

RockWorks Modeling to Support Hydrologic Model Development

Presented to the Upper San Pedro Partnership

November 15, 2003

by

Laurel Lacher, PhD, RG



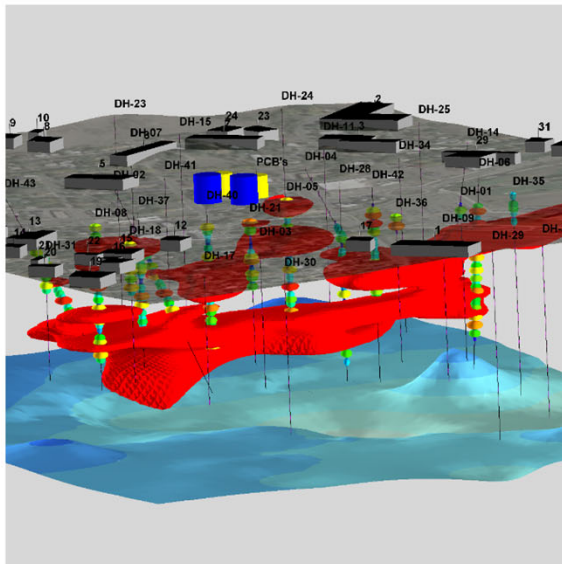
Lacher Hydrological Consulting





What is RockWorks?

ROCKWORKS



RockWorks is a comprehensive software program for creating 2D and 3D maps, logs and cross sections, geological models, volume reports, and general geology diagrams for the environmental, geotechnical, mining, and petroleum industries.

<input type="text" value="0"/>	RockWorks Single license: Basic Level	\$1,500.00
<input type="text" value="0"/>	RockWorks Single license: Standard Level	\$3,000.00
<input type="text" value="0"/>	RockWorks Single license: Advanced Level	\$5,000.00

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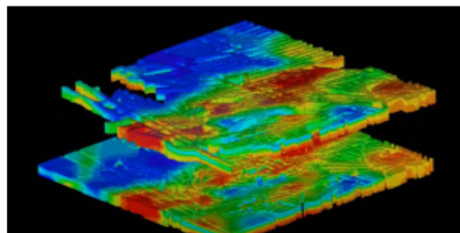
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ROCKWORKS NEW FEATURES

New in RockWorks: Playlists, animations, new interface, and more.

[Read More](#)

Description

RockWorks is the standard in the environmental, geotechnical, petroleum, and mining industries for surface and subsurface data visualization, with popular tools such as maps, logs, cross sections, fence diagrams, solid models and volume calculations.

RockWorks offers numerous options for analyzing your **surface and subsurface data**, and accepts many different data types, such as stratigraphy, lithology, downhole geochemistry / geophysics / geotechnical measurements, color intervals, fractures, and aquifer data.

We can help with migrating your data from gINT[®] software.

[What's New in RockWorks20](#) • [Feature Levels](#) • [RockWorks Brochure](#) • [RockWorks in Industry](#)

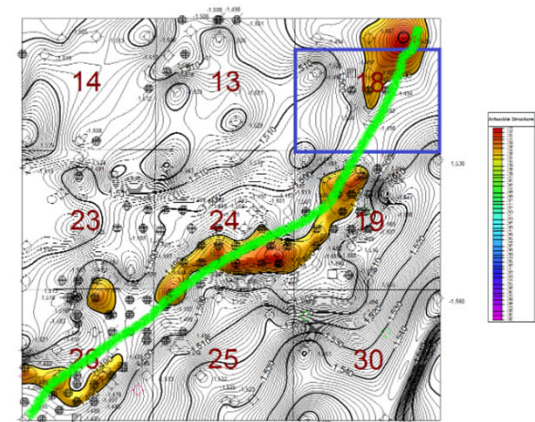
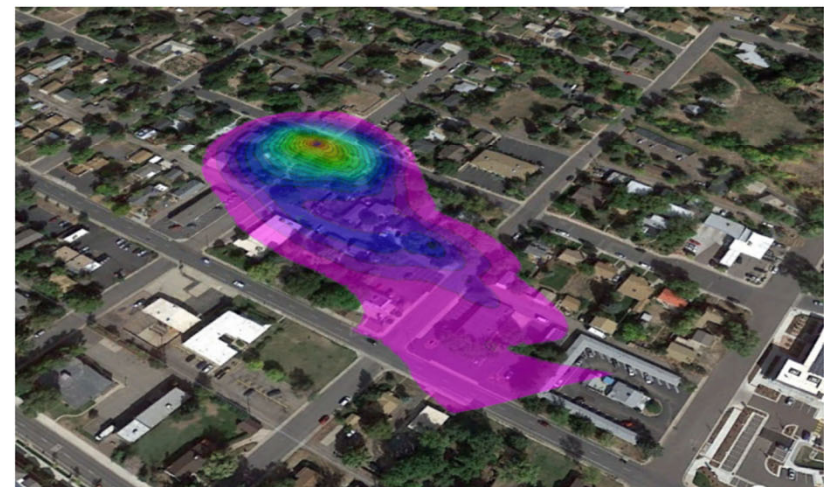
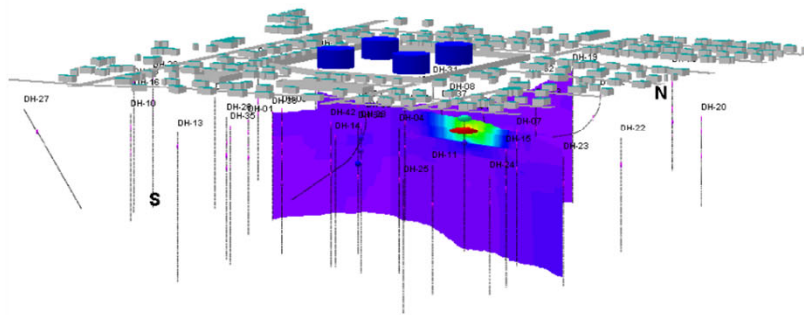
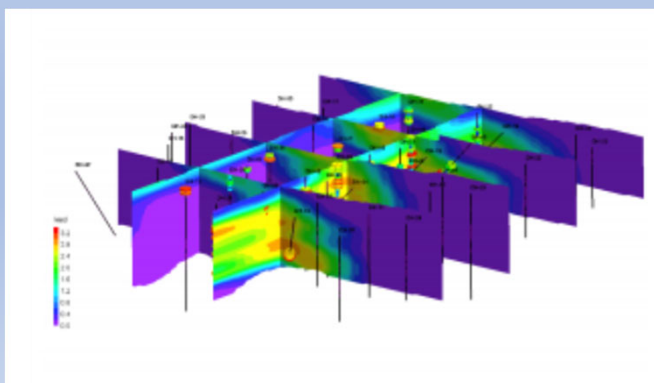
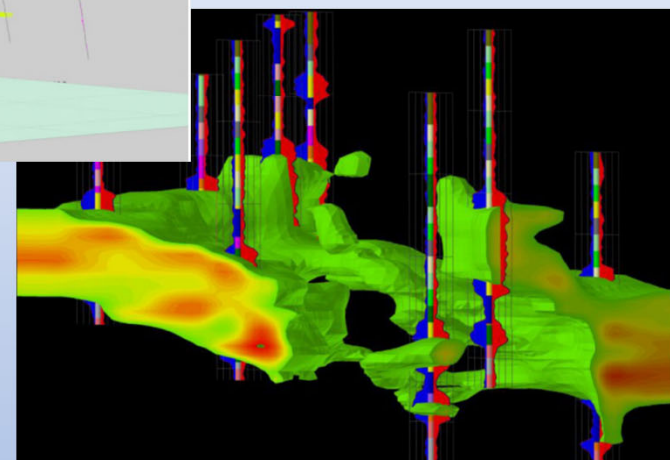
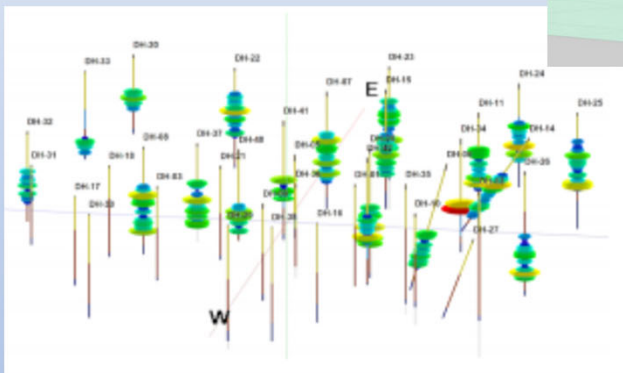
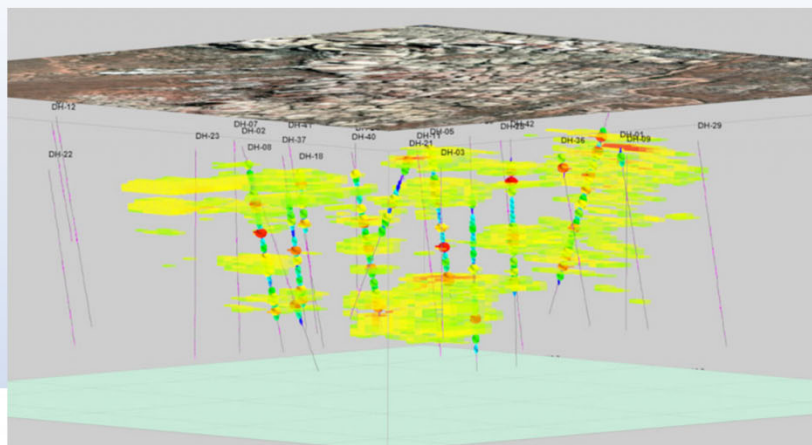
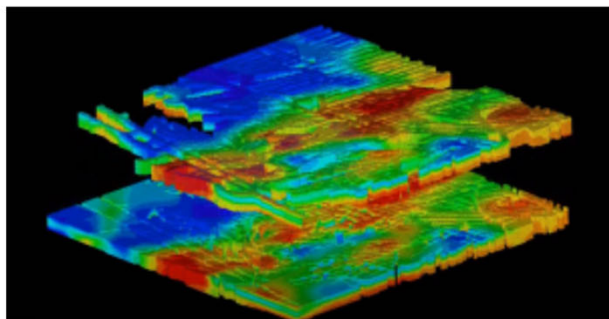


Image courtesy of Justin Prater, Stratakan Exploration



INTEGRATED HYDRO SYSTEMS, LLC



Why Do We Need a RockWorks Model?

To interpret a large body of subsurface geologic information (well logs) to inform the development of a hydrologic model

- Layering
- Hydraulic property distributions



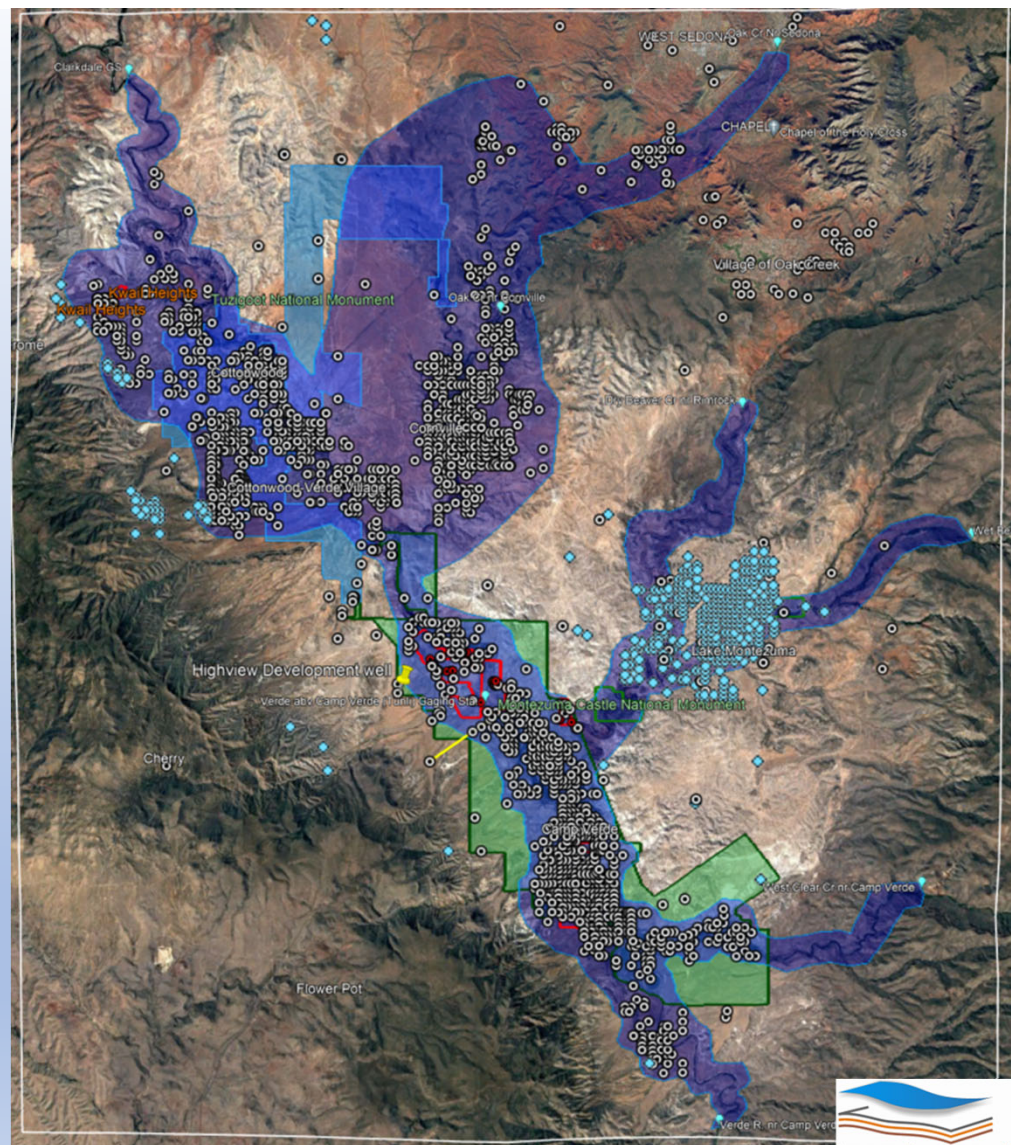


Example: Verde Valley RockWorks

Verde Valley RockWorks Model Development

Approximately 2100 Well Logs Interpreted
Across the Verde Valley

- Reveal geologic formations penetrated by wells
- Reveal water-bearing units
- Form basis for developing new model layers to represent the Verde Formation



RockWorks
Version 2023.10.31

How-To Search License Favorites Plot2D Plot3D Report Window Setup Help Layout

Project Folder: E:\Lacher Hydro\Verde Valley\Prucha\Verdelithology\

Summary
Dimensions
Coordinates
Units
Image
Notes

UTM System	WGS-84 1984 (NAD-83) Datum	12 Zone	Meters Units	398,926.0 X Min	439,400.0 X Max	3,811,700.0 Y Min	3,859,500.0 Y Max	600.0 Z Min	1,350.0 Z Max	100.0 x 100.0 x 5.0 XYZ Spacing	406 x 479 x 151 XYZ Nodes	29,365,574 Total Nodes	1:83.511646 Aspect	40,474.0 x 47,800.0 x 750.0 Size (XYZ)
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Borehole Operations

Maps
Stratigraphy
T-Data
Colors
Striplogs
I-Data
Fractures
Vectors
Lithology
P-Data
Aquifers
Production

ModOps
Grid
Solid
Volume

Utilities
Maps
Hydrology
3-D
Hydrochem
Earth
Linears

Planes
Coords
Stats
Widgets
Survey
Misc.

Graphics
Embellish
Animate
2D Tools
Images
3D Tools

Project Manager
Borehole Manager
Datasheet (untitled)
Faults
Playlist (untitled)
Execution History

File
Edit
View
Help

New
Erase
Erase Disabled
Duplicate
Enable
Disable
Calc XYZ
Calc All
Data Edit
Filter
Select
Locate
Sort

Borehole
10bca
11acc
11ccc
11dab
12ccd
15aaa
15bda
16aca
16bad
17caa
19abd
1bbcb
200090
200092
200150
200152
200158
200170
200171
200234
200271
200277
200290
200390

Borehole Data
QuickMap

Location
Orientation
Lithology
Stratigraphy
I-Data
I-Text
T-Data
P-Data
P-Text
Colors
Fractures
Water Levels
Symbols
Patterns
Bitmaps
Vectors
Construction
Production

Borehole Name*
10bca
Symbol
Raster: Vector:

Collar Coordinates
Comments
Other Coordinate Projections

Horizontal: UTM Meters, Datum: WGS-84 198
Vertical: Meters

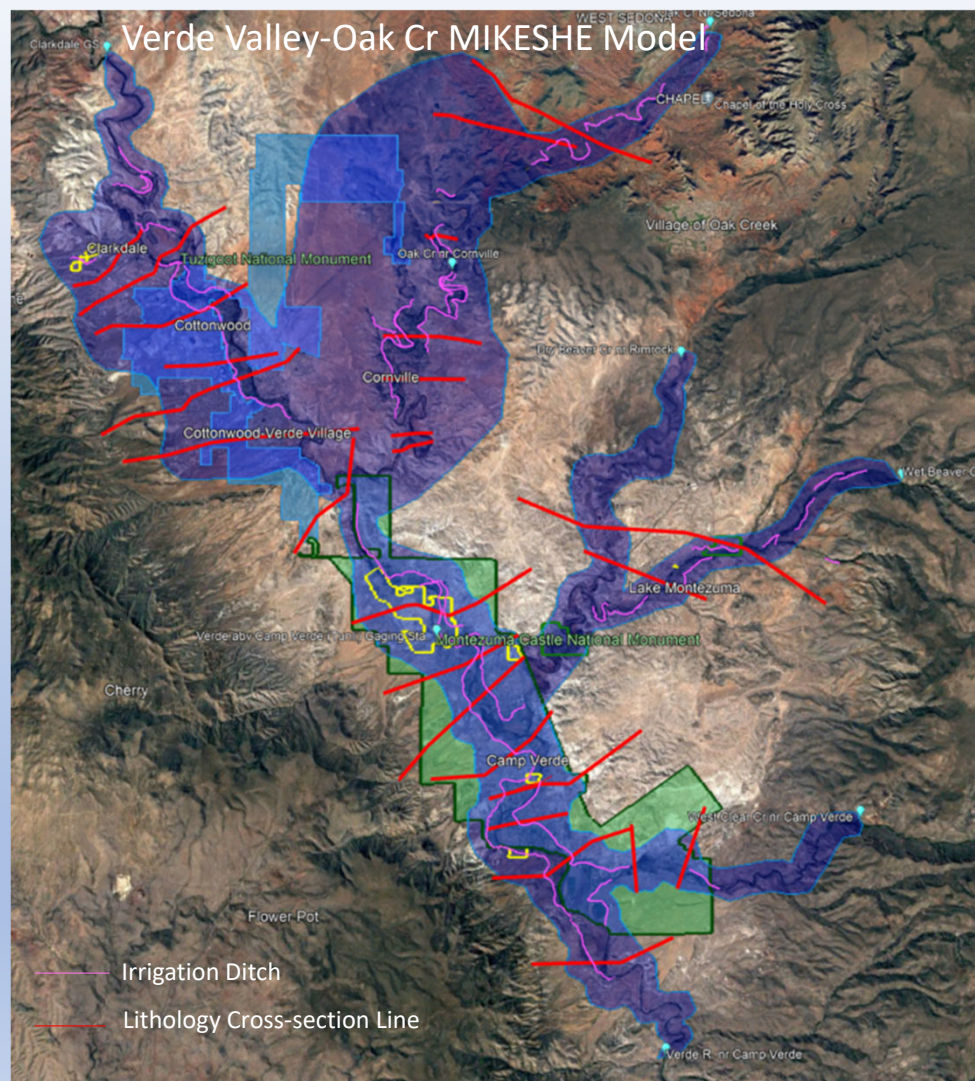
Easting*
425,183.00
meters
Northing*
3,821,780.00
meters

Z (Elevation)*
974.75
meters
Collar Elevation
974.75
meters
Total Depth*
495.30
meters

* Required fields.
Optional Fields
Show Location in Google Earth

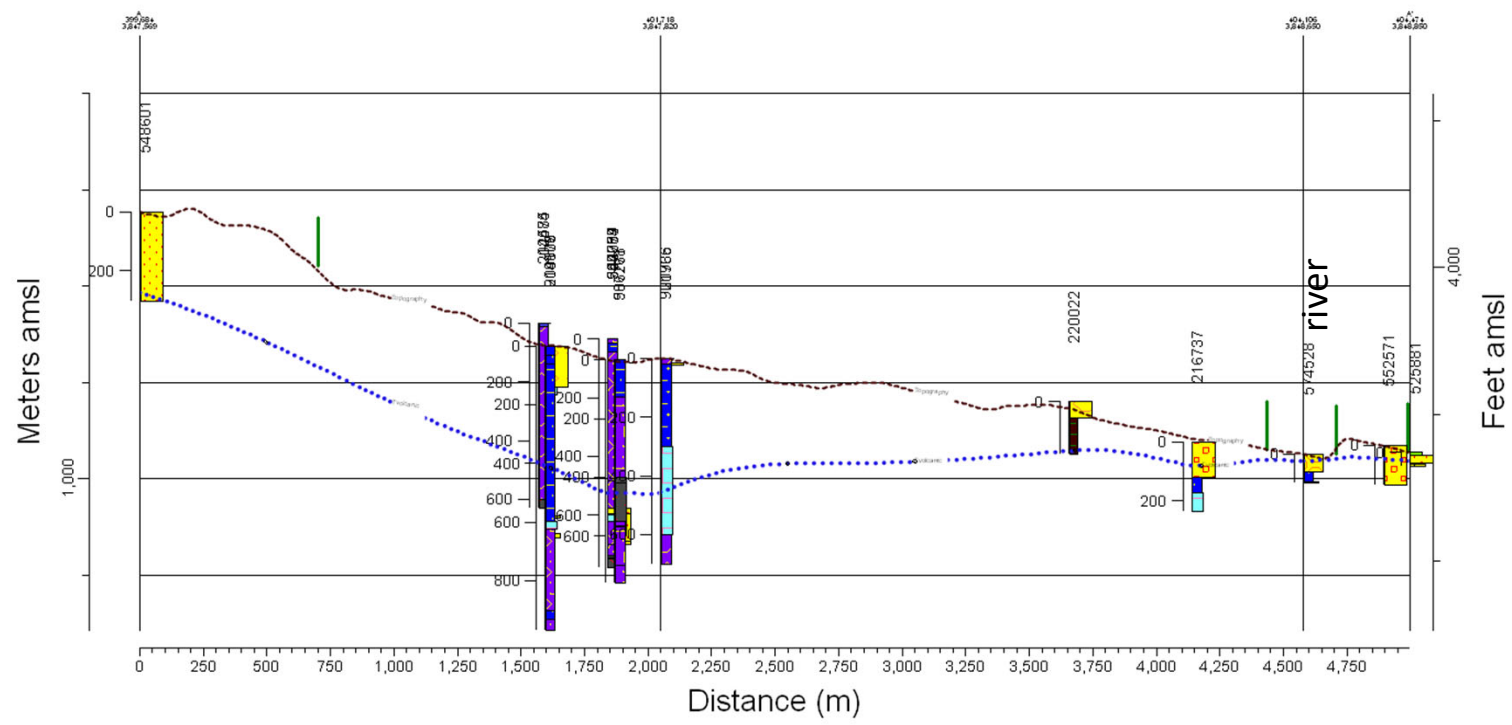
SQLite 2178 boreholes (2165 Enabled)

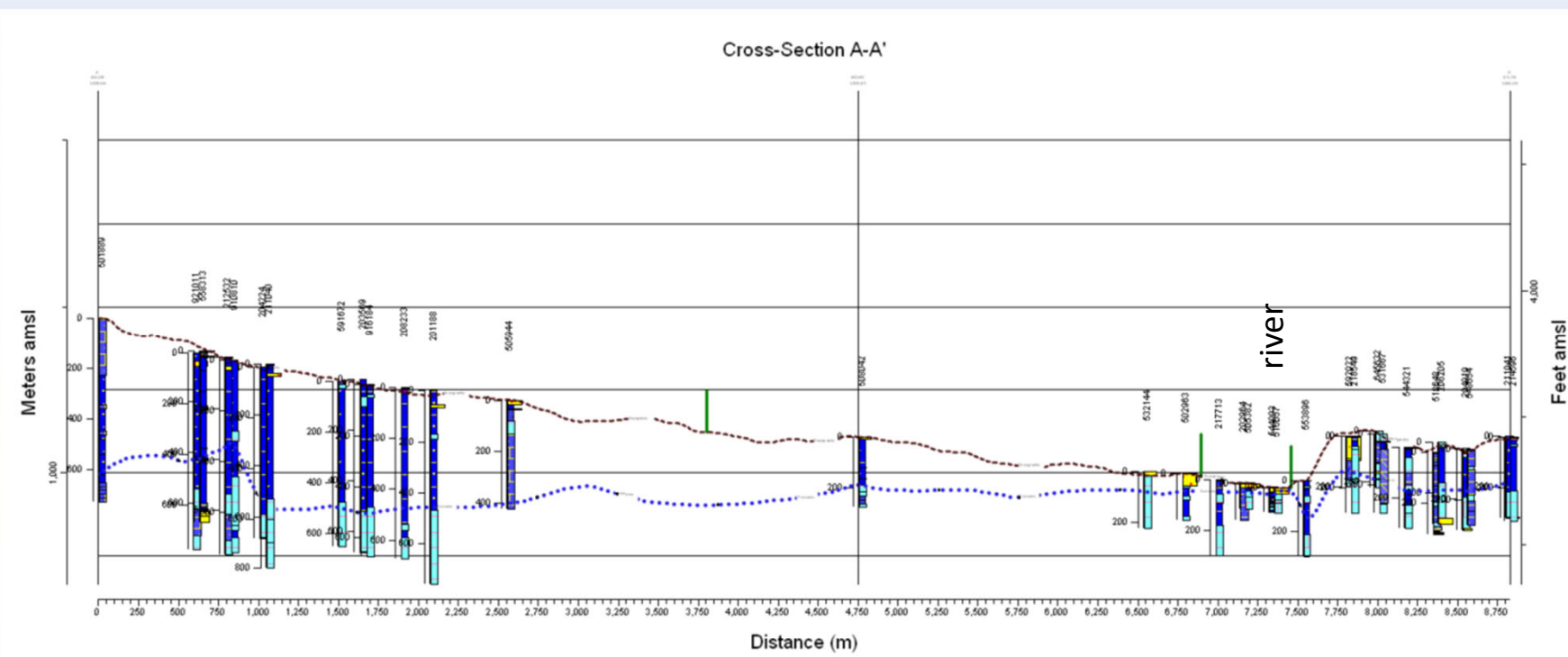
INTEGRATED HYDRO SYSTEMS, LLC

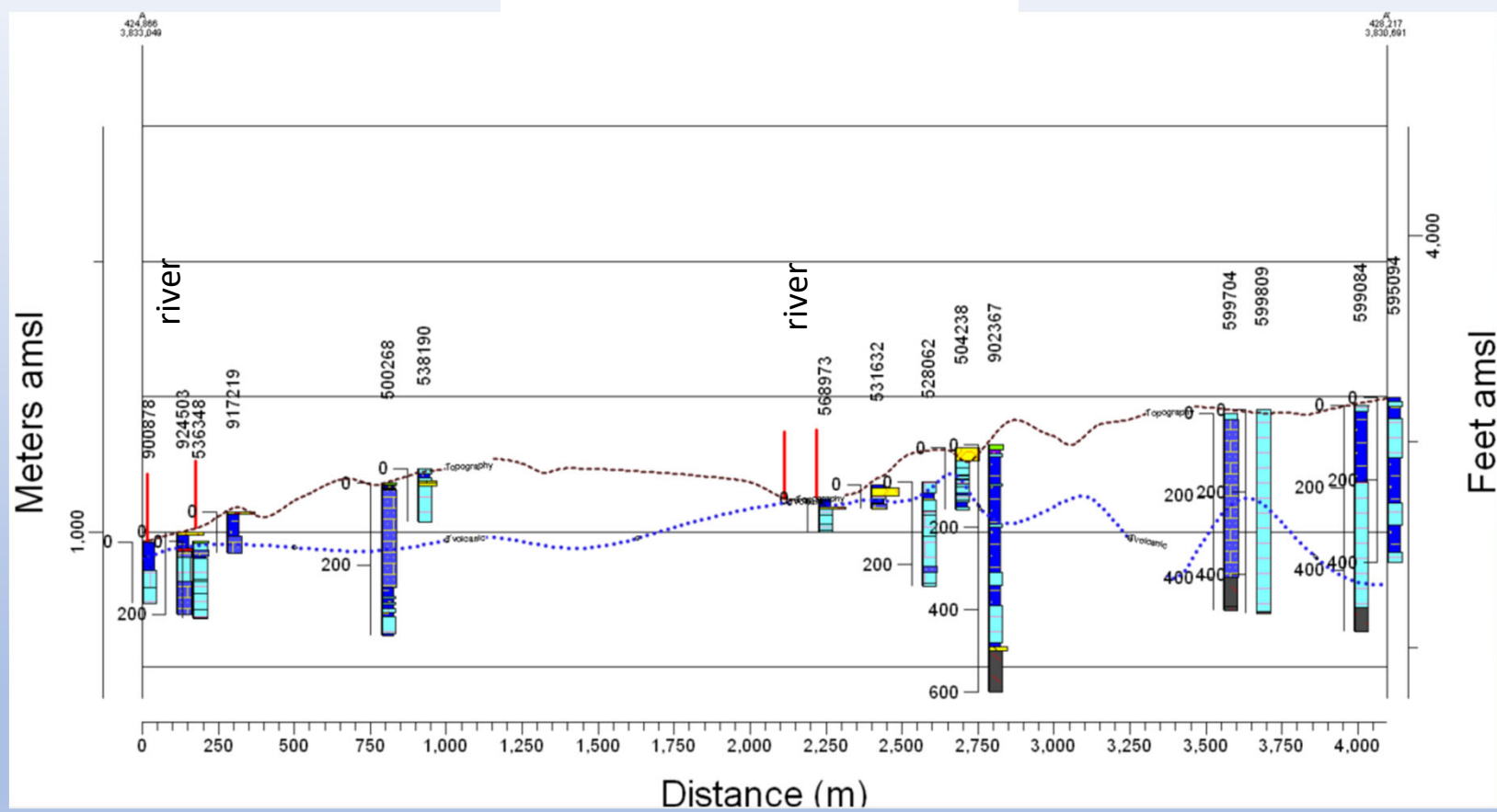


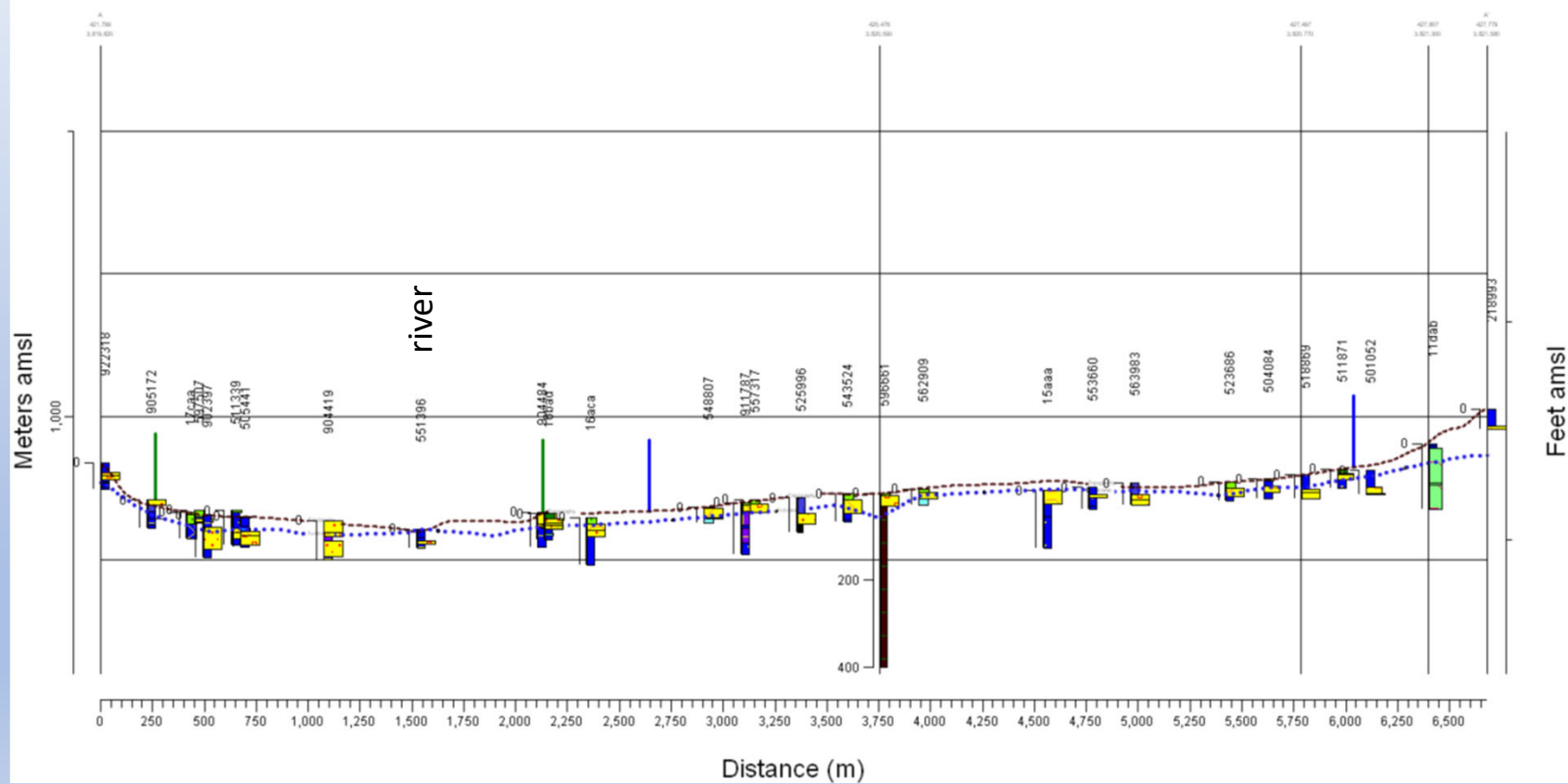
Cross-Section Lines

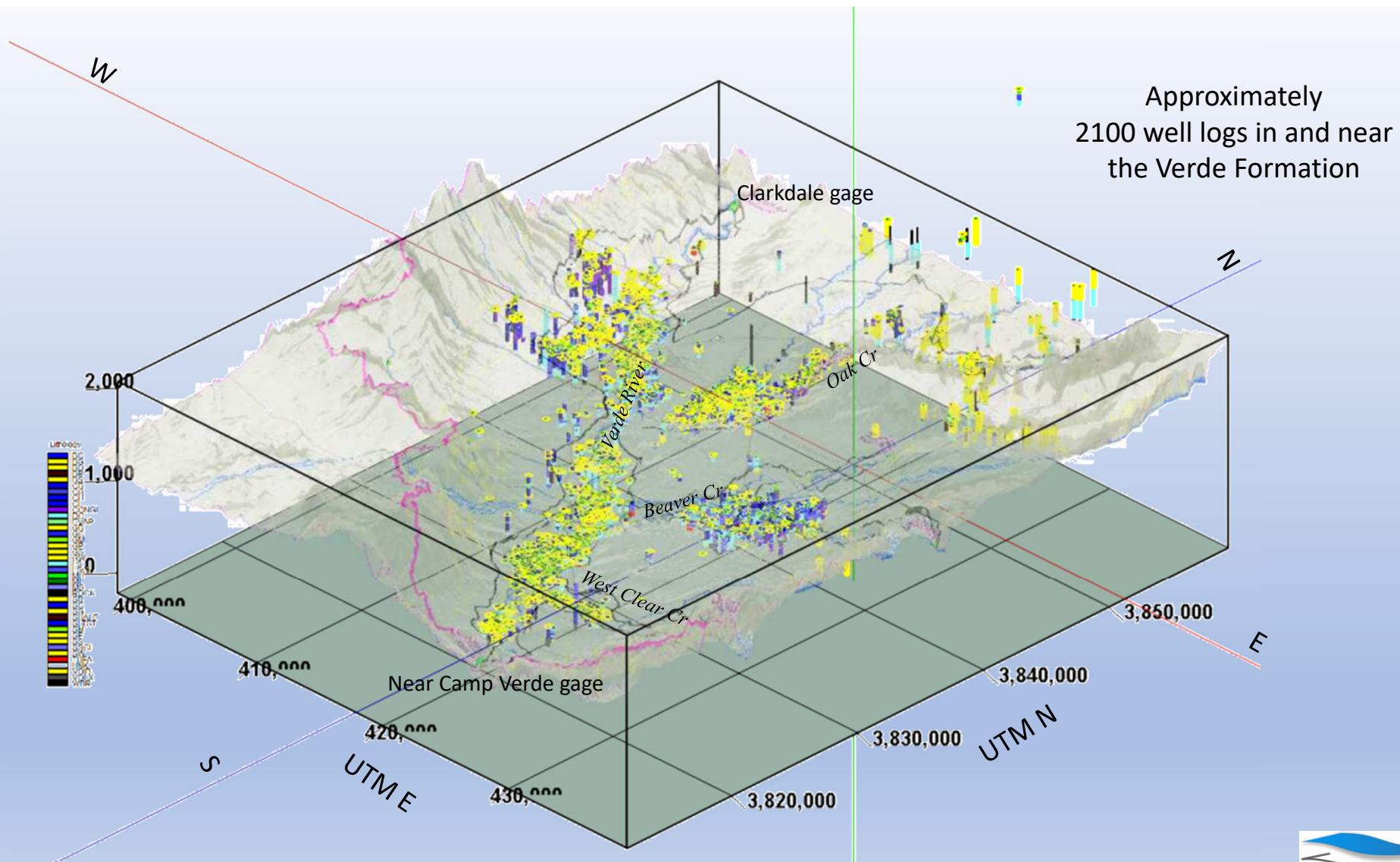
Ground Surface
Groundwater-level
Well depths
Lithology



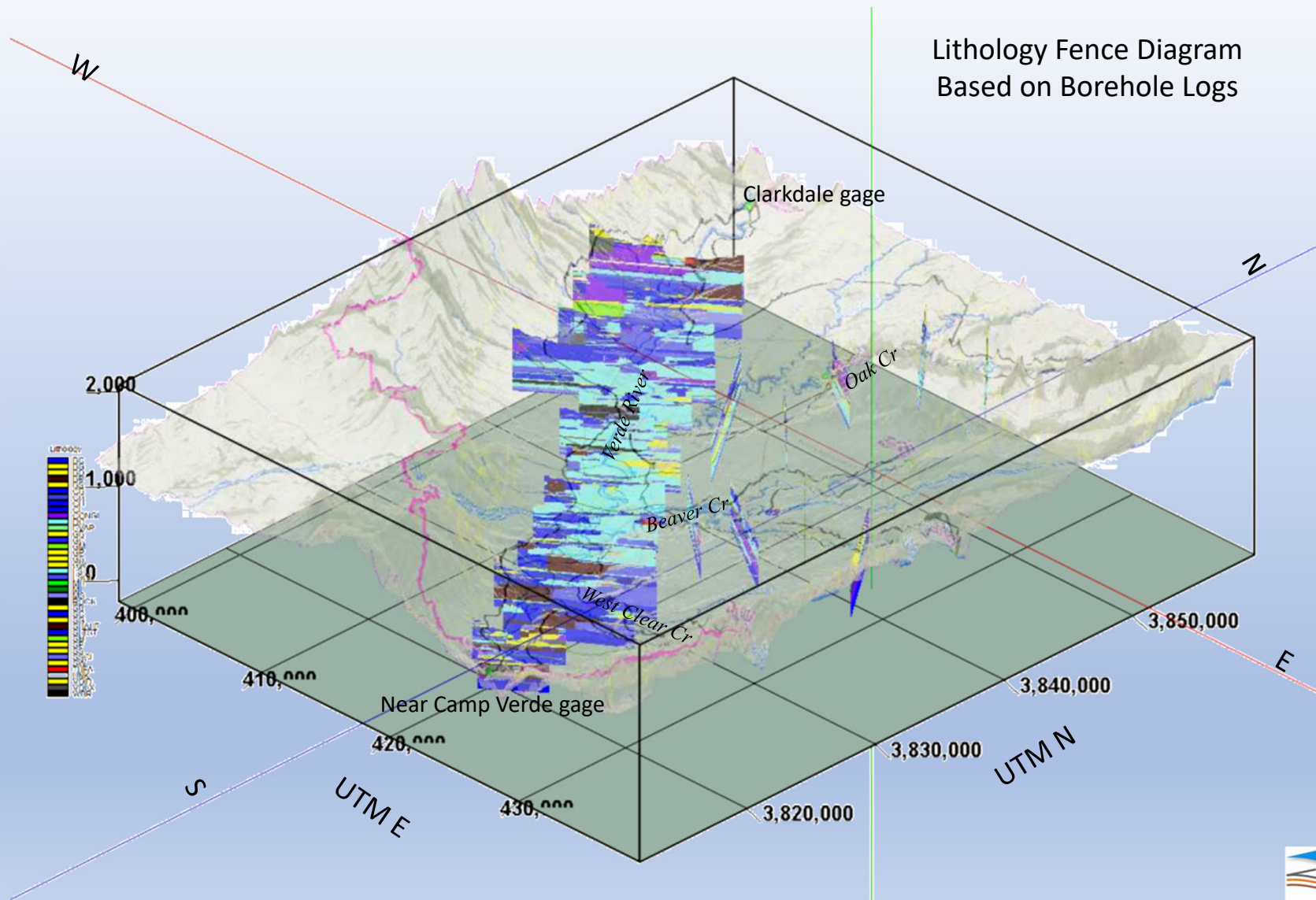


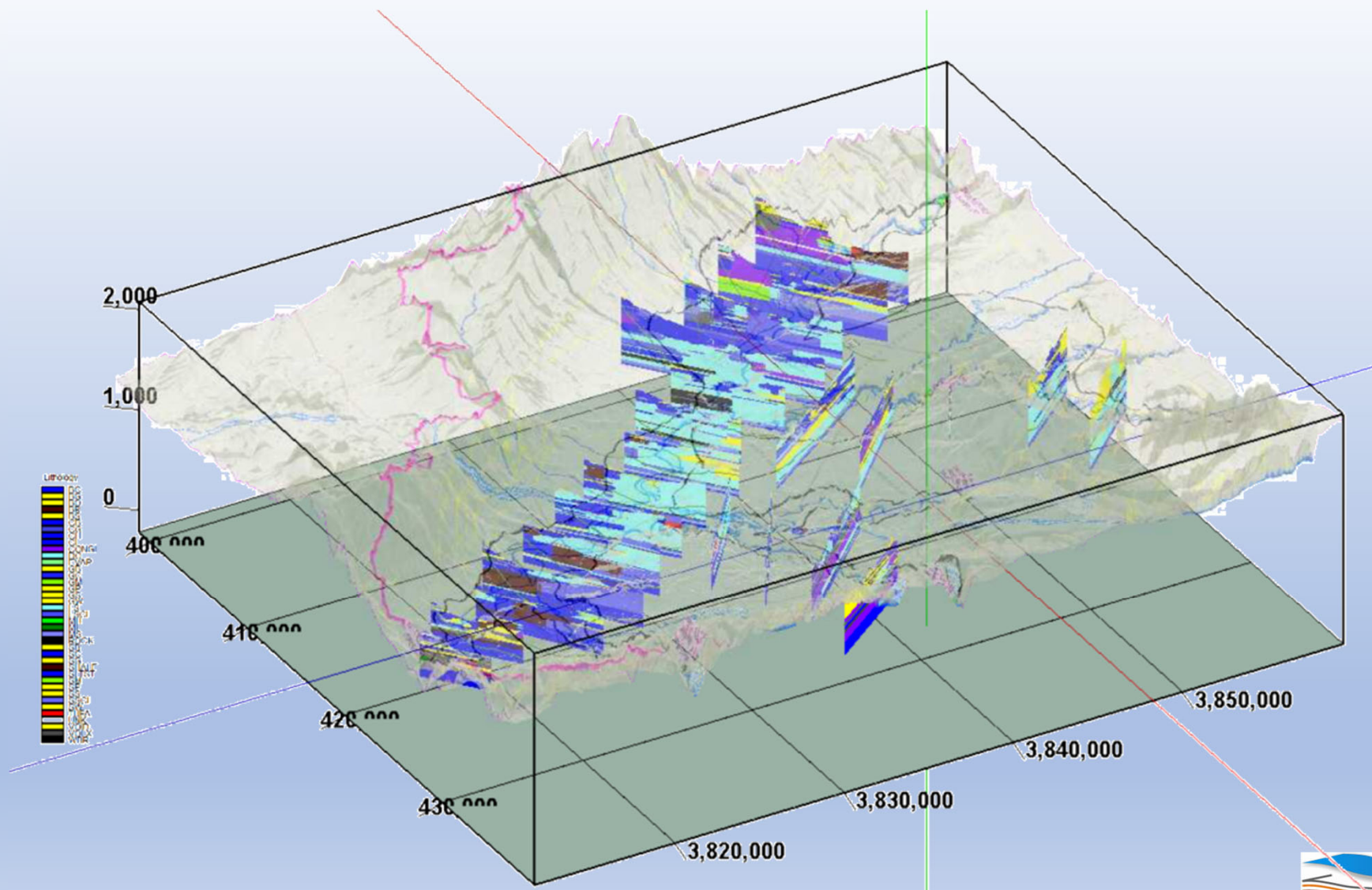


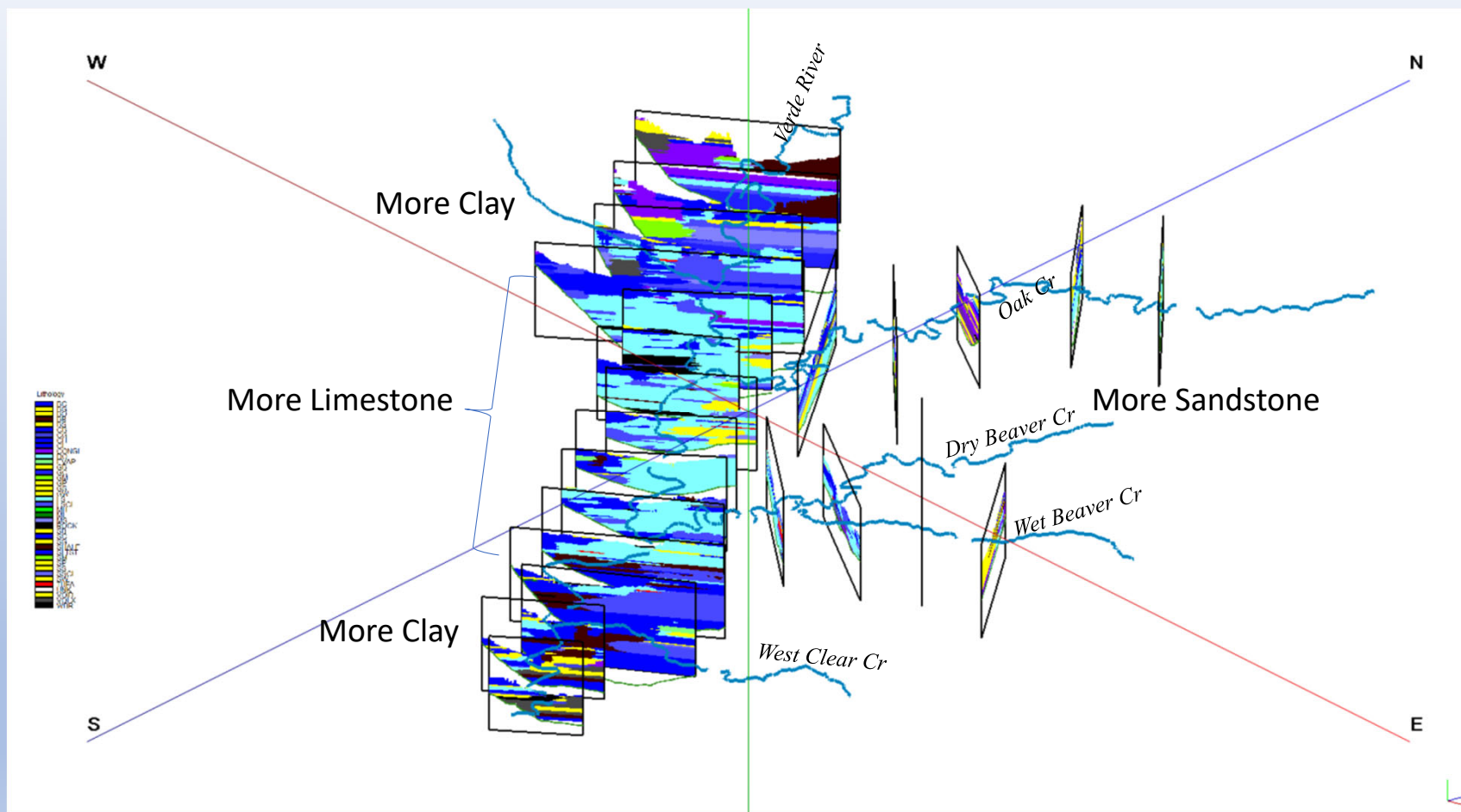




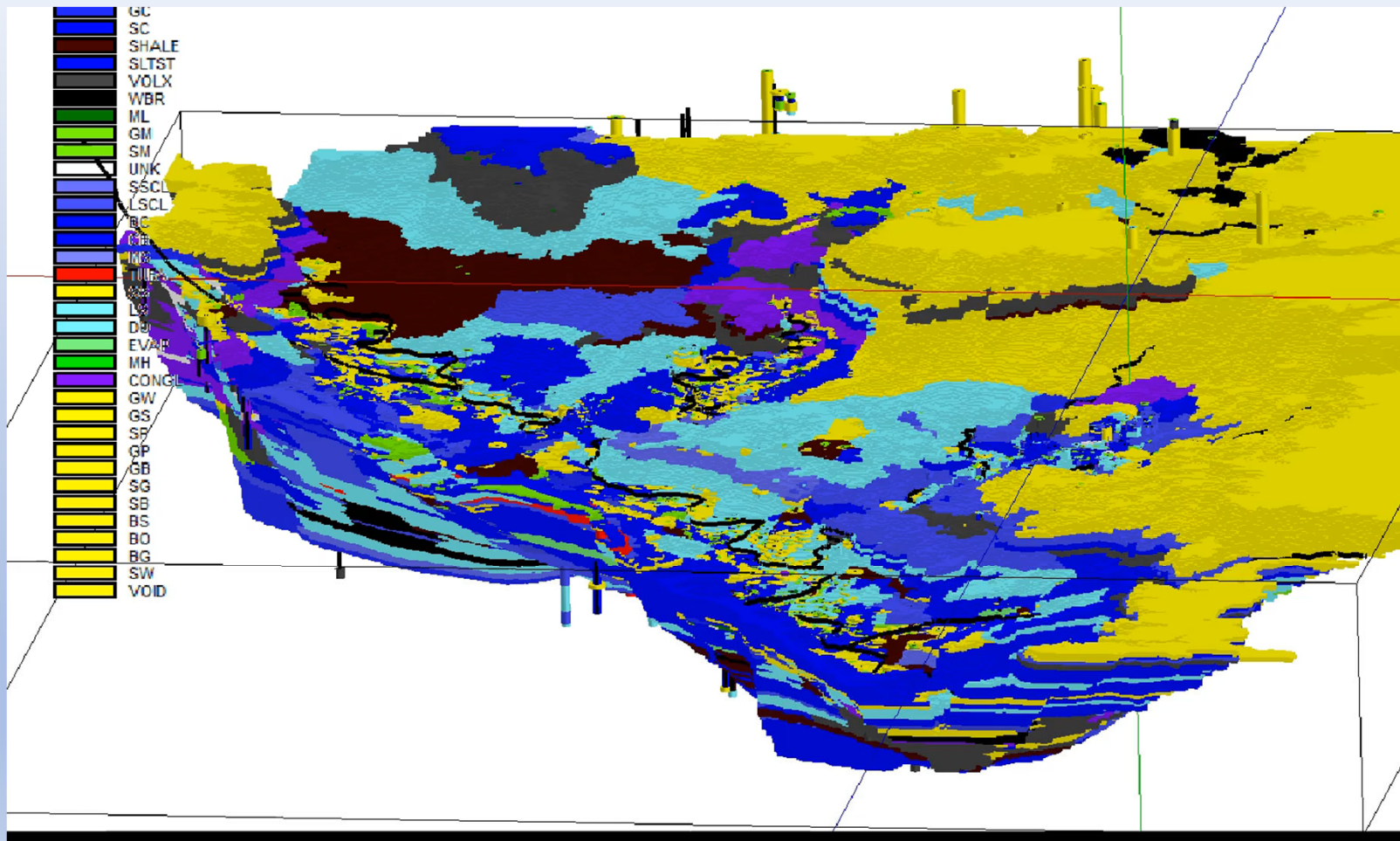
Lithology Fence Diagram Based on Borehole Logs





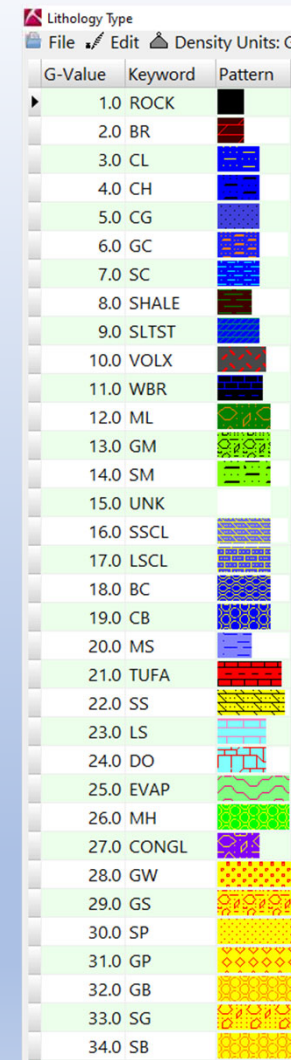


BOREHOLE LOGS INTERPOLATED TO 3D SURFACES



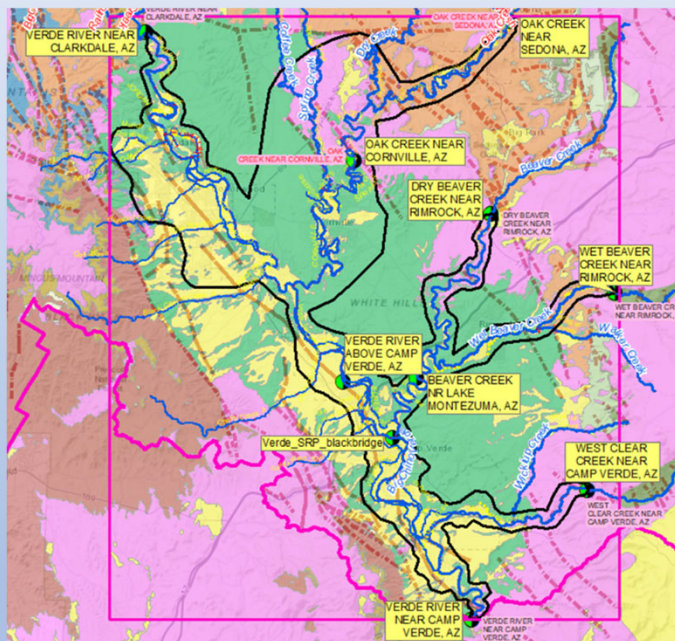
Lithology to Hydrology

- Every lithologic type is assigned a Kh
 - Different realizations of subsurface layering
 - Different realizations of K distributions
 - Completely distributed
 - Uniform based on average properties
- ➔ Compare results from different realizations

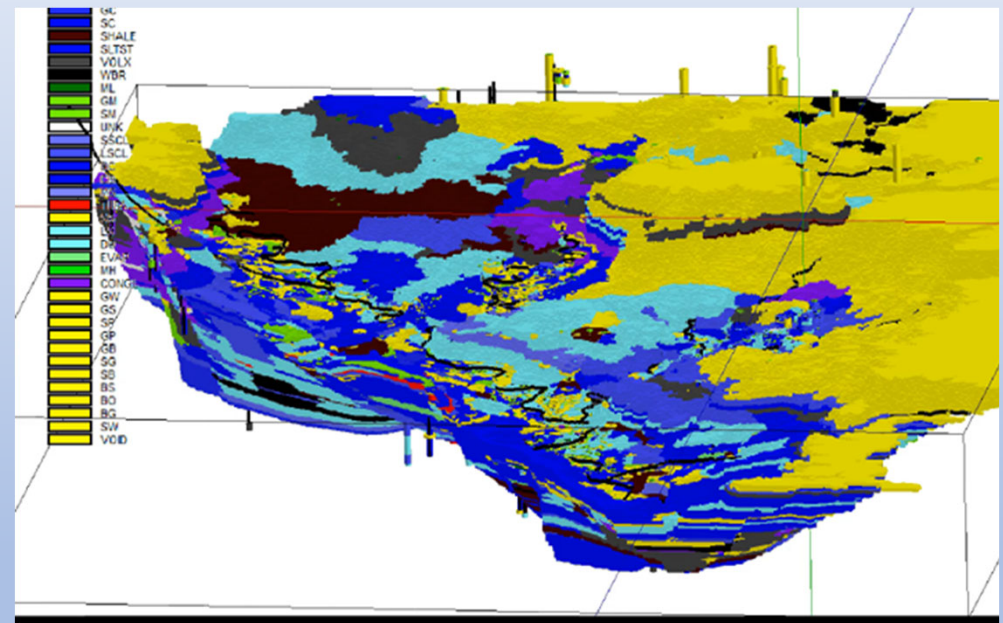


G-Value	Keyword	Pattern
1.0	ROCK	
2.0	BR	
3.0	CL	
4.0	CH	
5.0	CG	
6.0	GC	
7.0	SC	
8.0	SHALE	
9.0	SLTST	
10.0	VOLX	
11.0	WBR	
12.0	ML	
13.0	GM	
14.0	SM	
15.0	UNK	
16.0	SSCL	
17.0	LSCL	
18.0	BC	
19.0	CB	
20.0	MS	
21.0	TUFA	
22.0	SS	
23.0	LS	
24.0	DO	
25.0	EVAP	
26.0	MH	
27.0	CONGL	
28.0	GW	
29.0	GS	
30.0	SP	
31.0	GP	
32.0	GB	
33.0	SG	
34.0	SB	

Realization 1: Uniform Kh



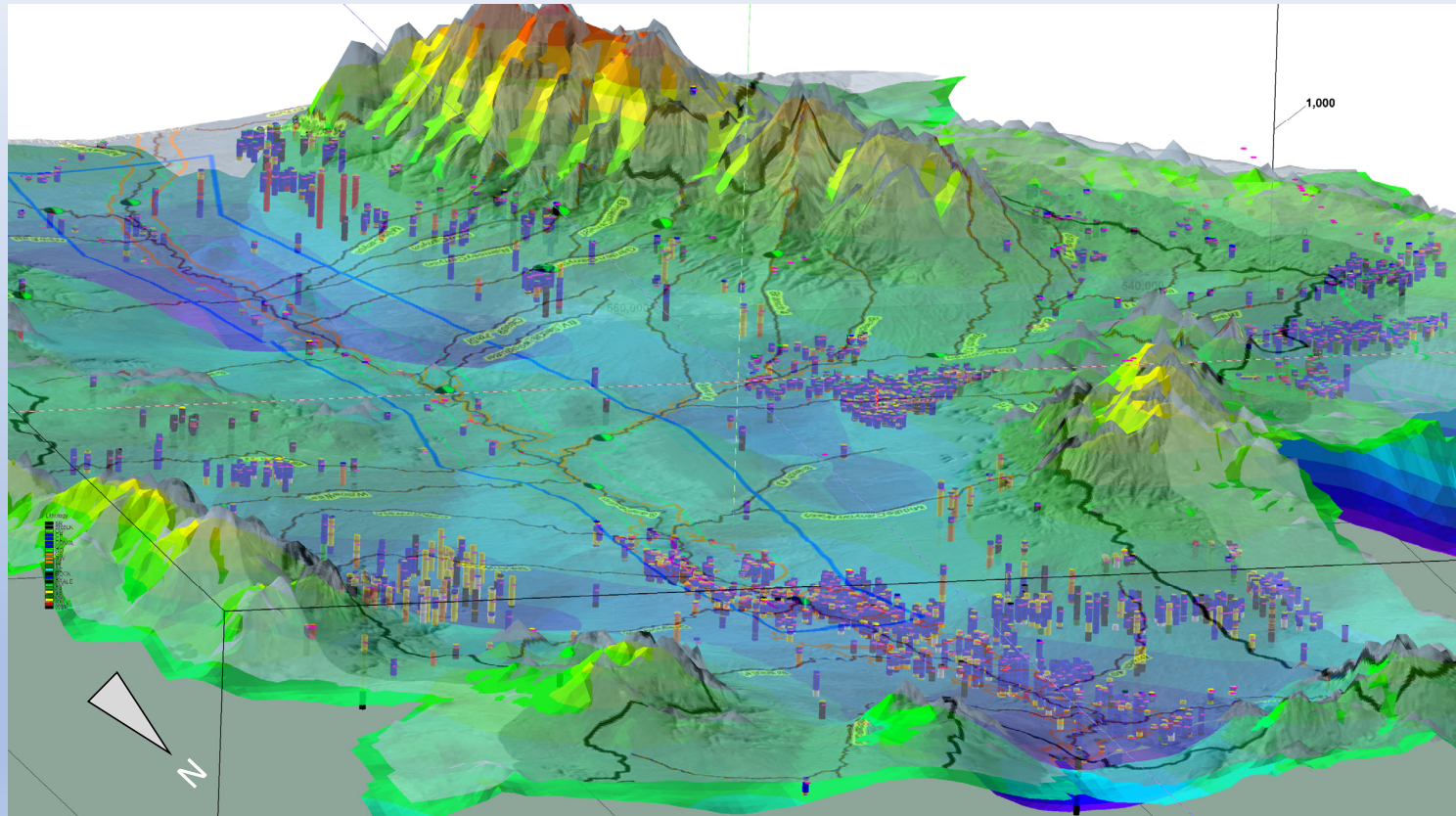
Realization 2: Fully Distributed Kh



Initial Upper San Pedro RockWorks



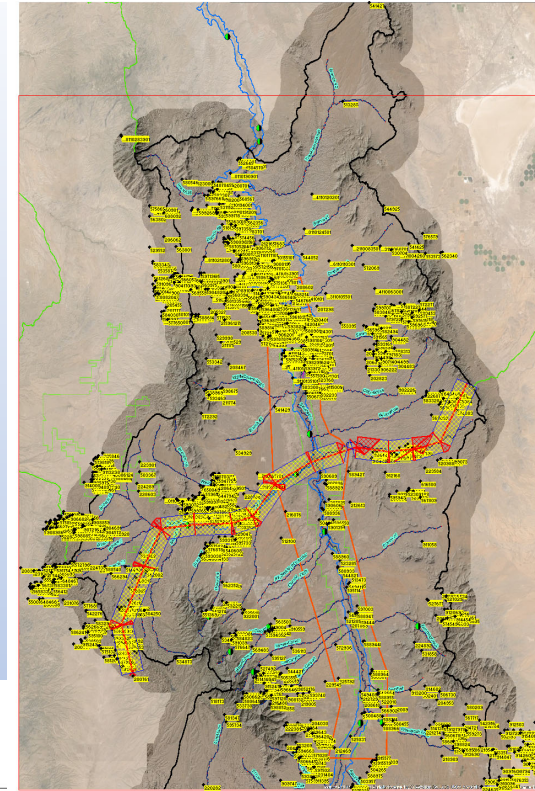
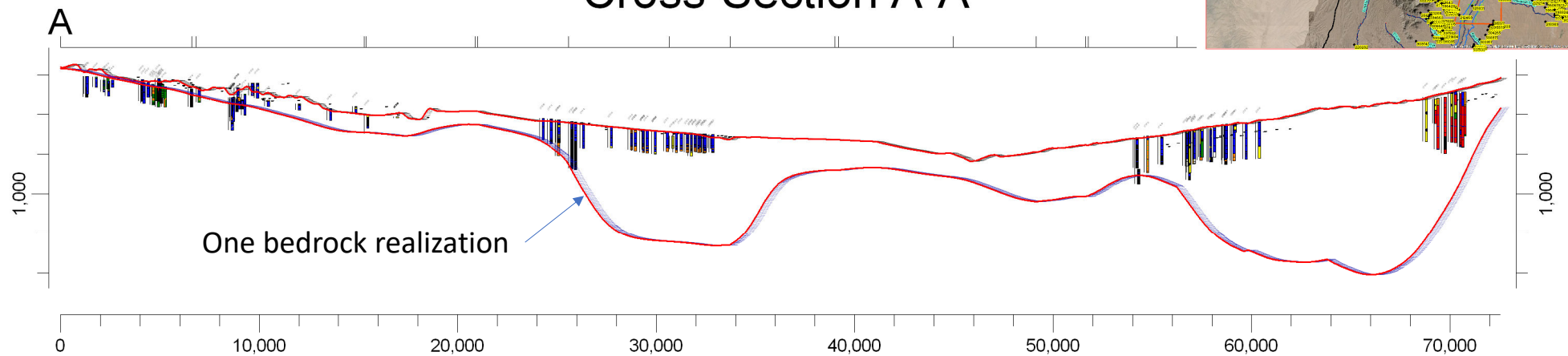
Initial RockWorks Model for Upper San Pedro



Focused on
Defining Bedrock
Surface

Projected Striplog Section

Cross-Section A-A'



Next Steps in USBP RockWorks

- Additional borehole logs focused on:
 - US-Mexico border area
 - Basin fill strata
 - Northern SPRNCA area

