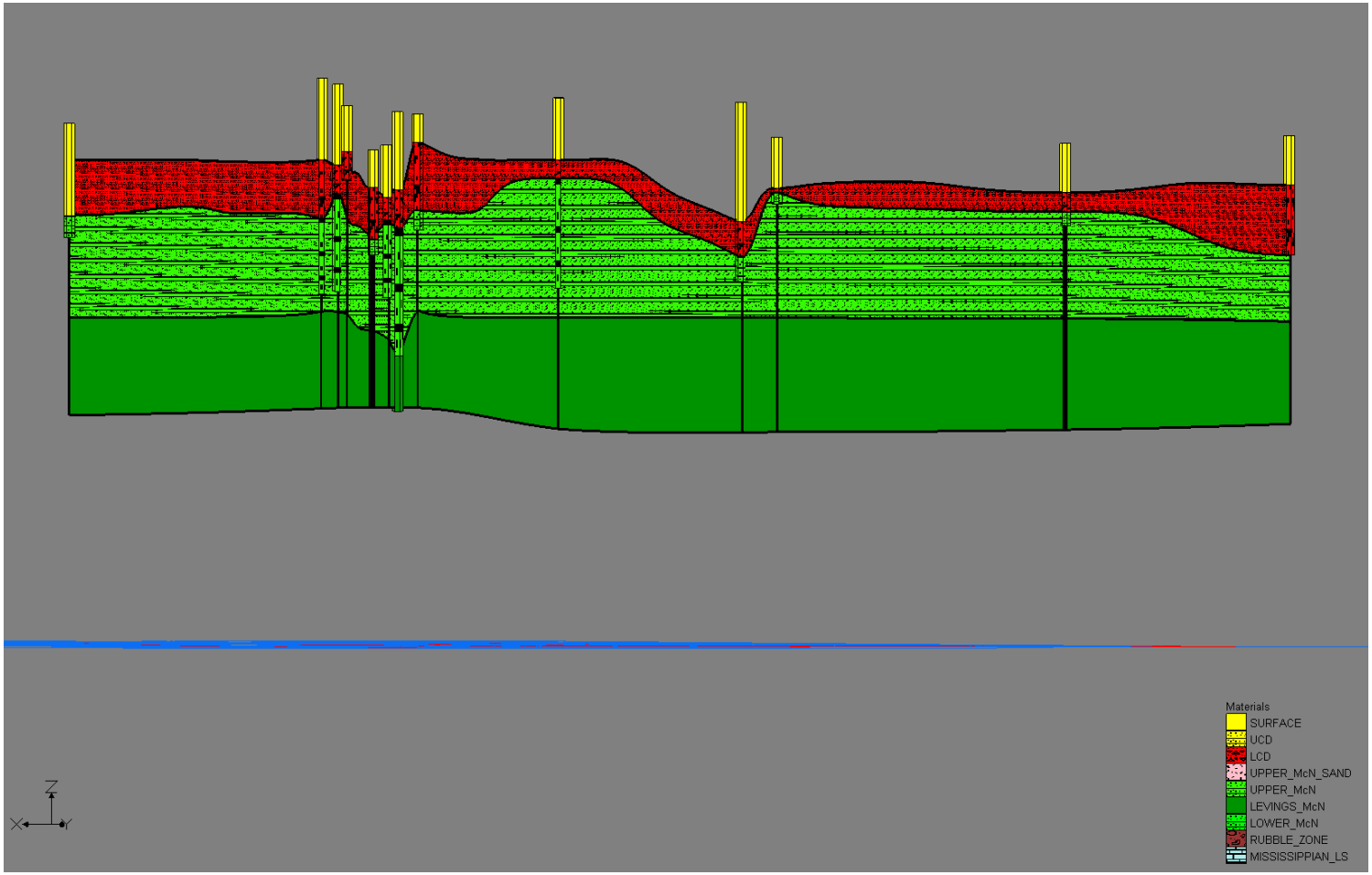
LithoStratigraphic & GMS Modeling Projects



LithoStratigraphic & GMS Modeling Projects



LithoStratigraphic & GMS Modeling Projects



KRCEE

LithoStratigraphic & GMS Modeling Projects

Existing Model	
Model Wide	Verify borehole stratigraphy/lithology
Model Wide	Verify available boreholes are in model
Model Wide	Determine Loess Horizons to include
Model Wide	Model faults at interpreted locations & Evaluate Results
Lithostratigraphic & Hydrogeologic Model	
HU2a	UCD/Loess Sand Horizons Focus on Red gravel sand/horizon apparent in many areas of site
HU2b	Silt, Clay Horizons with varying sand content.
HU3	Extrapolation Site-wide relative to HU designation
HU4	Extrapolation of Fine and Medium Sands of Lower Continental Deposits
HU5	Extrapolation of Coarse Grained Sands and Gravels near base of Lower Continental Deposits
HU6	Extrapolation of McNairy sands contiguous to Lower Continental Deposits
HU6	Extrapolation of first Silt/Clay Horizon in upper McNairy
HU6	Delineation of Porters Creek Clay

LithoStratigraphic & GMS Modeling Projects

General Summary

- Utilized Modeling Programs for PGDP Data & Lithostratigraphic Visualizations
- Data formats differ but could be automated via DWGIS
- All have significant strengths
  - Golden Software Surfer (Sexton, 2006)
  - ARCGIS/ARCMAP/ARCScene (KRCEE, UK)
  - SADA (KRCEE)
  - Golden Software Rockware (KRCEE, UK)
  - C-Tech ESV (CDM, Portage?)
  - GMS
  - Golden Software Voxler (3D)

LithoStratigraphic & GMS Modeling Projects
GMS Evaluation

- Evaluated USACOE Groundwater Modeling System (GMS) for use of Groundwater Modeling and Lithologic Database at PGDP through intense application
  - Tutorials
  - Setup USACOE files for viewing & evaluation of input data
  - PGDP Grids, Tins, Solids,
  - PGDP Contouring and Cross-Section creation
  - Groundwater Modeling (not accomplished per discussion with DOE and USACOE regarding model status)

LithoStratigraphic & GMS Modeling Projects

Strengths

- "one package fits all"
  - conceptual model development
  - Borehole management
  - Flow & transport models (finite element & finite difference)
  - Parameter estimation, particle tracking & other advanced tools
- Free to government and government contractors
- Data input formats compatible with automated DWGIS output

Maybe Not Strengths

- Output format compatibility with other modeling software (tins, solids, etc.)
- Intuitive tools & application of tools
- Intuitive training materials
- Ability to manipulate output graphics (label, scale, etc.)

1		**Real-Time Remediation**
	a	AOC 492 Field Demonstration
2		**Groundwater Modeling**
		Support for Numerical GW Model Development
3		**TCE Fate and Transport**
	a	TCE Fate and Transport White Paper (Aerobic - NWP)
	b	Scopinig TCE Fate and Transport & White Paper for Abiotic Mechanisms, Anaerobic Mechanisms for UCRS & Other Plumes
4		**Groundwater Remediation**
	a	Nano Particle TCE Dissolved Phase Remediation Field Demonstration
	b	Modified Fenton Reaction TCE Dissolved Phase Remediation Field Demonstration
	c	Source and secondary source applications of above

5		**Seismic (Regional & Local)**
	a	Preliminary Geophysical Investigation of NWP & LBC Seeps (Phase 1)
	b	Temporary Seismic Network Monitoring (incl. Deep Hole)
	c	Structural & Quaternary Mapping of Joppa/Heath Quads

6		**Ecological Monitoring**
	a	Implementation of Ecological Monitoring
7		**DWGIS Data and Tool Development**
	a	Document Indexing and Linkage Module
	b	Standardized Risk Assessment Module
	c	Ongoing Data Development (Additional GIS, format logs for retrieval, etc.)
	d	Development of Automated Site Reports
	e	Developmet of 3-D Data Linkage Layer
	f	Develop of Automated Data Output Interface
8		**SW Sediment Controls Demo**
9		**PGDP Area Garden Evaluation**