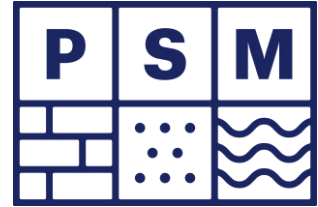


Addendum 1

Golden Point Underground – Discrete Modelling of DDFZ and 3D Stability Analyses of Panels 144, 164, 204 and the Life of Mine Plan. PSM71-383L DRAFT. 3 August 2026





Our Ref: PSM71-383L DRAFT

3 August 2026

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Dear [REDACTED]

RE: GOLDEN POINT UNDERGROUND - DISCRETE MODELLING OF DDFZ AND 3D STABILITY ANALYSES OF PANELS 144, 164, 204 AND LOMP

1. Introduction

This letter presents the discrete modelling within the Deepdell Creek Fault Zone (DDFZ) and update of the three-dimensional (3D) numerical analysis of selected panels for the Golden Point Underground (GPUG).

The letter presents:

- The discrete modelling of the DDFZ including methodology
- The numerical analysis
- Recommendations for mining and future work.

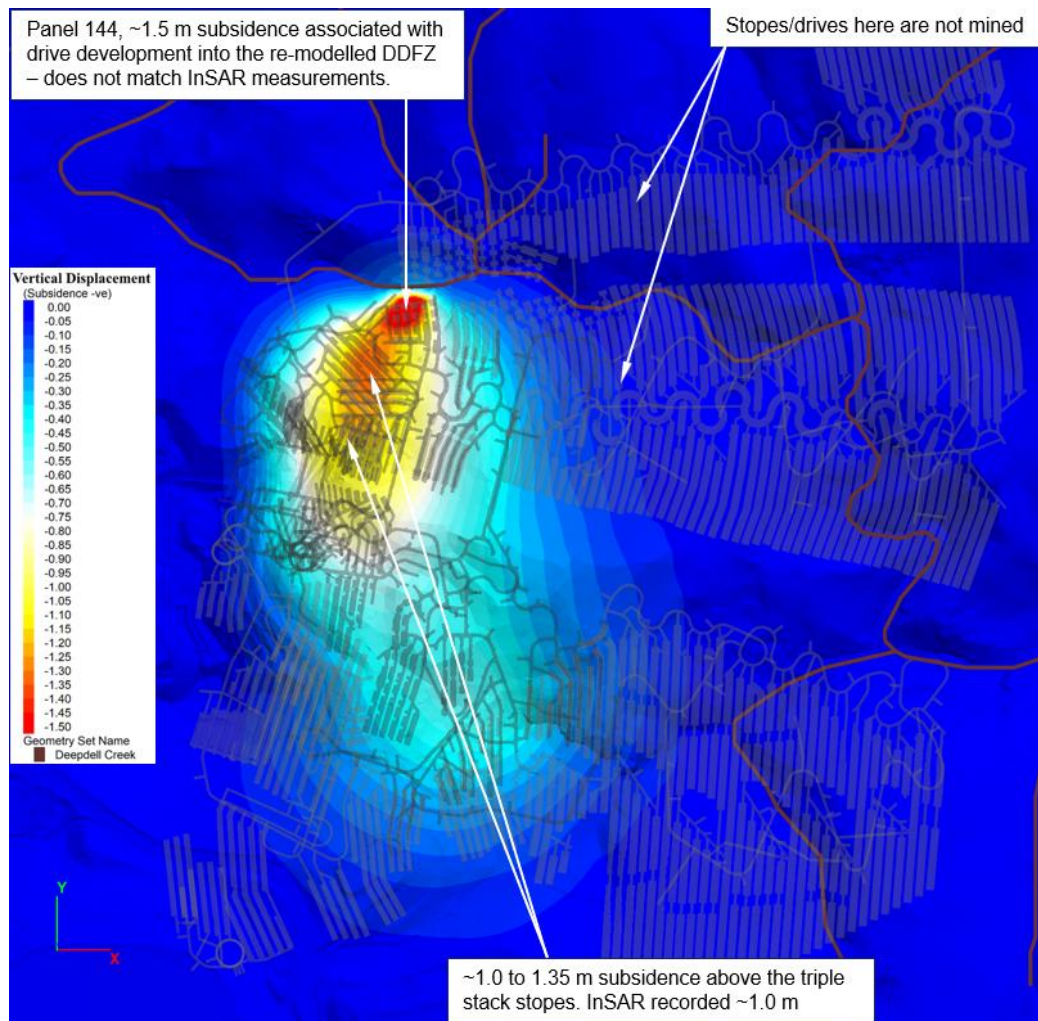
This work has been undertaken as requested by [REDACTED] of OceanaGold (New Zealand) Limited (OGNZL) and complements our existing work completed for Macraes Phase 4 – Fast Track Approvals Act for GPUG Mine Extension.

A meeting was held between OGNZL and PSM on 17 June 2026 to discuss the available data associated with the DDFZ and agree on a reasonable interpretation for numerical modelling. A follow up meeting was held on 2 July 2026 presenting the PSM discrete modelled DDFZ for comment by OGNZL. On 24 July 2026, PSM presented the results of the 3D numerical analyses to OGNZL.

2. Background

As part of the earlier GPUG subsidence assessment completed for MP4, PSM updated the geotechnical model with some changes to the DDFZ. The previous fault zone was about 100 m wide and follows the Deepdell Creek alignment. The modelled fault zone partially intersected underground drives in Panel 144. Numerical analyses simulated >1,000 mm of subsidence at the creek due to those drives intersecting the wide fault zone, refer Inset 1. Measured subsidence does not reflect this subsidence. Therefore, the fault model was likely overly conservative.

This body of work is to remodel the DDFZ as discrete faults rather than a wide zone of poor rock mass. The objective is to model conditions that more closely represent the data available and the ground behaviour to date.



Inset 1: Vertical Displacement (Subsidence) Previously Simulated for As-Mined GPUG (PSM071-373R REV2).

3. Available Data

The following points list the data provided by OGNZL for this assessment:

- Underground as-built solids as at May 2026
- Underground design solids:
 - GPUG6+6_Design_Solids_Base_Stopes
 - GPUG6+6_Design_Solids_Base_Development
 - GPUG6+6_Design_Solids_Addition1_Stopes
 - GPUG6+6_Design_Solids_Addition1_Development
 - GPUG6+6_Design_Solids_Addition2_Stopes
 - GPUG6+6_Design_Solids_Addition2_Development
 - GPUG6+6_Design_Solids_Addition3_Stopes
 - GPUG6+6_Design_Solids_Addition3_Development.
- Geological face mapping data from the Panel 144 to 17 July 2025
- Fault Control Point spreadsheet
- OGNZL fault model developed for GPUG.

4. Deepdell Fault Zone Inputs

This section describes the inputs used by PSM for modelling of the discrete faults proximal to Deepdell Creek.

4.1 Lineament Assessment

An update to the lineament assessment completed in PSM71-373R DRAFT REV2¹ for GPUG and surrounding area was undertaken at a local scale, focusing on the Deepdell Creek and proposed mining areas within the Deepdell Creek standoff area. The data utilised for this focused assessment comprised:

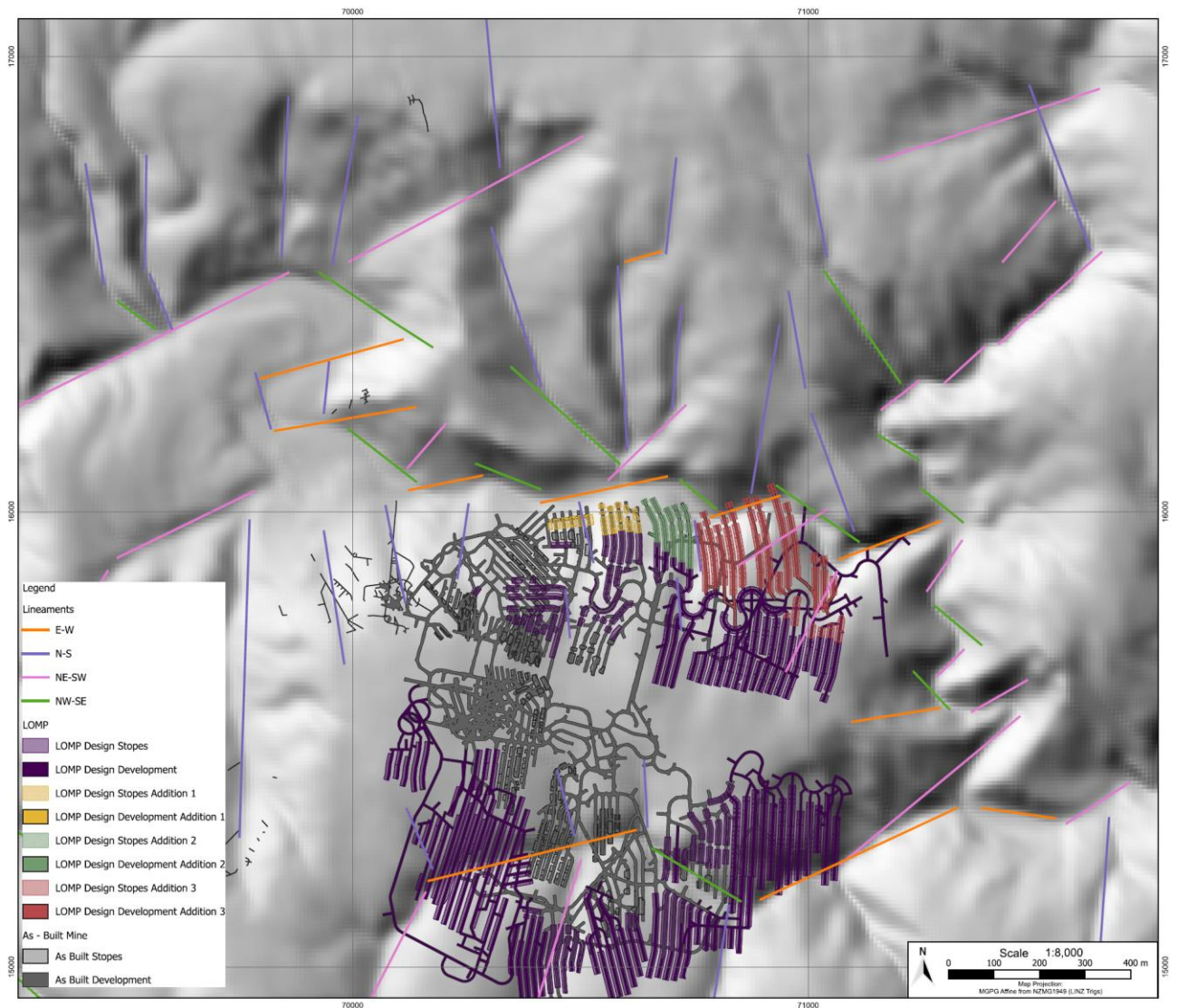
- Pre-mining topographic surface
- Aerial imagery
- Modelled ore body solids.

The lineament assessment was conducted on the data listed above, utilising both 3D visualisation software with a 2x vertical exaggeration applied as well as hillshade models.

Inset 2 presents the lineaments identified within this focused assessment. The lineaments have been categorised by orientation, and are summarised below:

- North-south trending set
- East-west trending set
- North-east south-west trending set
- North-west south-east trending set.

⁽¹⁾ PSM71-373R DRAFT REV2. Macraes Phase Four Project – Golden Point Underground Extension – Mine Subsidence Assessment. Issued 24 July 2026.

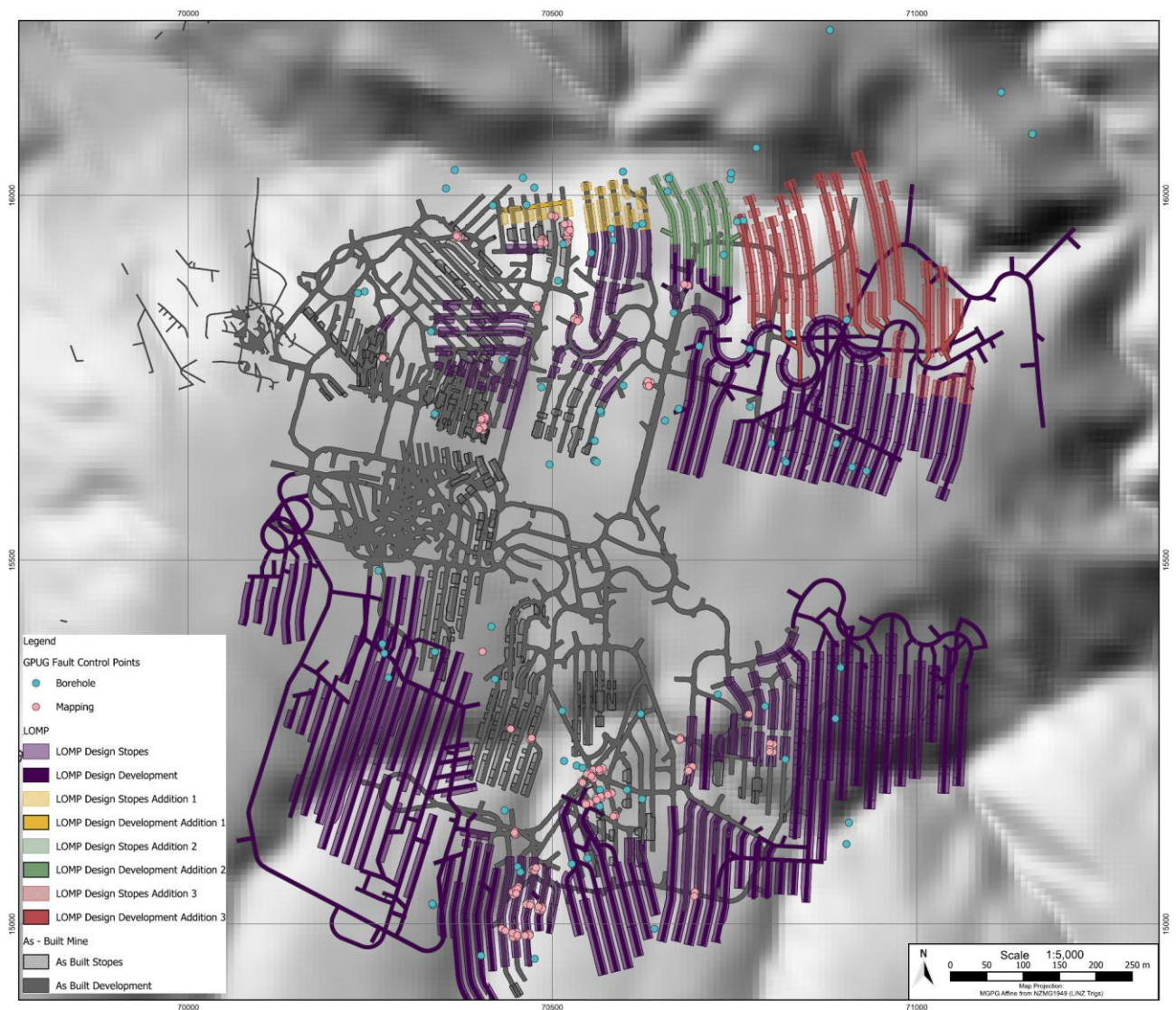


Inset 2: Plan View of Lineaments Proximal to DDFZ.

4.2 OGNZL Fault Control Points

Fault control points used by OGNZL in their modelling of faults within the GPUG area were provided for this update. Inset 3 provides a plan showing the spatial distribution of this data with orientation measurements, with the majority of this data coming from oriented core measurement in boreholes or geological mapping of development cuts. The database included the following fault characterisation data:

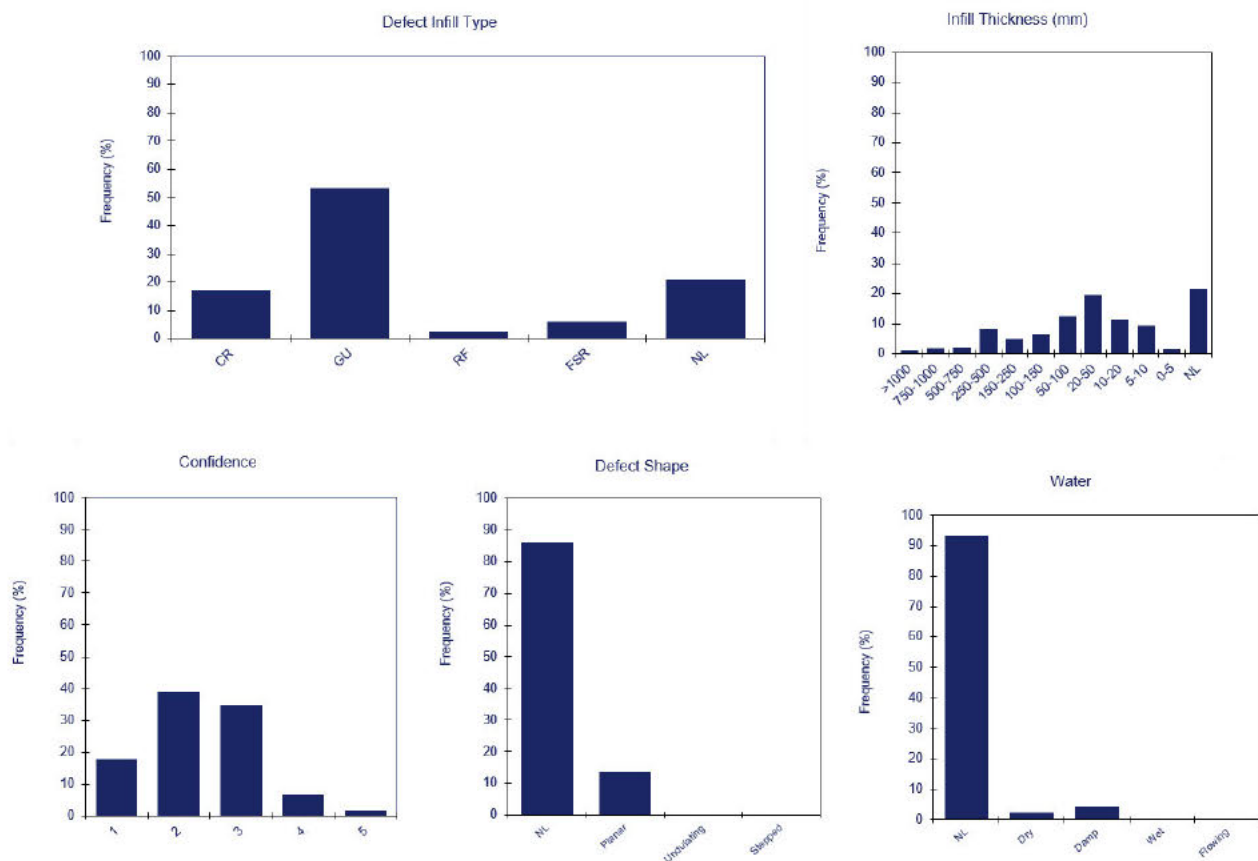
- Fault intercept source
- Orientation
- Infill type and thickness
- Confidence.



Inset 3: Plan View of Spatial Distribution of Fault Control Points with Orientation Measurement Data.

Histograms showing the typical characteristics of this data are presented in Inset 4 and are summarised below:

- Most faults are infilled with gouge and have thicknesses less than 50 mm
- Most structures are planar and dry to damp
- Confidence in the intercepts is typically recorded as 2 to 3 (i.e. moderate; 1 is high confidence and 5 is low confidence).

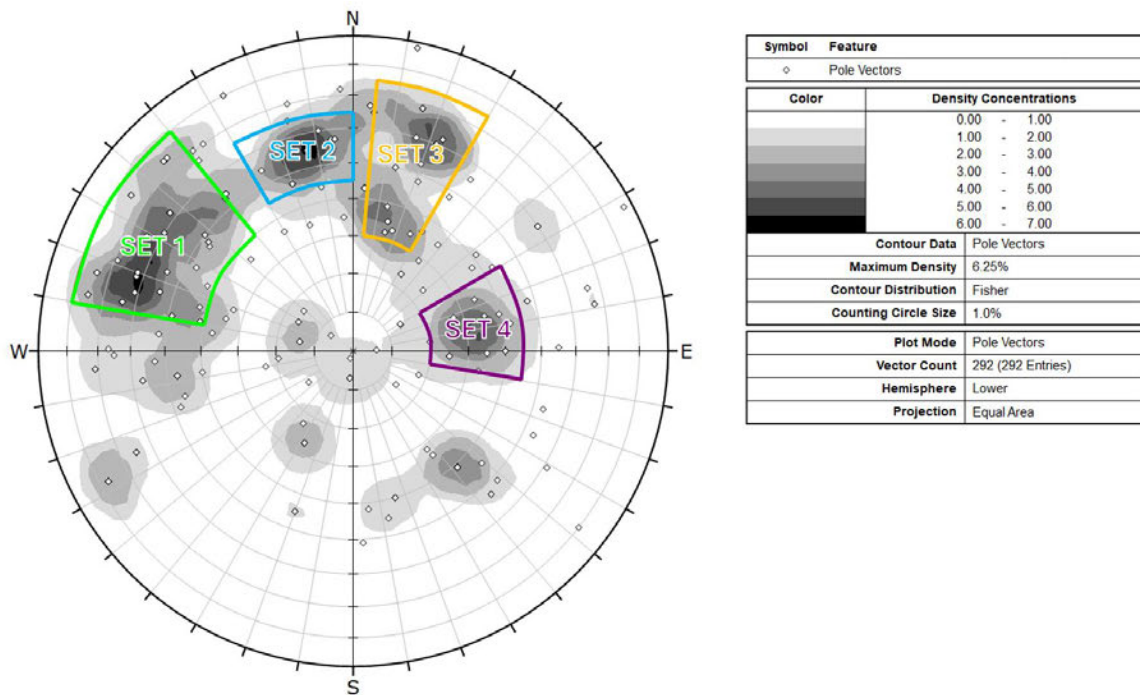


Inset 4: Summary of Characteristics of Major Structures Recorded by OGNZL in the Fault Control Points Database for GPUG. Note “NL” Means Not Logged.

Inset 5 presents a stereoplot of the structure points used by OGNZL in their fault modelling with the interpreted defect sets summarised in Table 1.

Table 1 – Summary of Interpreted Defect Sets Identified from OGNZL Fault Control Points

Defect Set	Dip (°)	Dip Direction (°)	Comment
Set 1	40 – 80	100 – 140	Foliation parallel shears
Set 2	45 – 65	150 – 180	Parallel to DDFZ
Set 3	30 – 75	185 – 210	Parallel to DDFZ
Set 4	20 – 45	240 – 280	Ramp Shears – antithetic to Macraes Shear Zone

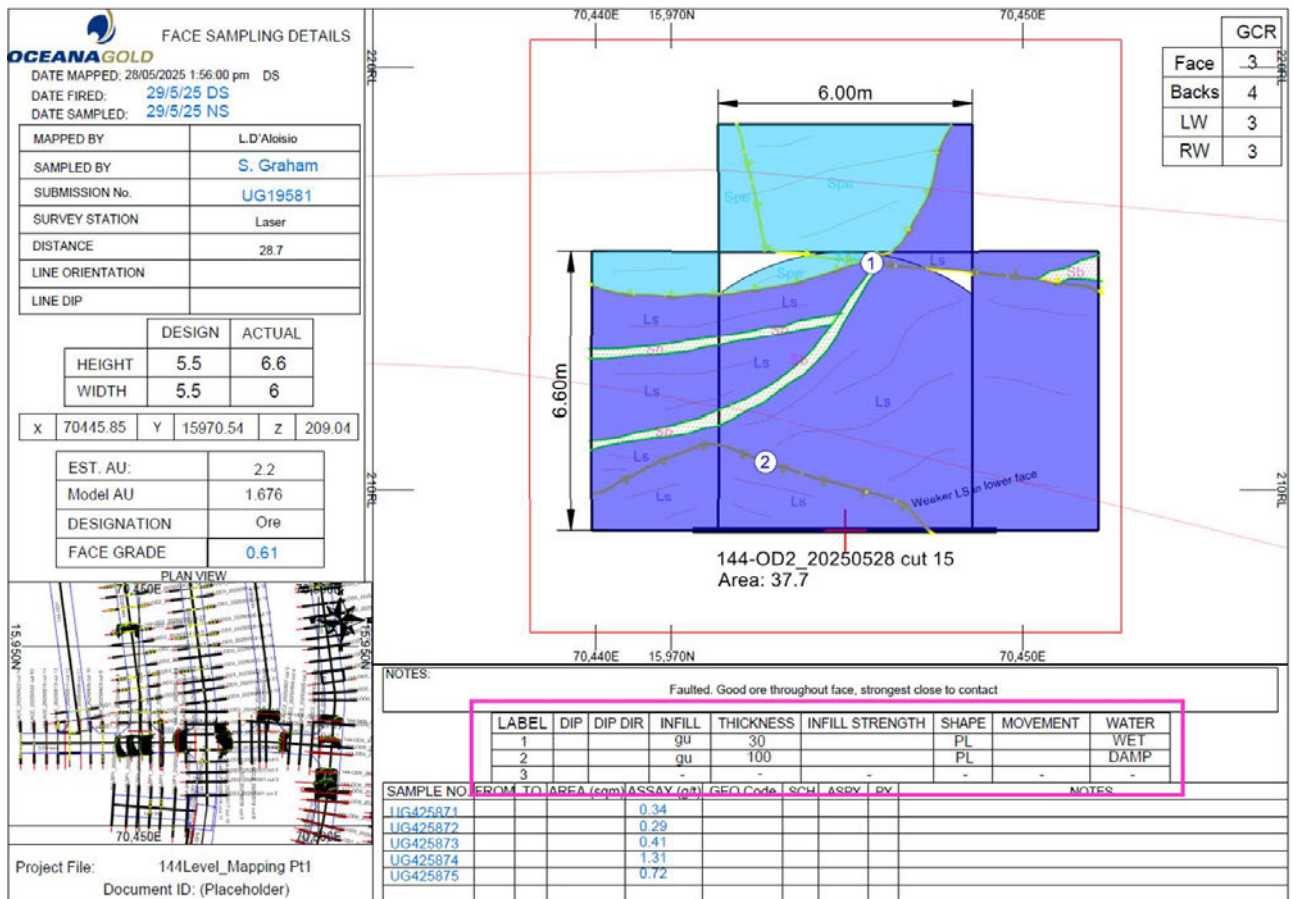


Inset 5: Stereoplot of OGNZL Structural Data Used for Fault Modelling from Mapping, Lidar Scans and Drillhole Data.

4.3 Panel 144 Mapping Data

Face mapping of the Panel 144 was completed by OGNZL geologists during mining via 2D sketches or 3D LiDAR face scans, an example of which is shown below in Inset 6. Major structures, when identified, were labelled on the map and typical information tabulated, including:

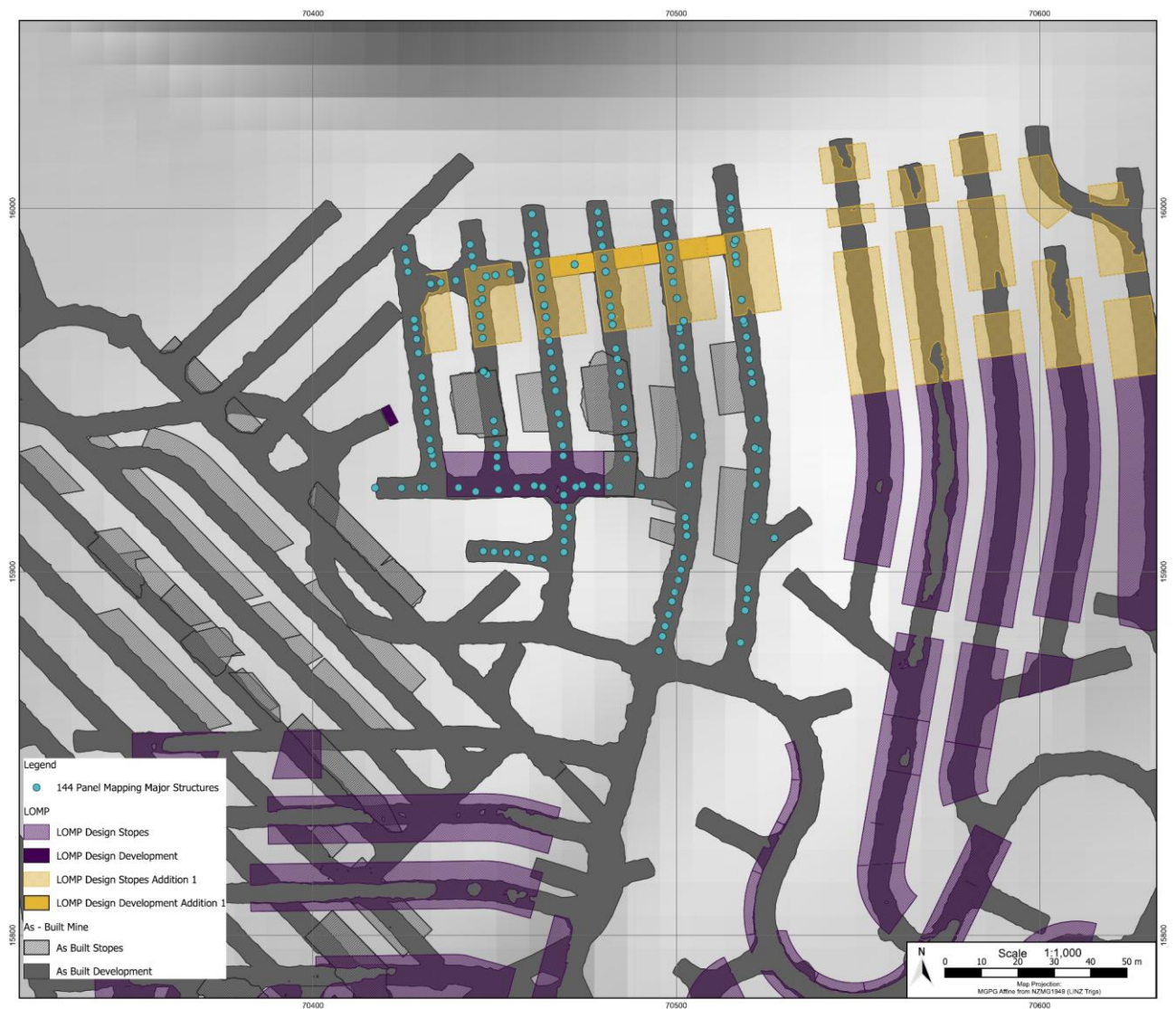
- Infill type and thickness (sometimes infill strength)
- Shape
- Water content.



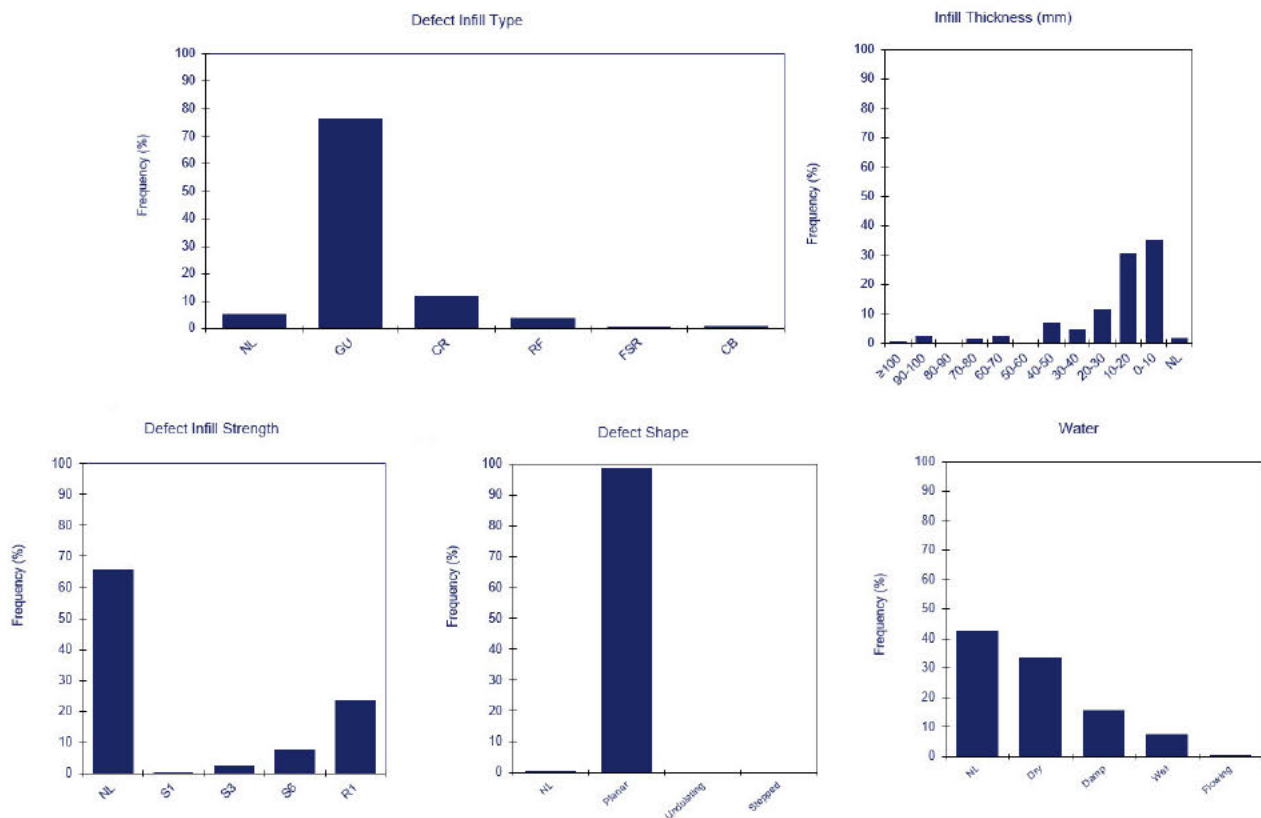
Inset 6: Example of OGNZL Face Mapping for Panel 144. Note the Pink Box Around the Major Structure Table That Corresponds to the Numbers on the Structures in the Face Map.

Face mapping of the Panel 144 identified a total of 274 major structures, with the spatial distribution of cuts with major structures shown in Inset 7. Histograms of the mapping characteristics are shown in Inset 8 and the typical characteristics summarised below:

- Gouge thickness is typically 10 to 20 mm
- Most structures are planar and dry to damp
- When logged, infill strength was typically R1 – very low rock strength
- The largest structure identified was a 150 mm thick gouge zone.



Inset 7: Spatial Distribution of Major Structures Identified by OGNZL Geologists During Mapping of Panel 144.



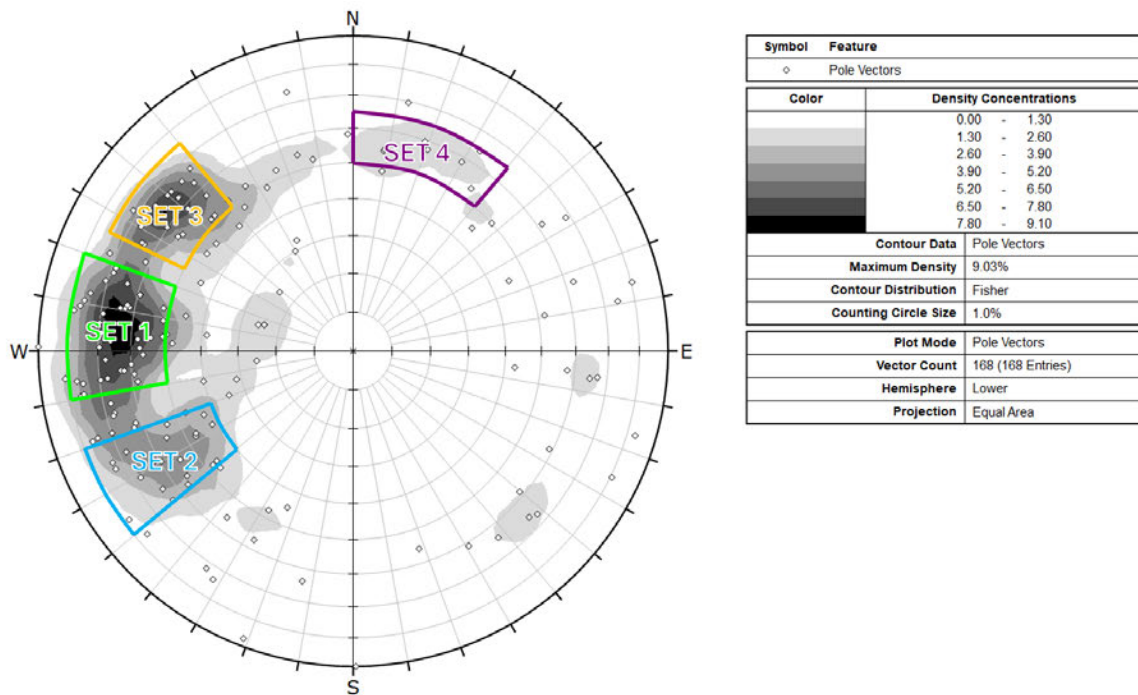
Inset 8: Histograms of Mapped Major Structure Characteristics in Panel 144. Note the “NL” Means Note Logged.

Structural traces identified during the face mapping had also been reprojected onto the 3D mine development geometry as linework traces. These lines were triangulated by PSM to form surfaces, of which the orientation was measured. Inset 9 presents a stereoplot of the major structures identified from mapping of the Panel 144 with the defect sets summarised in Table 2. It is noted that no westward dipping faults, parallel to ramp shears, were encountered during mapping of the Panel 144.

Care has been taken using this data as it is difficult to attribute which faults mapped by the geologists are of geotechnical significance or if those identified are primarily controlling and / or offsetting ore.

Table 2 – Summary of Interpreted Defect Sets Identified from Panel 144 Mapping

Defect Set	Dip (°)	Dip Direction (°)	Comment
Set 1	50 – 80	080 – 110	Foliation parallel shears
Set 2	50 – 75	115 – 140	Closely aligned to foliation parallel shears
Set 3	40 – 80	50 – 70	Closely aligned to foliation parallel shears
Set 4	50 – 65	180 – 220	Possible DDFZ



Inset 9: Stereoplot of OGNZL Mapped Major Structures from Panel 144.

4.4 Core Photo Logging

To assist with characterising the rock mass in the vicinity of the inferred DDFZ, photo logging has been undertaken on 92 diamond boreholes selected near the inferred DDFZ trace in the core photograph library. The purpose of the photo logging was to identify and characterise diamond core intervals of deformation that may be attributed to large scale faulting. Photo logging of boreholes was systematically assessed by identifying features that are potentially related to faulting.

Insets 10 to 13 present typical fault damage types observed in core photos. Each structure identified was classified as one of the following types:

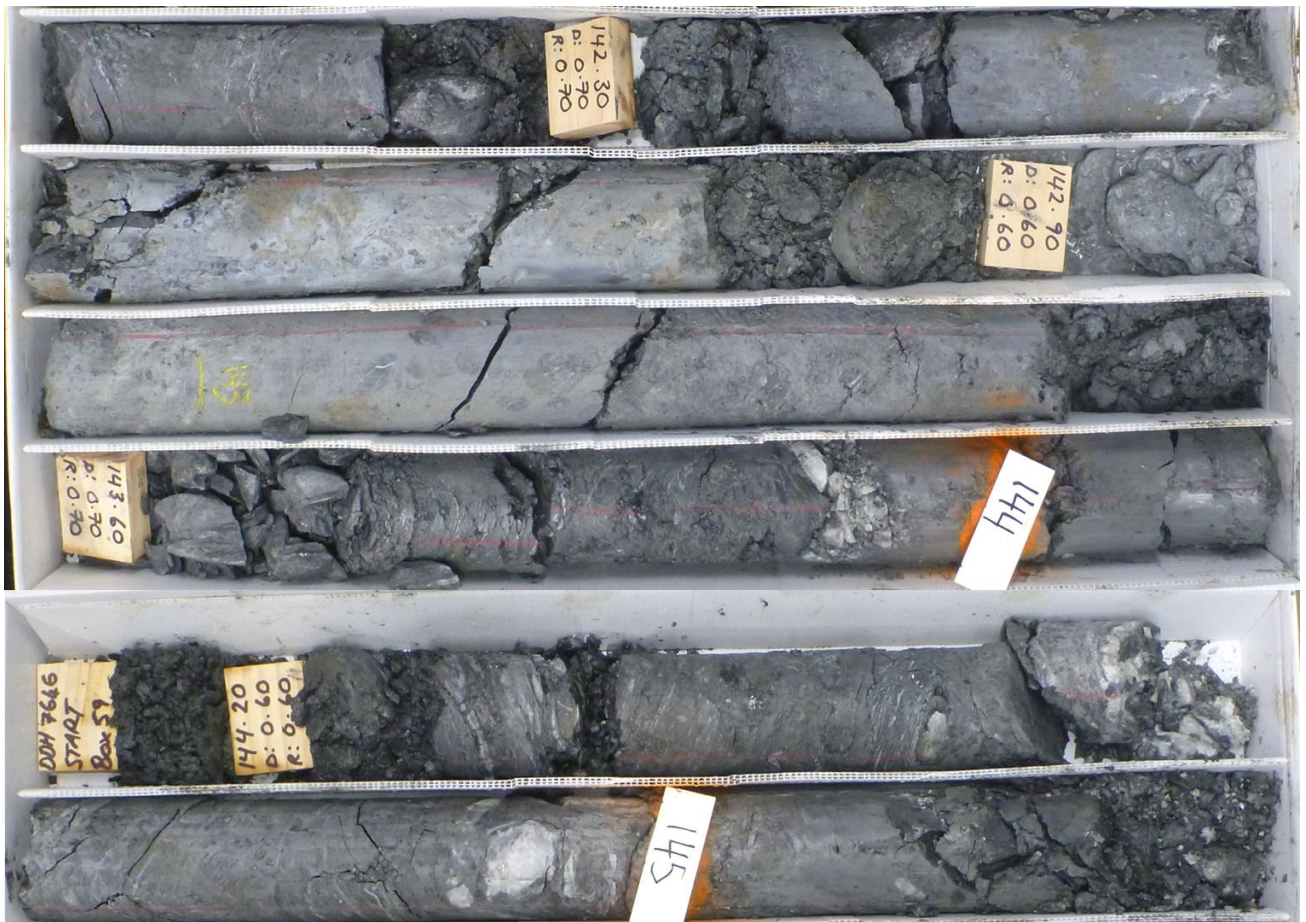
- **Fault Gouge Zone** - comprising primary zone of fault brecciated rock with fault gouge material
- **Fragmented Zone** - highly disturbed rock with discrete zones of crush or shearing. Located proximal to fault gouge zones, often as a halo surrounding the fault gouge zones
- **Fractured Zone** – rock which is typically distal to fault gouge zone but has evidence of disruption characterised by an increased degree of background fracturing
- **Intact Rock** – rock that has little to no increase in background fracturing but is overprinted with a sheared, brecciated or cataclastic texture, has an increase in alteration or veining or the foliation fabric is disturbed.

Other attributes assigned to the structure included:

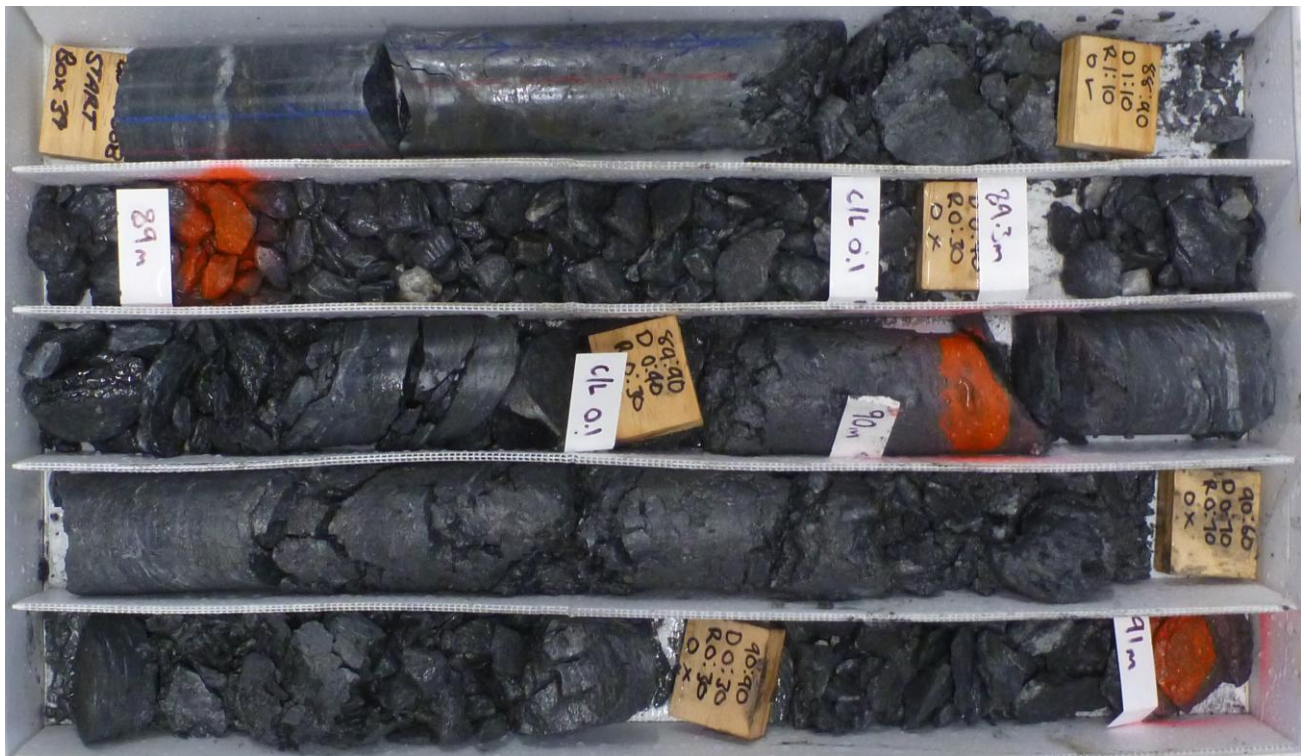
- Confidence – ranked highest (5) to lowest (1), based on the likelihood of the structure being the result of faulting or related processes
- Significance – ranked highest (3) to lowest (1), based on the thickness of the structure interval and degree of fault rock development and/or fracturing to estimate the relative importance of an interval
- Alpha – ranked low, moderate or high relative to core axis, an estimate of the alpha angle of any obvious planar discontinuity within the zone
- Structure relative to foliation – ranked parallel, orthogonal or opposite, discussed further in Section 4.4.1 below.

The purpose of this classification was to:

- Differentiate the primary fault gouge zone from the surrounding increase in background fracturing
- Delineate the extents of individual structures
- Characterise the rock mass condition within each structure.



Inset 10: Fault Gouge Zone – Example from DDH767.



Inset 11: Fragmented Zone – Example from DDH7668.



Inset 12: Fractured Zone – Example from DDH7776.

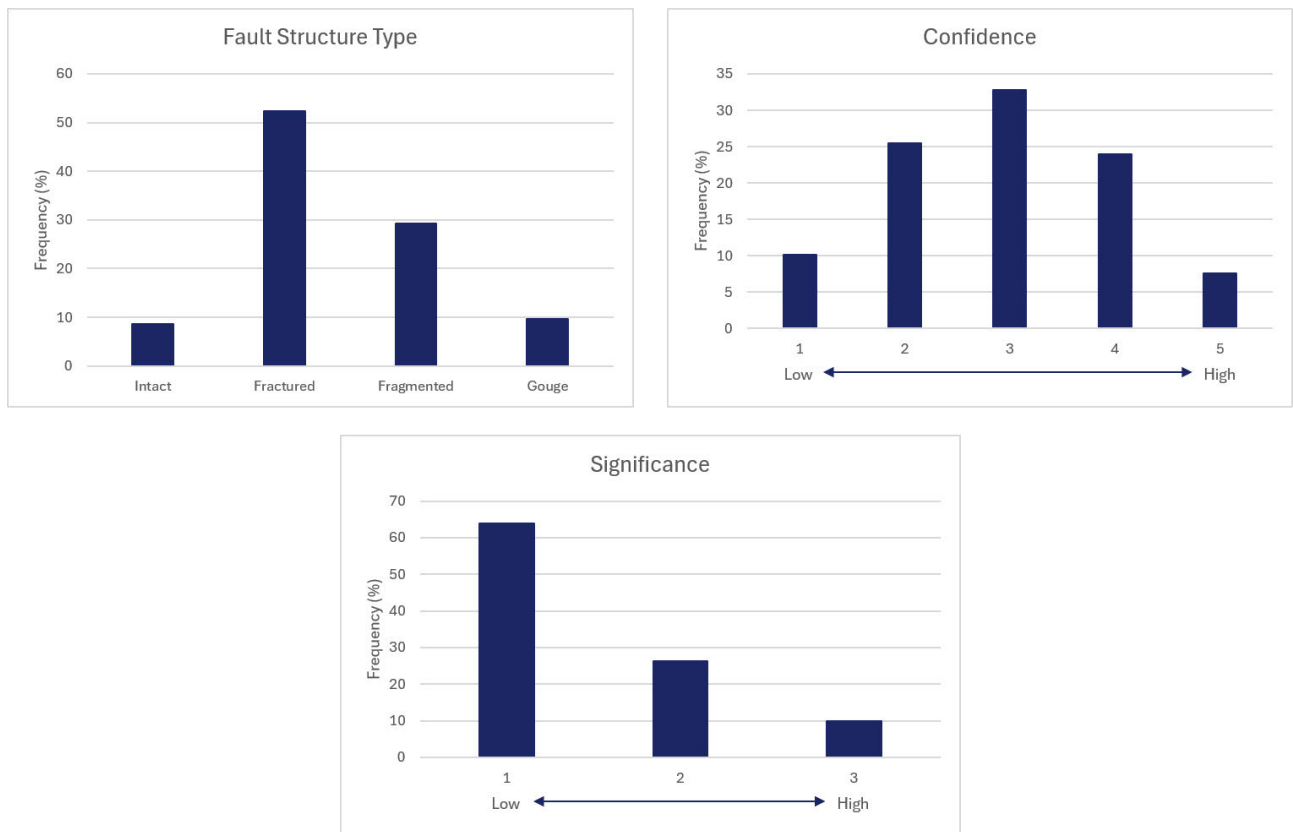


Inset 13: Intact Zone – Example from DDH7729.

A total of 643 structural intervals were identified across the 92 boreholes. The photologging database compiled by PSM is provided electronically in Appendix A. Inset 14 presents histograms of the key attributes recorded during the photo logging assessment.

Typically, the following is observed:

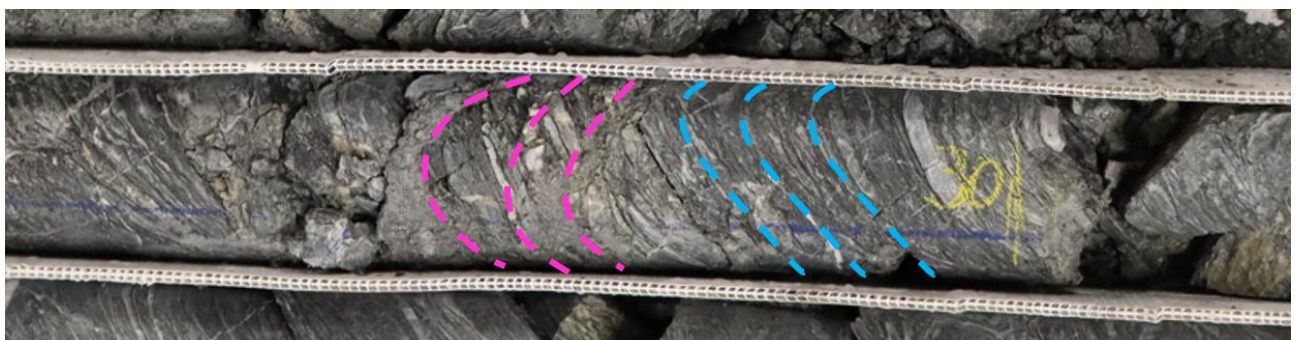
- Fractured and fragmented are the most common fault structure types observed
- Most structures identified have a confidence rating of 3, suggesting moderate confidence in picked structures. Structures picked as fracture zones, which show poor fault development, have typical confidence ratings of 2 to 3, suggesting low to moderate confidence. T Fragmented zones have typical confidence ratings of 3 and 4, suggesting moderate to high confidence in these intervals
- Structures identified typically have a significance rating of 1, suggesting most structures are relatively narrow or have poor fault rock development.



Inset 14: Histograms of Fault Characteristics Observed Via Photo Logging.

4.4.1 Foliation

The boreholes that were photo logged did not have oriented core or televiewer data available to assist with structure orientations. In an attempt to understand orientation, the orientation of the faults was estimated relative to foliation – which is understood to be older than faulting. The broad consistency in the metamorphic foliation fabric allowed the base of the fabric trace in core to be used as a reference orientation line. The geometric relationship between the structure and foliation was used to estimate the relative orientation of the structures with these being noted as; parallel, orthogonal or opposite to foliation. An example of this is shown below in Inset 15. Uncertainty can persist in relation to disturbance or irregularities in early formed foliation fabrics or mistaking the shear fabric for the foliation fabric.



Inset 15: Example of Structural Trace (Pink) Orthogonal to Foliation Trace (Blue).

5. Model Development

The following sections outline the modelling methodology and limitations of the resultant surfaces.

5.1 Methodology

The following section details the methodology adopted to develop 3D wireframes for geotechnical faults. This has been undertaken using the datasets described in Section 4, and includes:

- Lineaments identified in the topography surface and aerial image
- Structural measurements from fault control points
- Mapped structures from Panel 144
- Photo logged fault intervals.

The process for wireframe modelling is summarised as follows:

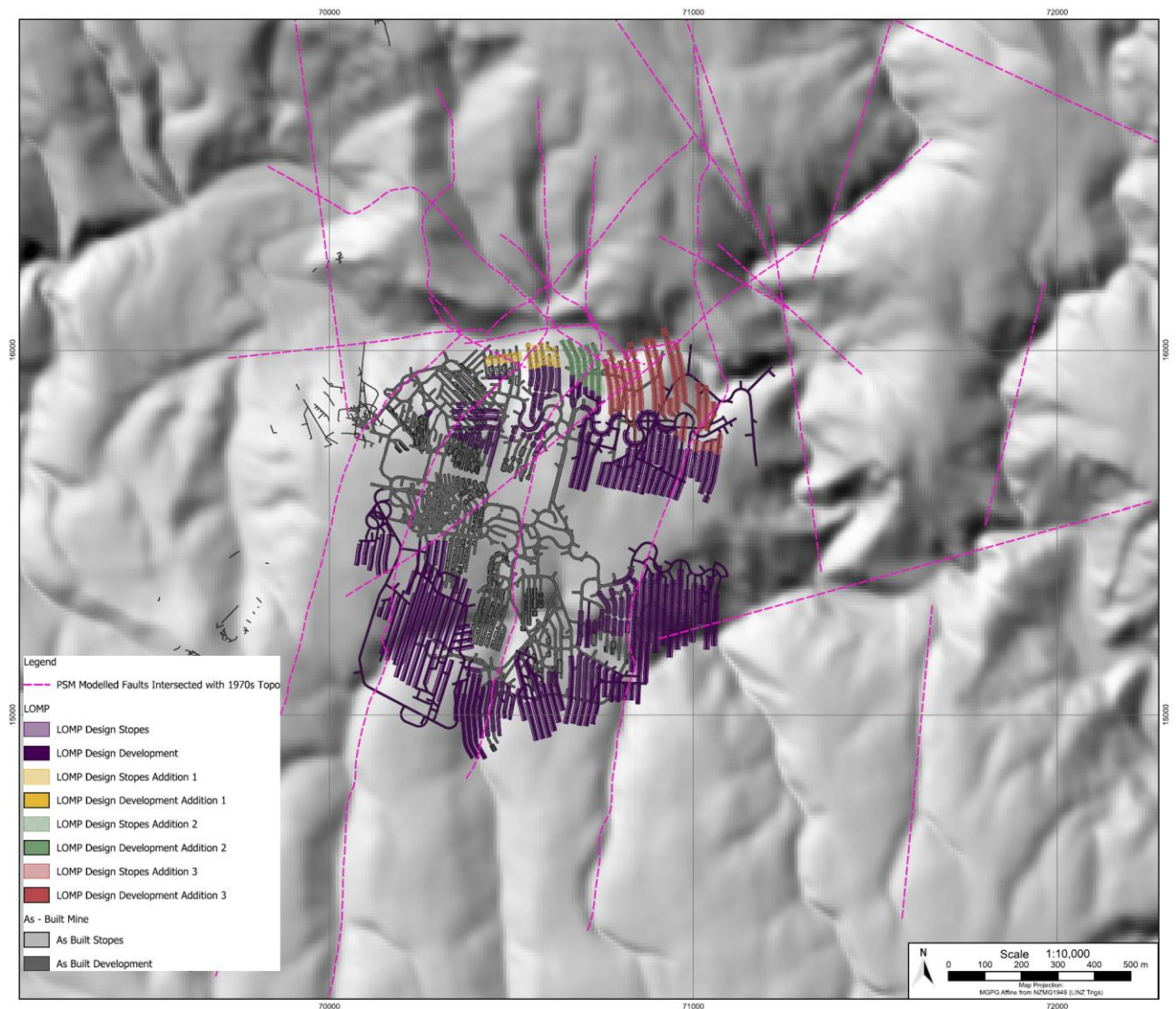
1. Upload of available datasets into the software GeologyCore developed by Maptek, including:
 - a. Importing lineaments, structural measurements and mapped structures from Panel 144 in 3D space
 - b. Importing fault interval database allowing the fault intervals to be visualised along borehole traces.
2. The modelling of faults was undertaken using the following process:
 - a. Structural measurements or mapping data were linked with:
 - i. Borehole fault intervals identified in photo logging, attempting to use intervals that were high confidence or had structural orientations relative to foliation trending in the targeted direction.
3. Additional faults were modelled for borehole intercepts beyond the extents of data coverage for the structural or mapping data using:
 - a. The structural orientation relative to foliation from borehole logging
 - b. Lineament strike.
4. Once structures were identified, modelling of:
 - a. A hanging wall and footwall to define the lateral extent of the zone based on widths of individual or clustered borehole intervals
 - b. A fault gouge plane which went through the inferred “worst” part of the zone based on core photo logging, targeting fault gouge intervals.
5. Resulting wireframes were extrapolated along the lineation strike and / or structural trend identified in structural measurements, mapping and / or photo logging.
6. Wireframes were terminated based on:
 - a. Intersection (along strike) of boreholes without logged fault intervals
 - b. The limit of the lineament/s the fault is following
 - c. Against perpendicular lineaments.
7. Where faults were inferred, a check of intersecting data for complimentary structures (mapping or photo logging) was undertaken for characterisation of the structure.
8. All modelled faults were terminated on the Footwall Fault.

5.2 Results

A total of 13 discrete fault structures were modelled within the vicinity of Deepdell Creek as part of this iteration. Each structure has been modelled with:

- A hanging wall and footwall surface defining the extent of the fault structure
- A fault gouge surface, corresponding to the most intensely deformed portion of the fault structure.

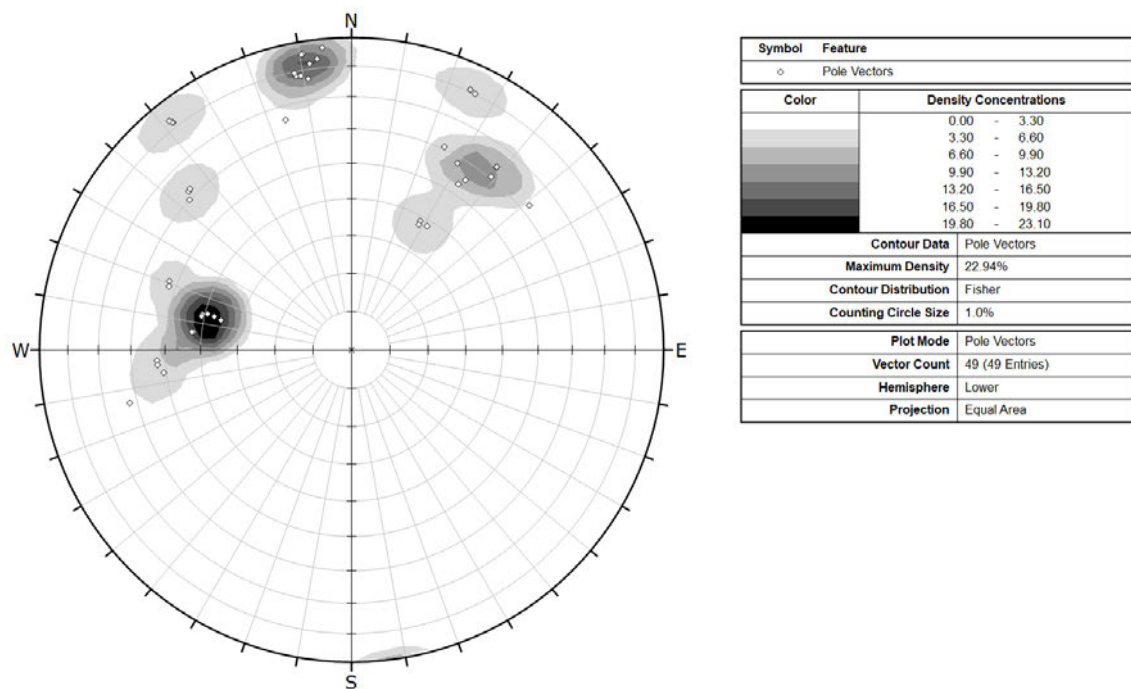
These newly modelled faults replace the previously modelled DDFZ by PSM and supersede five fault structures modelled from topographic lineaments within the vicinity Deepdell Creek. The surficial fault traces (only the fault gouge traces for simplicity) are presented in Inset 16 with wireframes (.dxf files) provided electronically in Appendix B.



Inset 16: Plan View Showing Fault Traces of PSM Modelled Faults.

Due to the deformational history, there is likely to be complexity in the shape, orientation and dip of the faults that is not captured by the discrete fault plane. The modelling completed is an interpretation of the available data and our understanding of the geological history. It is recommended that this model be continually updated as more data is collected including from mapping and borehole investigations.

Inset 17 presents the orientation of the modelled faults on a stereoplot.



Inset 17: Stereoplot of PSM Modelled Fault Structures for GPUG and Deepdell Creek.

5.3 Fault Characteristics

Fault characteristics, including average true thickness of modelled fault and dominant fault RMU, are presented below in Table 3 with the following points summarising the overall typical fault characteristics observed within core photos:

- Fault intervals within the modelled fault surfaces present as:
 - Zones of fragmented core, typically consisting of angular rock clasts and crushed rock or clay gouge. These zones are typically 3 to 4 m thick although can be locally thicker
 - Zones of fractured rock, consisting of angular rock clasts and minor clay - typically 2 to 4 m thick.
- Zones of core loss are not common in diamond cored boreholes
- There is evidence of shearing and brecciation between zones of gouge or fragmented
- No oxidation reversal observed in the fresh rock from borehole review, i.e. deep weathered pockets along major structures in fresh rock.

5.4 Confidence

Confidence for each of the modelled fault wireframes is summarised in Table 3 with a summary of the input data used to inform each wireframe. Confidence has been applied subjectively and has been assigned based on an evaluation of:

- Number of borehole intersections and associated confidence and significance of fault intersections
- Confidence in measured orientation, i.e. mapping vs structure orientation relative to foliation
- Lineament strength
- Proximity to measured orientations and borehole data
- Expected fault geometries based on regional tectonics and structural history.

Expected fault trends based on structural point and mapping data from OGNZL.

Table 3 – Summary of Modelled Faults Characteristics, Inputs and Fault Confidence

Fault ID	Dip (°)	Dip Direction (°)	Maximum Length Along Strike (m)	Modelled Thickness (m)	Number of Intersecting Boreholes	Dominant Fault RMU	Input Types	Confidence
Fault 01	61	134	800	17	11	Fragmented	Borehole, Lineament	Moderate
Fault 02	84	171	365	20.5	20	Fragmented and fractured	Borehole, Lineament	High
Fault 03	78	167	180	12	6	Fractured	Borehole, Lineament	Low
Fault 04	82	142	2045	17.5	9	Fractured	Borehole, Lineament, Mapping	Moderate
Fault 05	35	103	2690	13	37	Fractured	Borehole, Lineament, Mapping	High
Fault 06	37	104	2735	7.5	28	Fragmented	Borehole, Lineament	Moderate
Fault 07	40	103	1850	13.5	19	Fragmented	Borehole, Lineament, Mapping	High
Fault 08	42	097	2535	7	5	Fragmented	Borehole, Lineament	Low
Fault 09	38	209	1290	19	43	Fractured	Borehole, Lineament, Mapping	High
Fault 10	83	172	765	31	5	Fractured and Intact	Borehole, Lineament	Low
Fault 11	55	212	335	23.5	21	Fractured	Borehole, Lineament, Mapping	High
Fault 12	64	218	545	11.5	19	Fragmented and fractured	Borehole, Lineament	Moderate
Fault 13	81	205	405	19	3	Fragmented	Borehole, Lineament	Low
Fault 14	52	087	1010	-	0	-	Lineament	Low
Fault 15	51	083	1225	-	0	-	Lineament	Low
Fault 16	62	231	680	-	0	-	Lineament	Low
Fault 17	62	077	1265	-	0	-	Lineament	Low
Fault 18	66	164	1405	-	0	-	Lineament	Low
Fault 19	60	219	530	-	0	-	Lineament	Low
Fault 20	61	205	1700	-	0	-	Lineament	Low
Fault 21	52	086	865	-	0	-	Lineament	Low
Fault 22	52	111	680	-	0	-	Lineament	Low
Fault 23	52	109	1475	-	0	-	Lineament	Low

5.5 Limitations

The following limitations apply to the structural modelling:

- The modelled structures are based on the available data. Orientation of faults modelled outside of available mapping data points have inherent lower confidence in the overall structural model
- Review of the mapping data suggests major structures mapped may be attributed to geological structures controlling ore as opposed to geotechnical structures with the potential for geotechnical structures to have been underrepresented in the dataset
- Certain modelled faults are not evidence in the core photos of all intersecting boreholes. This discrepancy may arise from variation in fault geometry, orientation, or dip caused by subsequent deformation events which are not accounted for in the model
- Some moderate to high-confidence photo logged fault intervals lack corresponding modelled wireframes. These intercepts could indicate fault structures or splays of modelled fault structures that cannot be accurately modelled with the current available data
- Not all lineaments may be related to faulting. Some faults may not have a strong surface expression.

6. Geotechnical Stability Analysis

6.1 Model Description

6.1.1 Model Set-Up and Geometry

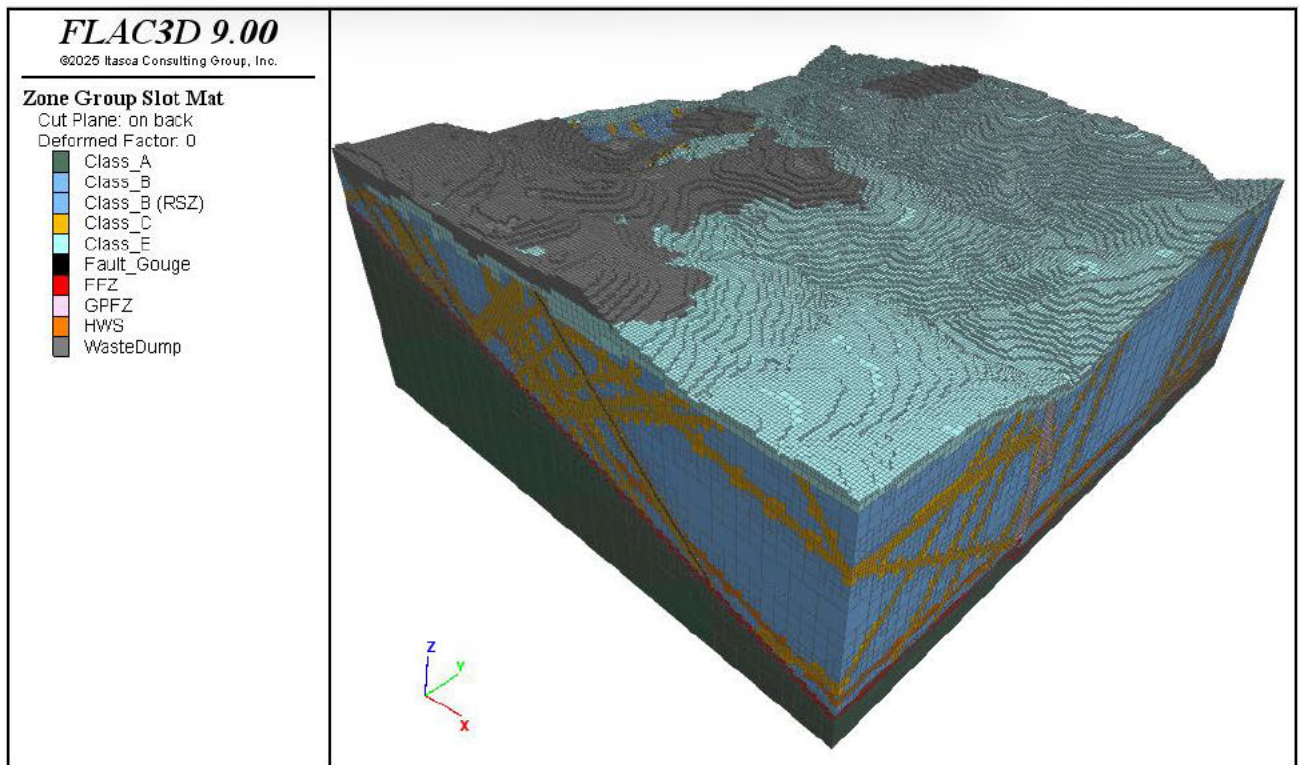
3D numerical stability analyses has been undertaken using the commercial software FLAC3D version 9.0 from Itasca.

The model extent is approximately 2,000 m by 2,200 m in plan and about 1,000 m deep, with the underground mining extent positioned centrally within the model domain. The finite element mesh comprises approximately 9.5 million elements with a refined element size of 1 to 2 m applied within and surrounding the drives and stopes. Element size is progressively coarsened with distance from the stope excavation to optimise computational efficiency whilst maintaining accuracy in the zone of interest.

The model geometry set-up for the analysis incorporated the following:

- OGNZL modelled faults as per previous modelling
- PSM revised faults around the DDFZ in addition to those modelled previously
- Latest as-built geometry for existing underground
- Base case mining scenario incorporating all Life of Mine Plan (LOMP) stopes outside Deepdell Creek standoff zone (defined by 24° draw angle plus 25 m)
- Additional mining scenario's incorporating LOMP stopes within the Deepdell Creek standoff zone.

Inset 18 shows an overview of the 3D model geometry.



Inset 18: Overview of the FLAC3D Model Geometry.

6.1.2 Material Properties

The material properties adopted for modelling are based on the properties outlined in Table 4. Faults are modelled as zones of Class C material. Rock mass units have been modelled using a strain softening approach to capture the squeezing ground behaviour observed in drives and progressive failure observed in around stope openings. As discussed in PSM71-383R DRAFT REV2, calibration of the extent of strain softening was undertaken on the basis of the observed ground movement data. The rock mass shear strengths have been adjusted to match measured subsidence, that work is presented in PSM71-383R DRAFT REV2. The 'calibrated' model is applied here.

Table 4 – Adopted Rock Mass Parameters

Rock Mass/Class	Unit Weight (kN/m³)	UCS (MPa)	GSI	<i>m_i</i>	Mohr-Coulomb		Tensile Strength (MPa)	Poisson's Ratio	Rock Mass Modulus (MPa)
					Cohesion (kPa)	Friction Angle (°)			
Class A	0.027	40	65	12	N/A		0.2	0.25	2,000
Class B		40	55				0	0.25	1,500
Class C		35	45				0	0.25	1,000
Fault Gouge	0.025	N/A			50	20	0	0.35	250
GPFZ ⁽¹⁾					100	40	0	0.35	500
Class E / Weathered Zone					100	38	0	0.35	100
Waste Dump / Backfill					10	37	0	0.35	100

Note:

(1) Golden Point Fault Zone.

6.1.3 In-situ Stress

The in-situ stress conditions considered for this modelling assessment are:

- Vertical stress: $\sigma_v = \gamma \times depth$
- Major horizontal stress: $\sigma_{NS} = 1.0 \times \sigma_v$
- Minor horizontal stress: $\sigma_{EW} = 1.0 \times \sigma_v$.

PSM note, the in-situ stress applied to the model are less than the measured insitu stress described in PSM71-383R DRAFT REV2. Application of the measured insitu stress will lead to slightly less ground surface deformation.

6.1.4 Groundwater Conditions

The groundwater is anticipated to drain into the underground excavations and therefore groundwater pressure as not been incorporated in the current model.

6.1.5 Model Staging

The adopted model staging comprises the following stages:

- Initial Stage – Initialisation of pre-mining in-situ stresses
- Stages 1 – Simulation of mining of the as-built drives and stopes
- Stage 2 – Simulation of mining of the currently consented LOMP drives and stopes located south of the Deepdell Creek standoff zone (i.e. Base case analysis)
- Stage 3 – Simulation of additional scenarios for mining of LOMP stopes within the Deepdell Creek standoff zone (three additional mining scenarios provided by OGNZL were considered for this stage).

The following model runs have been undertaken:

- **Base Case Analysis:**
 - Mining of all LOMP GPUG workings (existing and consented) located south of the Deepdell Creek standoff zone.
- **Scenario 1:**
 - Scenario incorporating mining of Panels 144 and 164 located within Deepdell Creek standoff zone (i.e. OGNZL's Mining Addition 1).
- **Scenario 2:**
 - Scenario incorporating mining of Panels 144, 164 and 204 located within Deepdell Creek standoff zone (i.e. OGNZL's Mining Additions 1 and 2).
- **Scenario 2 sensitivity case:**
 - Re-run of Scenario 2 by excluding the Panel 204 stopes at the end of each ore drive.
- **Scenario 3:**
 - Scenario incorporating the remaining consented LOMP drives and stopes located within the southern side of Deepdell Creek standoff zone (i.e. OGNZL's Mining Additions 1, 2 and 3).

6.2 Results

Results of the FLAC3D analysis are presented in Appendix C and include contours of surface settlement, horizontal movement and tensile strains at the ground surface. Separate plots have also been produced to show the predicted vertical subsidence and total strains along the Deepdell Creek alignment.

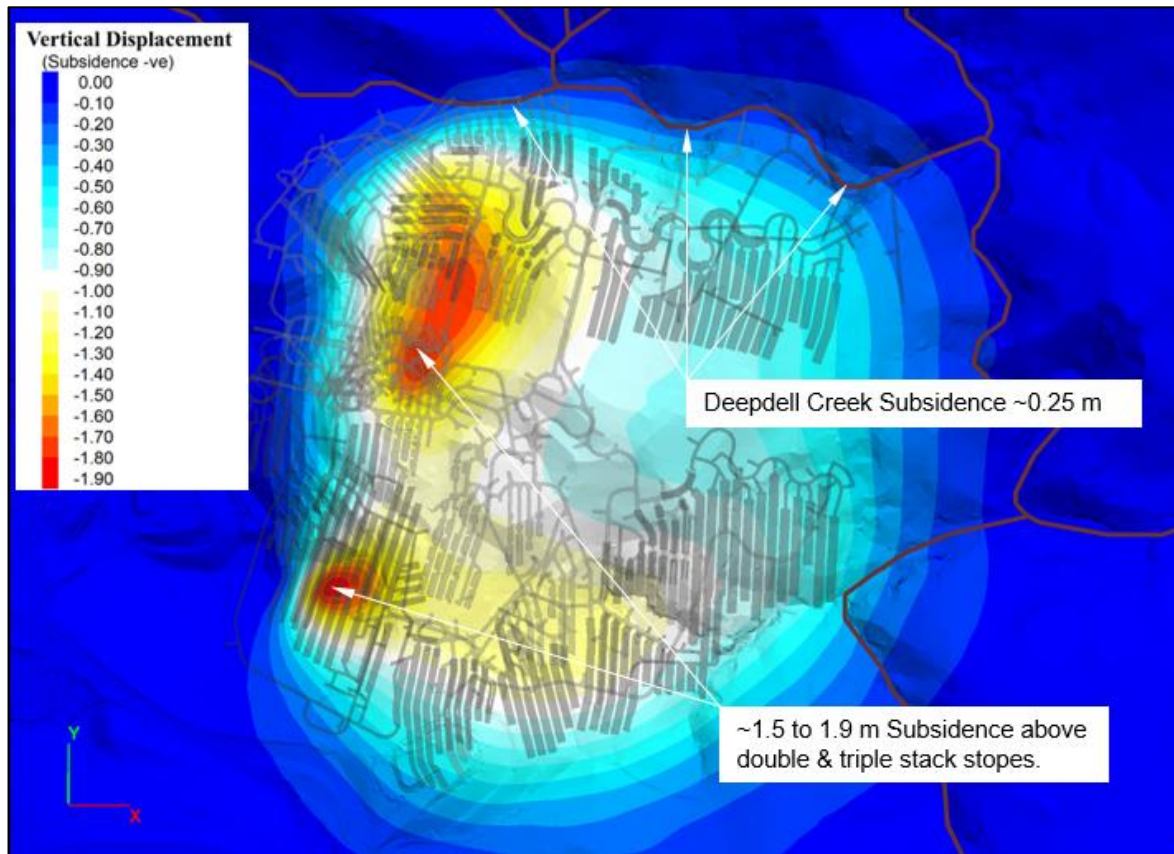
GPUG As-mined results

The modelling results for the as-mined GPUG drives and stopes indicated maximum simulated subsidence of about 1.5 m. The maximum subsidence was encountered above the triple stack stopes/lodes (Inset 1), with the predicted settlement trend showing good agreement with InSAR measurements.

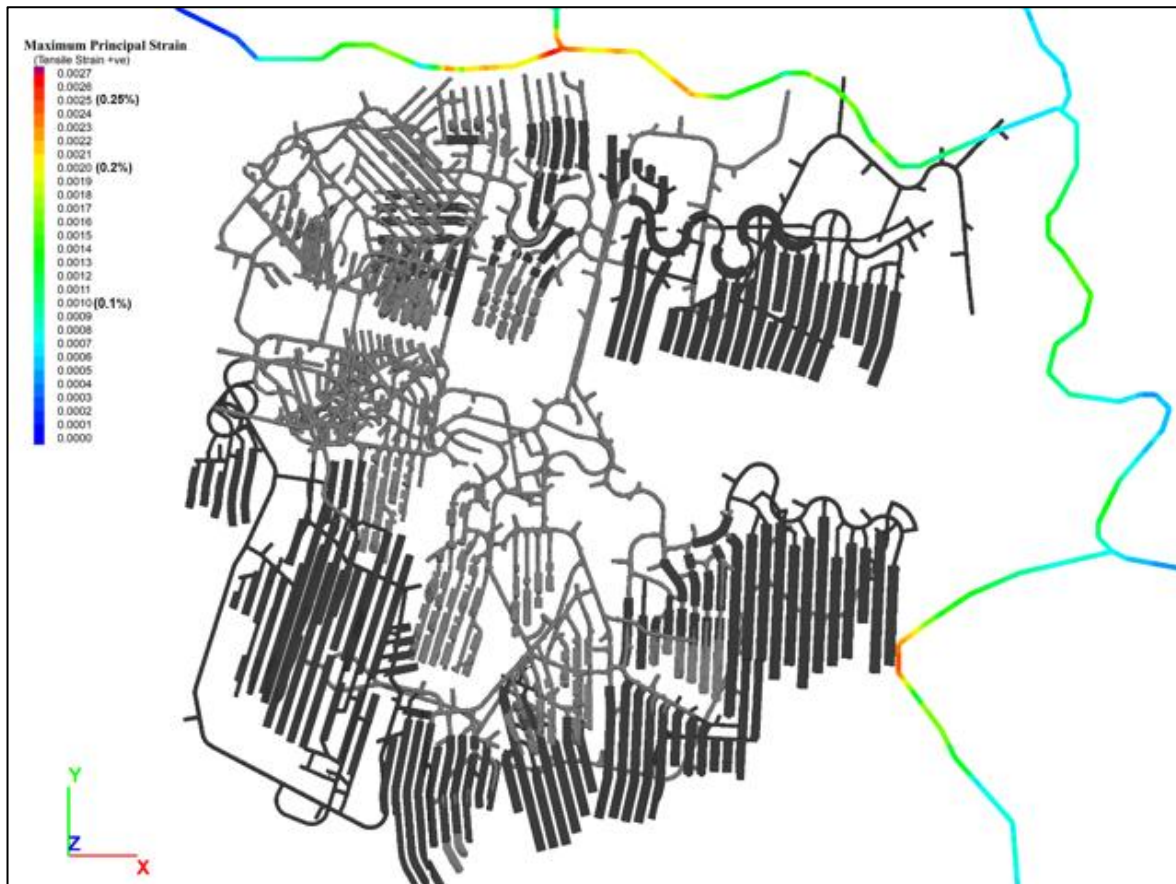
The predictions for the as-mined GPUG also indicated maximum subsidence of about 0.2 m and maximum tensile strain of 0.25% (i.e. 2.5 mm/m) along Deepdell Creek. The maximum Deepdell Creek subsidence was encountered adjacent to the Panel 144 ore drives.

LOMP Base Case results

The numerical analysis results the LOMP Base Case (i.e. mining of all consented LOMP GPUG drives and stopes south of the Deepdell Creek standoff zone) indicated maximum simulated subsidence of about 1.9 m. This maximum subsidence was also encountered above the double and triple stack stopes/lodes (Inset 19). The predictions for the LOMP Base Case analysis indicated maximum subsidence of about 0.25 m and maximum tensile strain of 0.25% (i.e. 2.5 mm/m) along Deepdell Creek (Inset 20).



Inset 19: Vertical Displacement (Subsidence) Predictions for LOMP Base Case.

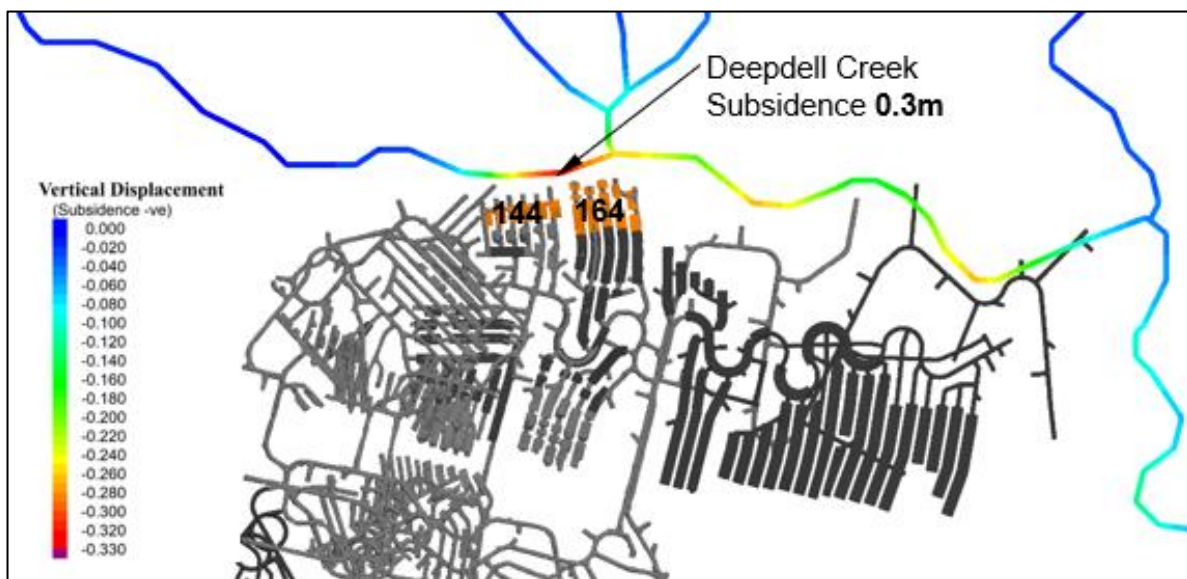


Inset 20: Tensile Strains Predictions for LOMP Base Case.

Scenario 1 (Panels 144 and 164) results

The overall subsidence prediction for Scenario 1 are broadly similar to the LOMP Base Case predictions (Inset 19) across the site. However, a slight increase in the predicted subsidence is noted above and adjacent to Panels 144 and 164.

Along Deepdell Creek, the Scenario 1 predictions indicate maximum subsidence of about 0.35 m and the predicted maximum tensile strain of 0.3% (i.e. 3.0 mm/m). As shown in Inset 21, the maximum subsidence along Deepdell Creek is predicted to occur above the north-western corner of Panel 164.



Inset 21: Scenario 1 Subsidence Predictions along Deepdell Creek.

Scenario 2 (Panels 144, 164 and 204) results

The overall subsidence prediction for Scenario 2 are also broadly similar to the LOMP Base Case predictions (Inset 19) across the site but with is a slight increase in the predicted surface subsidence above and adjacent to Panels 144, 164 and 204. Along Deepdell Creek, the Scenario 2 predictions indicate maximum subsidence of about 0.45 m and the predicted maximum tensile strain of 0.45% (i.e. 4.5 mm/m). As shown in Inset 22, the maximum subsidence along Deepdell Creek is predicted to occur at two locations above the north-western corner of Panel 164 and above the north-western corner of Panel 204.

It is noted that, the Deepdell Creek subsidence above Panel 164 increased by an additional 100 mm due to mining of Panel 204.

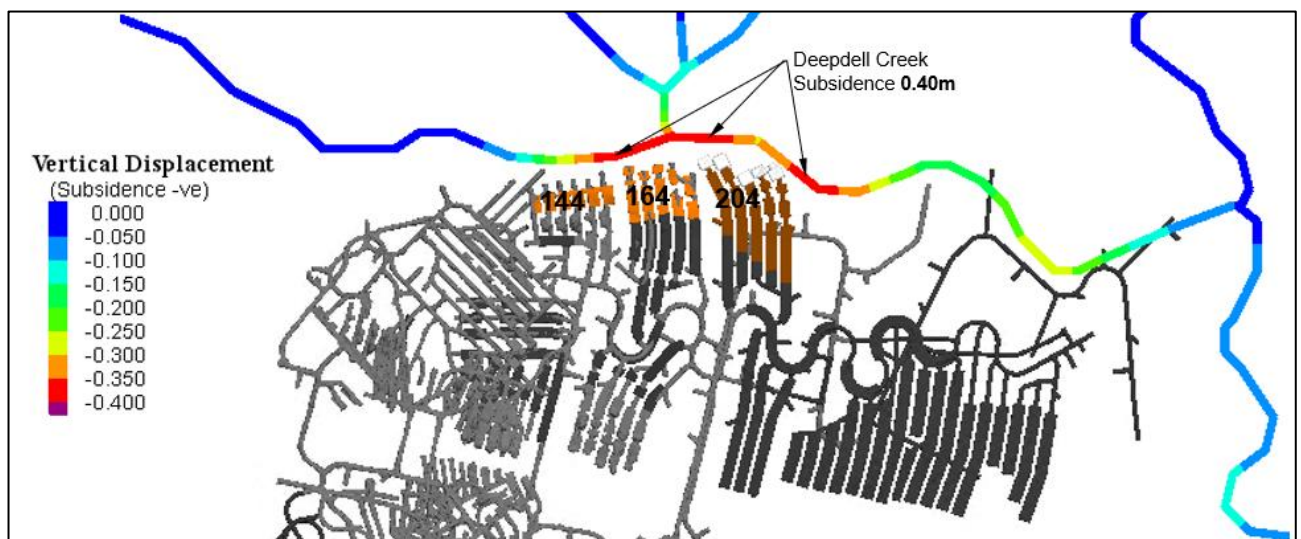


Inset 22: Scenario 2 Subsidence Predictions along Deepdell Creek.

Scenario 2 sensitivity case results

The sensitivity analysis for Scenario 2 is the exclusion of mining the end stopes for Panel 204 has resulted in slight reduction of the predicted subsidence along Deepdell Creek. Inset 23 shows the maximum predicted subsidence along Deepdell Creek is about 0.4 m if mining of Panel 204 excludes the stopes at the end of the ore drives.

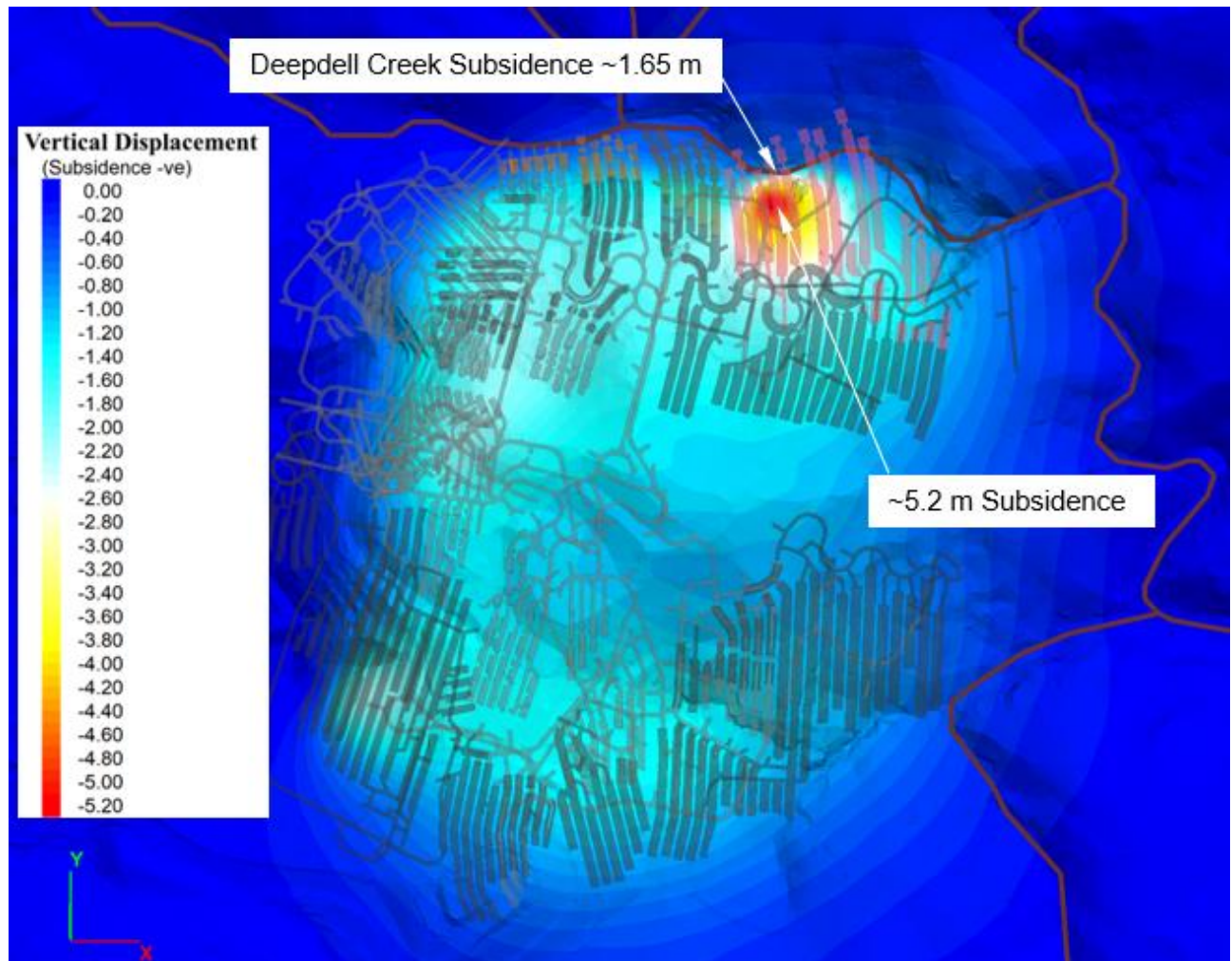
To reduce subsidence to less than 0.4 m, removing the end stopes of Panel 204 is a viable option, as well as other options (i.e. backfilling) not analysed here.



Inset 23: Scenario 2 Sensitivity Case Subsidence Predictions along Deepdell Creek.

Scenario 3 results

Scenario 3 involves extensive mining within the Deepdell Creek standoff zone (Orange Zone). The maximum surface subsidence for Scenario 3 is about 5.2 m (Inset 24) and is predicted to occur above a location where Scenario 3 stopes intersect the sub-vertical Fault 3. Along Deepdell Creek, the Scenario 3 predictions indicate maximum subsidence of about 1.65 m and the predicted maximum tensile strain of up to 6.5% (i.e. 65 mm/m).



Inset 24: Vertical Displacement (Subsidence) Predictions for Scenario 3.

Summary of Results

Summary of the subsidence and strain predictions for Deepdell Creek is presented in Table 5. Based on the predicted subsidence and strain results, the risk of adverse impacts on Deepdell Creek is expected to be low for the mining of Panels 144 and 164. For Panel 204, however, the exclusion of the end stopes (or the implementation of other mitigation measures) may be required to reduce the potential for adverse impacts on Deepdell Creek.

The results for Scenario 3 indicate subsidence of up to 1.65 m and tensile strains significantly exceeding 0.5% (i.e. >5 mm/m). These predicted ground movements suggest an increased risk of potentially adverse impacts along Deepdell Creek if the proposed Scenario 3 mining is undertaken within the Deepdell Creek standoff zone

Table 5 – Summary of Predicted Maximum Subsidence and Strains along Deepdell Creek Alignment

Analysis Case	Maximum Subsidence (m)	Maximum Tensile Strain	Valley Closure (m)
Existing GPUG	0.20	0.25% (2.5 mm/m)	0.25
LOMP Base Case	0.30	0.25% (2.5 mm/m)	0.30
Scenario 1	0.35	0.30% (3.0 mm/m)	0.30
Scenario 2	0.45	0.45% (4.5mm/m)	0.30
Scenario 2 Sensitivity Case	0.40	0.35% (3.5mm/m)	0.30
Scenario 3	1.65	6.5% (65 mm/m)	2.5

Note:

(1) Red font indicates simulated ground deformation exceeds limits previously recommended by PSM (PSM71-383R DRAFT REV2)

7. Recommendations

The following points list recommendations to address limitations and uncertainties:

- Mining:
 - Mining of Panels 144 and 164 (as planned) is predicted to cause ground deformation below the recommended limits:
 - Subsidence: <400 mm
 - Strain: <5mm/m (0.05%).
 - Mining of Panel 204 is expected to cause 450 mm subsidence, but can be reduced with some modifications to stoping
 - Mining of stopes beyond Panel 204 within the Orange Zone will cause significant ground deformation
 - Monitoring, as previously recommended in PSM71-383R DRAFT REV2, should be established prior to any further mining of Panels 144 and 164. At least two-weeks of cross-sectional prism data is recommended to establish a baseline near the creek.
- Fault modelling:
 - Regular underground mapping of development targeting geotechnical faults as opposed to geological faults that control ore. Collecting characterisation data associated with mapped geotechnical faults, including infill thickness, shape and orientation. Record co-ordinates
 - Targeted geotechnical mapping of existing drives to confirm modelled Faults 3, 4, 6 and 12, including characteristics and persistence
 - Continuously update the fault model as more development is mined, drives are mapped and borehole data becomes available.
 - Televiewer image any new diamond cored boreholes drilled from the ground surface near Deepdell Creek
 - Drill boreholes in unmined critical areas, such as proximal to Panel 204 (Addition 2) and the remaining consented LOMP drives and stopes located within the southern side of Deepdell Creek standoff zone, to confirm the location and characteristics of potential structures. Complete televiewer surveys where possible to obtain structural orientation data for fault modelling.

It is important to note, while PSM have recommended conservative limits for subsidence and strain to protect creek flowrates, there is little data to inform mining induced ground behaviour causing stream flow loss. Adherence to the OGNZL GCMP and Subsidence Management Plan for GPUG is strongly recommended.

8. Closure

We trust this memorandum is in keeping with your immediate requirements. Please contact the undersigned should you have any queries.

Yours Sincerely

DRAFT

**VICTORIA ROBBINS
SENIOR ENGINEERING GEOLOGIST**

**MICHAEL HABTE
PRINCIPAL**

**DANIEL STRANG
PRINCIPAL**

Encl:

Appendix A – Core Photo Logging Database (Provided Electronically)

Appendix B – Modelled Wireframes (Provided Electronically)

Appendix C – 3D Analysis Results

Appendix A

Core Photo Logging Database (Provided Electronically)

Appendix B

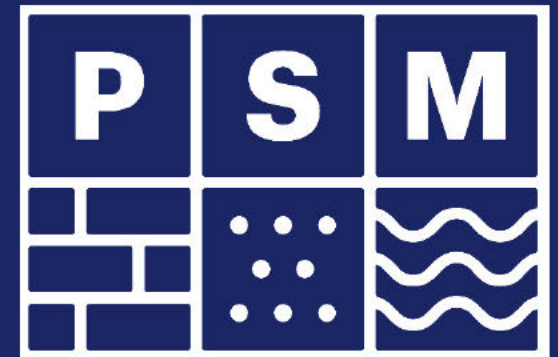
Modelled Wireframes (Provided Electronically)

Appendix C

3D Analysis Results

GPUG Subsidence Assessment

3D Numerical Analysis Results



GPUG Updated 3D Numerical Analyses

An updated 3D numerical analysis has been undertaken for GPUG by incorporating the latest Fault model and additional mining scenario's proposed by OCG.

The analyses is undertaken in FLAC3D and incorporates the following:

- OGC's Fault models as per the previous modelling
- PSM's fault
- Latest as-built geometry for the existing underground workings
- Base case mining scenario incorporating all the LOMP stopes outside the Deepdell Creek Standoff zone (defined by a 26° draw angle)
- Additional mining scenario's incorporating LOMP stopes within the Deepdell Creek Standoff zone

Model Description

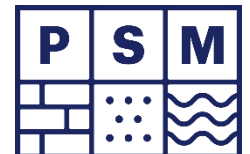
- The 3D numerical model was developed in FLAC3D version 9.0
- The model extent is about 2000 m (east-west, x-direction), about 2200 m (north-south, y-direction) and 1000 m (vertical, z-direction)
- The adopted mesh size for the zones is 1 to 2m at the boundary of the GPUG workings and 5 to 10m around fault surfaces
- Fault zones modelled as zones of class C material
- Strain softening incorporated to capture squeezing ground and progressive failure observed around underground openings.



GPUG 3D Numerical Analyses

Model Staging

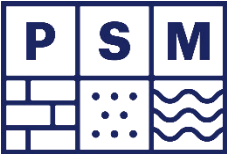
- Initial stage - Stress initialisation under gravity loading using the pre- GPUG model geometry
- Stage 1 – Mining of the existing GPUG workings
- Stage 2 – Mining of the base case scenario (i.e. LOMP GPUG workings outside the Deepdell Creek standoff zone)
- Stage 3 - Additional 3 Mining Scenarios for mining of LOMP stopes within the Deepdell Creek standoff zone
 - Scenario 1 – mining addition 1 (Panels 144 & 164)
 - Scenario 2 – mining addition 1 & 2 (Panels 144, 164 & 204)
 - Scenario 2 Sensitivity case – mining addition 1 & 2 excluding the end stopes for Panel 204
 - Scenario 3 - mining addition 3 (Panels 144, 164, 204 and consented LOMP panels within the



Model Setup

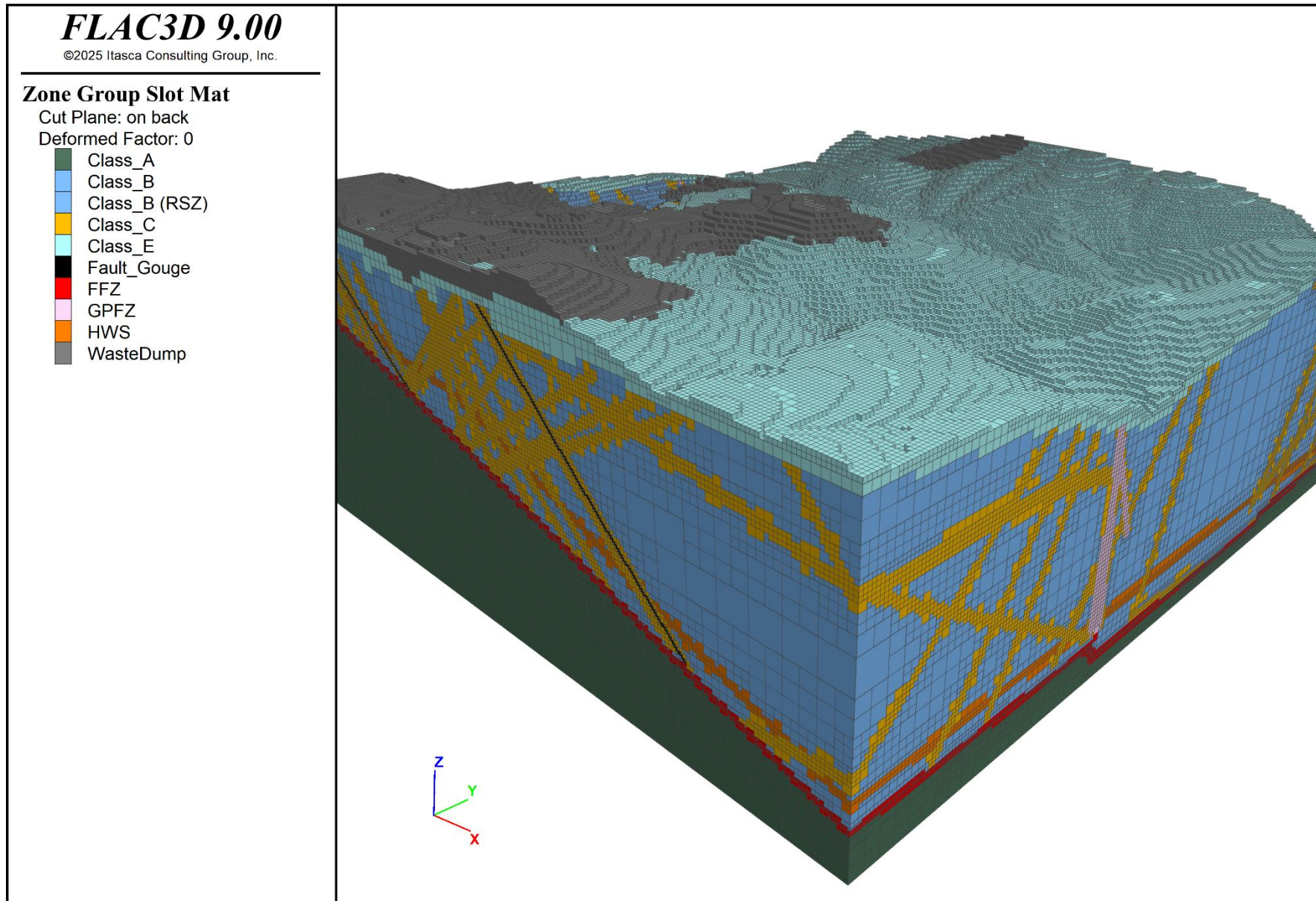
Model Parameters

Rock Mass Unit	Unit Weight (MN/m³)	UCS (MPa)	GSI	m _i	Mohr-Columb		Tensile strength (MPa)	Poisson's ratio	Rock mass modulus (MPa)
					Cohesion (kPa)	Friction Angle (°)			
Class A	27	40	65	12	NA		0.2	0.25	2000
Class B		40	55				0	0.25	1500
Class C	27	35	45				0	0.25	1000
GPFZ	25	NA			100	40	0	0.35	500
Fault Gouge	27				50	20	0	0.35	250
Class E /Weathered Zone	25				100	38	0	0.35	100
Waste Dump/Backfill	20				10	37	0	0.35	100



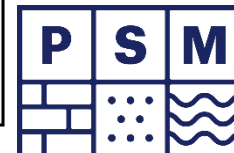
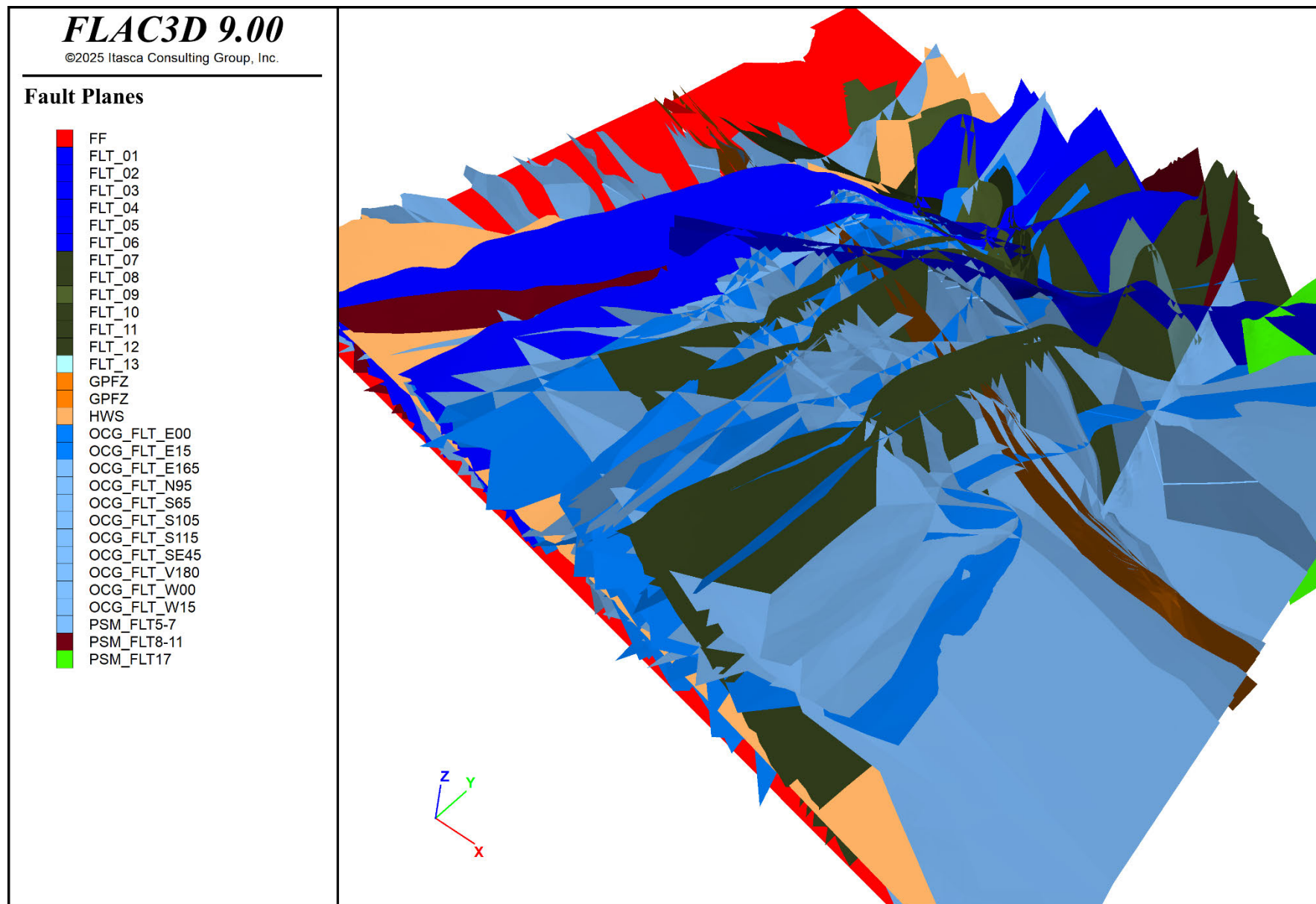
Model Setup

Rock mass units



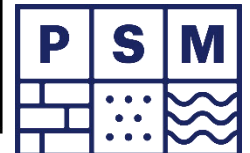
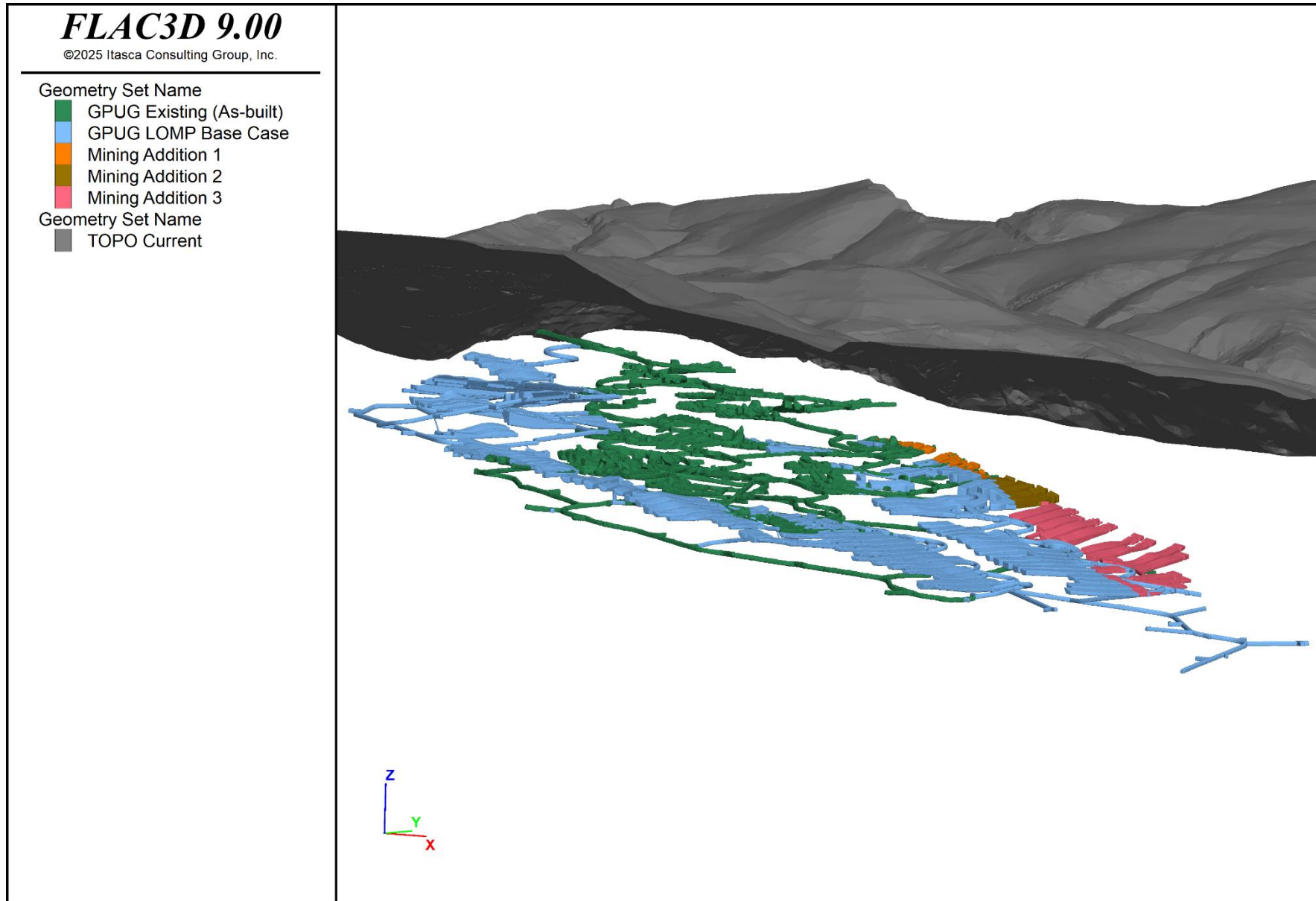
Model Set-up

Modelled Faults



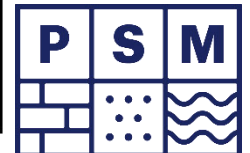
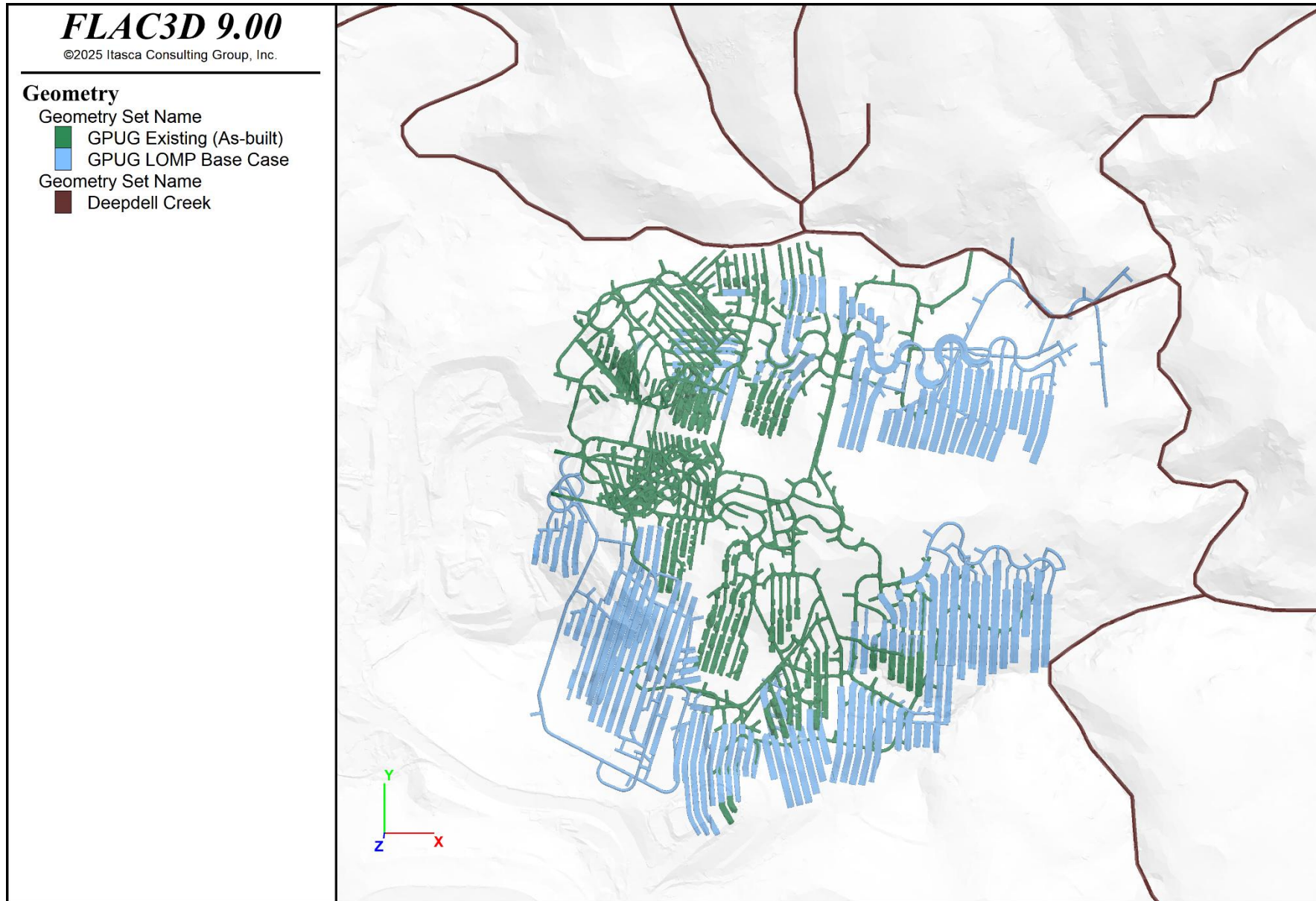
Model Set-up

GPUG - existing & proposed workings



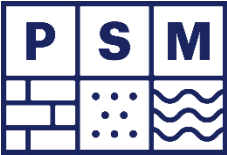
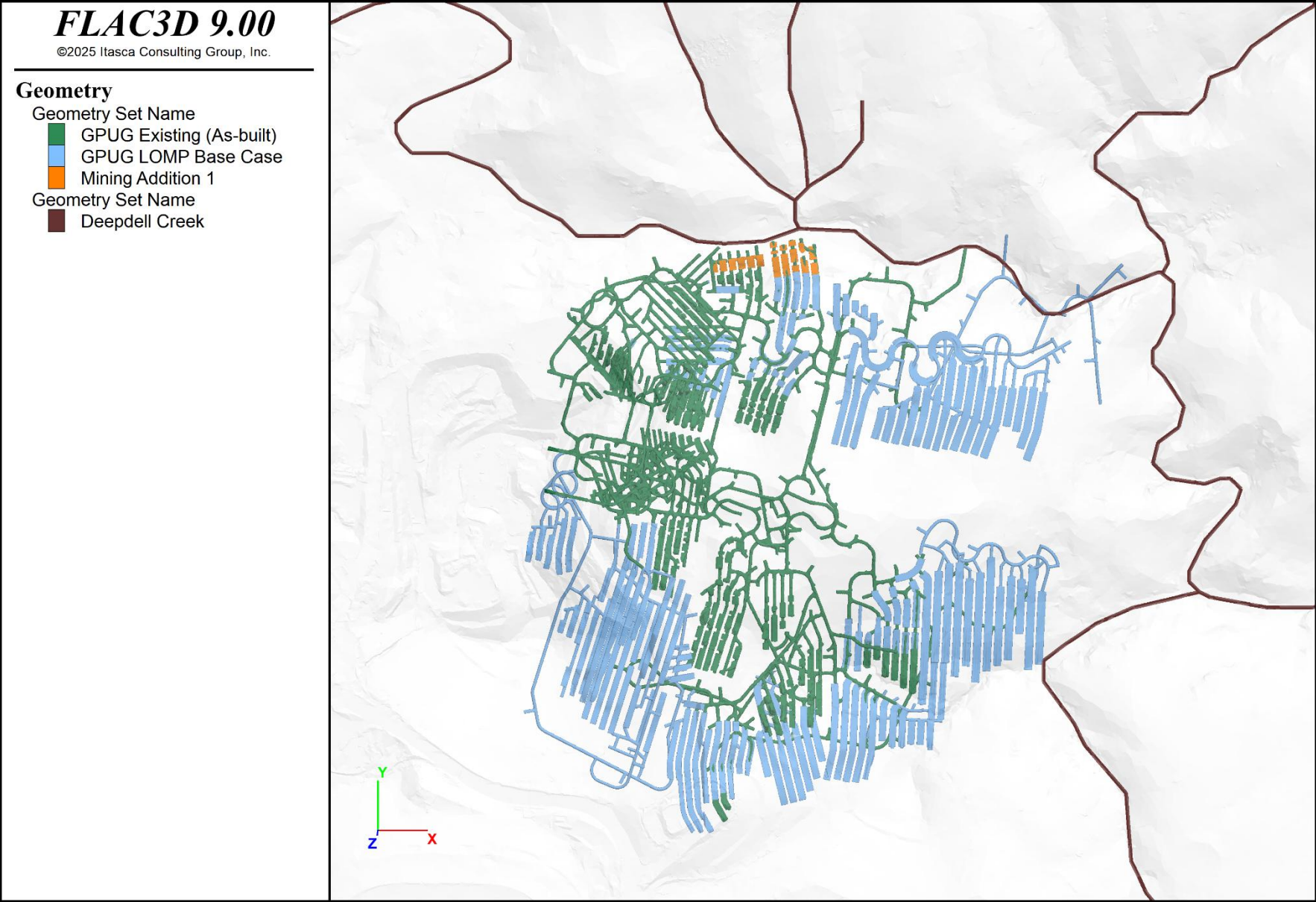
Model Set-up

Existing (As-built) & Base Case LOMP GPUG workings



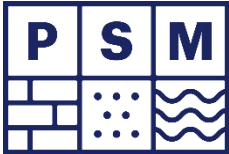
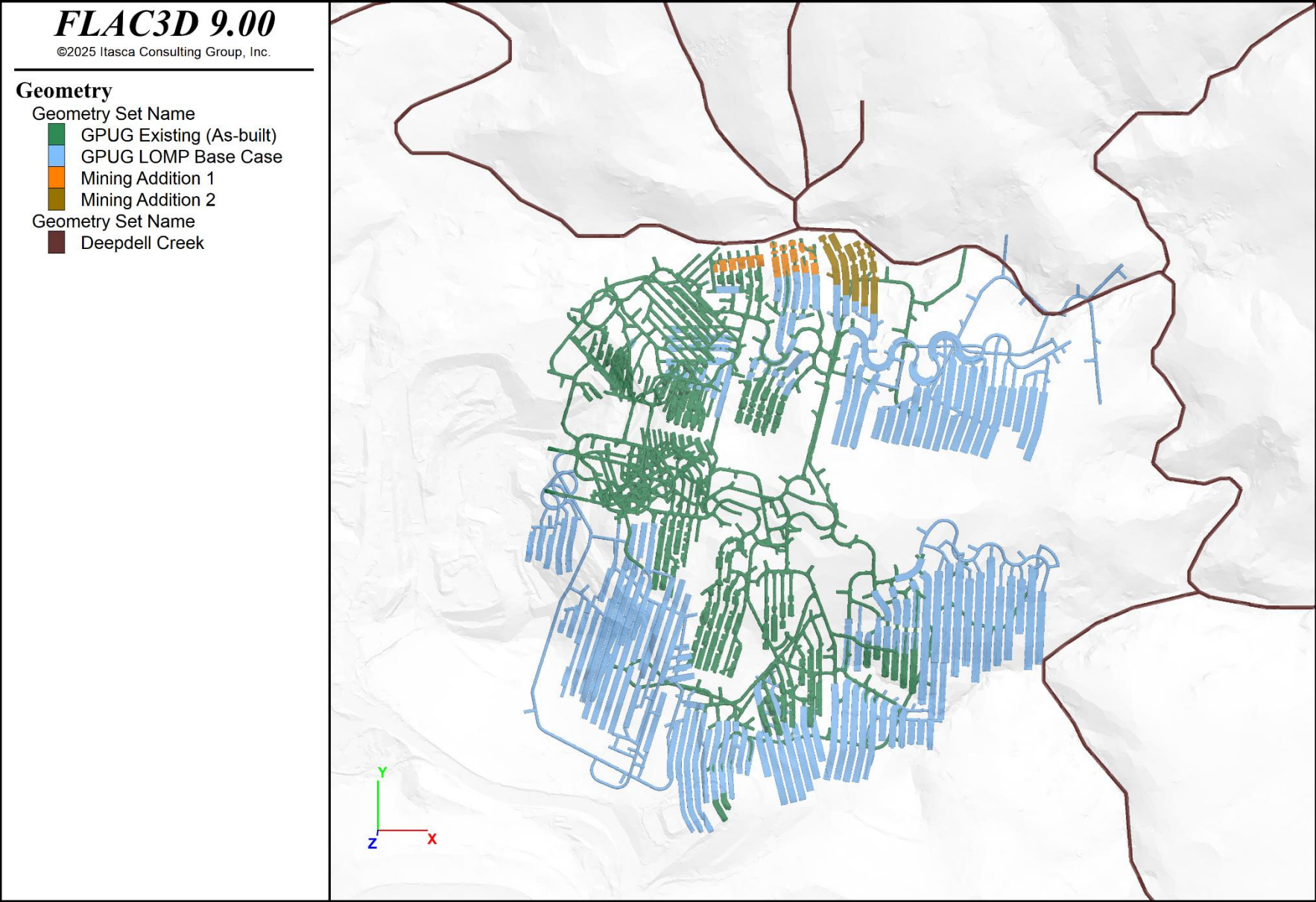
Model Set-up

Scenario 1



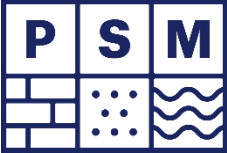
Model Set-up

Scenario 2



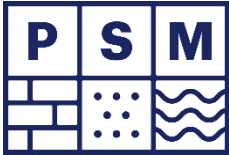
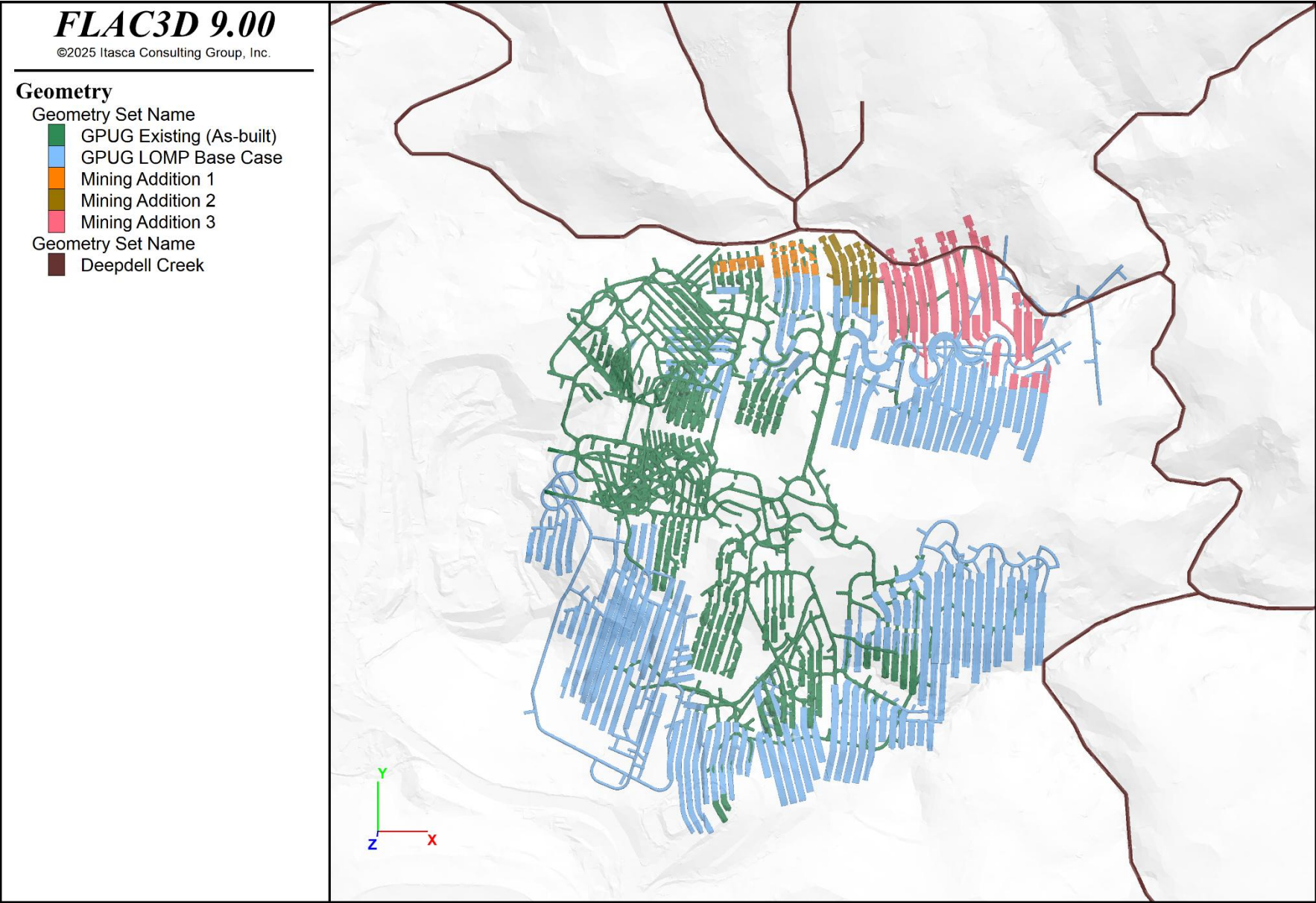
Model Set-up

Scenario 2 Sensitivity Case



Model Set-up

Scenario 3



Presentation of Results

Stages include:

- Stage 1: Completion of the existing GPUG
- Stage 2: Completion of the Base case GPUG (LOMP stopes outside standoff zone)
- Stage : Additional Scenarios 1 to 3

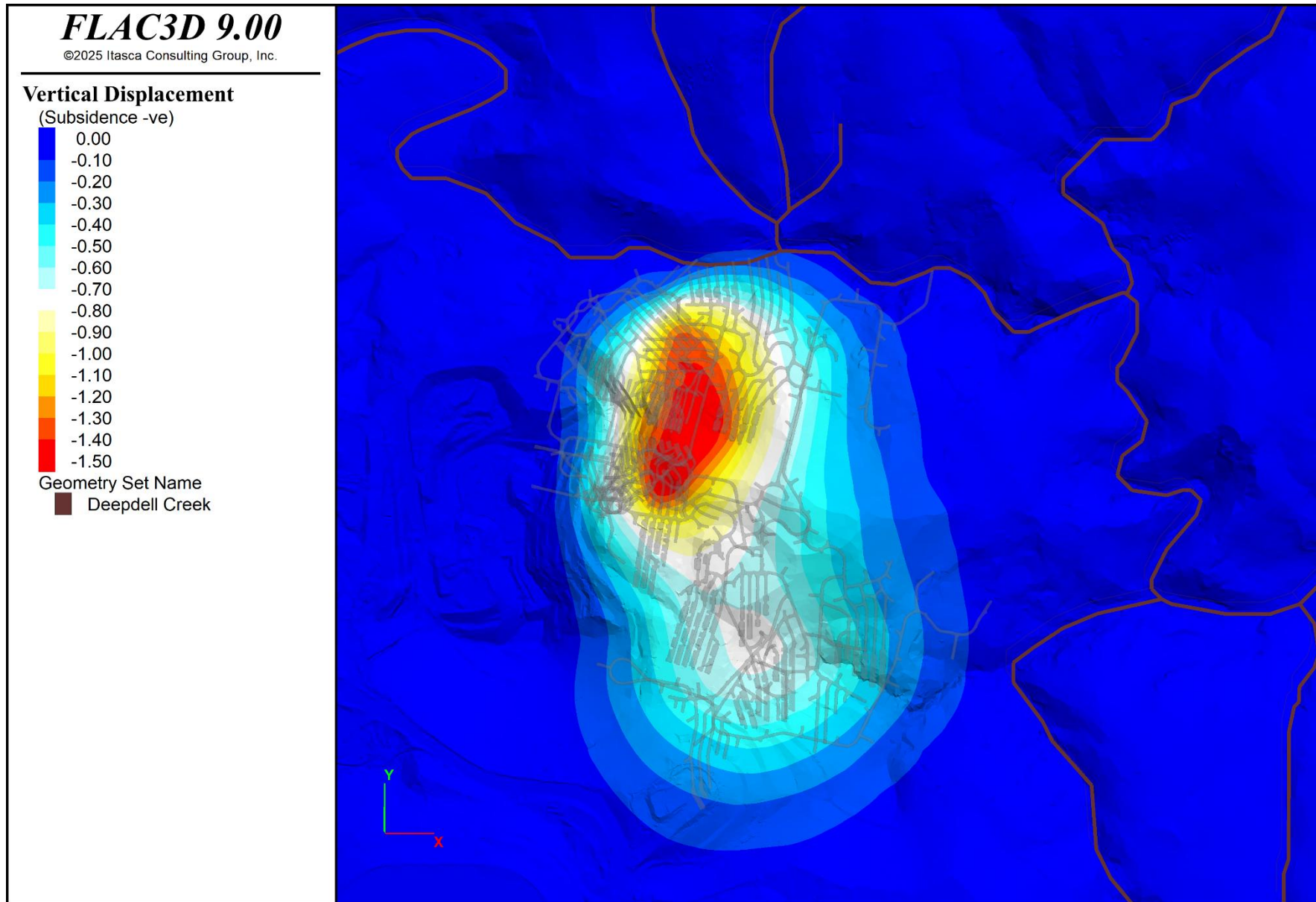
The following plots are presented as plan views of :

- Vertical displacement at the ground surface
- N-S & E-W Horizontal displacements at the ground surface
- Maximum tensile strain at the ground surface
- Horizontal strain at the ground surface
- Trace of vertical displacement along Deepdell Creek
- Trace of maximum tensile strain along Deepdell Creek



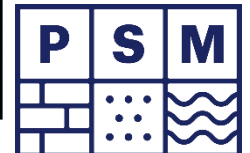
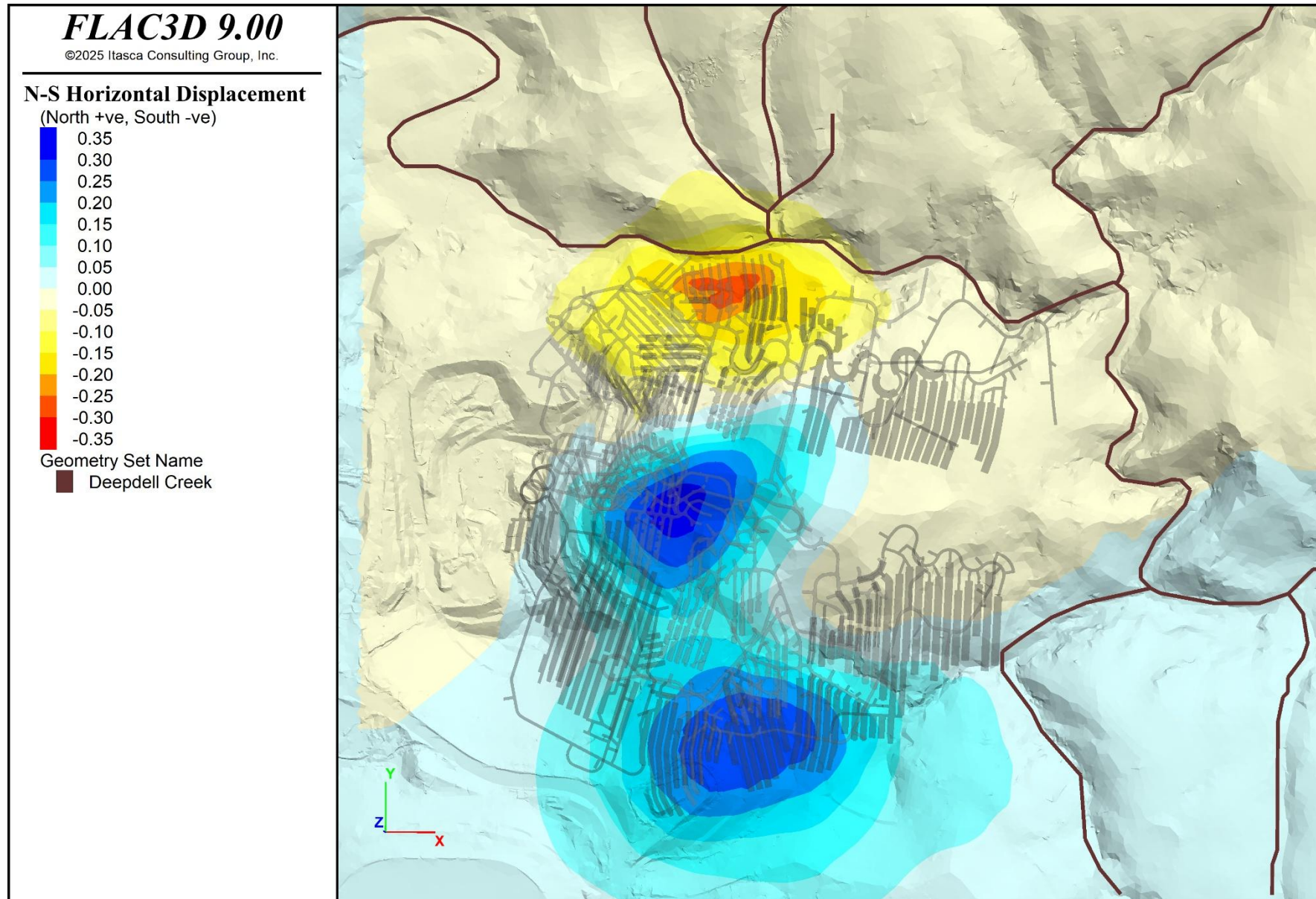
Base Case Existing GPUG

Planview: Vertical Displacement



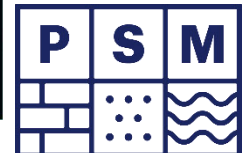
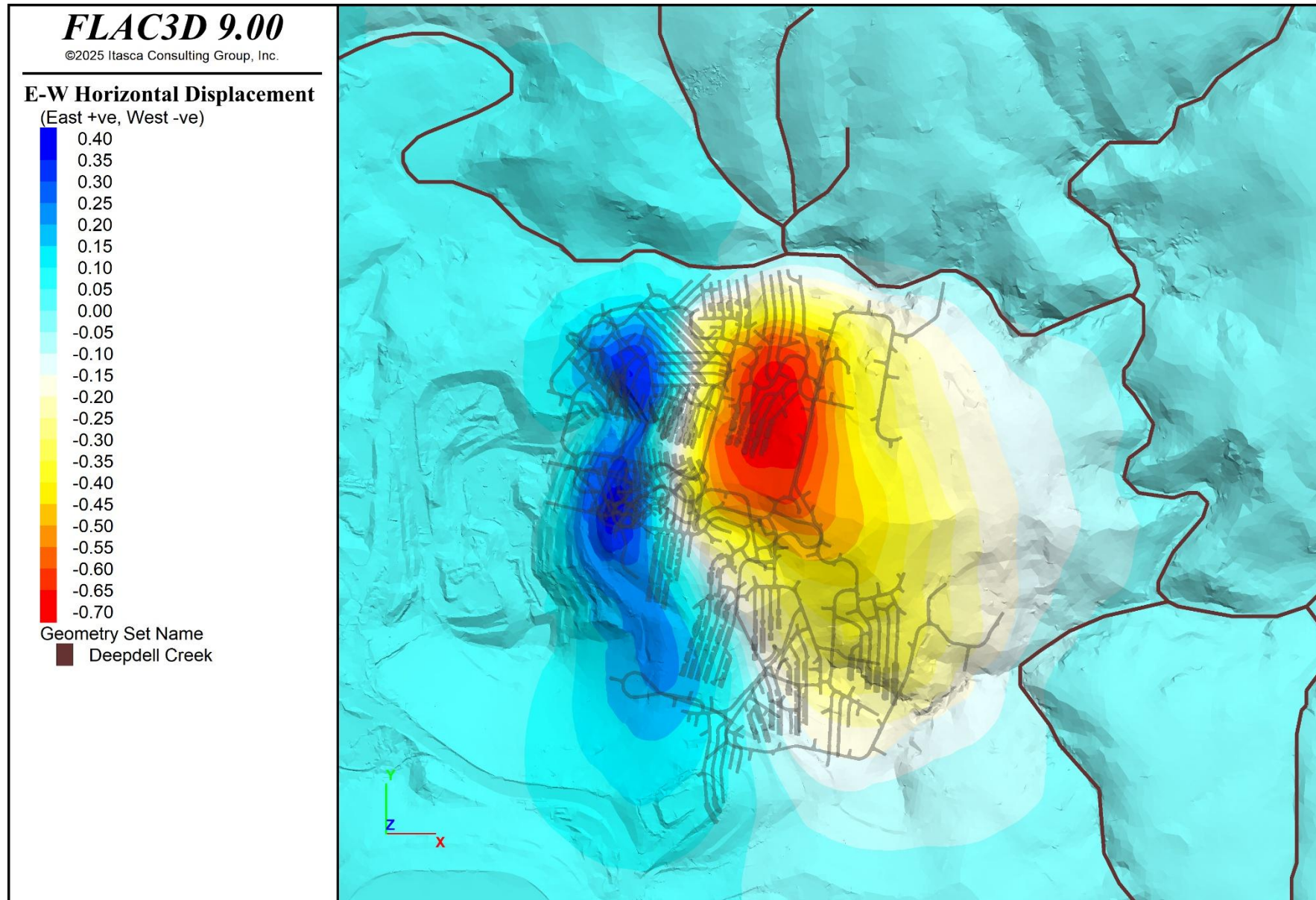
Base Case Existing GPUG

Planview: N-S Horizontal Displacement



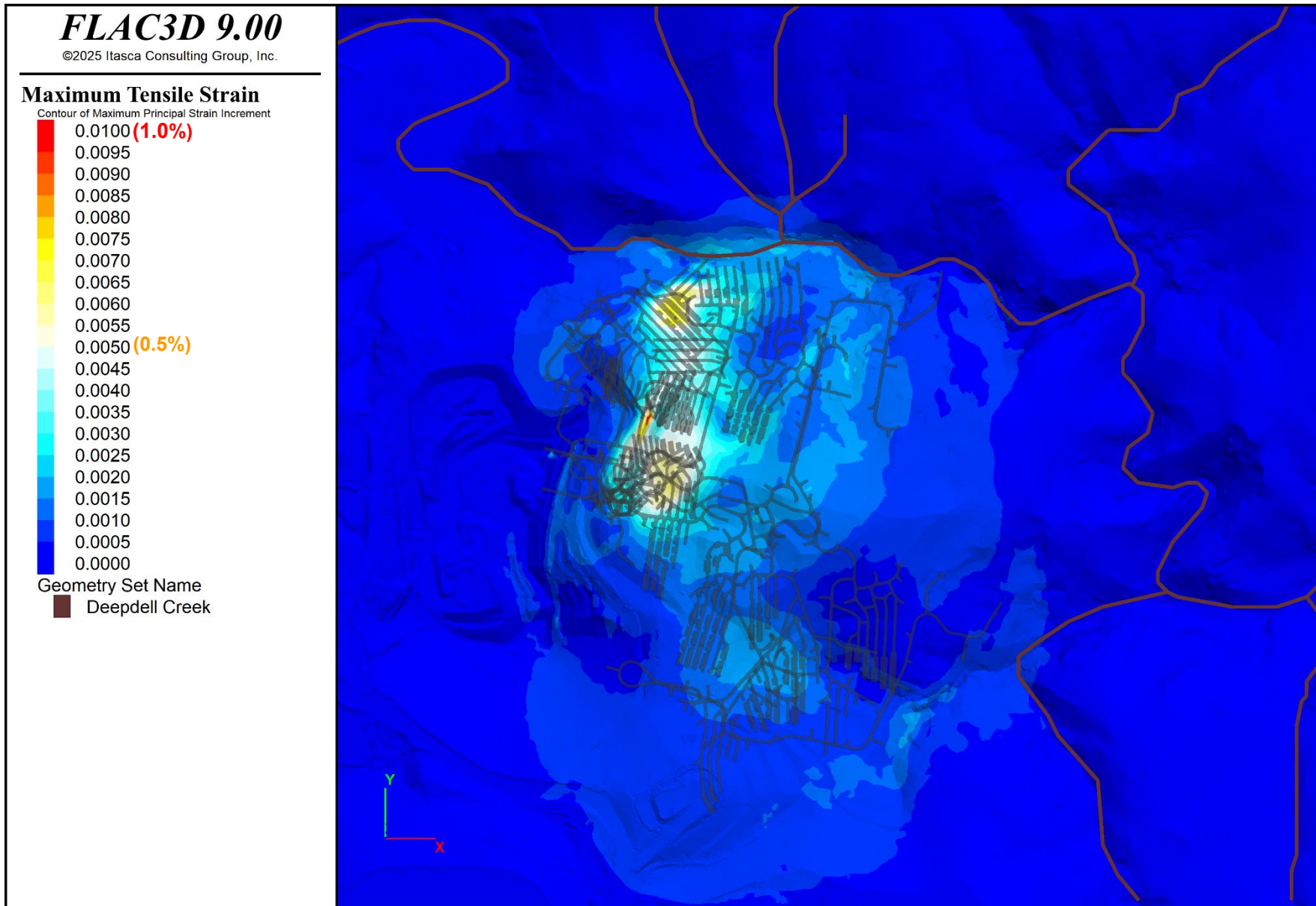
Base Case Existing GPUG

Planview: E-W Horizontal Displacement



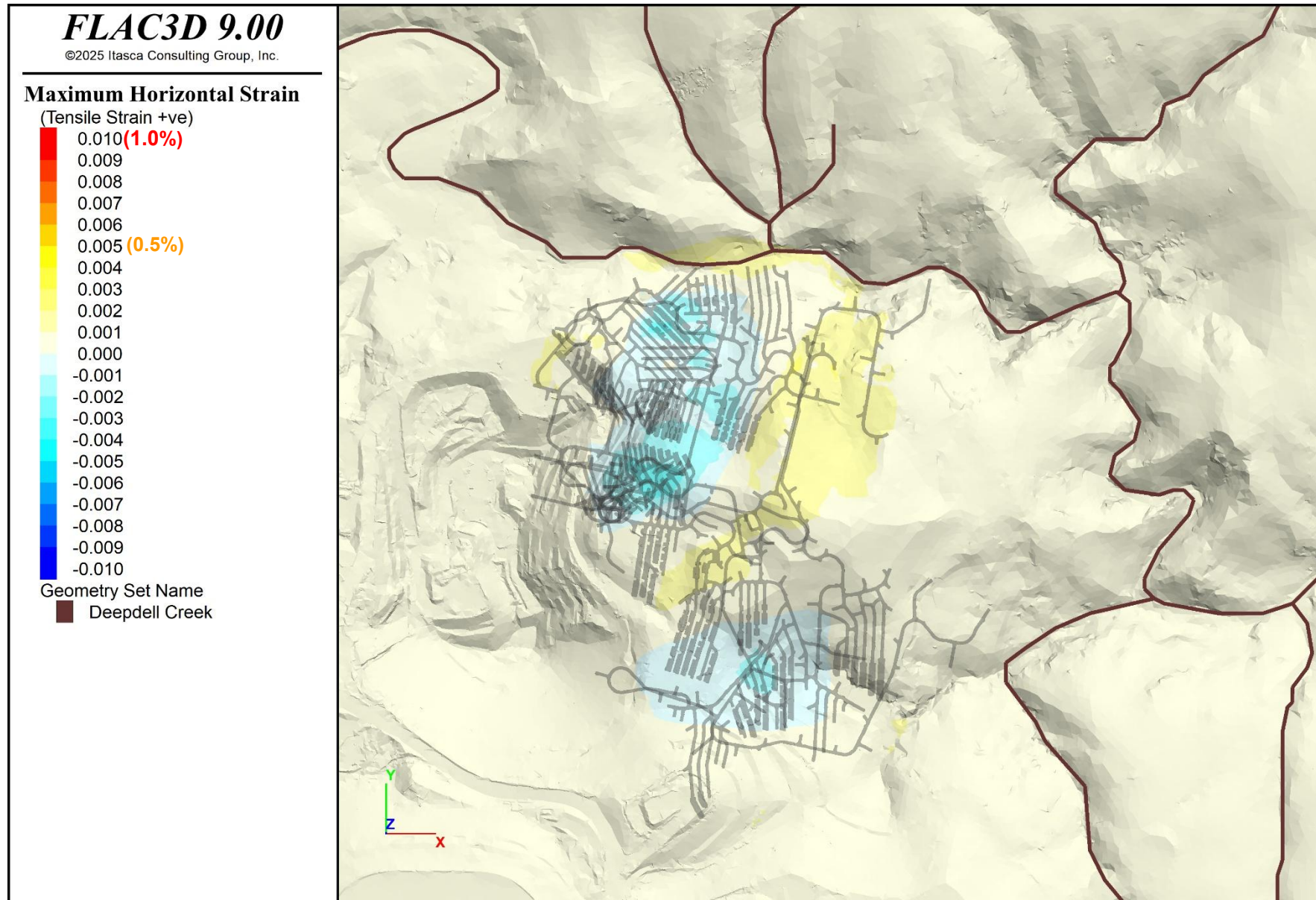
Base Case Existing GPUG

Planview: Maximum Tensile Strain



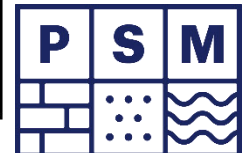
Base Case Existing GPUG

Planview: Horizontal Strain



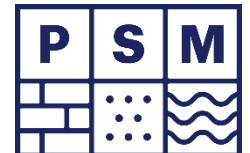
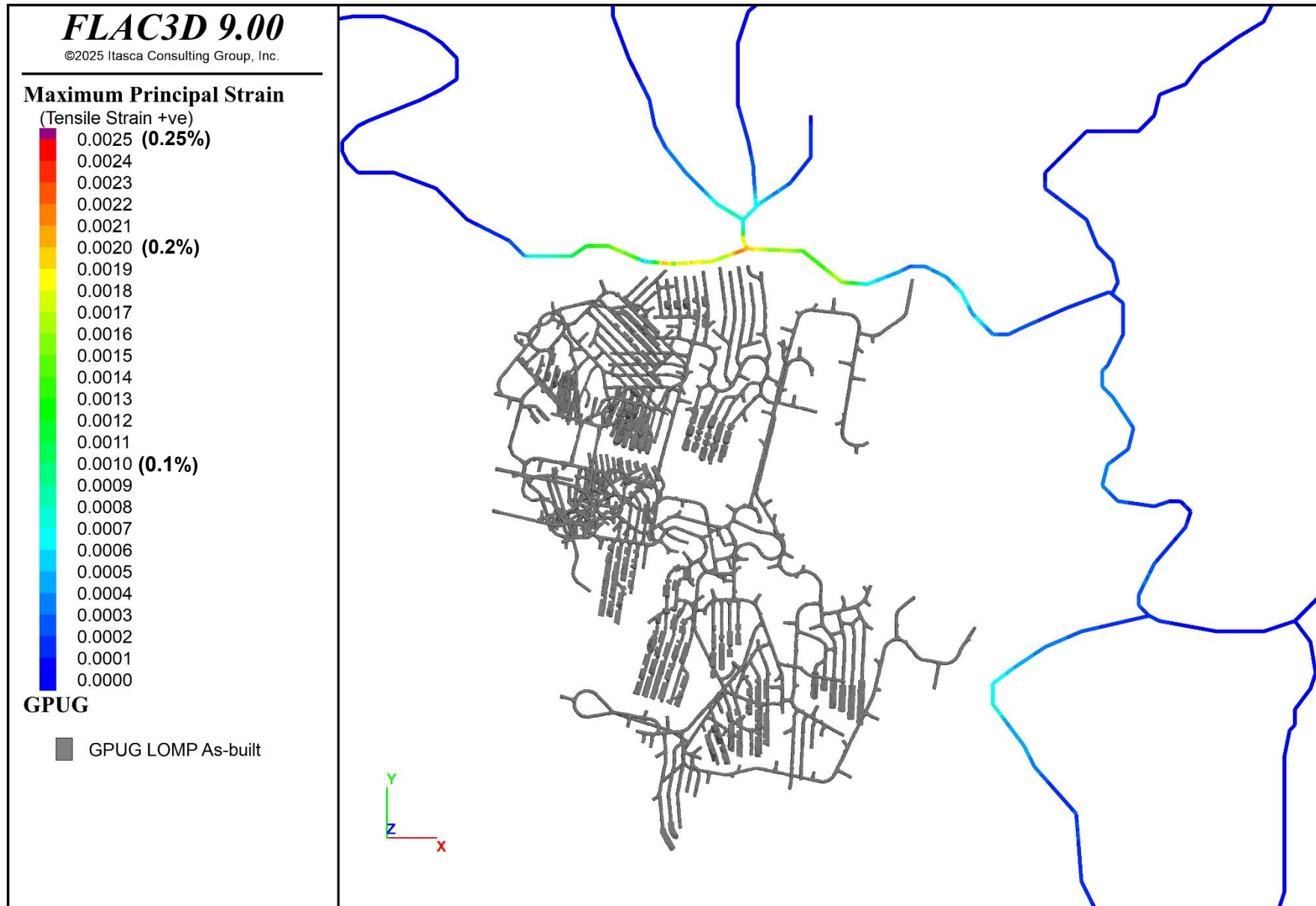
Base Case Existing GPUG

Deepdell Creek - Vertical Displacement



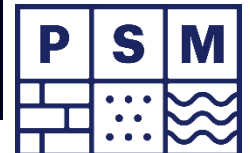
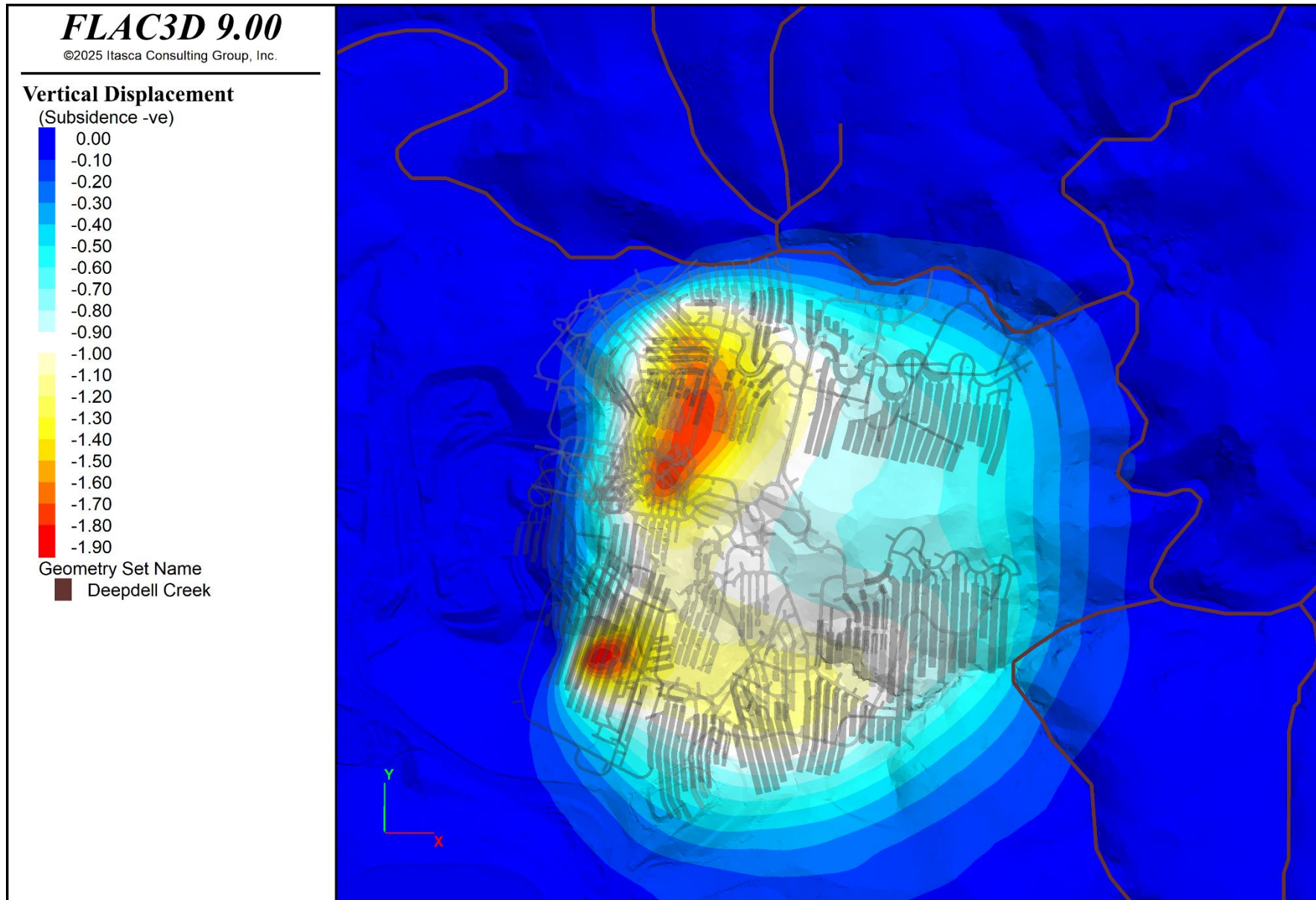
Base Case Existing GPUG

Deepdell Creek - Maximum Tensile Strain



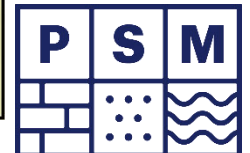
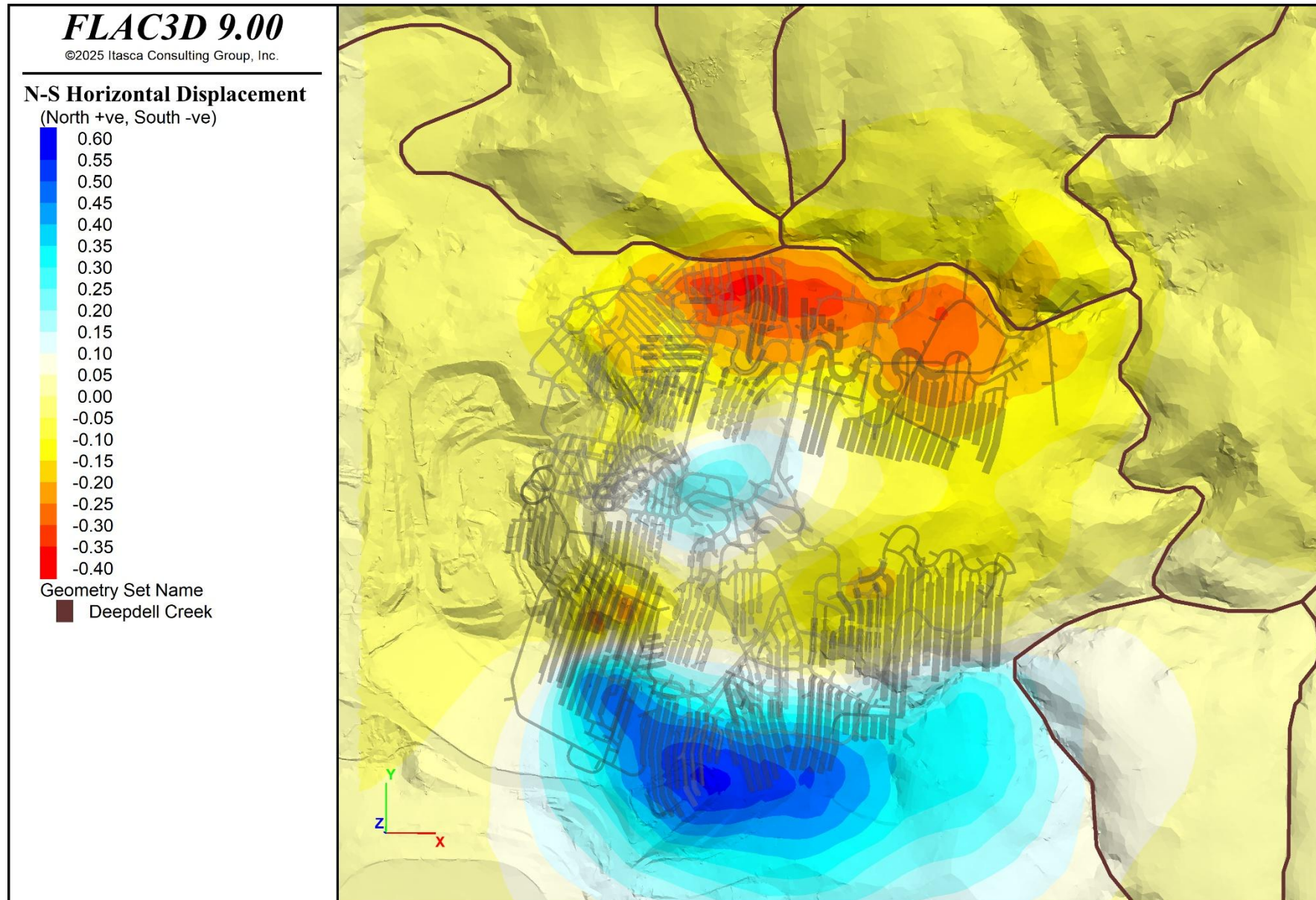
Base Case LOMP GPUG with Standoff

Planview: Vertical Displacement



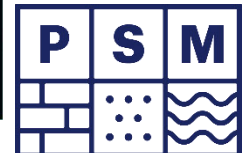
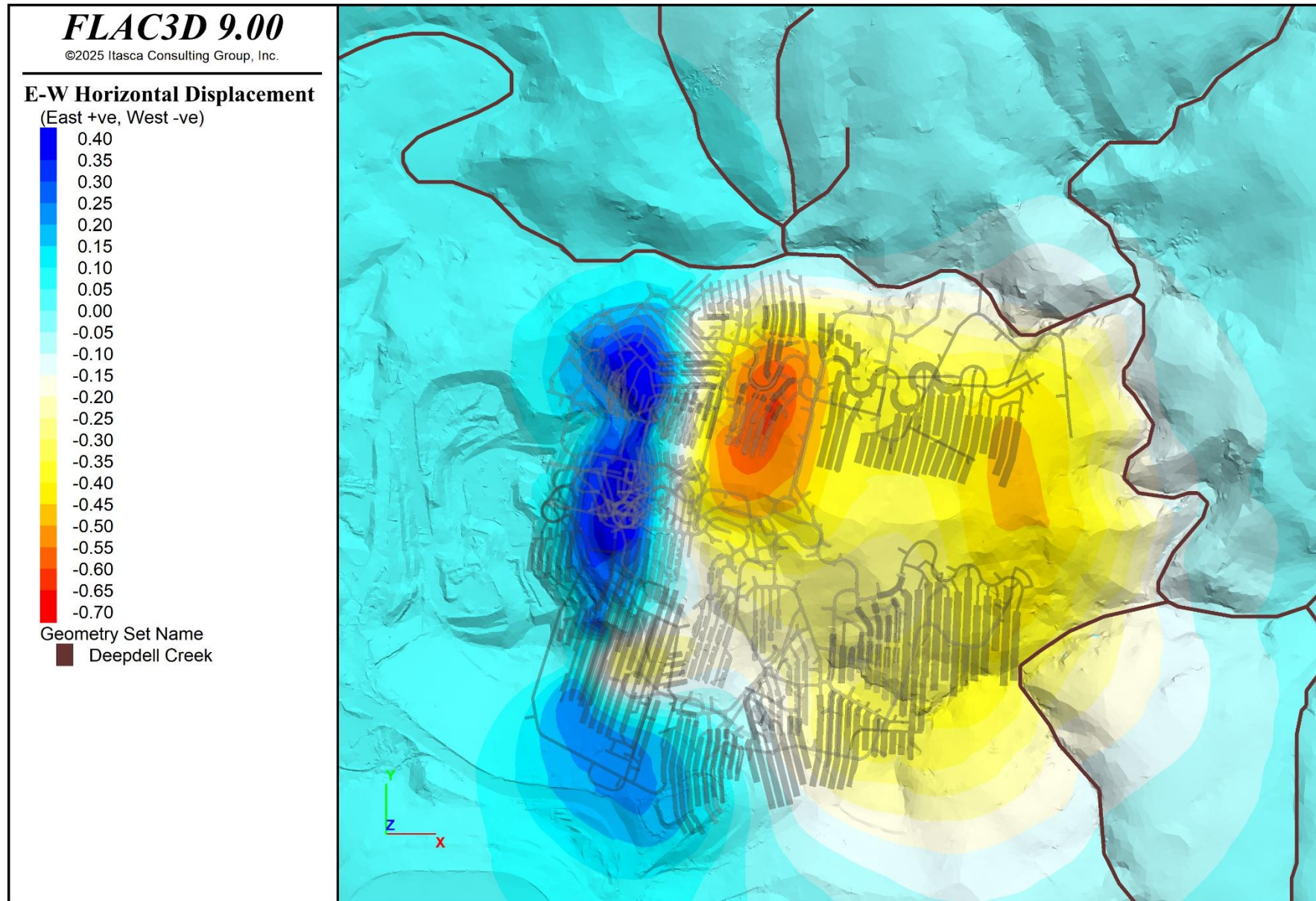
Base Case LOMP GPUG with Standoff

Planview: N-S Horizontal Displacement



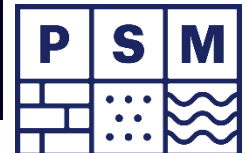
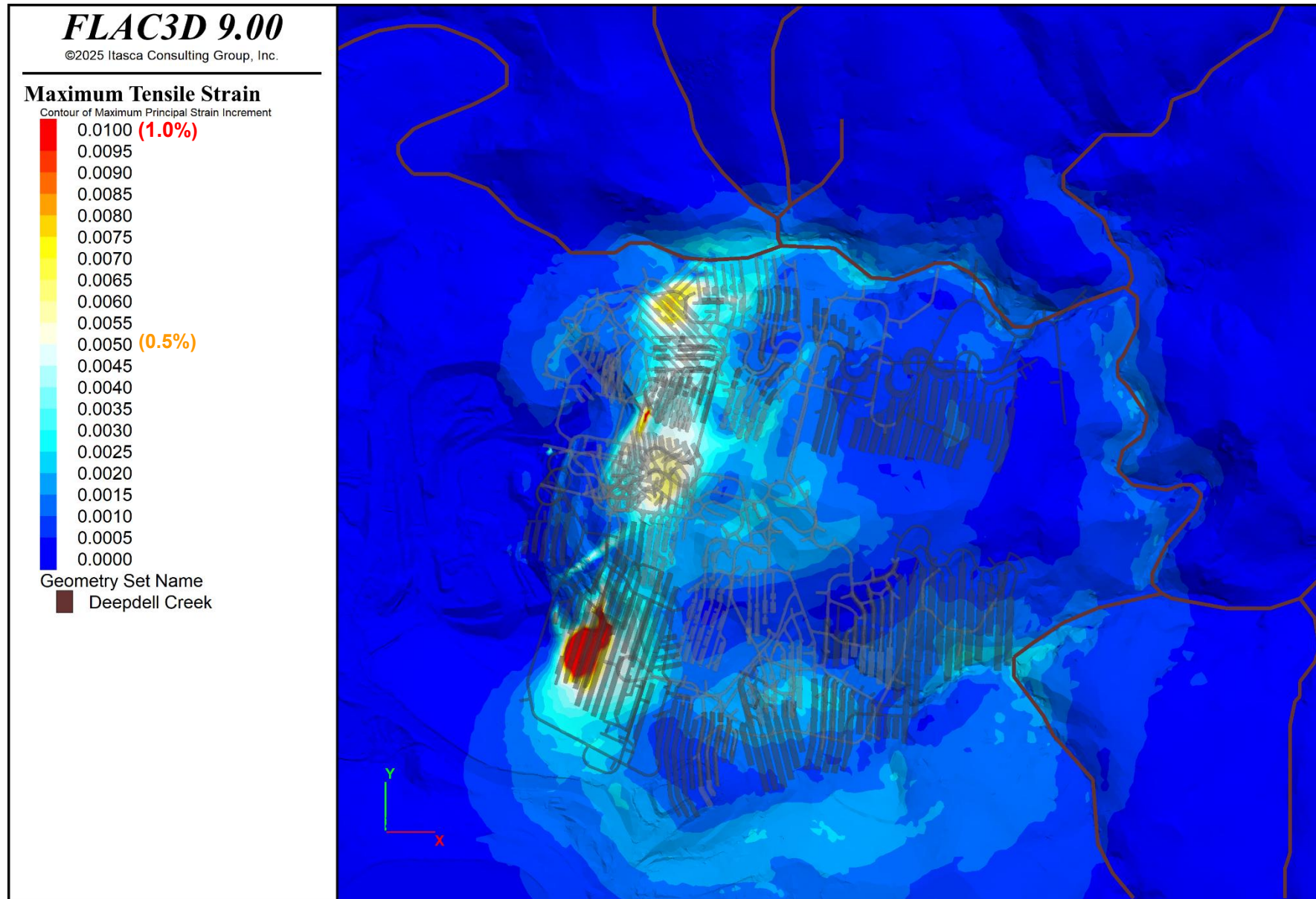
Base Case LOMP GPUG with Standoff

Planview: E-W Horizontal Displacement



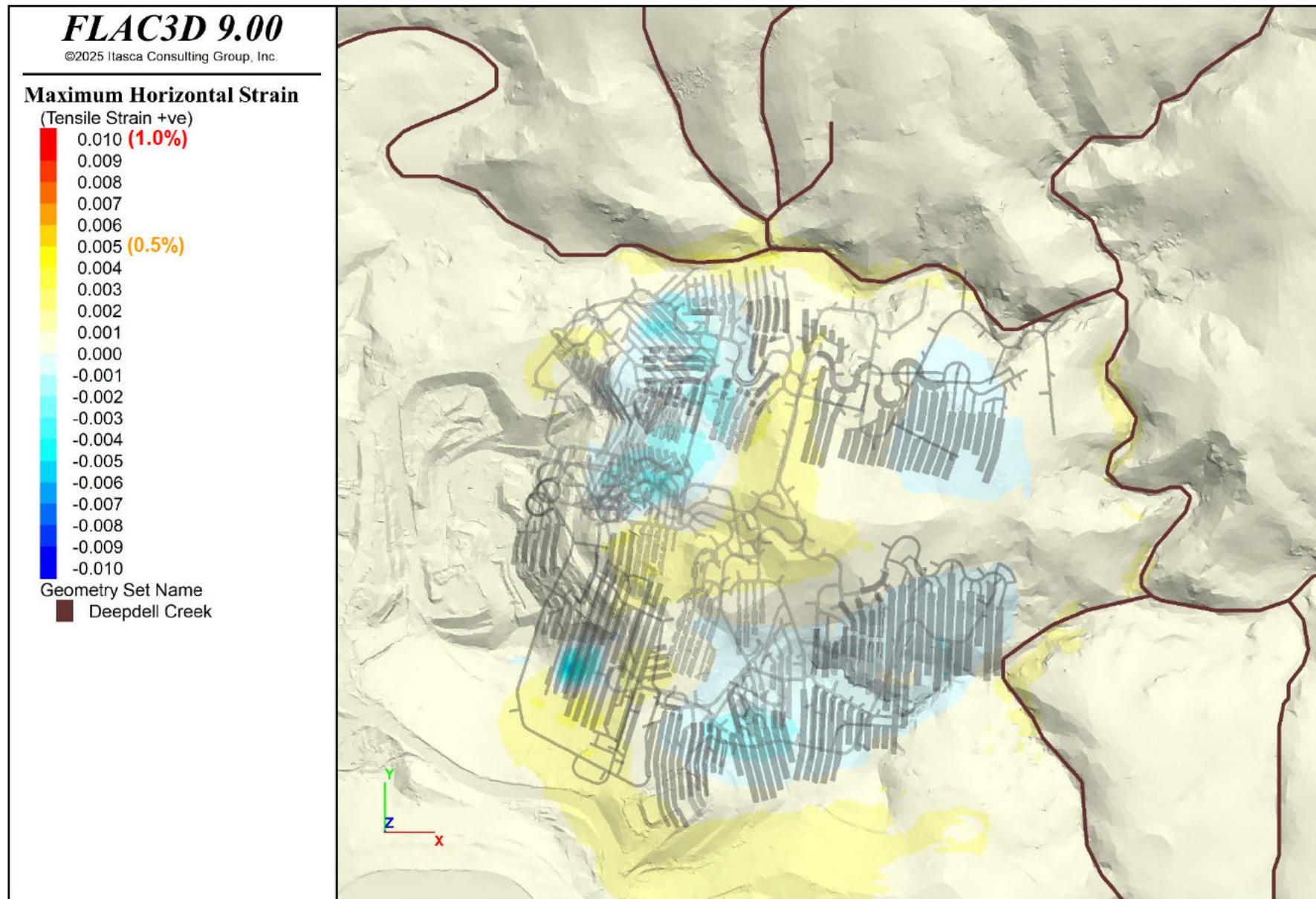
Base Case LOMP GPUG with Standoff

Planview: Maximum Tensile Strain



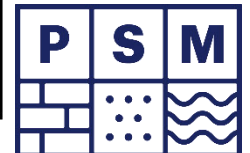
Base Case LOMP GPUG with Standoff

Planview: Horizontal Strain



Base Case LOMP GPUG with Standoff

Deepdell Creek - Vertical Displacement



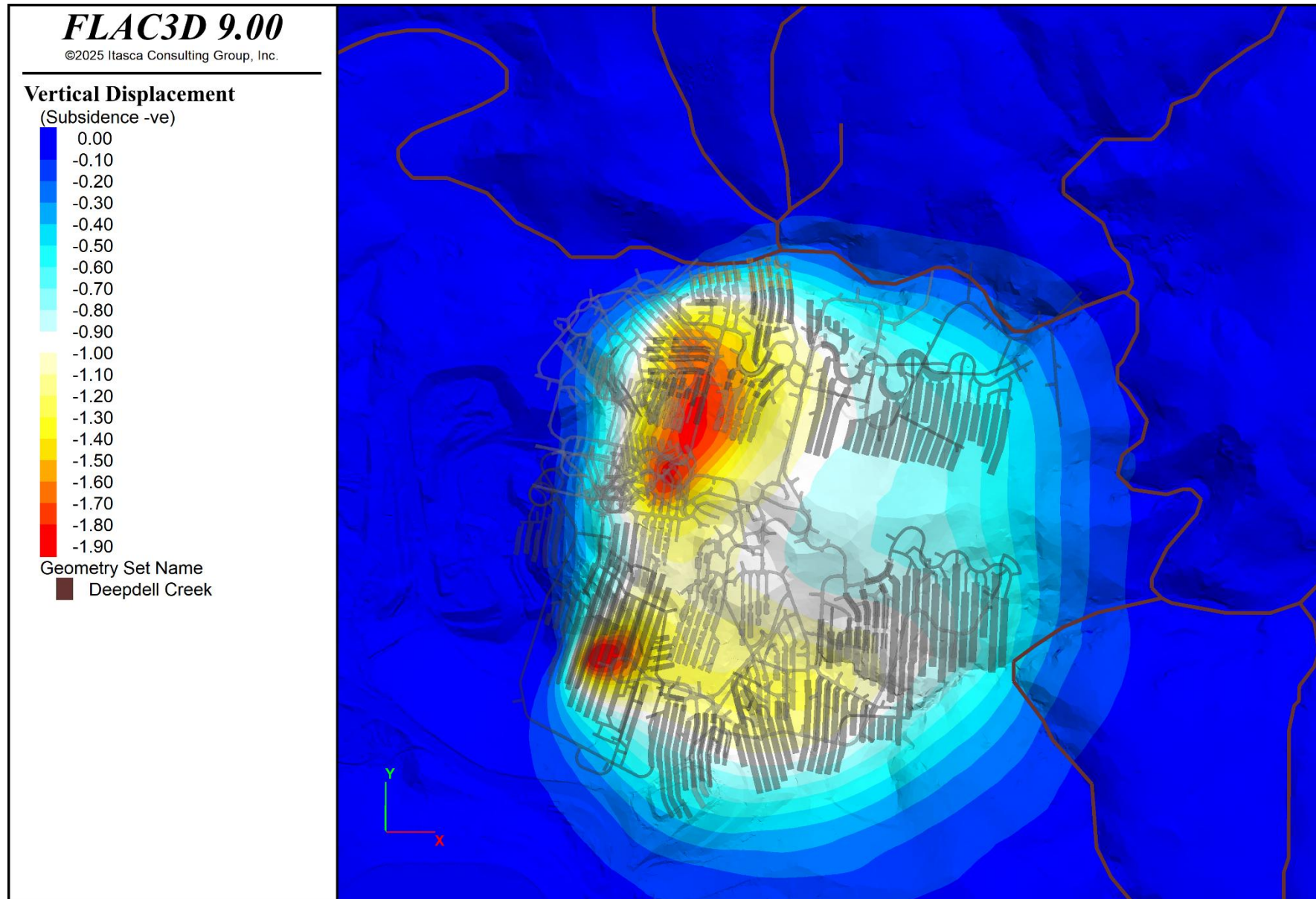
Base Case LOMP GPUG with Standoff

Deepdell Creek - Maximum Tensile Strain



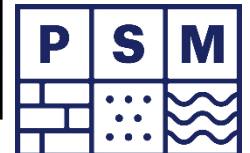
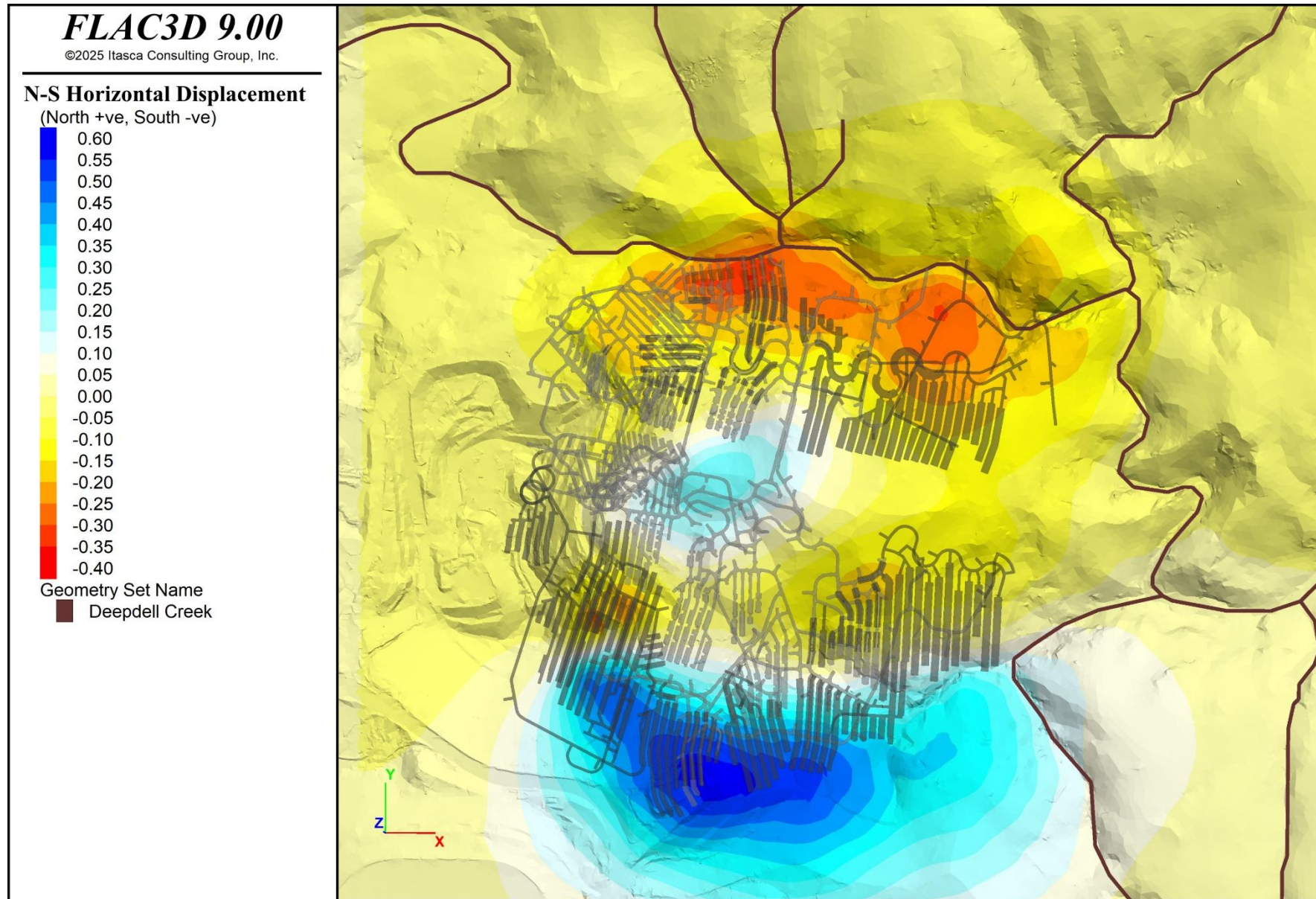
Scenario 1

Planview: Vertical Displacement



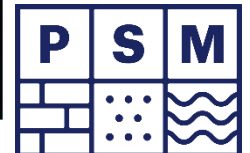
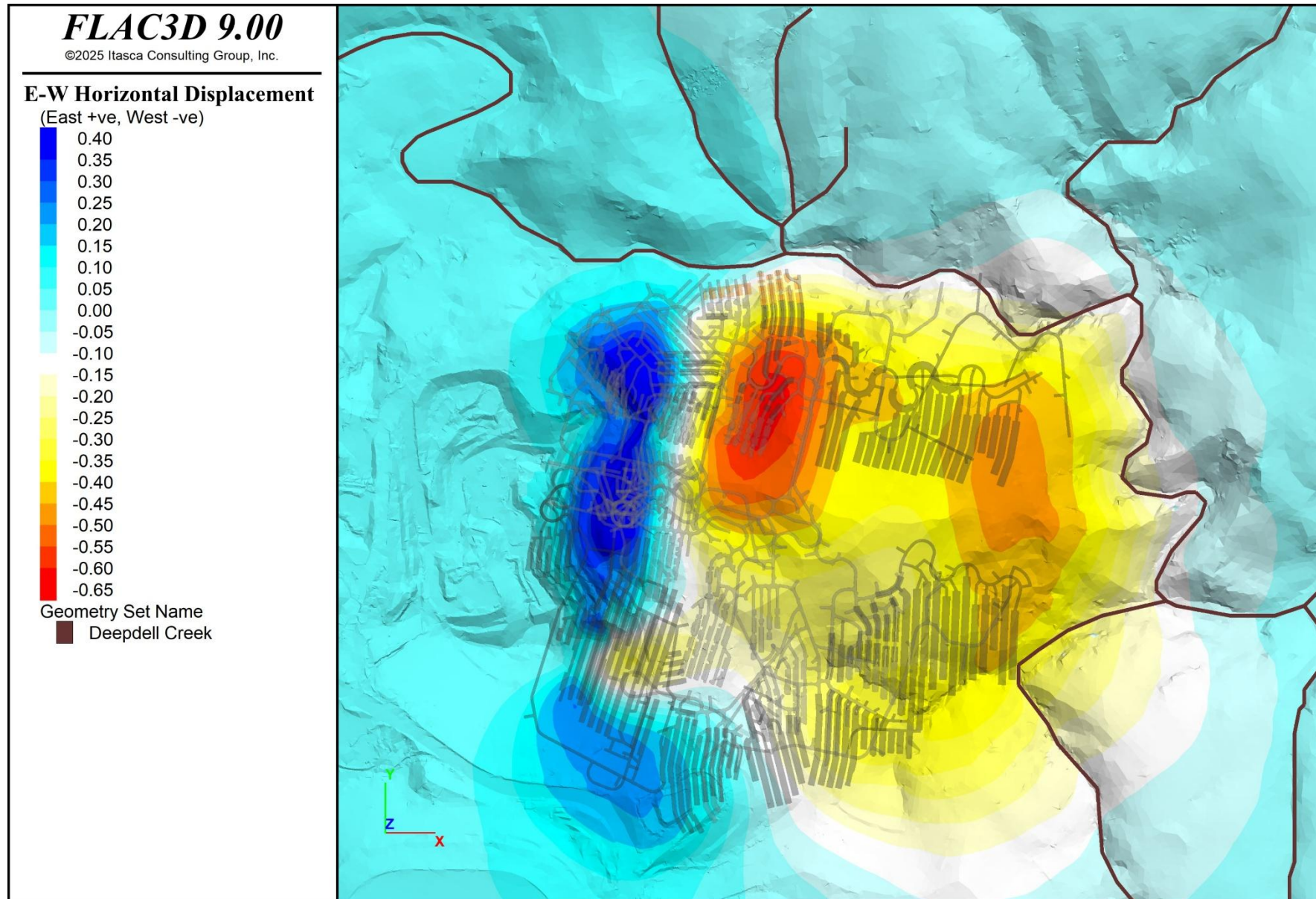
Scenario 1

Planview: N-S Horizontal Displacement



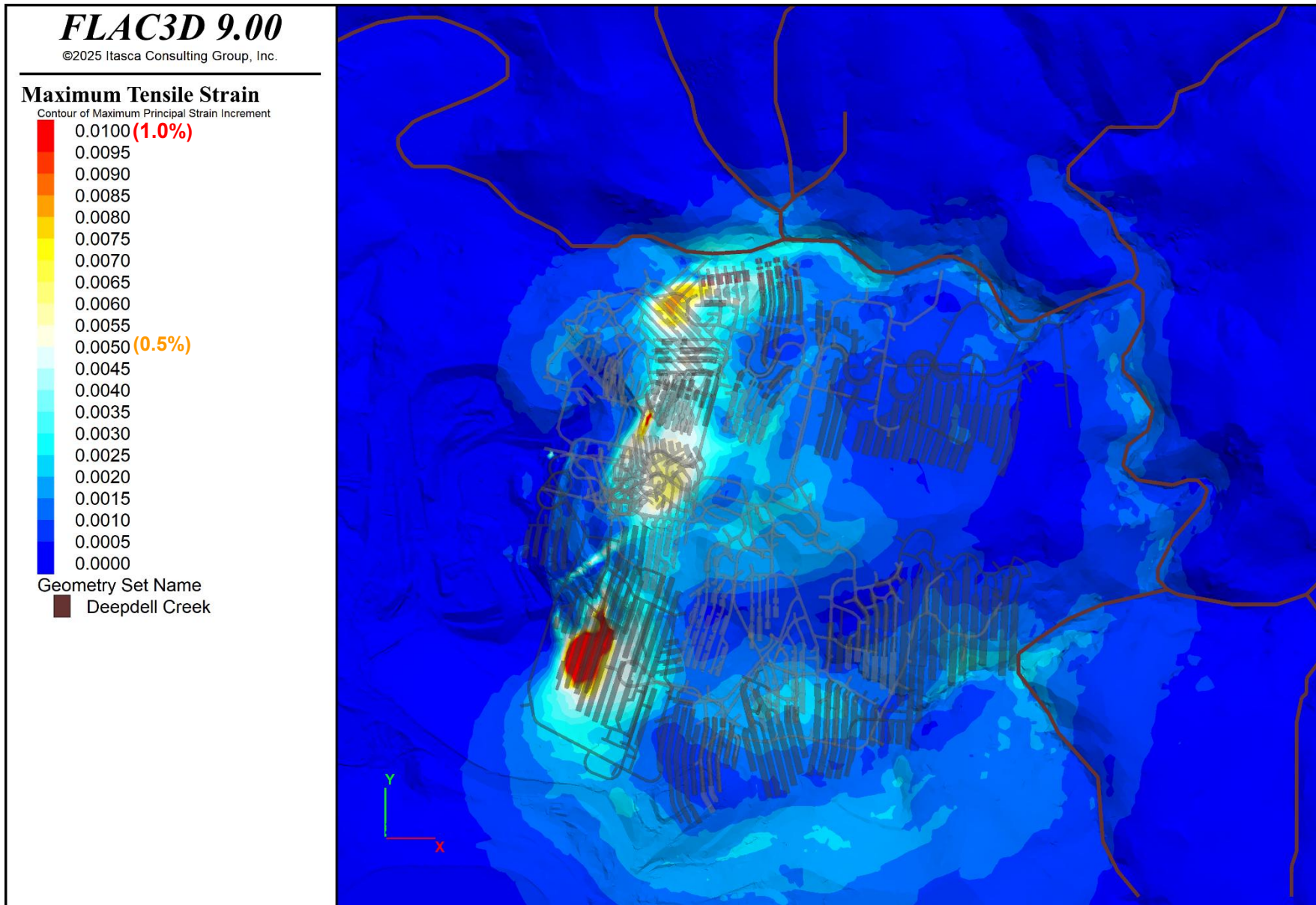
Scenario 1

Planview: E-W Horizontal Displacement



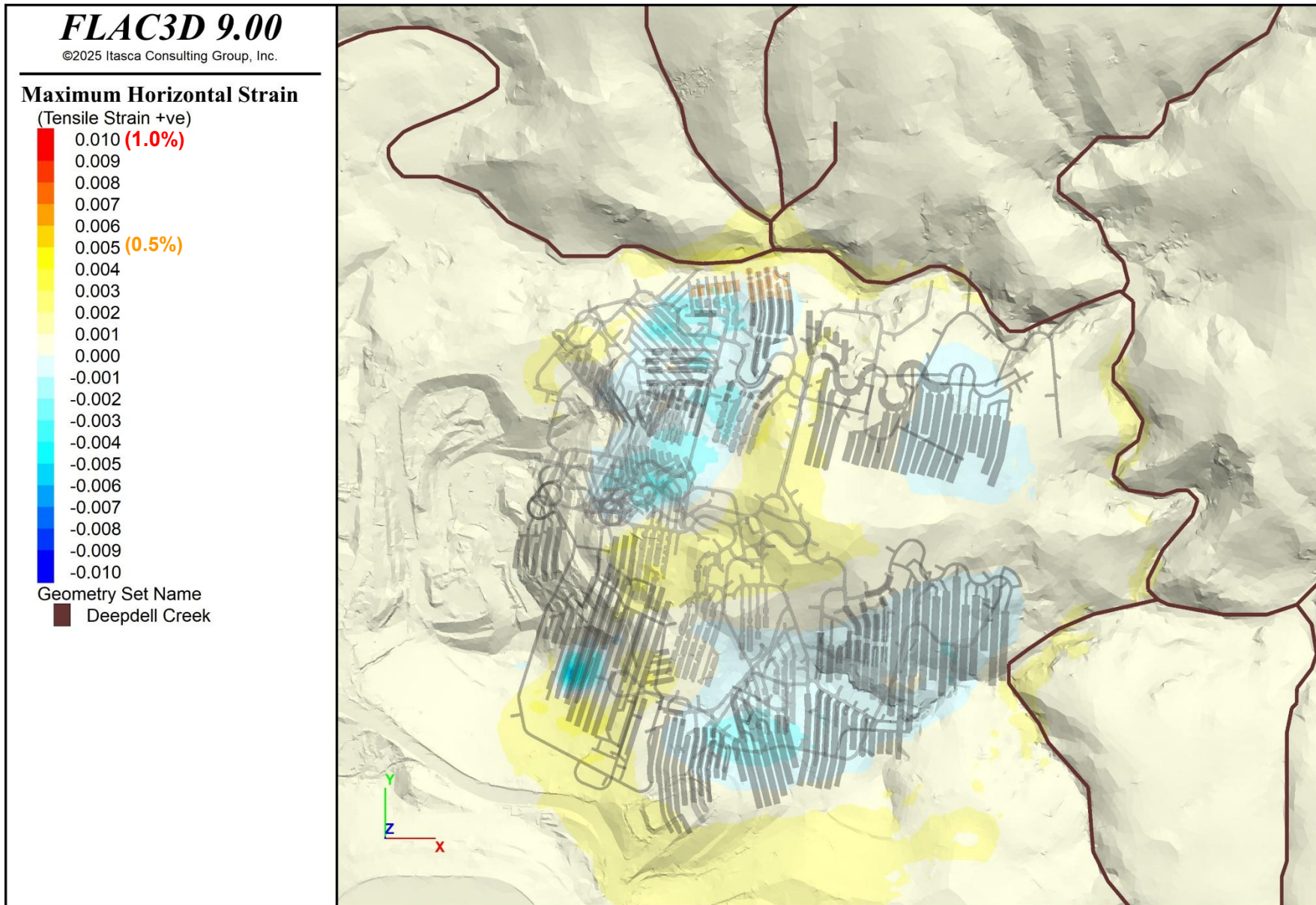
Scenario 1

Planview: Maximum Tensile Strain



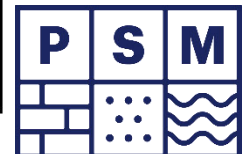
Scenario 1

Planview: Horizontal Strain



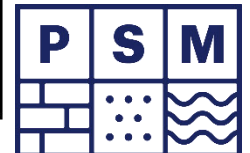
Scenario 1

Deepdell Creek - Vertical Displacement



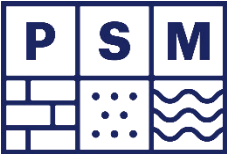
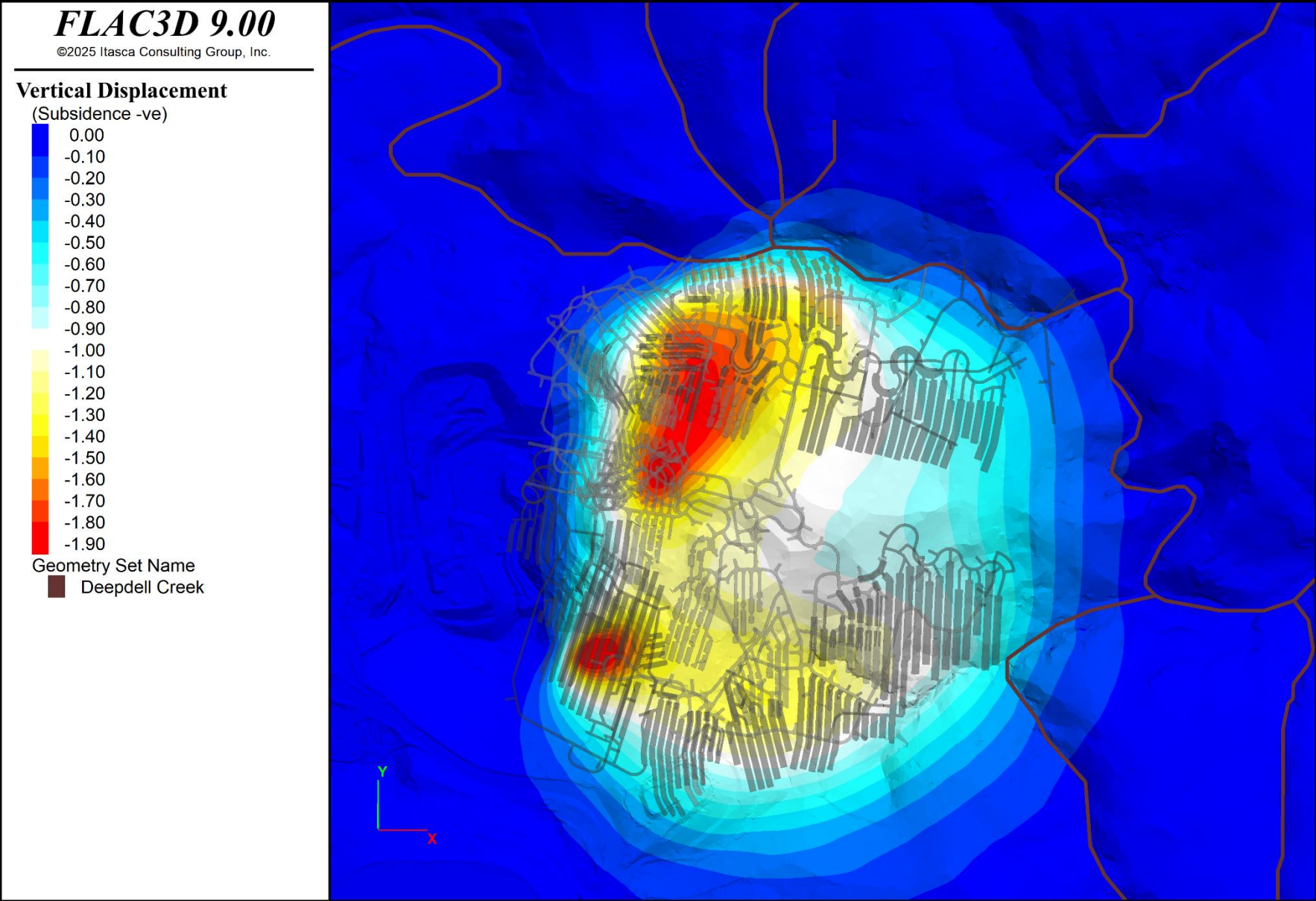
Scenario 1

Deepdell Creek - Maximum Tensile Strain



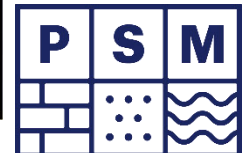
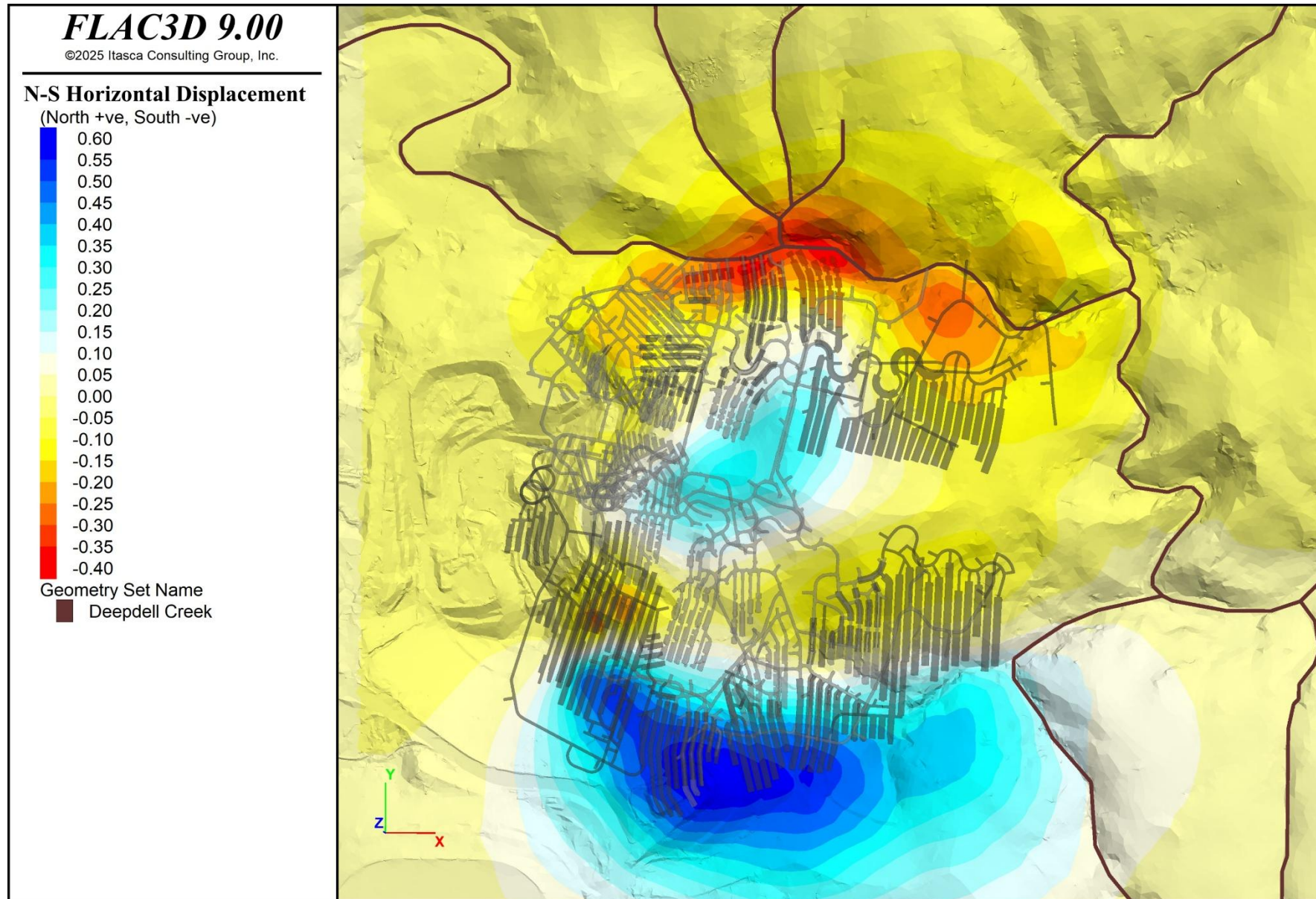
Scenario 2

Planview: Vertical Displacement



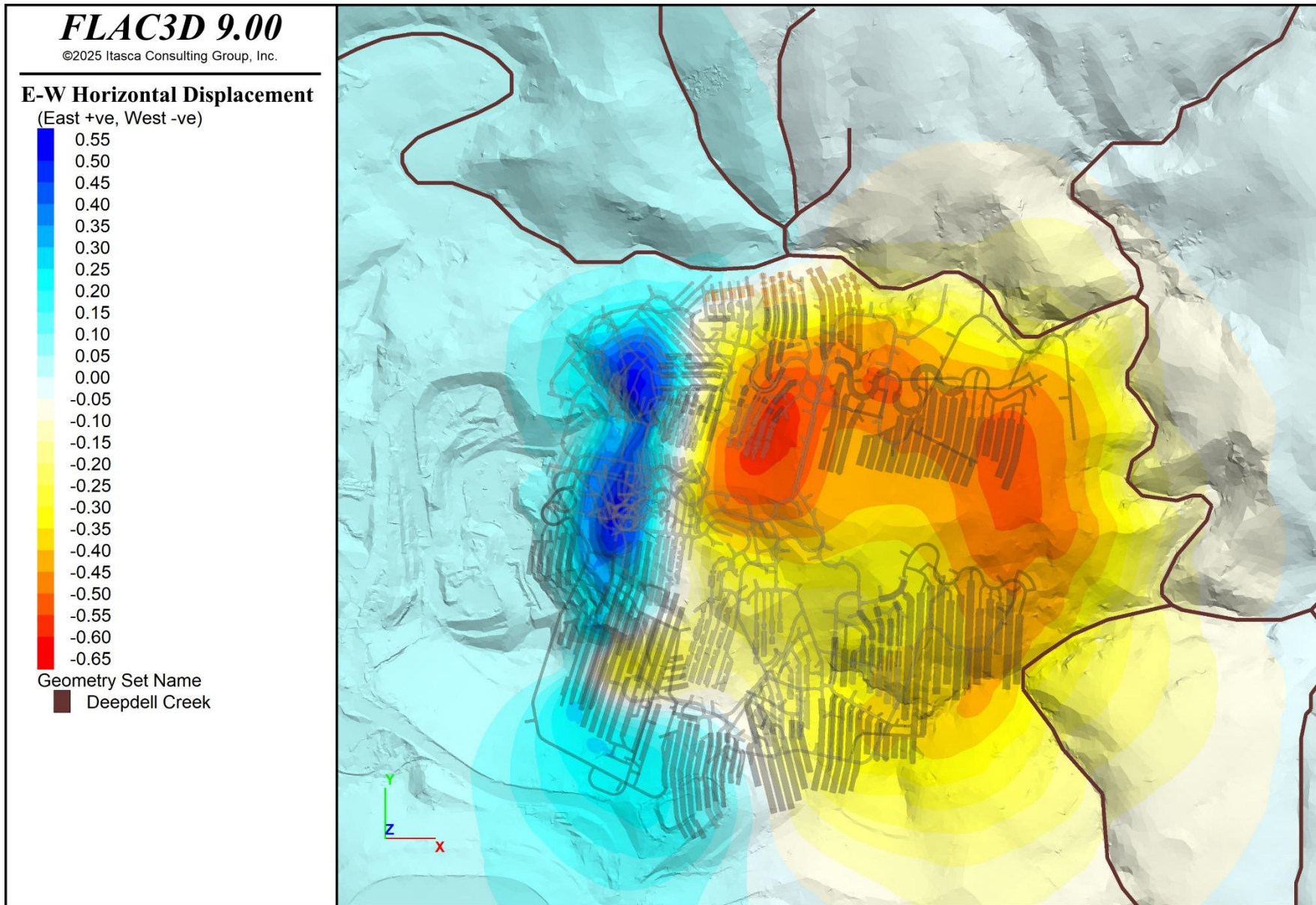
Scenario 2

Planview: N-S Horizontal Displacement



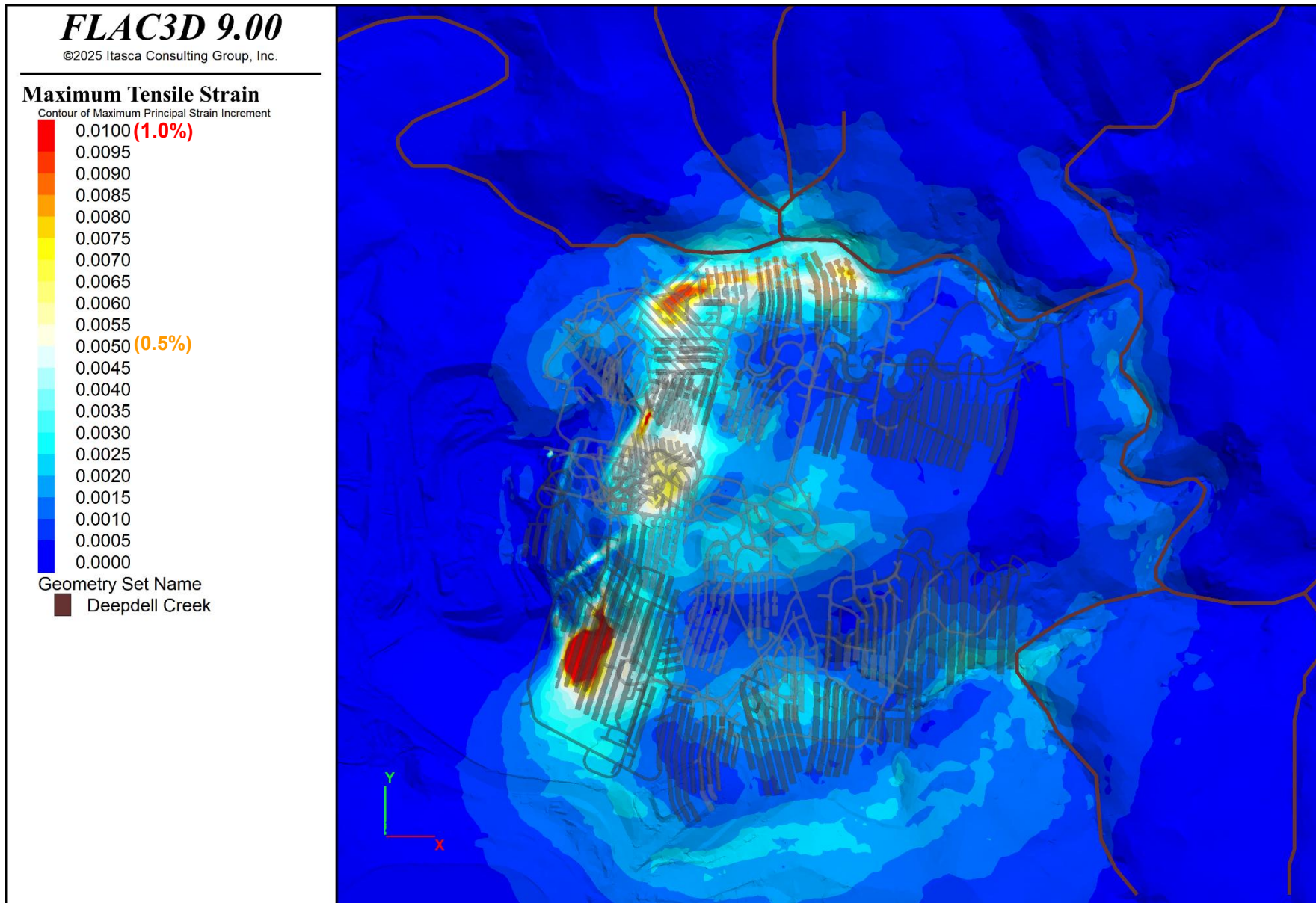
Scenario 2

Planview: E-W Horizontal Displacement



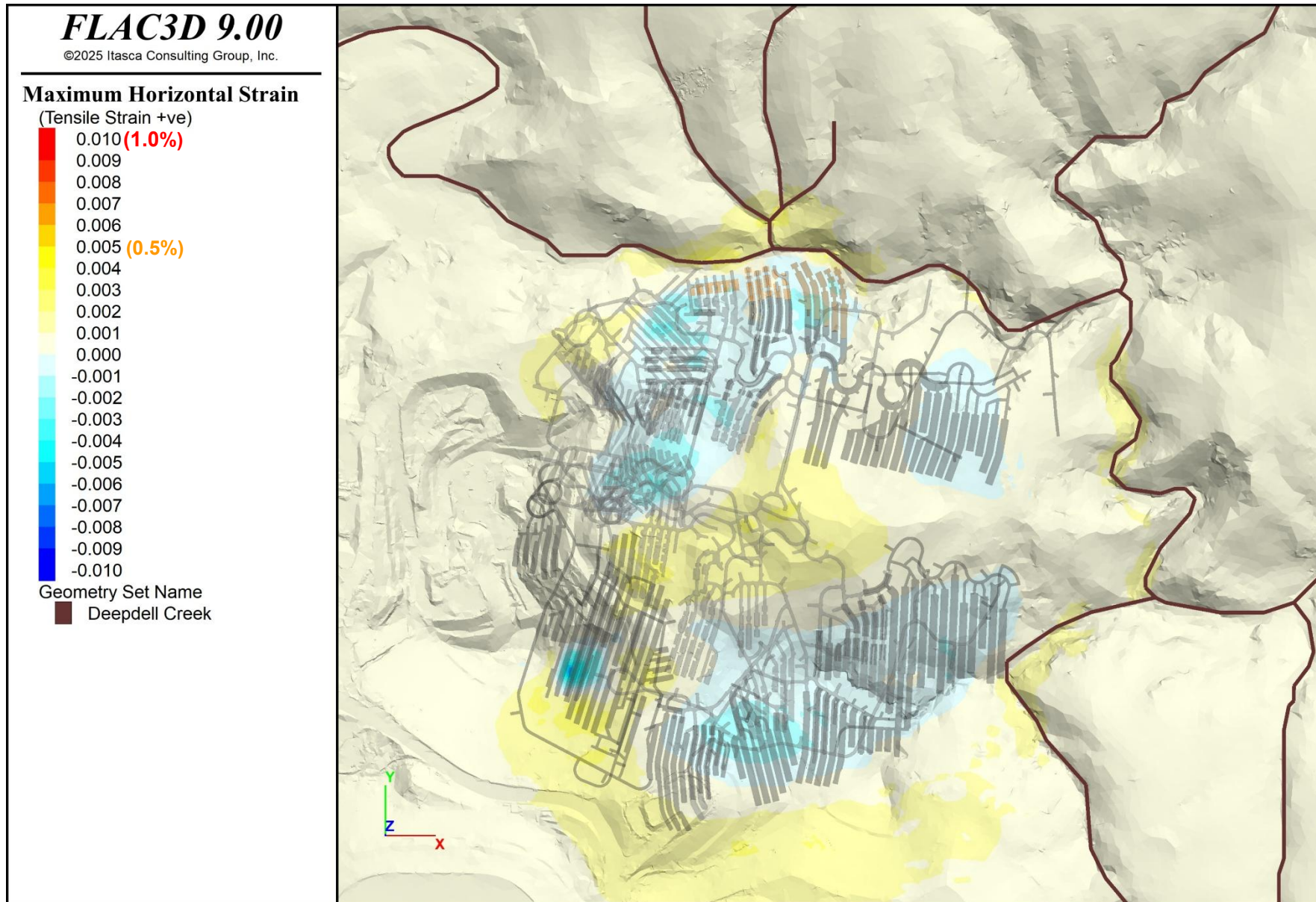
Scenario 2

Planview: Maximum Tensile Strain



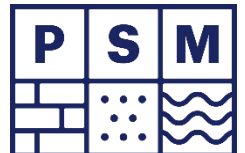
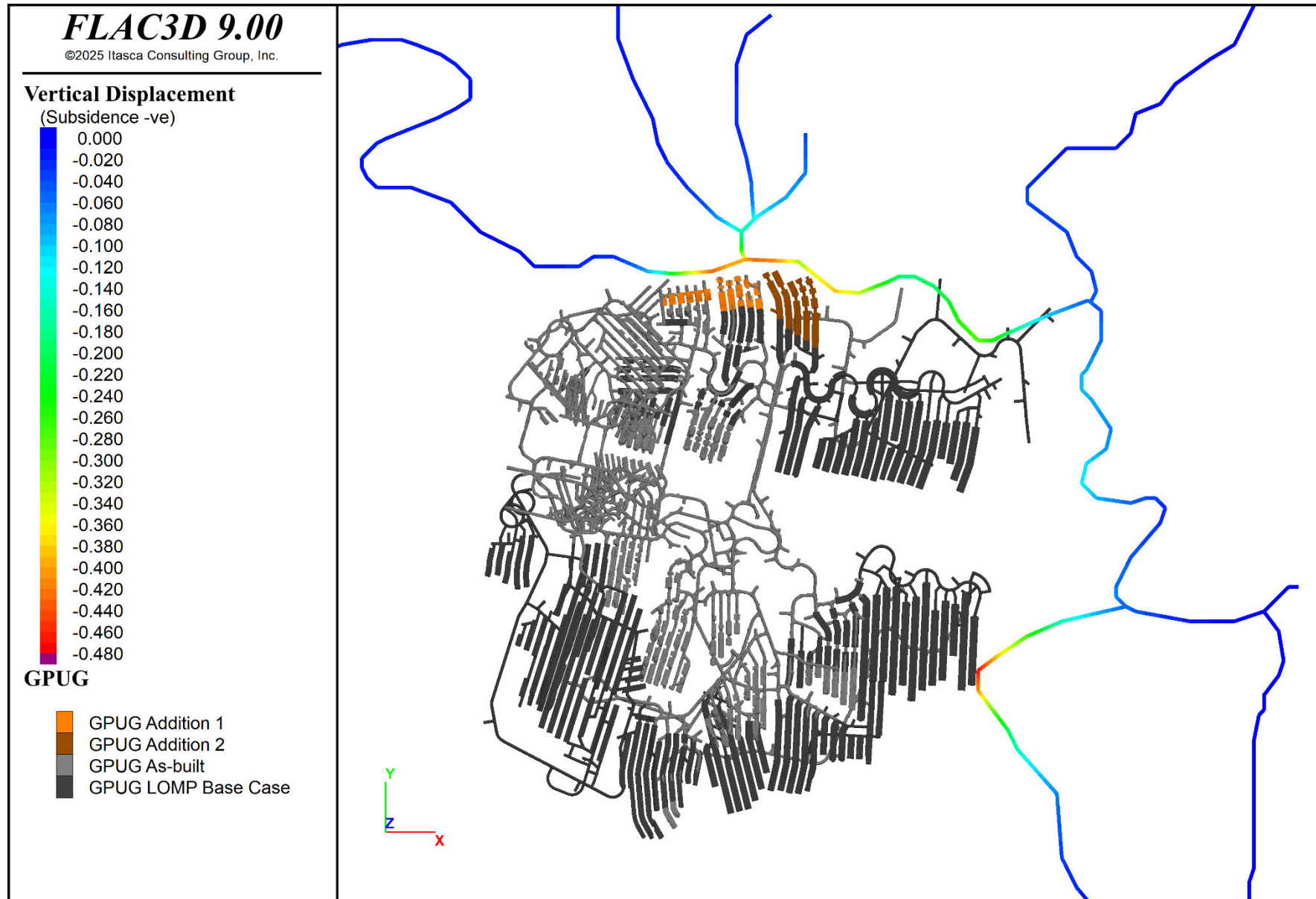
Scenario 2

Planview: Horizontal Strain



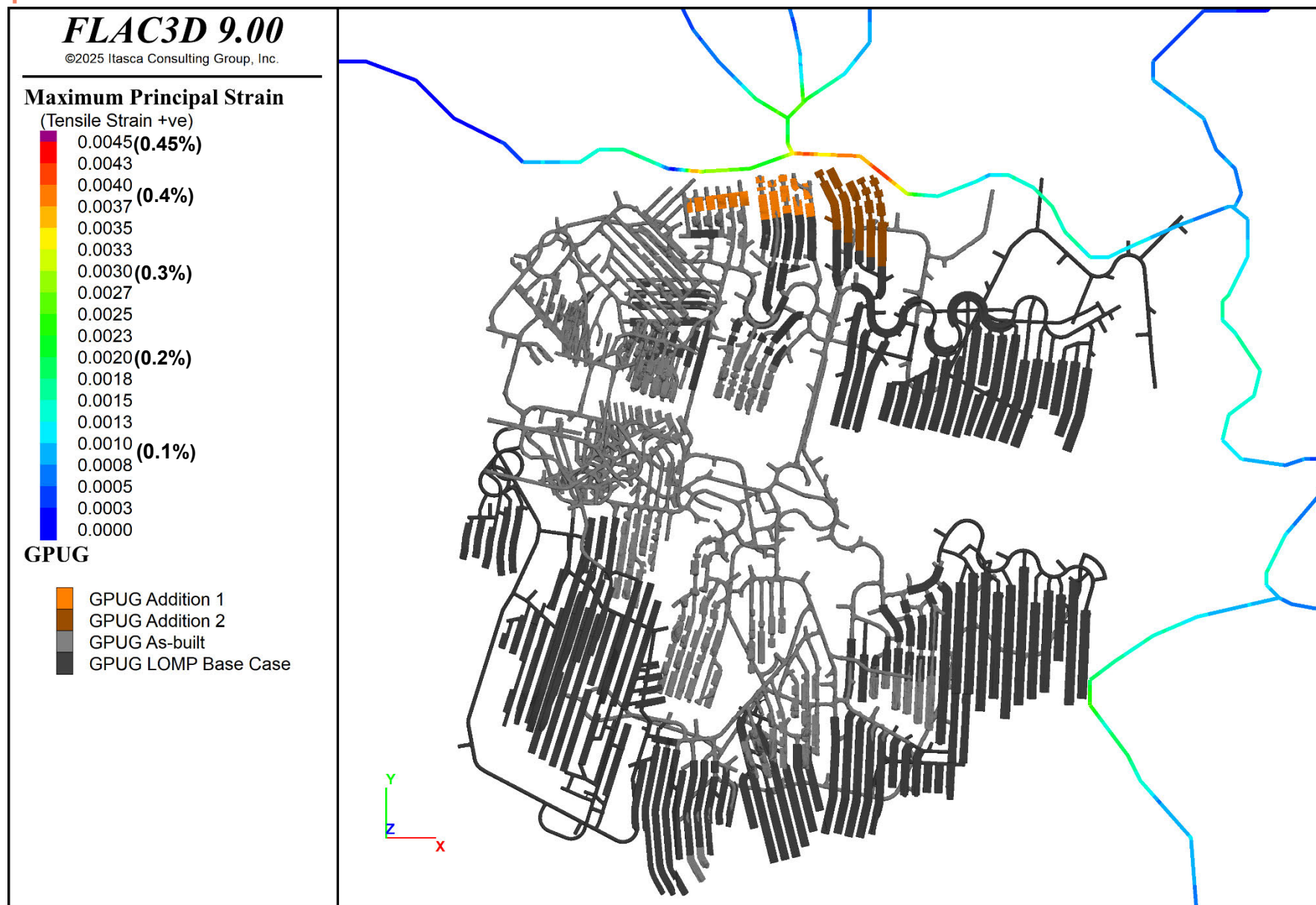
Scenario 2

Deepdell Creek - Vertical Displacement



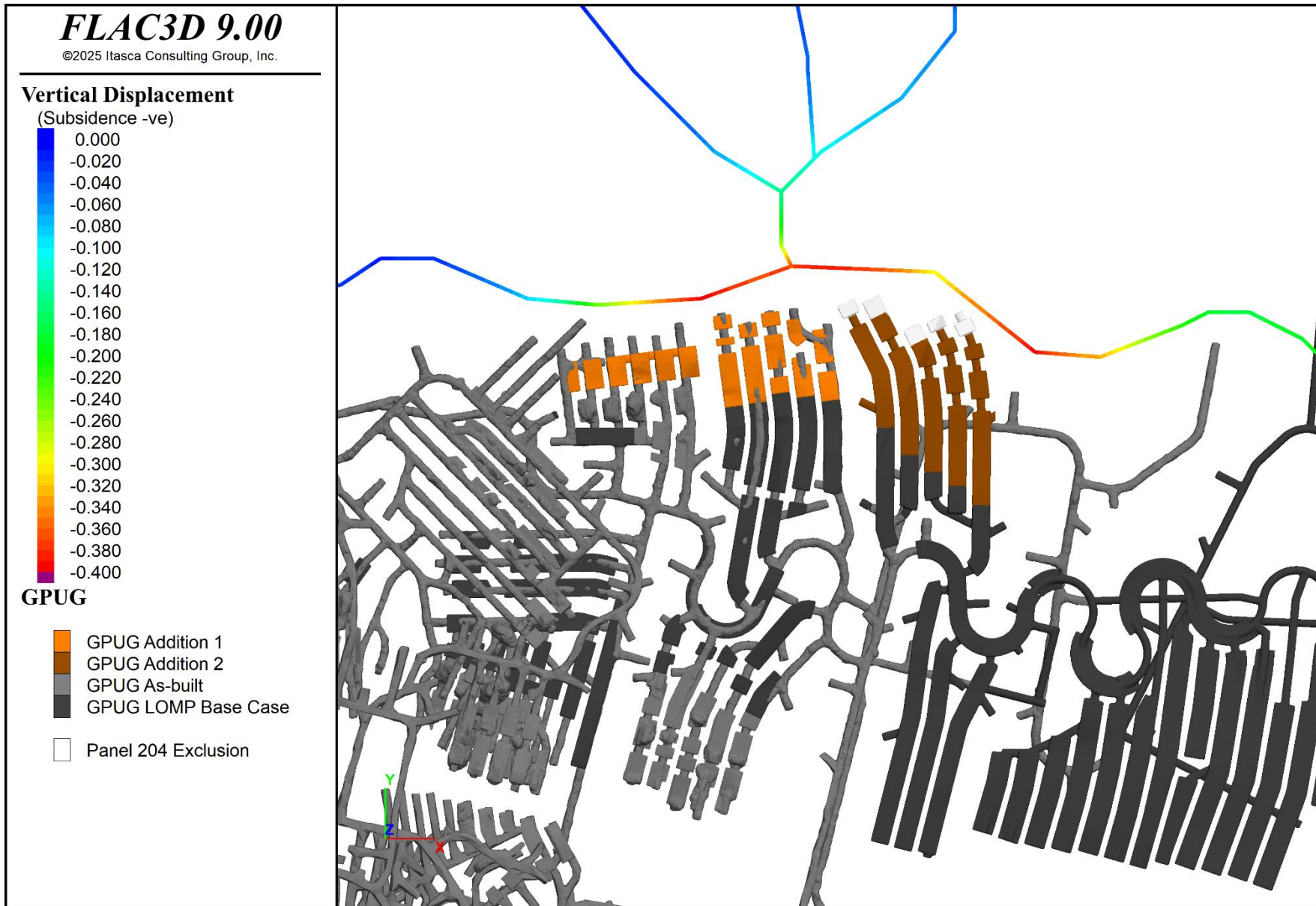
Scenario 2

Deepdell Creek - Maximum Tensile Strain



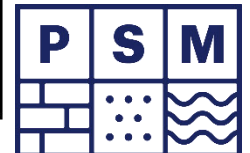
Scenario 2 Sensitivity Case

Deepdell Creek - Vertical Displacement



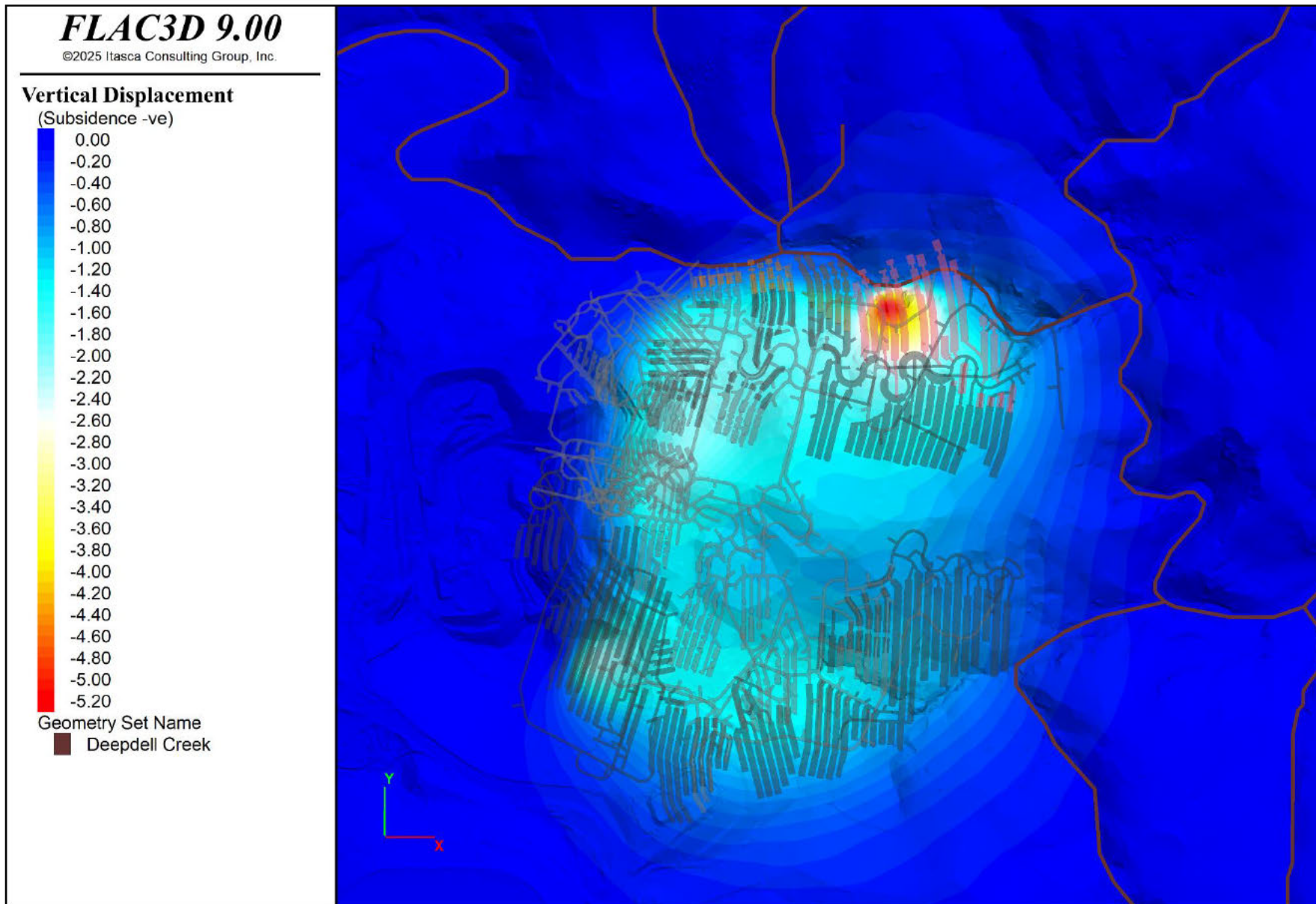
Scenario 2 Sensitivity Case

Deepdell Creek - Maximum Tensile Strain



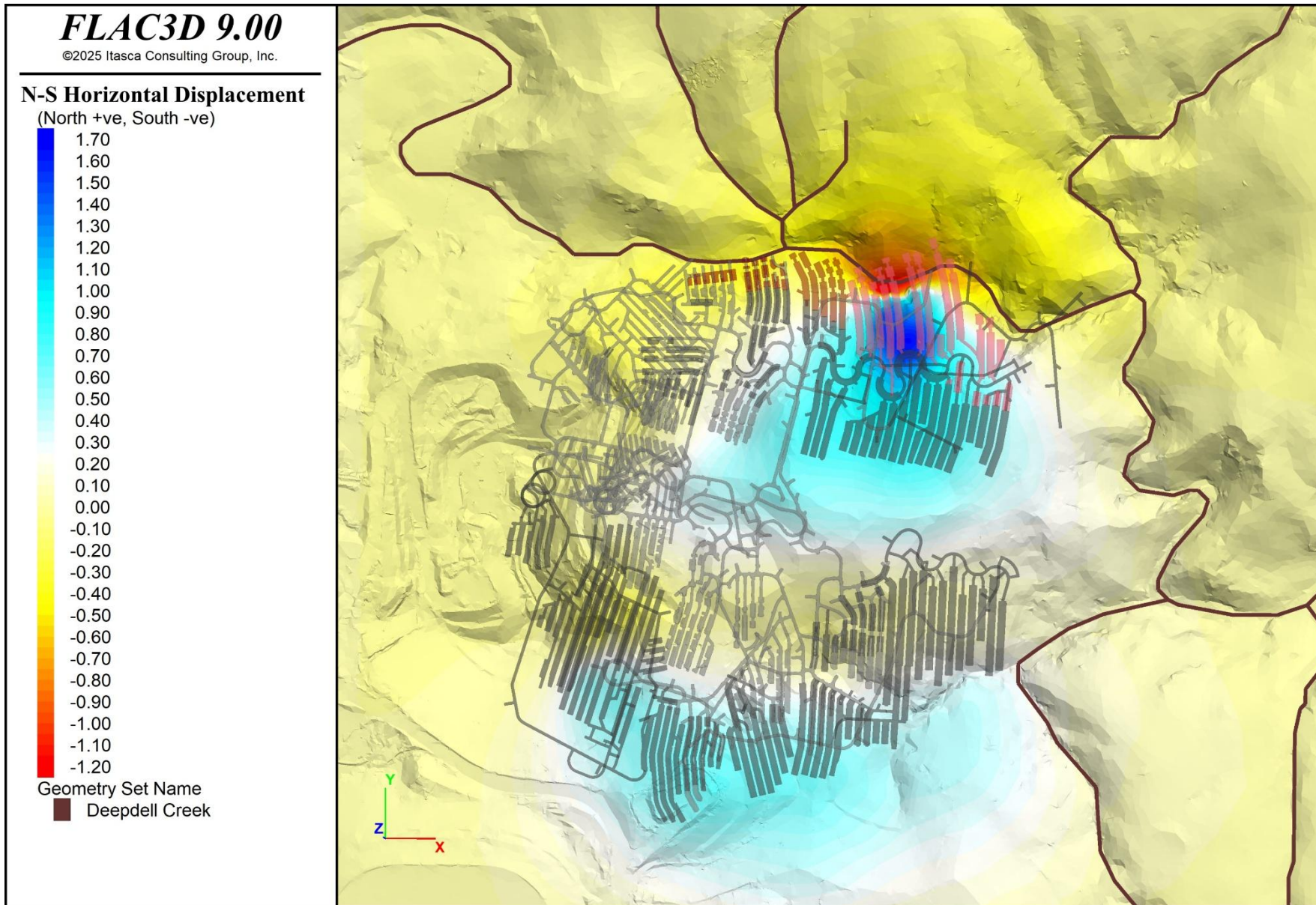
Scenario 3

Planview: Vertical Displacement



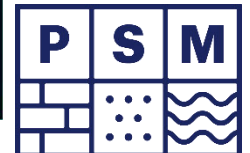
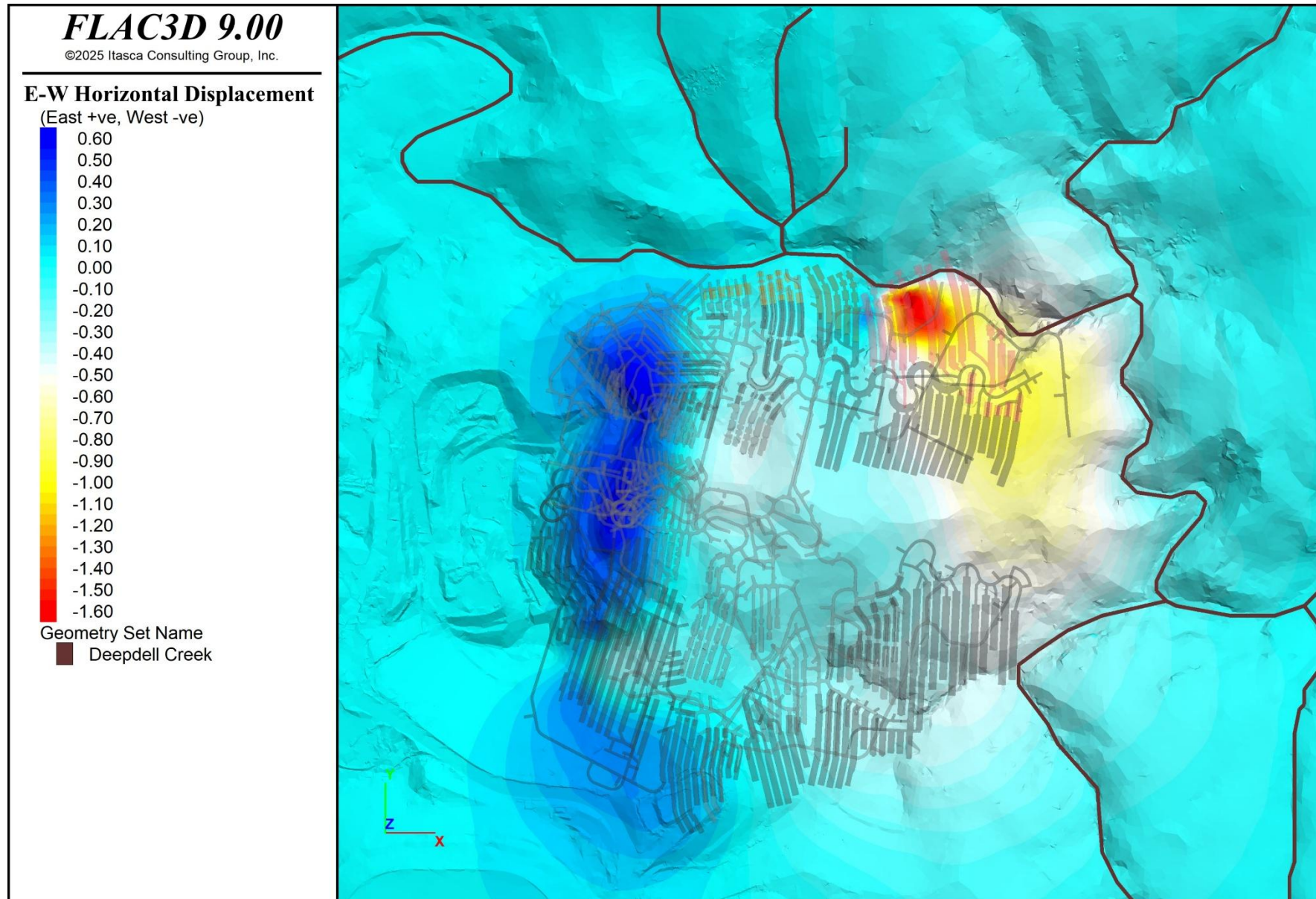
Scenario 3

Planview: N-S Horizontal Displacement



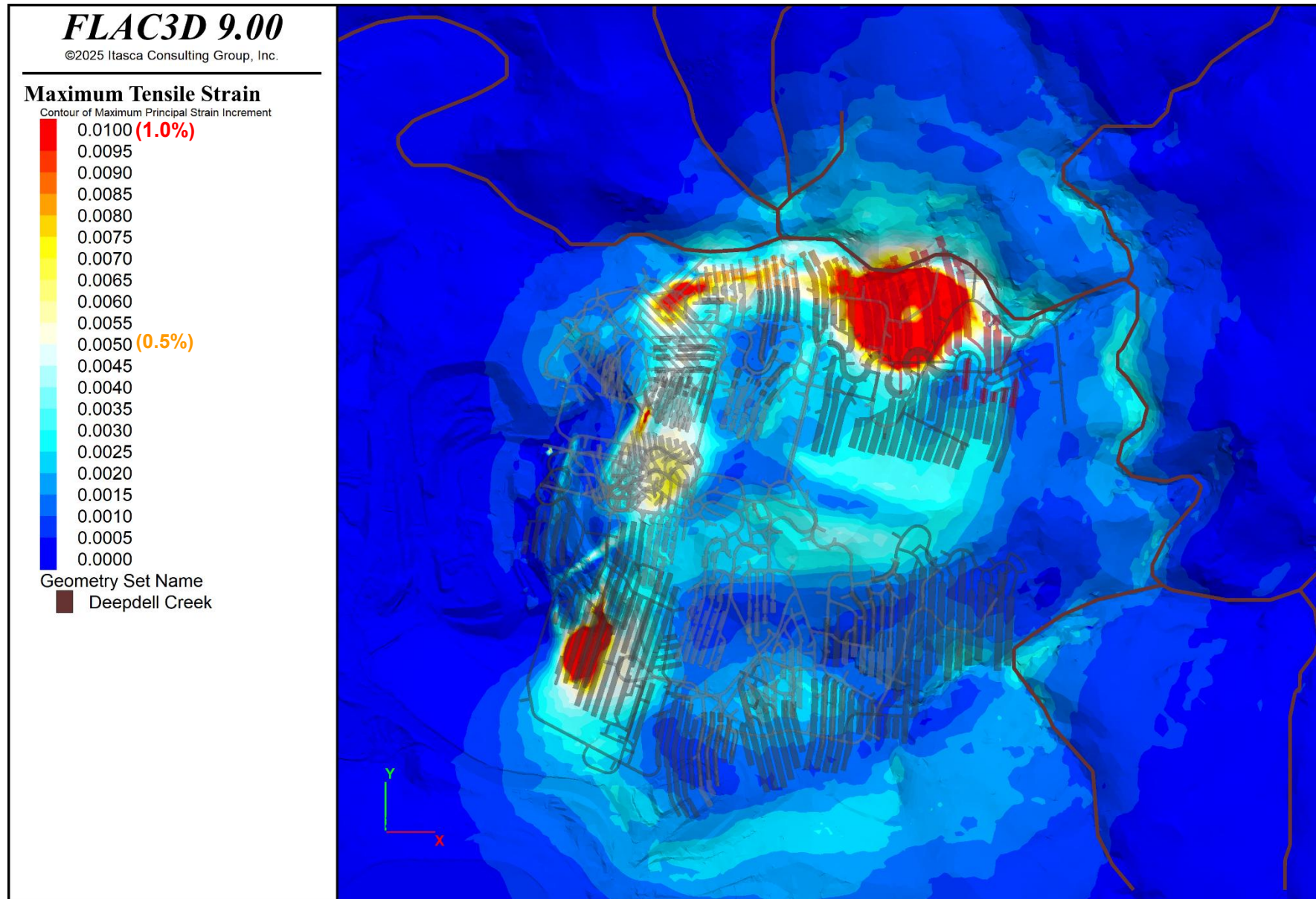
Scenario 3

Planview: E-W Horizontal Displacement



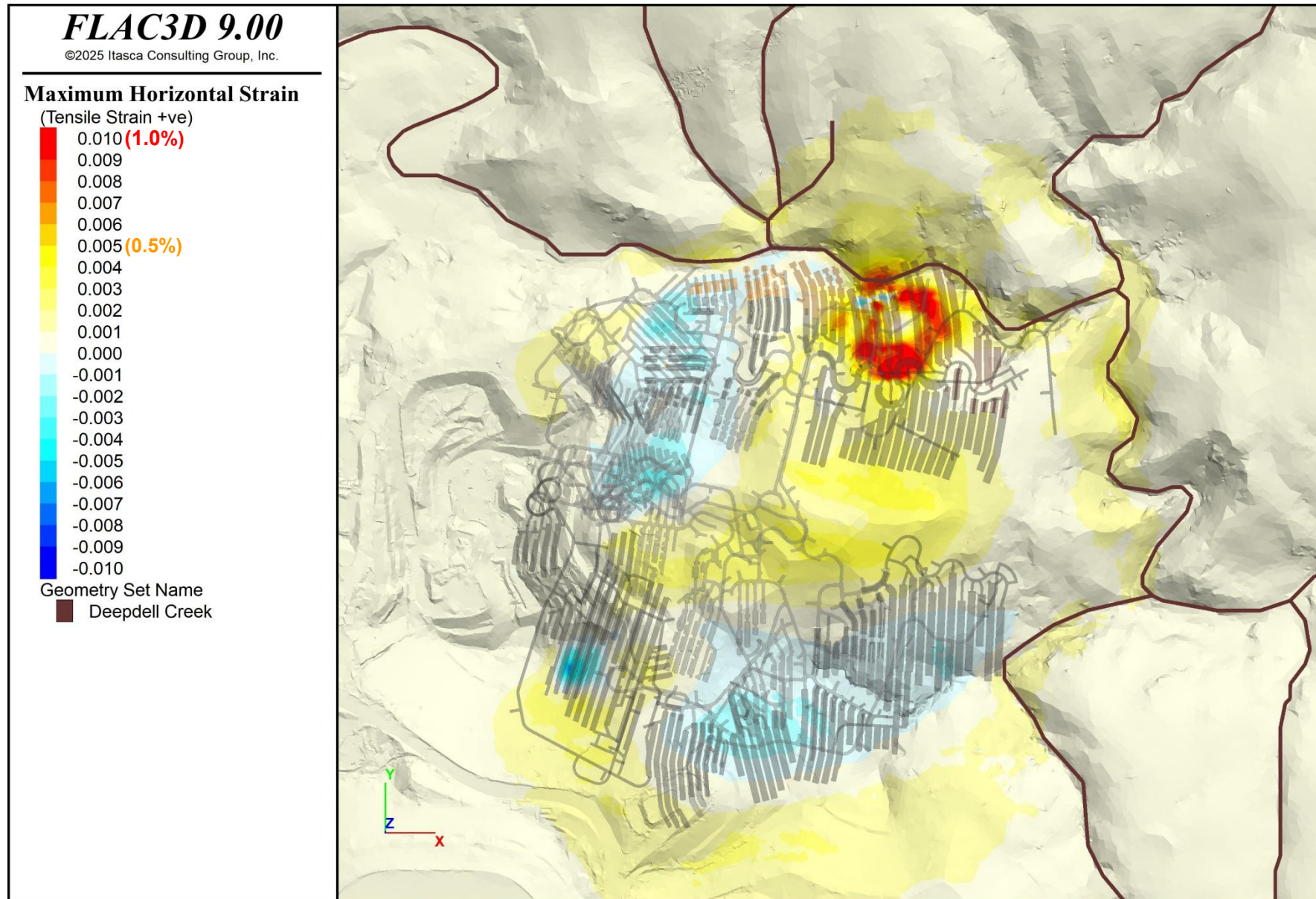
Scenario 3

Planview: Maximum Tensile Strain



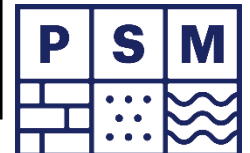
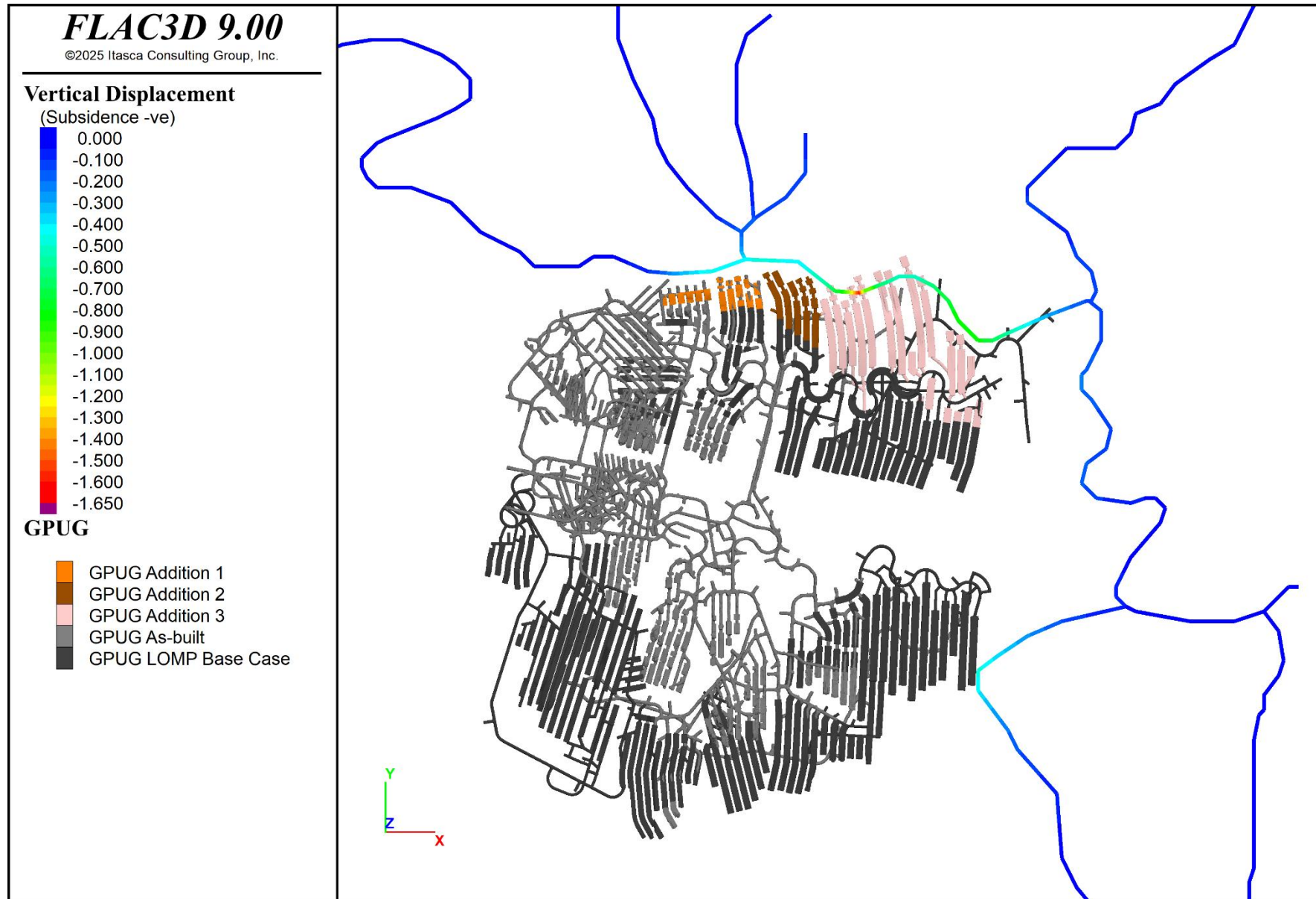
Scenario 3

Planview: Horizontal Strain



Scenario 3

Deepdell Creek - Vertical Displacement



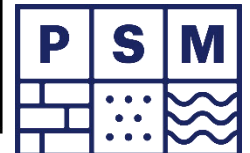
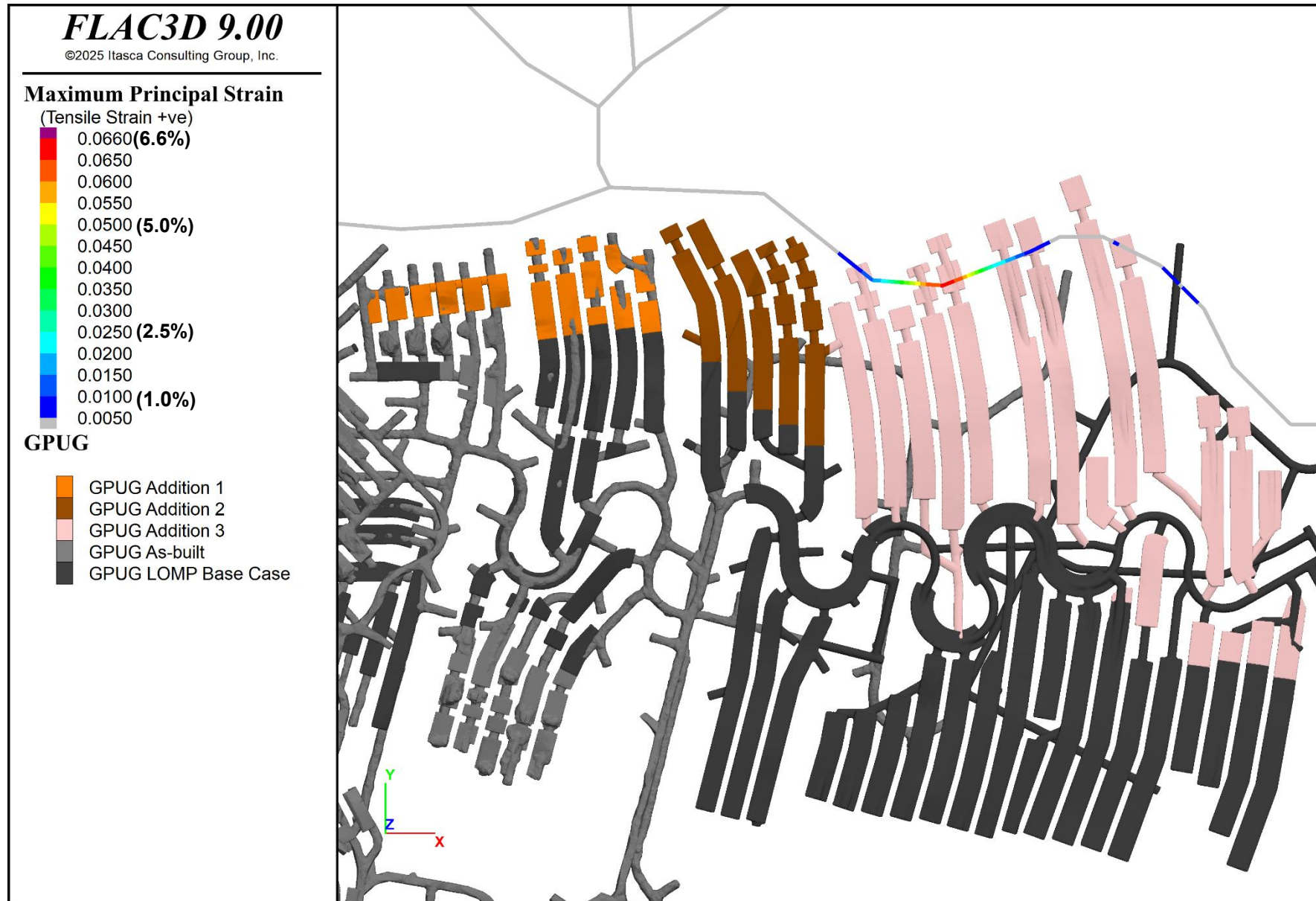
Scenario 3

Deepdell Creek - Maximum Tensile Strain



Scenario 3

Deepdell Creek - Maximum Tensile Strain



Summary

Maximum Predicted Subsidence and Strains along Deepdell Creek

Analysis Case	Maximum Subsidence (m)	Maximum Tensile Strain	Valley Closure (m)
Existing GPUG	0.20	0.25% (2.5 mm/m)	0.25
LOMP Base Case	0.30	0.25% (2.5 mm/m)	0.30
Scenario 1	0.35	0.30% (3.0 mm/m)	0.30
Scenario 2	0.45	0.45% (4.5mm/m)	0.30
Scenario 2 Sensitivity Case	0.40	0.35% (3.5mm/m)	0.30
Scenario 3	1.65	6.5% (65 mm/m)	2.5

- The above results indicate results low risk of adverse impacts on Deepdell Creek for the Base case, Scenario 1 and Scenario 2 (sensitivity case) mining of proposed LOMP GPUG
- The results for Scenario 3 indicate subsidence of up to 1.65 m and tensile strains much greater than 1% (i.e >> 10mm/m) implying likelihood of adverse impacts along Deepdell Creek

