Completion Deliverable

Boggess 9H

Geometric Design Summary

Fracture ID

Limited Entry Calculator Inputs: ehd: 0.42” Cd: 0.70 Injection rate: 85 bpm Net stress: 1200 psi (regional estimate) Shots per cluster: 8 Clusters per stage: 5
Results Summary: Stages analyzed: 3-56 Pred avg stage cluster efficiency: 60% Pred max stage cluser efficiency: 60% Pred min stage cluster efficiency: 60% Total clusters analyzed: 270 Total clusters effectively stimulated (predicted): 162
Problem stage indicators: Stress variability (scaled 0-300 psi) Layering (scaled 25-40% layered)

Perforation Efficiency and Problem Stage Identifier

Fracture ID

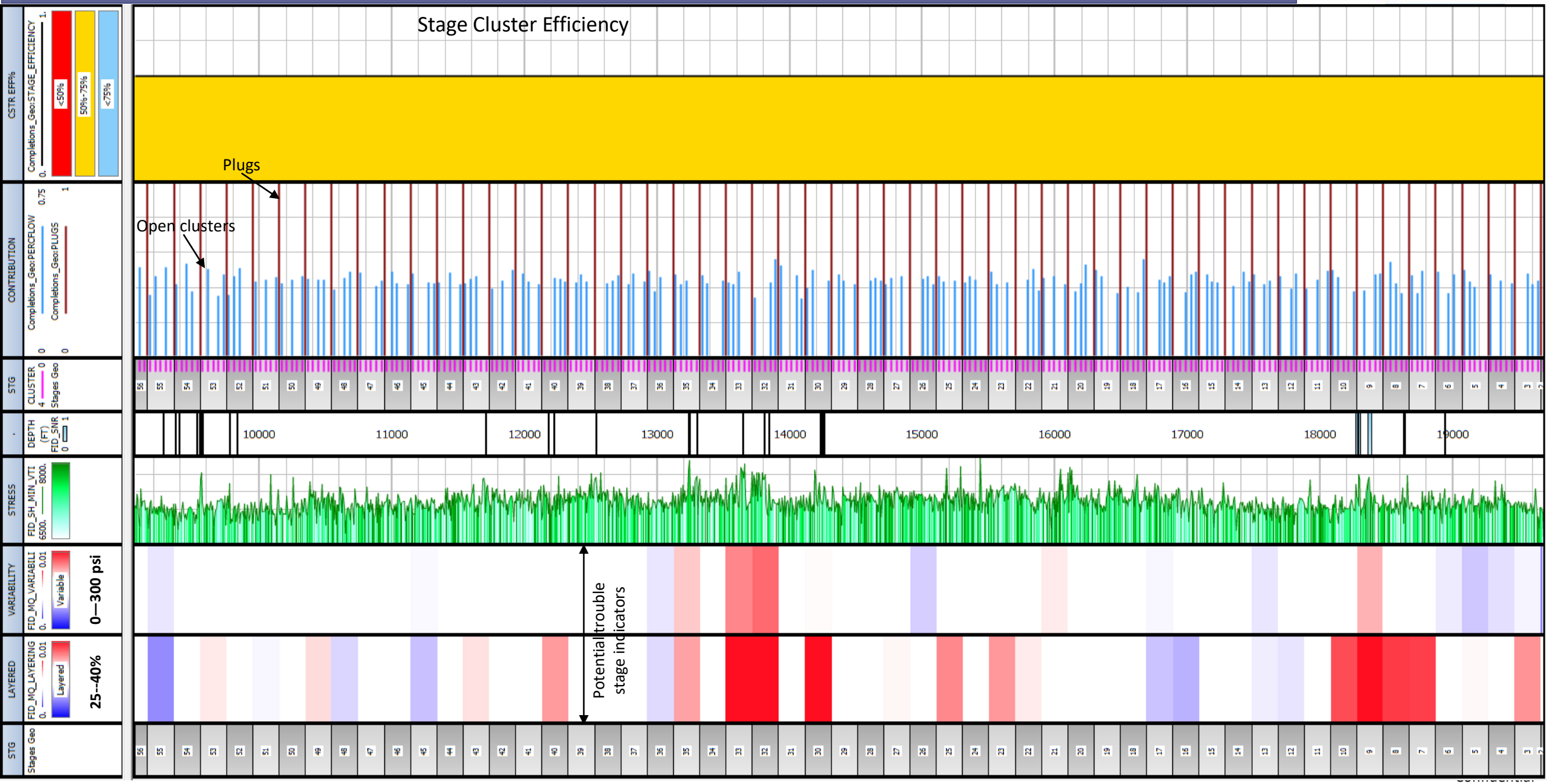
The following slides show graphical images of the completion's **predicted perforation efficiency** by stage and **potentially difficult stages**. Predicted perforation efficiency is calculated by determining if the design's perforation friction is sufficient to overcome the measured stress variability. Then, the percent flow is computed using plain strain.

Based on Fracture ID's experience, the following measurements can indicate **potentially difficult stages**:

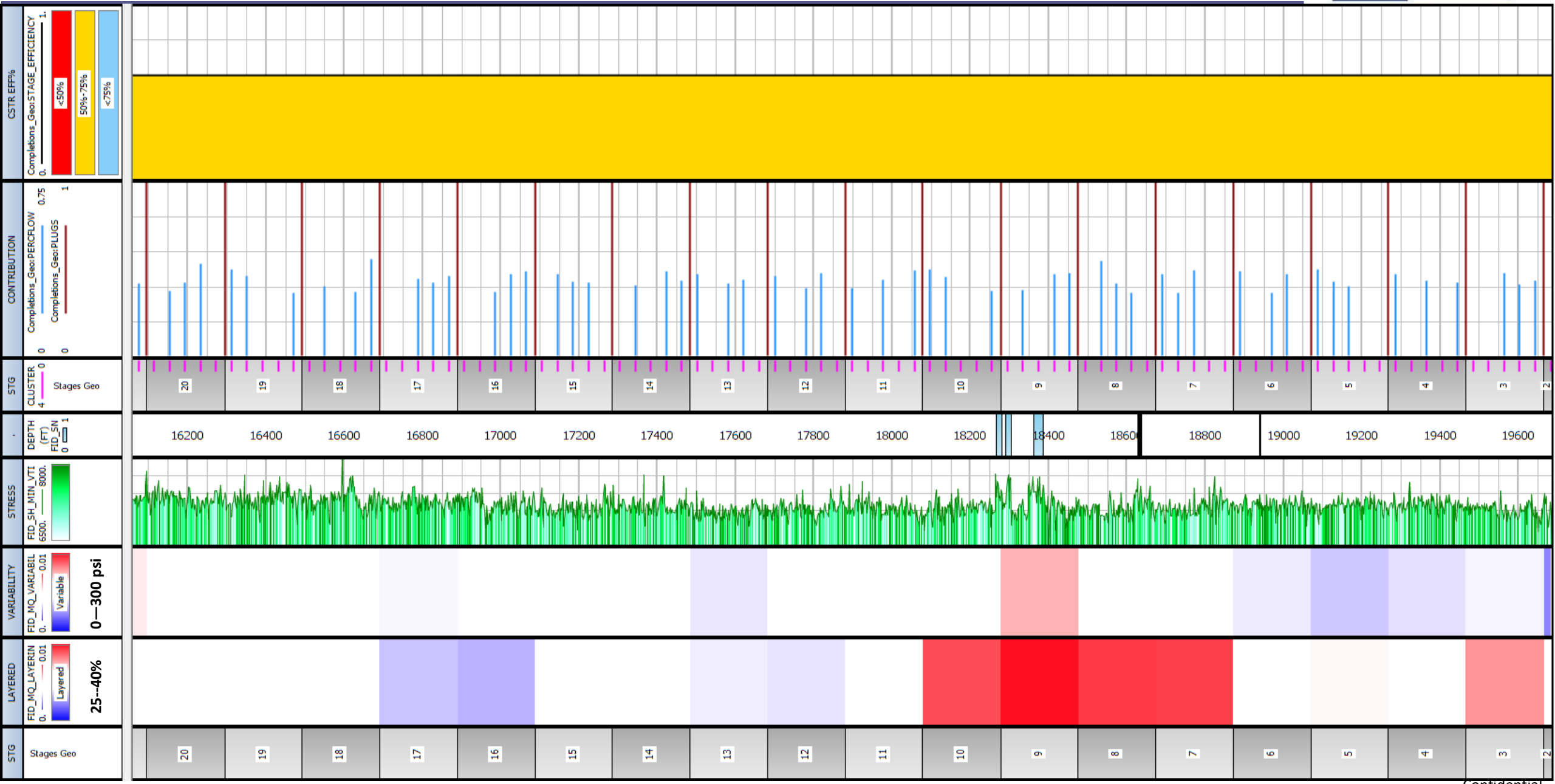
Layering: High layering can indicate higher clay content and/or more ductile rock. Thus, in highly layered stages initiating and maintaining a fracture may be more difficult. Intervals with High Layering have a higher likelihood of "screenout" events.

Stress Variability: Stages with the highest Stress Variation may have lower perforation efficiency because of the additional perforation friction required to effectively distribute fluid and proppant to all clusters. Low perforation efficiency can result in increased treating pressures and proppant bridging.

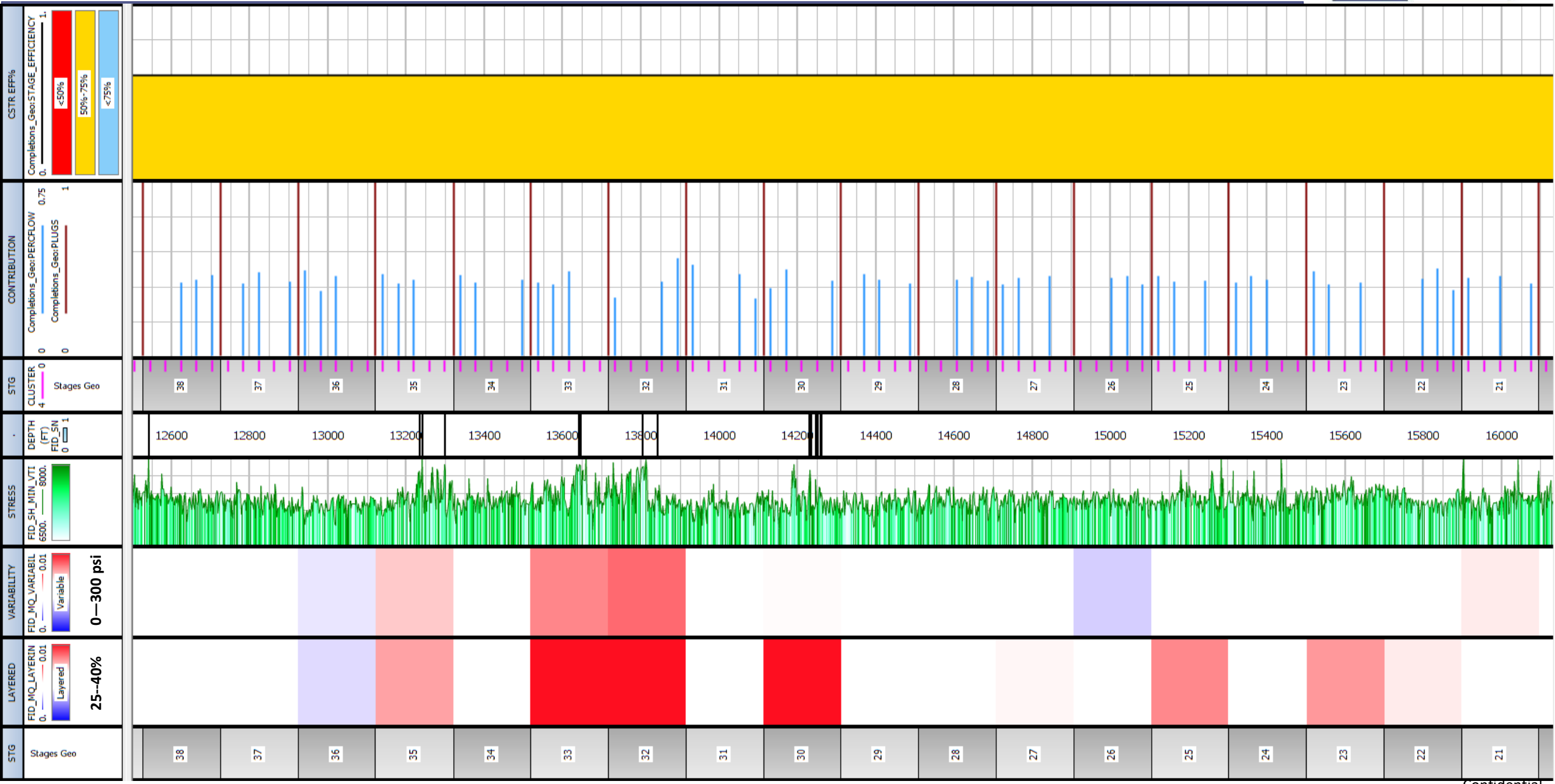
Geometric Completion: All Lateral Data



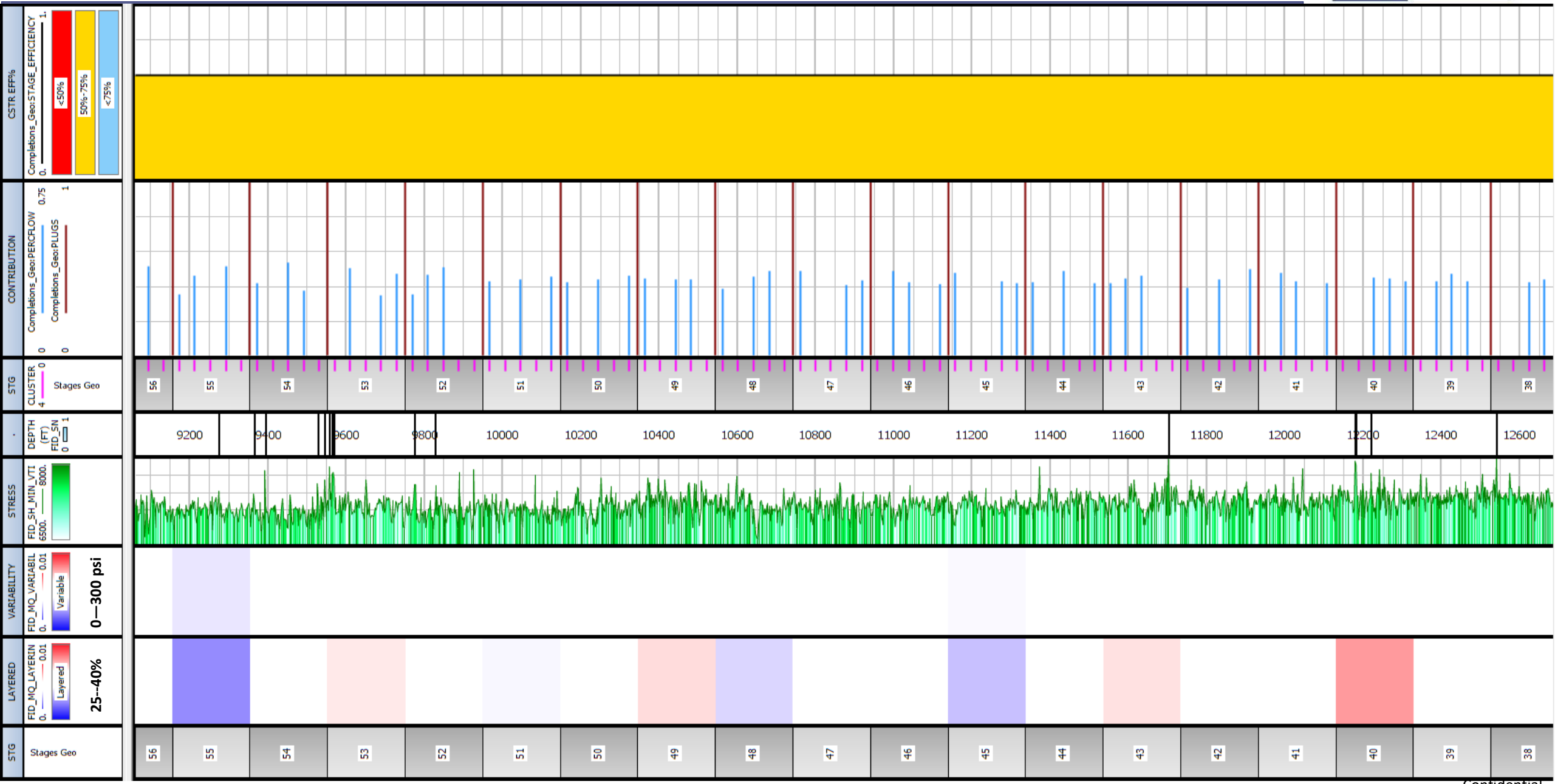
Geometric Completion: Stages 3-20



Geometric Completion: Stages 21-38



Geometric Completion: Stages 39-56



Geometric Stage Summary

Fracture ID

Stage	Layering	Stress Variability (psi)	Cluster Efficiency
3	37%	120	60%
4	33%	109	60%
5	35%	98	60%
6	35%	115	60%
7	39%	133	60%
8	39%	147	60%
9	50%	224	60%
10	38%	149	60%
11	33%	135	60%
12	31%	136	60%
13	31%	112	60%
14	34%	135	60%
15	32%	149	60%
16	29%	150	60%
17	30%	121	60%
18	33%	181	60%
19	33%	148	60%
20	31%	148	60%
21	34%	198	60%
22	35%	126	60%
23	37%	135	60%
24	34%	190	60%
25	37%	172	60%
26	33%	101	60%

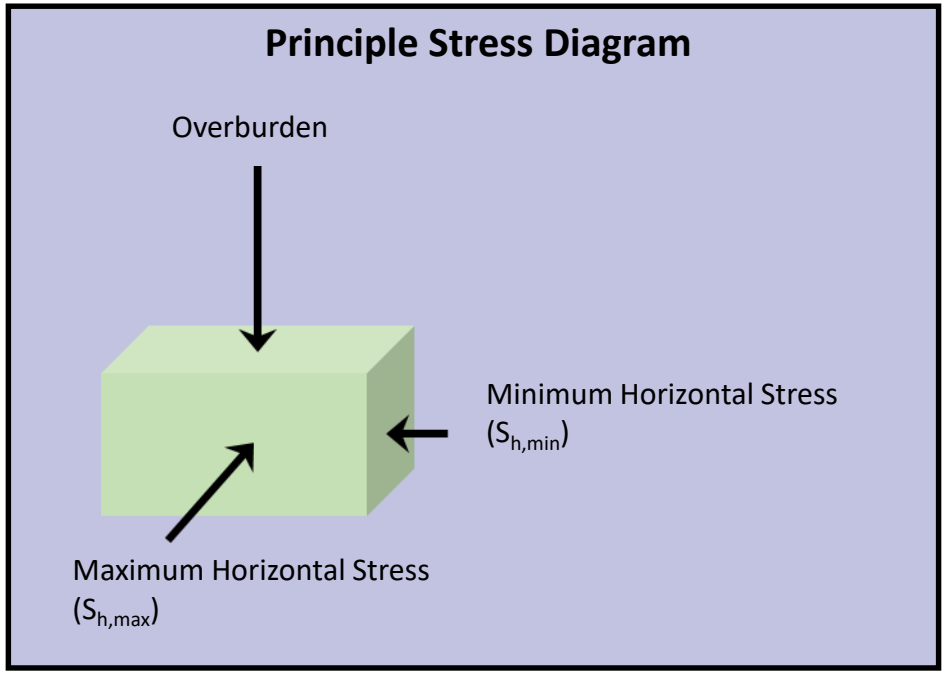
Stage	Layering	Stress Variability (psi)	Cluster Efficiency
27	35%	130	60%
28	33%	136	60%
29	34%	145	60%
30	41%	191	60%
31	34%	138	60%
32	44%	258	60%
33	45%	244	60%
34	34%	131	60%
35	37%	213	60%
36	30%	113	60%
37	32%	135	60%
38	32%	158	60%
39	34%	138	60%
40	37%	173	60%
41	33%	131	60%
42	31%	154	60%
43	35%	183	60%
44	32%	143	60%
45	30%	123	60%
46	32%	129	60%
47	33%	159	60%
48	30%	191	60%
49	35%	167	60%
50	32%	162	60%

Stage	Layering	Stress Variability (psi)	Cluster Efficiency
52	34%	174	60%
53	35%	174	60%
54	31%	178	60%
55	28%	112	60%
56	34%	157	60%
57*			

*Stage 57 is in the curve section

Fracture ID data did not cover Stages 1 and 2

Minimum Horizontal Stress Calculation and Assumptions



$$\sigma_{h,min} = \frac{\upsilon_{13}}{(1-\upsilon_{12})}(\sigma_{obg} - \alpha \cdot P_{ppg}) + P_{ppg}$$

- υ_{13} = Fracture ID Horizontal-Vertical Poisson's Ratio, unitless
- υ_{12} = Fracture ID Horizontal-Horizontal Poisson's Ratio, unitless
- σ_{obg} = Overburden Gradient, psi/ft
- P_{ppg} = Pore Pressure Gradient, psi/ft
- α = Biot's Poroelastic Constant, unitless
- TVD = True Vertical Depth, ft

Overburden Gradient (psi/ft):	1.166
Pore Pressure Gradient (psi/ft):	0.68
Biot's Poroelastic Constant:	0.9