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Geotechnical Addendum

2023 Annual Report

Holcim – US Deer Creek Quarry

Permit M1977-014
Jefferson County, Colorado

December 2023

Prepared By:

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Geotechnical Engineer

Howard Hume, Ph.D., P.G.
Senior Engineering Geotechnical Advisor

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1 Introduction

This 2023 Annual Report provides information required by permit M-1977-014, that allows the Colorado Division of Reclamation, Mining and Safety (DRMS) to review existing and evolving quarry conditions at the Deer Creek Quarry, which is operated by Holcim Group | Holcim – WCR, Inc. (Holcim). This report summarizes geotechnical observations made by HDR Engineering, Inc. (HDR) field staff during bi-monthly site visits through 2023 and is a supplement to the Minerals Reclamation Permit Annual Report.

HDR staff noted and documented exposed rock conditions such as joint and foliation orientation, shear zones, intrusions, rock type, and critical highwalls still exposed from previous mining activities.

1.1 Quarry Location and Description

The Deer Creek Quarry is a hard rock aggregate pit located north of State Route 124, west of Ken Caryl, Colorado. The quarry location is shown in Figure 1, Project Location Map. The quarry site is located southwest of the South Hogback along the Colorado Front Range west of Denver.

The Deer Creek Quarry currently consists of reclaimed slopes and highwall benches. Existing faces have two primary slope directions, facing approximately east and north. Per the permit conditions of a limited production quarry, the site need only be minimally mined in order to keep the permit active. However, the highwalls have historically not been significantly mined since full production ceased in 2003.

1.2 Quarry Configuration

The quarry consists of two dominant highwalls, facing east and north, which are near vertical faces with approximately 40-foot wide benches. East facing highwall extends from approximately elevation (El.) 6820 above mean sea level (msl) to El. 6380. The north facing highwall begins at approximately El. 6650. Both highwalls have been unmined since approximately 2003, with limited mining activities including moving stockpiled materials and material storage occurring along the floor of the pit and the lower bench at approximately El. 6420. An access/haul road is present north of the pit and provides access to the benches of the east-facing highwall. Refer to Figures 2 and 3, Quarry Extents and Bench Type and Quarry Aerial Map and Bench View, respectively, for additional information.

2 Site Geology

The Deer Creek Quarry is situated in the Colorado Front Range, within the Colorado Province of the Southern Rocky Mountains (Scott, 1972). The Front Range forms the easter margin of the Southern Rocky Mountains, situated above the Denver Basin and High Plains to the east. Bedrock geology in the area is mapped as Biotite Gneiss, Schist, and Migmatite of early

Proterozoic. Locally, the Deer Creek Quarry typically consists of a fine- to medium-grained granitic gneiss or biotite gneiss, with occasional pegmatitic intrusions.

3 2023 Observations

The following section includes observations of mine conditions made by HDR staff. Joint and foliation orientations, highwall trends, and rock mass rating (RMR) classification estimates were not included in this task order, as this effort was limited to evaluating conditions resulting from the work done in the current year. Therefore, historical aerial imagery through Google Earth and imagery provided through the Propellor online portal were reviewed for changes relevant to the mine conditions and any reclamation activities. Additionally, a UAV survey was performed by Chinook Landscape Architecture, LLC, under contract to HDR, in September 2023, which was compared to the September, 2022 UAV survey to assess changes that have occurred at the quarry throughout the current year. The following sections detail the findings for the 2023 mining year. Refer to Figure 3 for additional information regarding the quarry feature locations.

During the site visit performed in June, surface water runoff was identified at the site. The weather conditions leading up to the site visit included significant rain events, which appeared to pool in the basin of the primary mining area, which then seeped through the basin and appeared to flow onto the main access road into the quarry. The runoff event had resulted in significant damage to the access road, including rutting and washout, as well as introducing some rockfall onto lower elevations. Runoff was seen extending to the edge of the property, and the owner was notified. It should be noted, that the weather conditions leading up to the site visit were not typical for the area; however, future considerations should be made to minimize storm event runoff. Refer to Appendix A for the June Site Visit Memorandum.

3.1 Mining Conditions

Based on aerial imagery and site visits, no appreciable mining occurred in 2023. Historical imagery from 2021 indicated the site was previously being used as a storage facility for timber in the laydown area to the east of the highwalls. Existing benches did not appear to be mined, with no recent excavations observed. The access road leading to the upper benches to the north of the highwalls was viewed during the site visit, which was overgrown with vegetation, and had experienced numerous slope failures that has left the road inaccessible to typical vehicular traffic.

3.2 Reclamation Slope Conditions

Site reclamation has been performed at the quarry prior to HDR's involvement. The upper benches have developed vegetation on the slopes, and talus has accumulated along the benches. East-facing benches have continued to maintain integrity, with minimal significant talus accumulation. The primary area of talus accumulation appeared to be at the junction of the east facing and south facing highwalls.

3.3 2023 Condition Changes

With the UAV survey performed in the 2023 calendar year, HDR was able to perform a Change Detection Analysis between the 2022 and 2023 pointcloud data to determine areas of movement. The methodology uses the two pointclouds, compares each point from one year to the next, to determine the amount of location change in the X, Y, and Z directions. This distance, calculated in feet, is then identified as a color change on the resulting output as a heat map, showing larger areas of movement compared to others. Refer to Appendix B for the outputs.

In general, HDR noted that at the corner of the existing north and east facing highwalls, the most amount of rockfall or movement was identified. Specifically between Elevation 6470 and 6650, a significant amount of rockfall from the bench above was noted in the analysis. On the east facing highwall specifically, a rockfall event occurred near Elevation 6564. Then, on the north facing highwall, a noted rockfall event occurred at Elevations 6640 and 6540. Minor raveling / talus accumulation was aboserved, primarily retained on the bench below.

During the site visit, structural features such as joint sets and general foliation trends were noted in relation to the bench configurations. Detailed scanlines were not performed since the existing benches did not exhibit features of recent mining; however, general measurements were collected in order to ascertain potential failure mechanisms associated with the recent rockfall events.

3.4 Kinematic Analyses

Kinematic analyses were performed to assess the natural discontinuity patterns on the slopes relative to the slope geometry, and to evaluate the potential and type(s) of failures that may occur (i.e., planar, wedge, or toppling failure). HDR utilized Rocscience's Dips program to perform the kinematic analyses. The site has not significantly been mined in the 2023 calendar year, and as such, no additional structural features were seen during the site visits or through the UAV survey. In general, the structural geology of the quarry has remained the same as previously identified in the calendar year 2022, during which limited orientation data was collected by remote means. The previously identified primary joints sets were: Set 1 (J1) was identified as being oriented at 20°,120°, Set 2 (J2) was approximately 85°,45° and Set 3 (J3) was approximately 30°,320°. Foliation throughout the site varied locally; however, a prominent foliation feature (F1) noted throughout was identified at approximately 70°,310°. Structure values are presented in dip/direction notation. Limited strike and dip measurements were collected due to accessibility concerns with the existing slopes.

4 Results and Recommendations

4.1 Summary of Results

The site evaluation and background research of the Deer Creek Quarry indicates that minimal mining has occurred in recent years. As such, the condition of the quarry appears to be generally stable, with localized failures occurring most often at the junction of the existing highwalls. These features appear to be local, raveling type failures, rather than kinematically-driven global instabilities, consistent with the kinematic analysis results derived from the previously collected orientation data. See Table 1 below for a summary of the Kinematic Analyses, and Appendix C for the Steronet Projections. If significant mining is to be performed in the future, a thorough mapping and slope analysis should be performed to further develop the global stability of the site.

Table 1 – Summary of Kinematic Analyses

Failure Mode	North-Facing Slopes Risk	East-Facing Slopes Risk	South-Facing Slopes Risk	West-Facing Slopes Risk
Planar Sliding	0.0%	0.0%	0.0%	0.0%
Wedge Sliding	16.7%	0.0%	0.0%	16.7%
Flexural Toppling	0.0%	0.0%	0.0%	0.0%
Direct Toppling	0.0%	0.0%	16.7%	0.0%

4.2 Recommendations

Due to the presence of recent rockfall conditions, and the potential larger scale failure risk identified through the kinematic analyses, HDR recommends that ongoing monitoring as part of the annual inspections continue moving forward. Additionally, as noted during the change detection analysis, any work along the existing benches should be limited, as it is noted that the benches are continuing to weather and ravel in numerous areas. If rockfall persists beyond an adjacent lower bench, as noted during our research, benches should be cleaned and/or stabilized to mitigate excessive rockfall energies.

Regarding the evidence of recent surface water runoff and access road degradation observed during our June 2023 site visit, HDR recommends a drainage survey be performed to identify positive drainage channels and methods to channelize future surface water runoff away from sensitive features such as access roads, highwalls slopes, and benches.

5 References

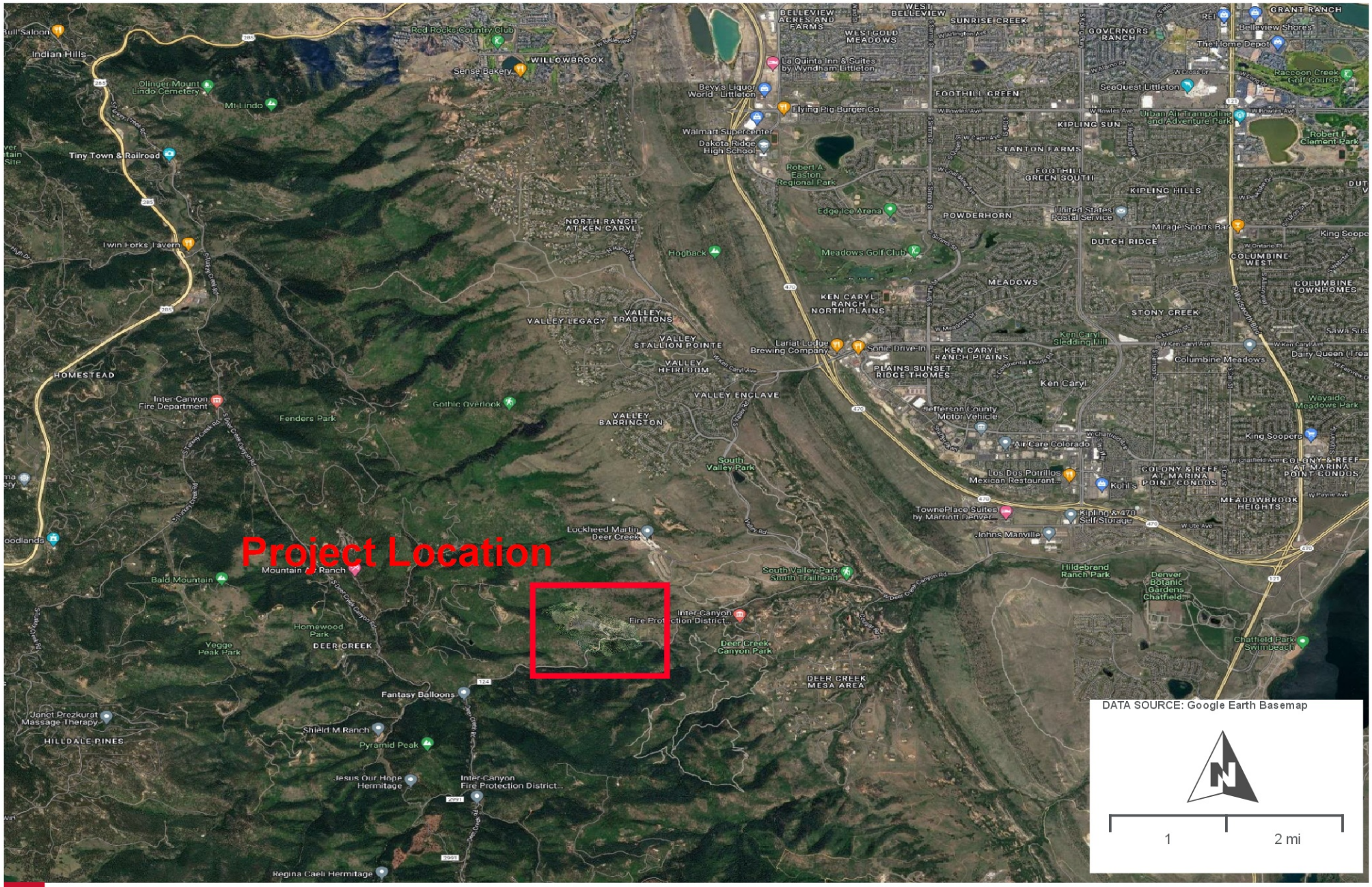
Aggregate Industries, Inc (2020). “Aggregate Industries – WCR, Inc. Deer Creek Quarry (M1997-014) Interim Stability Evaluation,” prepared for Aggregate Industries, September.

HDR, Inc. (2022). “Geotechnical Addendum, 2022 Annual Report, Aggregate Industries Deer Creek Quarry,” prepared for Aggregate Industries, December.

Rocscience, DIPS Stereographic Projection Program, Version 7.0.

Scott, Glenn R., Geologic Map of Morrison Quadrangle, Jefferson County, Colorado 1972.

Figures

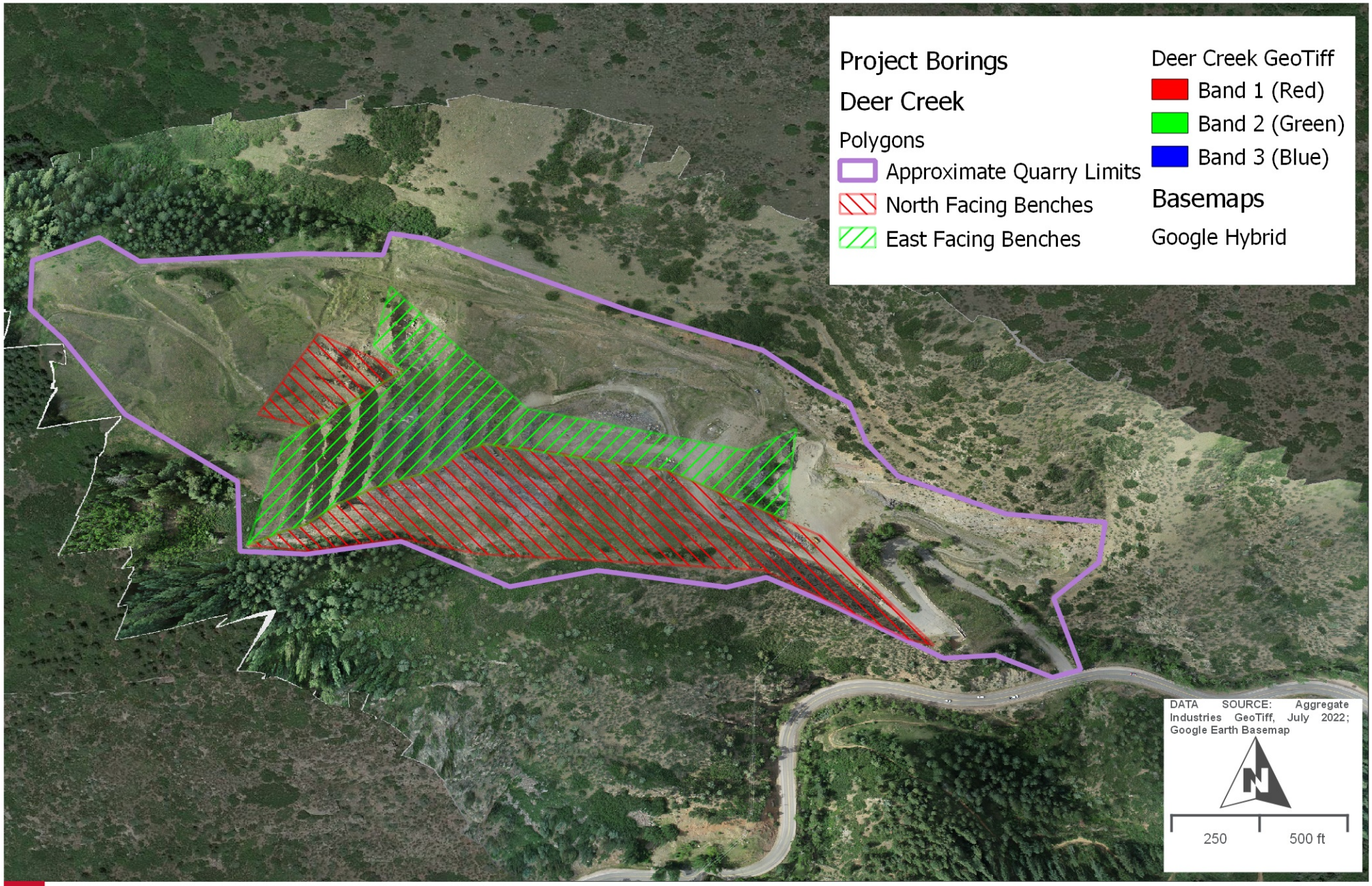


PROJECT LOCATION MAP

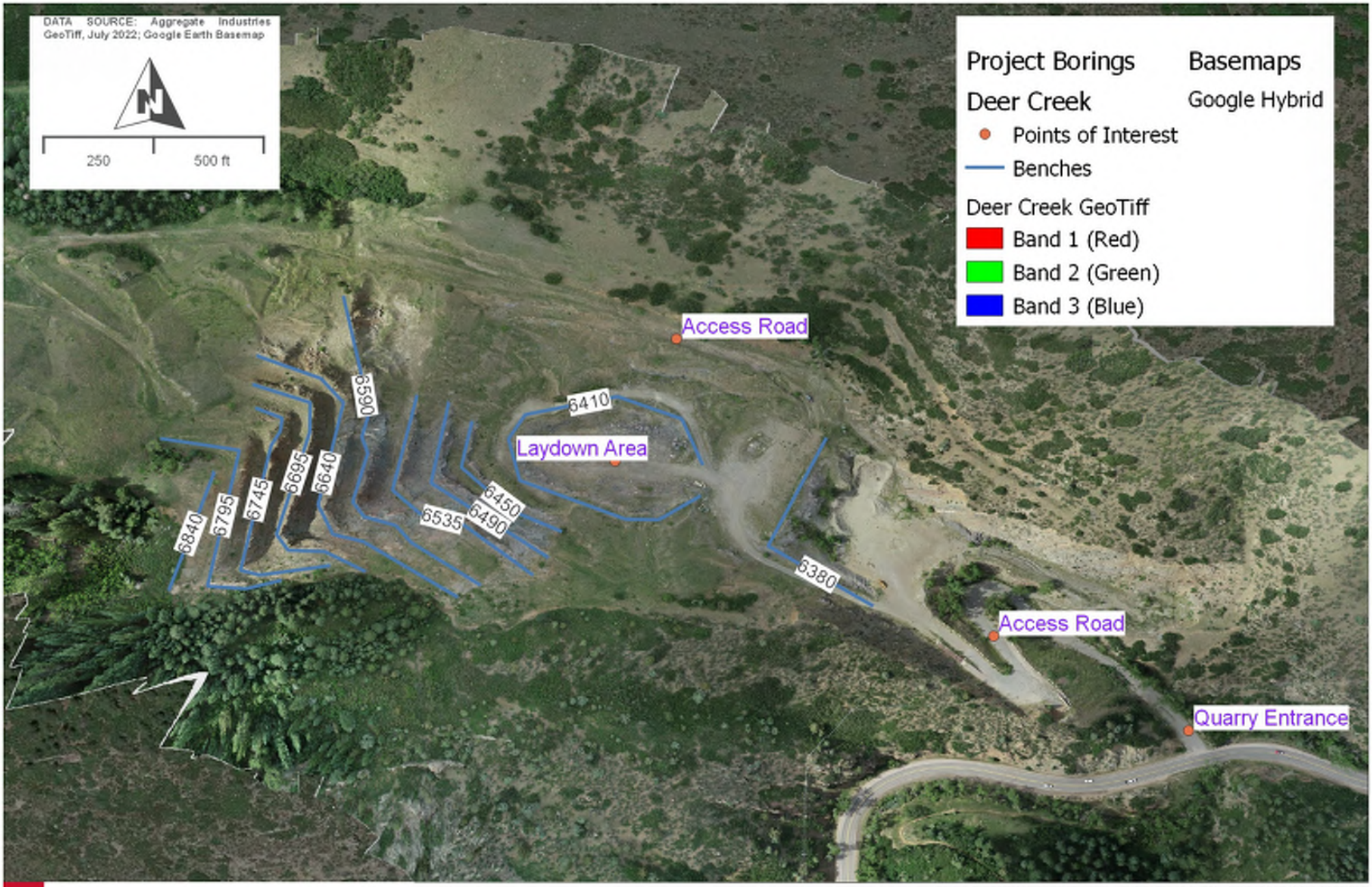
DEER CREEK QUARRY

JEFFERSON COUNTY, COLORADO

FIGURE 1

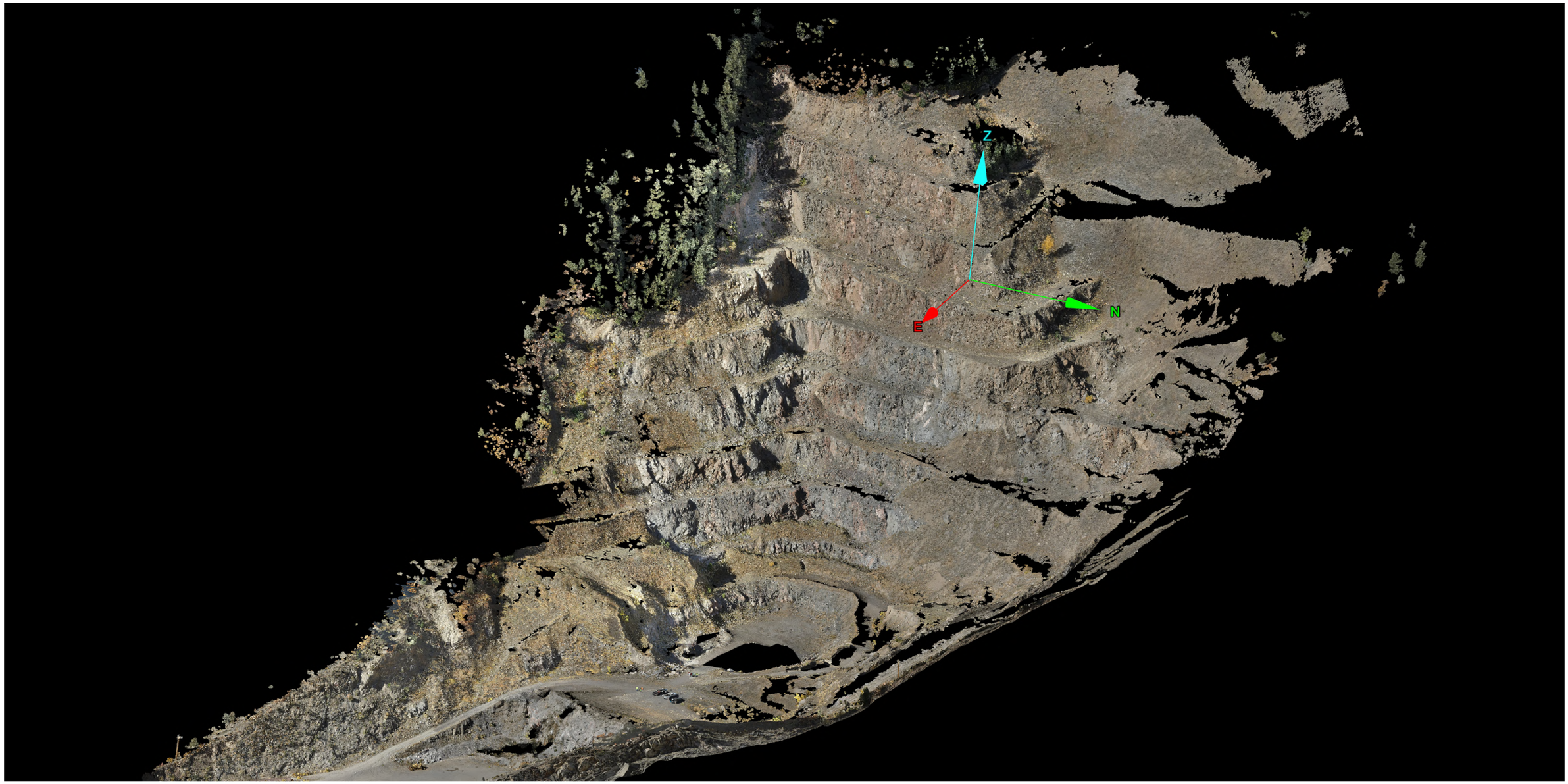


QUARRY EXTENTS AND BENCH TYPE
DEER CREEK QUARRY
JEFFERSON COUNTY, COLORADO
FIGURE 2



QUARRY AERIAL MAP AND BENCH VIEW

DEER CREEK QUARRY
JEFFERSON COUNTY, COLORADO
FIGURE 3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Appendix A

June Site Visit Memorandum

Memo

Date:	Tuesday, July 11, 2023
Project:	TO 29 Morrison Geotech – HDR PN 10338007
To:	Wyatt Webster – Holcim – WCR, Inc.
From:	David Crotsley – HDR Engineering, Inc.
Subject:	Surface Water Conditions at Deer Creek Quarry

HDR personnel performed the bi-monthly site visits for the Morrison and Deer Creek Quarries on Friday, June 30th, as part of the Task Order 29, Task 400 effort. Upon arrival at the Deer Creek Quarry, at approximately 11:45 am, HDR noticed an unusual amount of surface water present and flowing throughout the access road in the quarry. Upon tracking the path of the water, HDR noticed the headwaters appeared to be originating from the uppermost quarry floor, flowing through an existing embankment. The image below is an overview of the conditions identified during the site visit.

Figure 1 – Aerial view of noted site conditions

Based on HDR's observations, it appears a significant rain event occurred and impacted the existing flowpaths throughout the site. Existing overland flow does not appear to be controlled by the existing BMP's on site, and the current discharge location is not consistent with the approved discharge point. The following photos document the observed conditions.

Photo 1 – View of existing “sump” area and standing water

Photo 2 – View of damaged access road

Photo 3 – View of exposed bedrock and flowing water

Photo 4 – View of flowing water by guard gate and unmaintained drainage ditch

Photo 5 – View of flowing water and unmanaged drainage behind existing wingwall

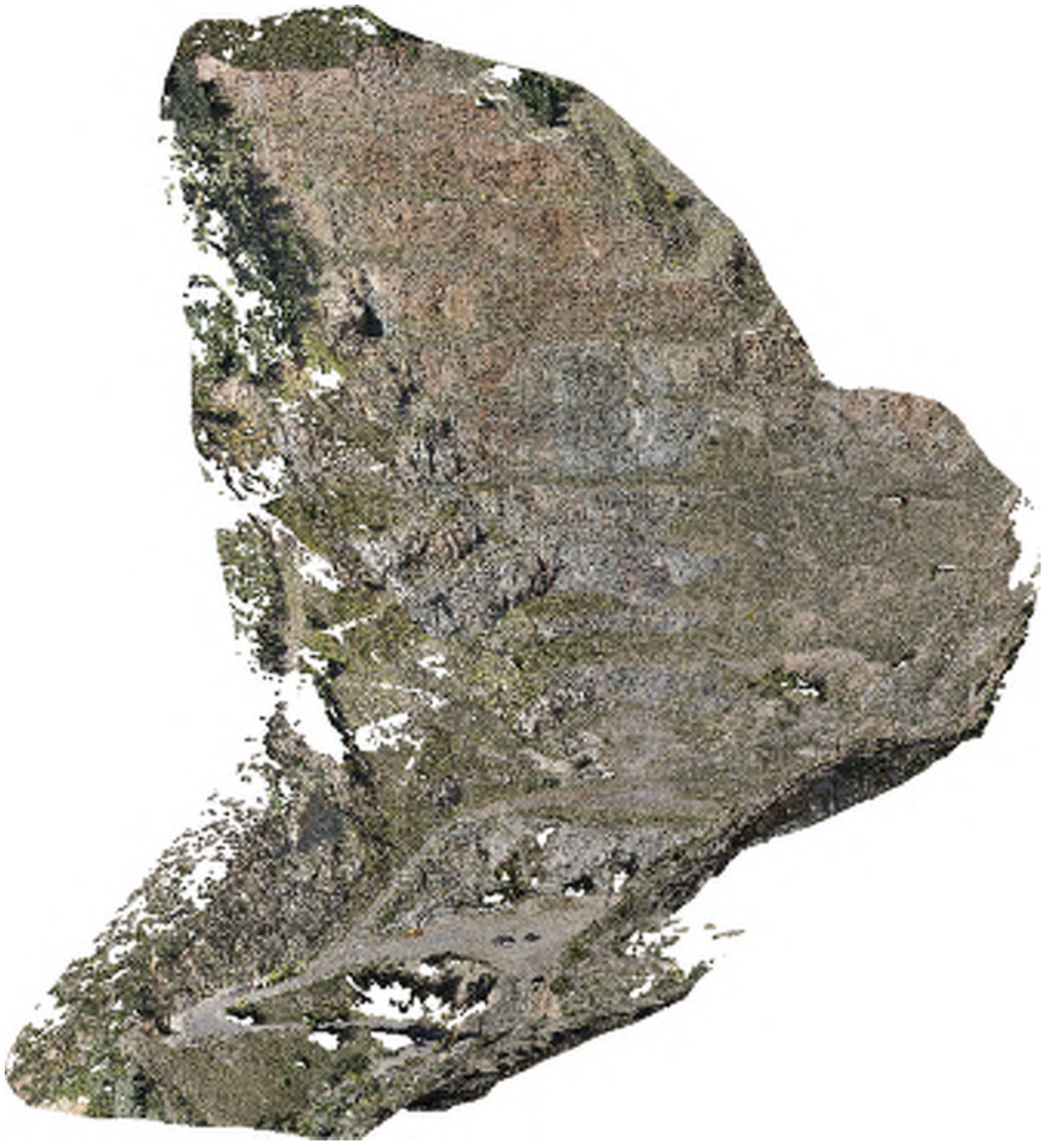
Photo 6 – View of scoured out wingwall

Appendix B

Change Detection Results

PLAN VIEW

OBLIQUE VIEW

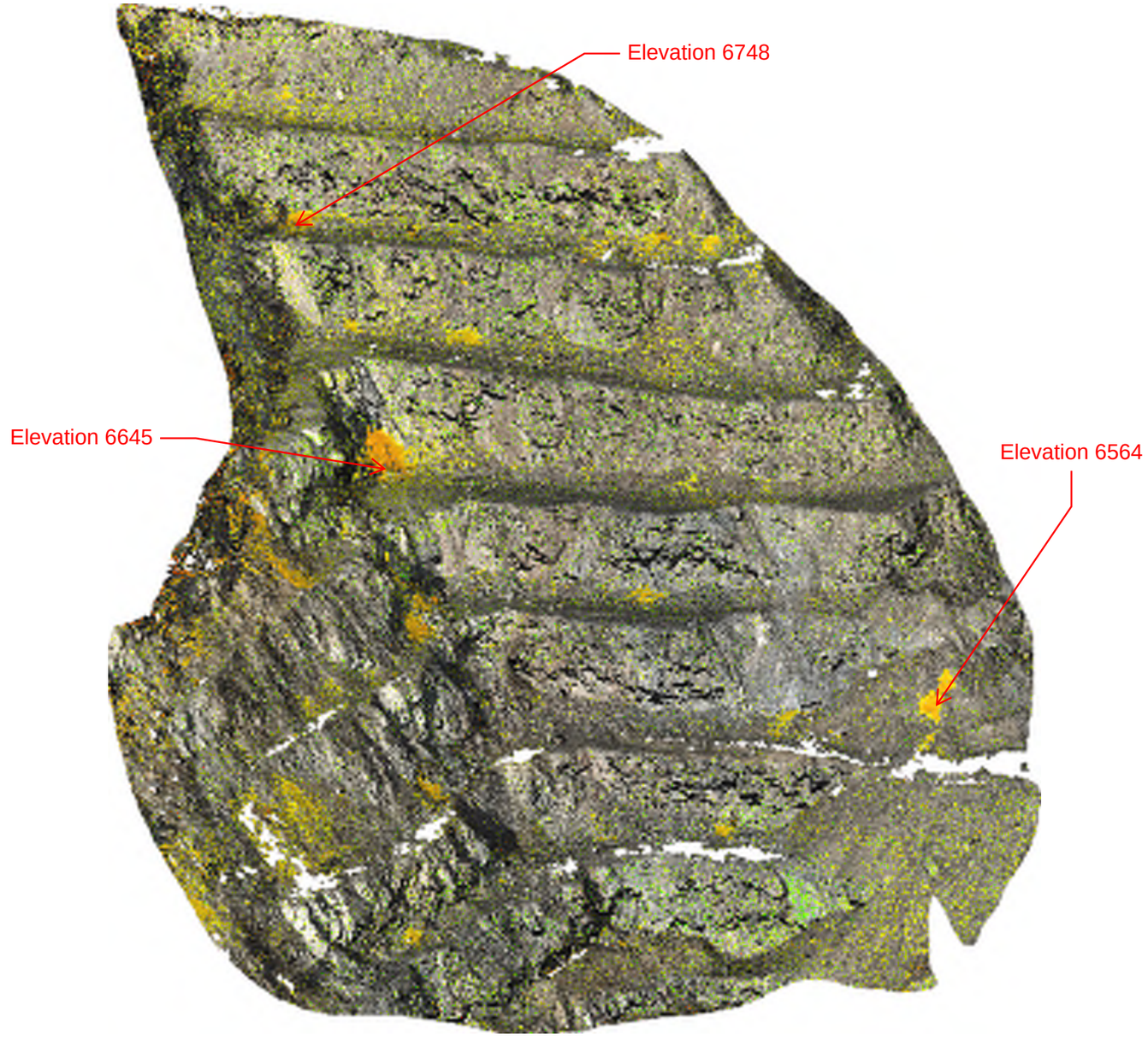


EL. 6800' TO EL. 6300'
EAST FACING HIGHWALL

10' of Movement

2.5' of Movement

0' of Movement

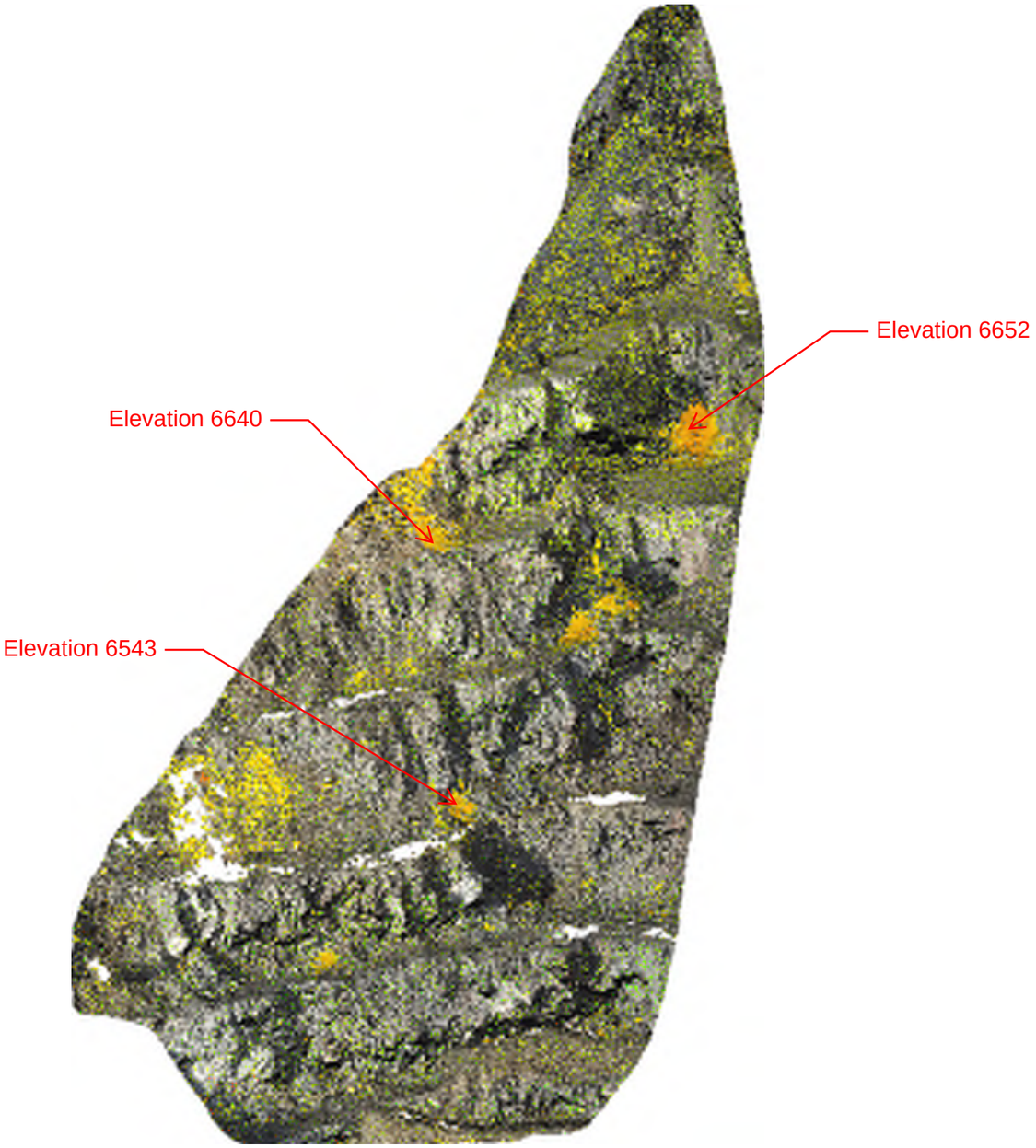


EL. 6800' TO EL. 6300'
NORTH FACING HIGHWALL

10' of Movement

2.5' of Movement

0' of Movement

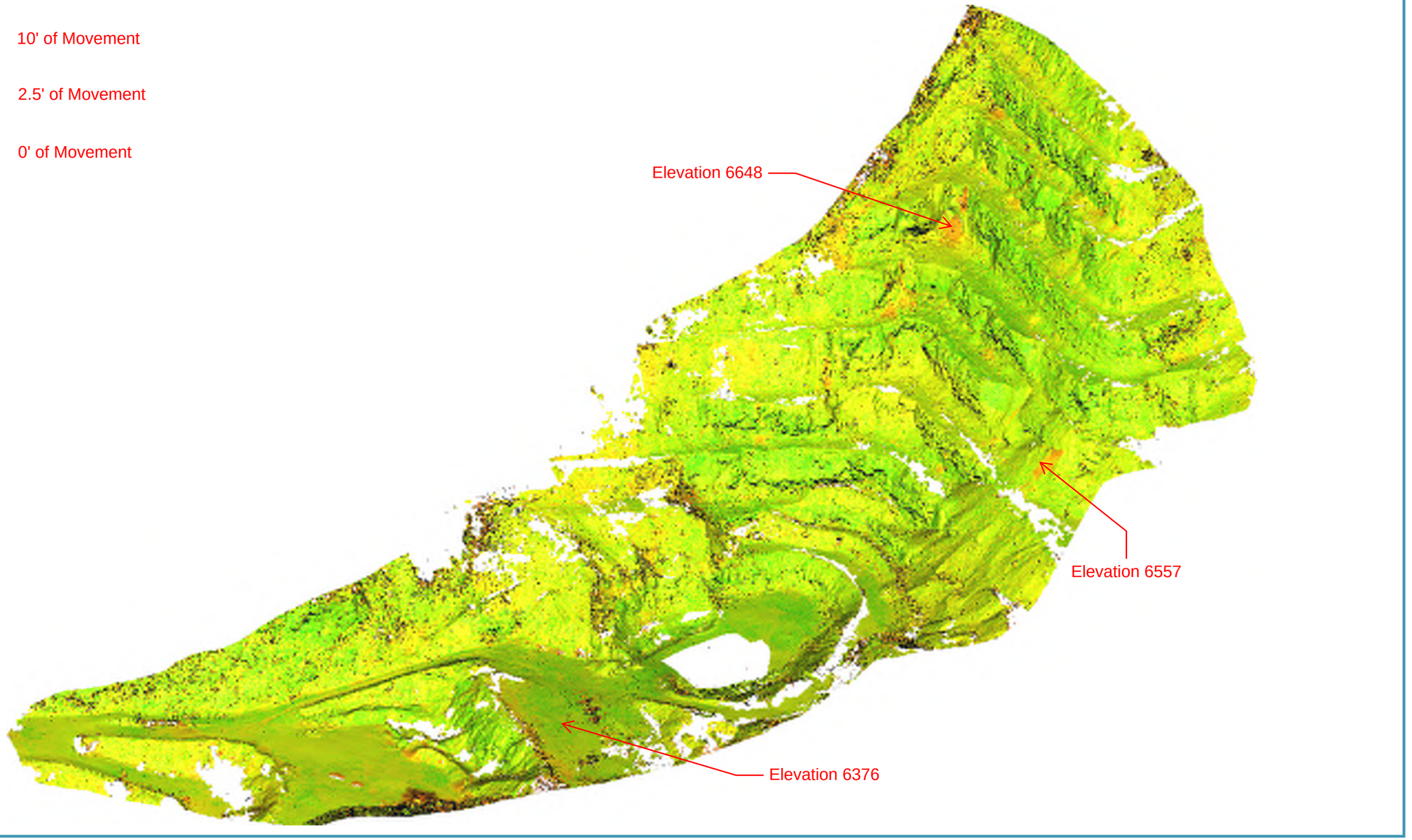


EL. 6800' TO EL. 6300'
FALSE COLOR OBLIQUE VIEW

10' of Movement

2.5' of Movement

0' of Movement

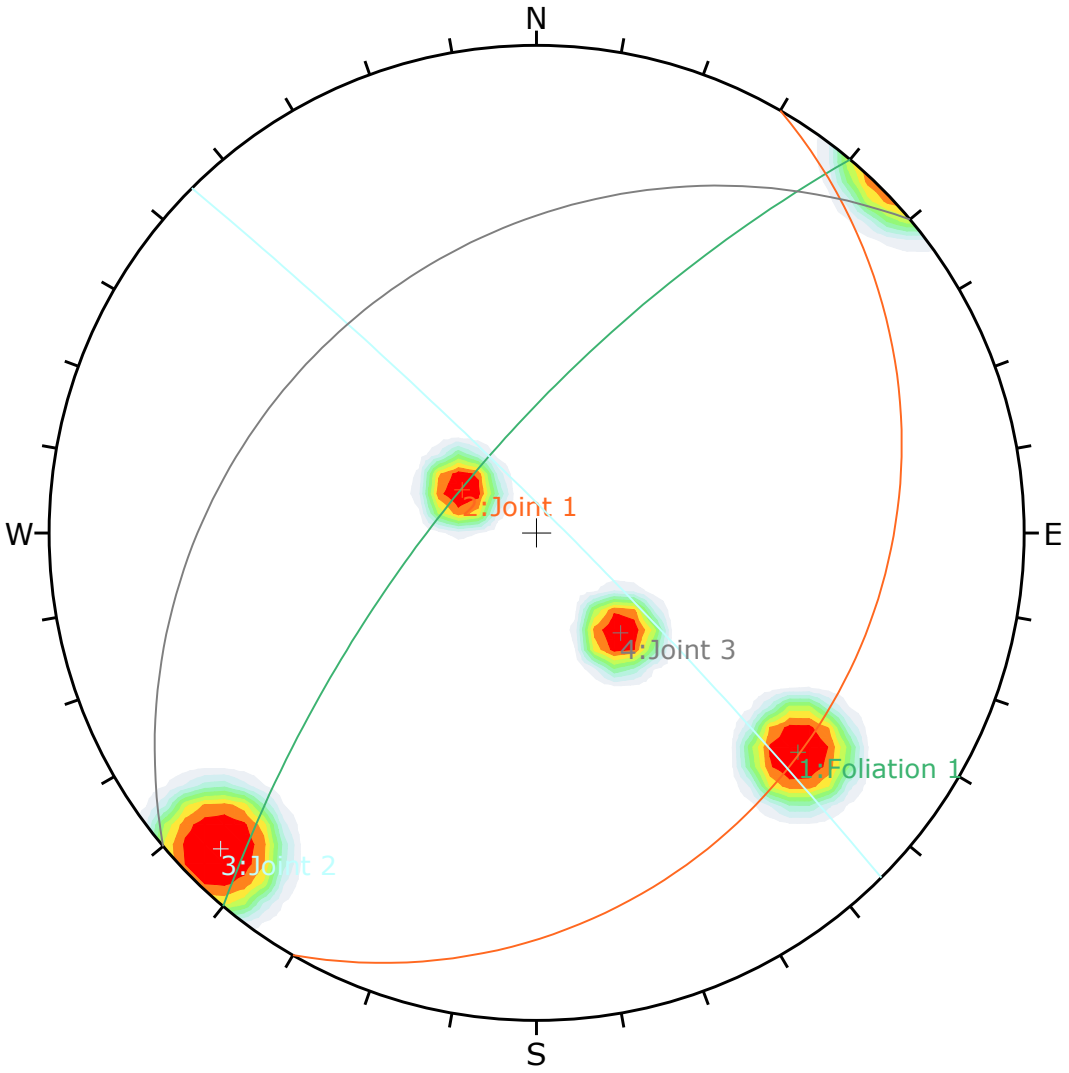


Appendix C

Stereonet Projections

Joints and Foliations

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



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	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

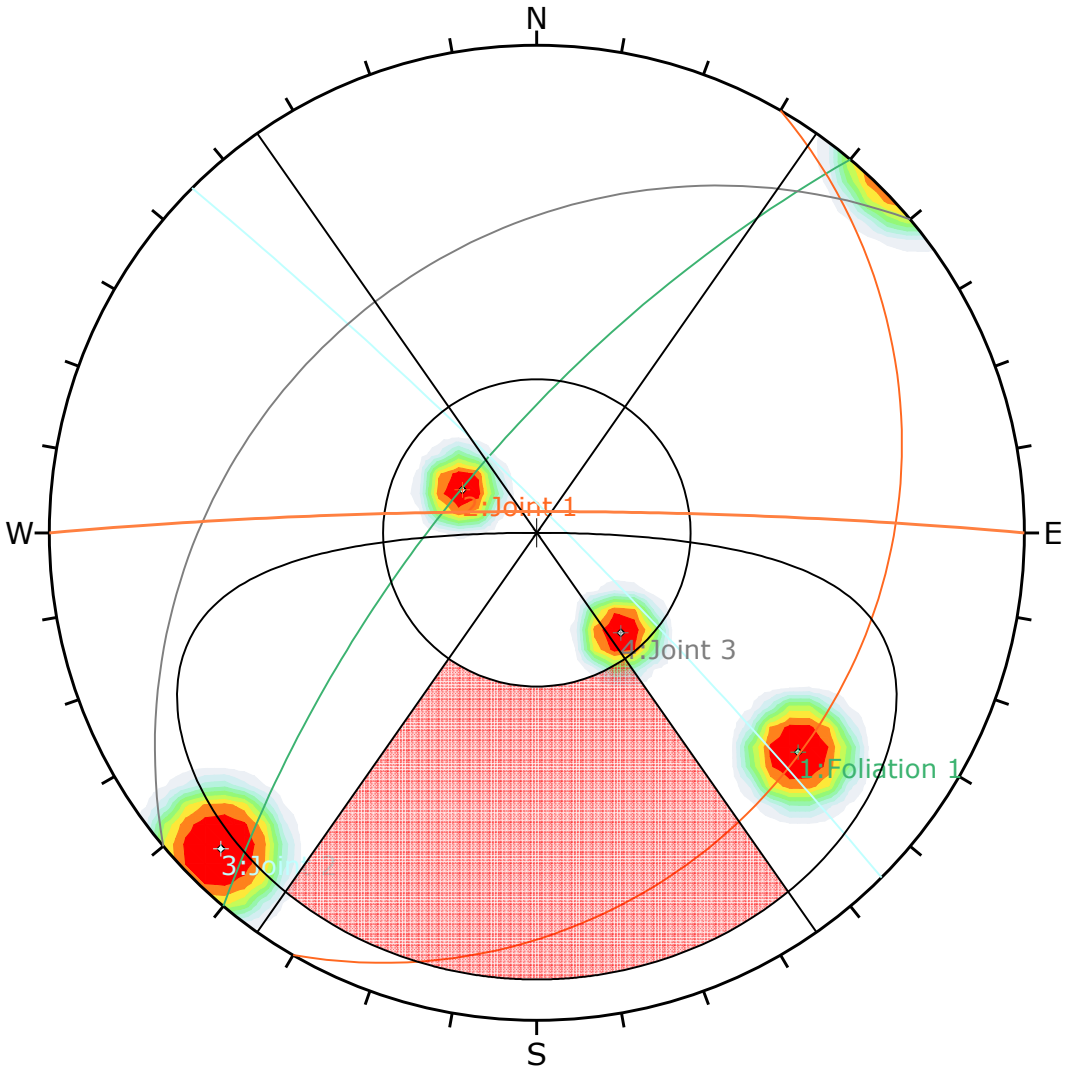
rocscience

DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	*Company*	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	*File Name*	20221213_Stereonets.dips8

North Facing - Planar Failure

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
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	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding
Slope Dip	85
Slope Dip Direction	0
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Planar Sliding (All)	0	4	0.00%

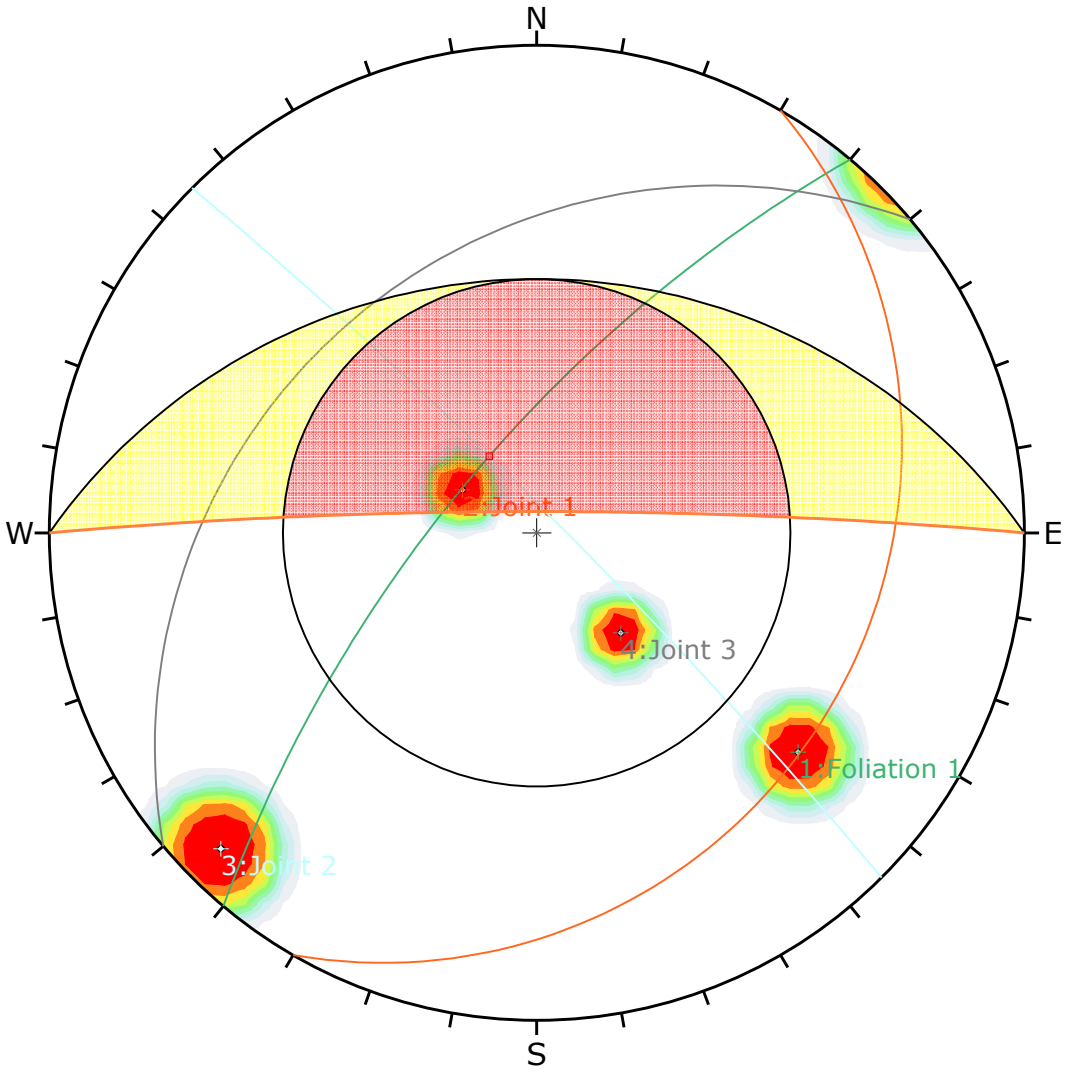
	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
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	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding
Slope Dip	85
Slope Dip Direction	0
Friction Angle	35°

	Critical	Total	%
Wedge Sliding	1	6	16.67%

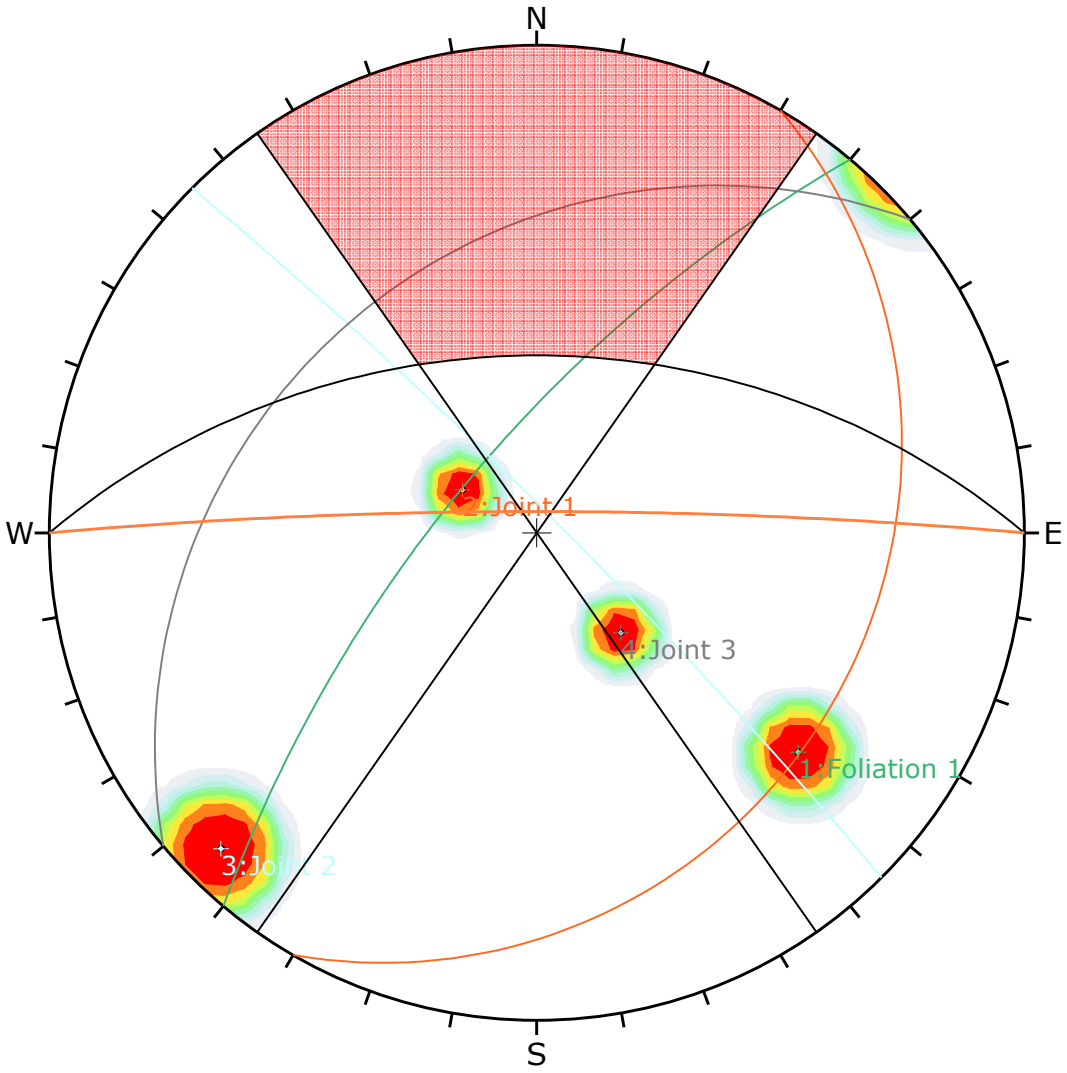
	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	*Company*	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	*File Name*	20221213_Stereonets.dips8



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
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	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Flexural Toppling
Slope Dip	85
Slope Dip Direction	0
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Flexural Toppling (All)	0	4	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

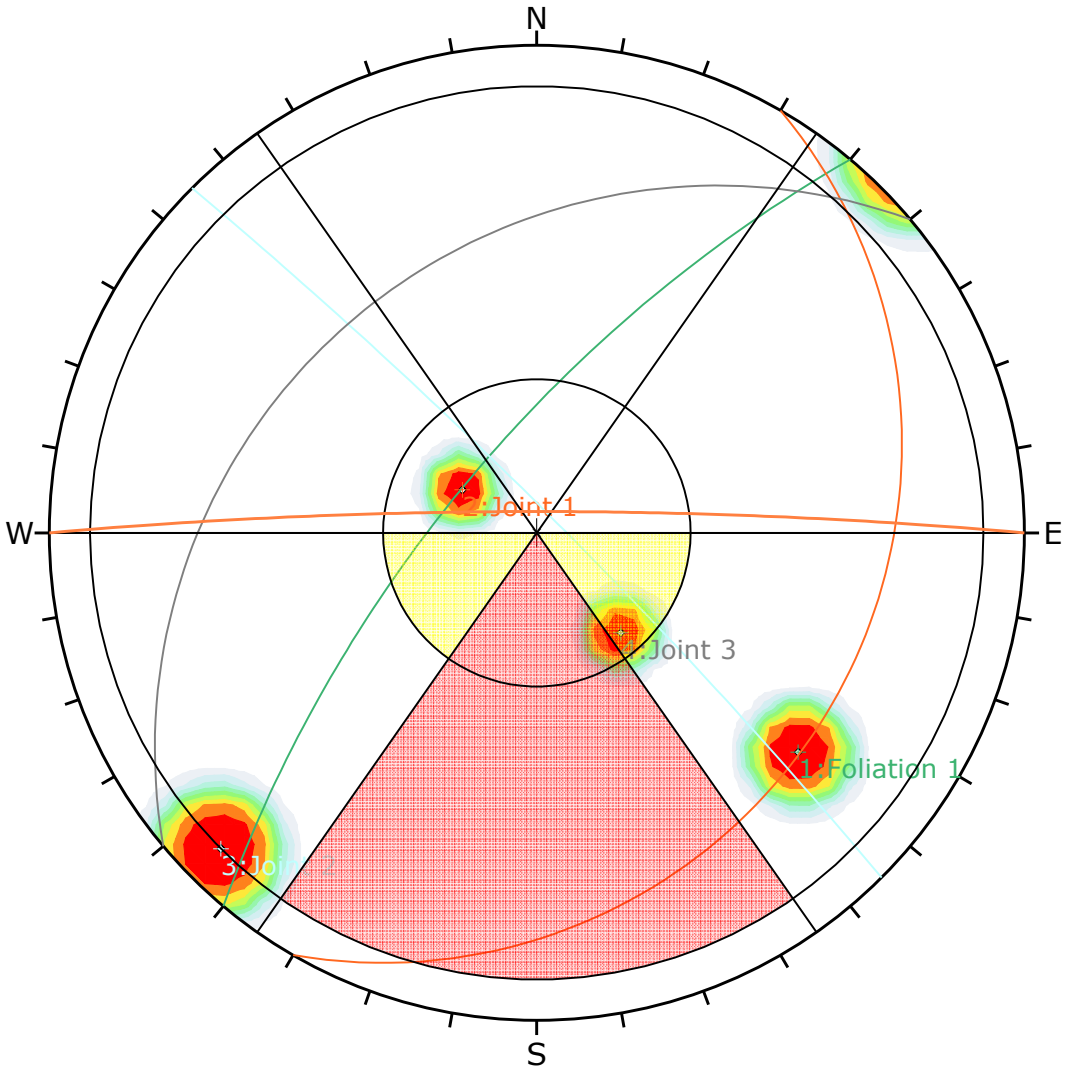
rocscience

DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

North Facing - Direct Toppling

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
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	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Direct Toppling
Slope Dip	85
Slope Dip Direction	0
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Direct Toppling (Intersection)	0	6	0.00%
Oblique Toppling (Intersection)	0	6	0.00%
Base Plane (All)	1	4	25.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

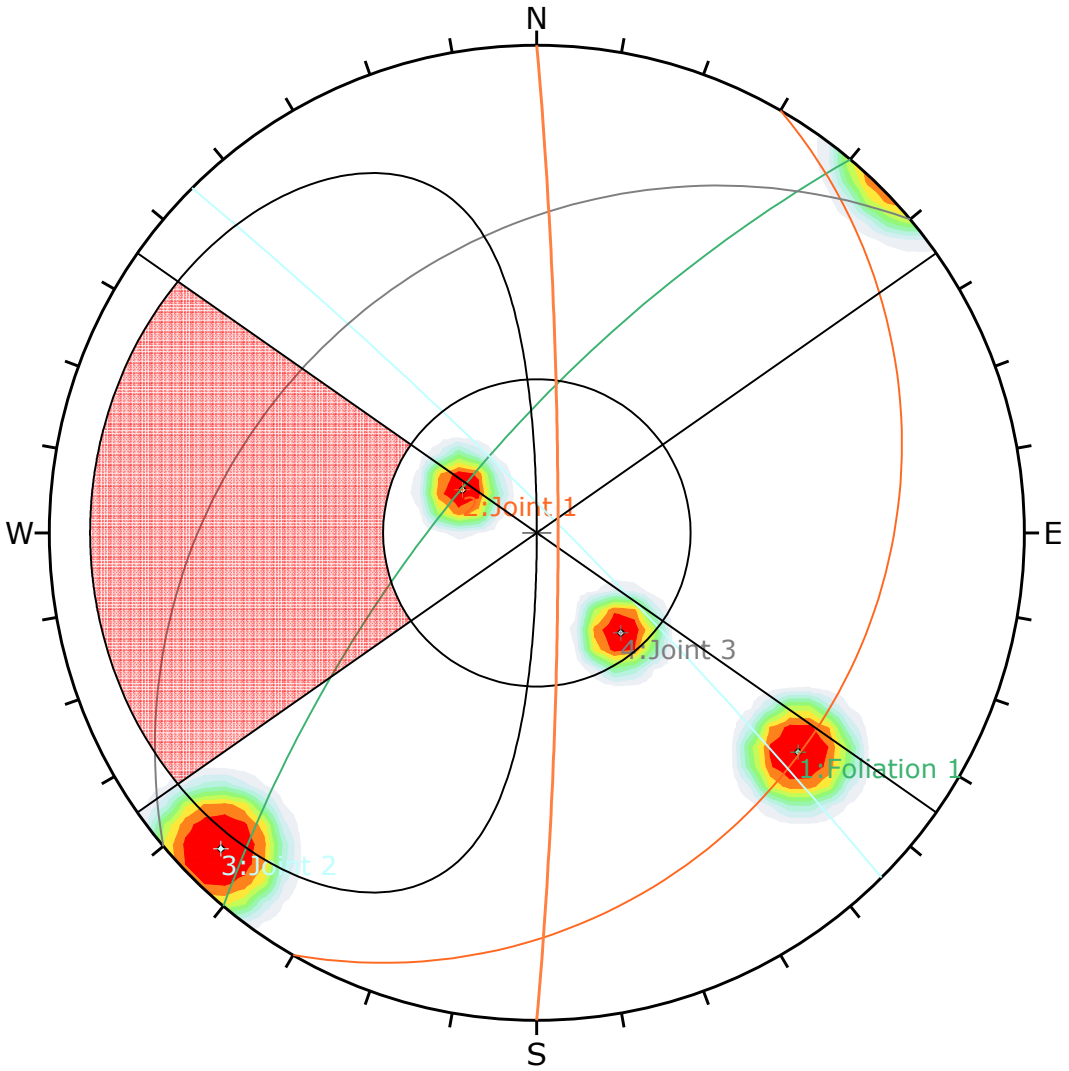
rocscience

DIPS 8.018

Project	Deer Creek Quarry
Analysis Description	Joint and Foliations
Drawn By	DSC
Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM
File Name	20221213_Stereonets.dips8

East Facing - Planar Failure

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
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	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding
Slope Dip	85
Slope Dip Direction	90
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Planar Sliding (All)	0	4	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

East Facing - Wedge Failure

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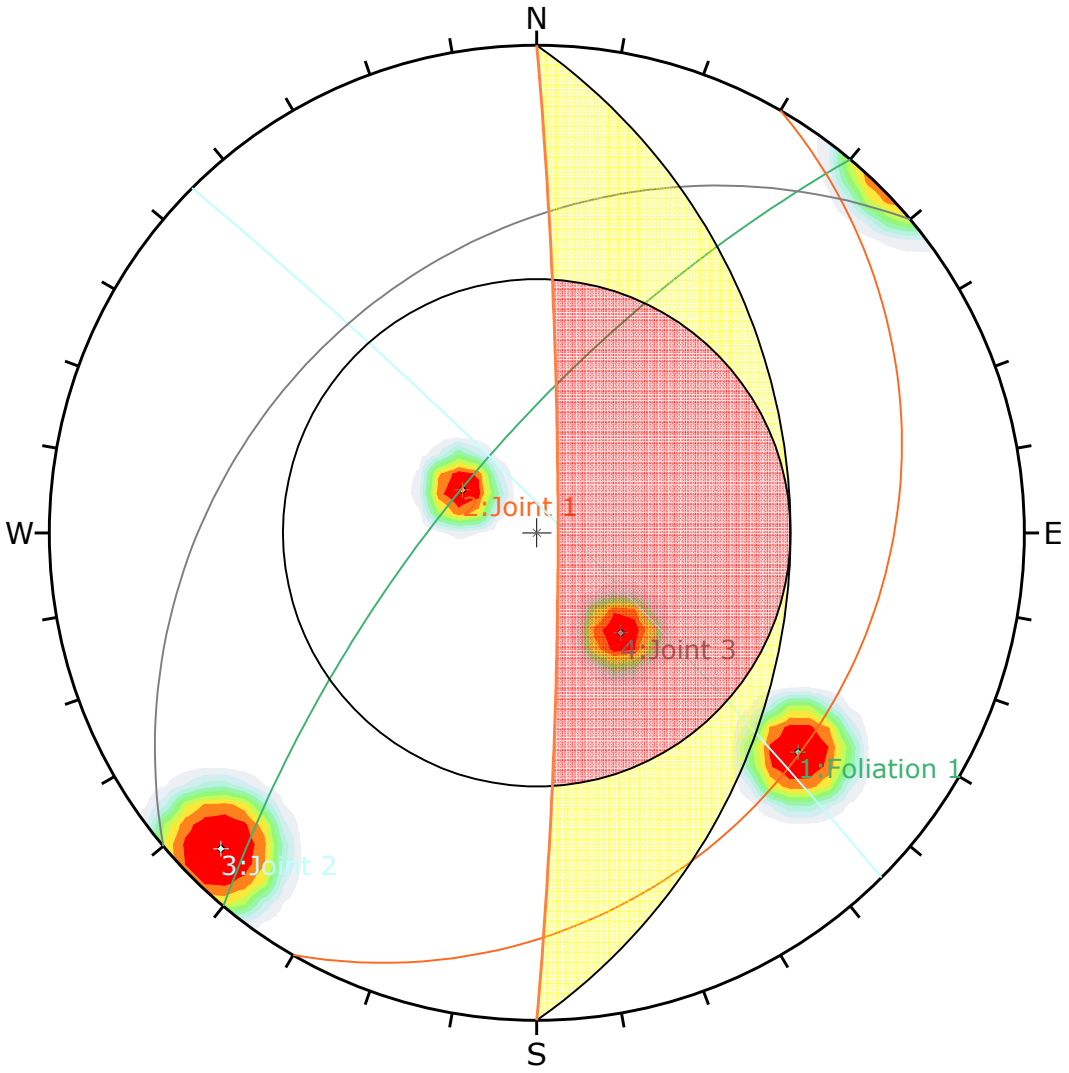
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
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	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding		
Slope Dip	85		
Slope Dip Direction	90		
Friction Angle	35°		
	Critical	Total	%
Wedge Sliding	0	6	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

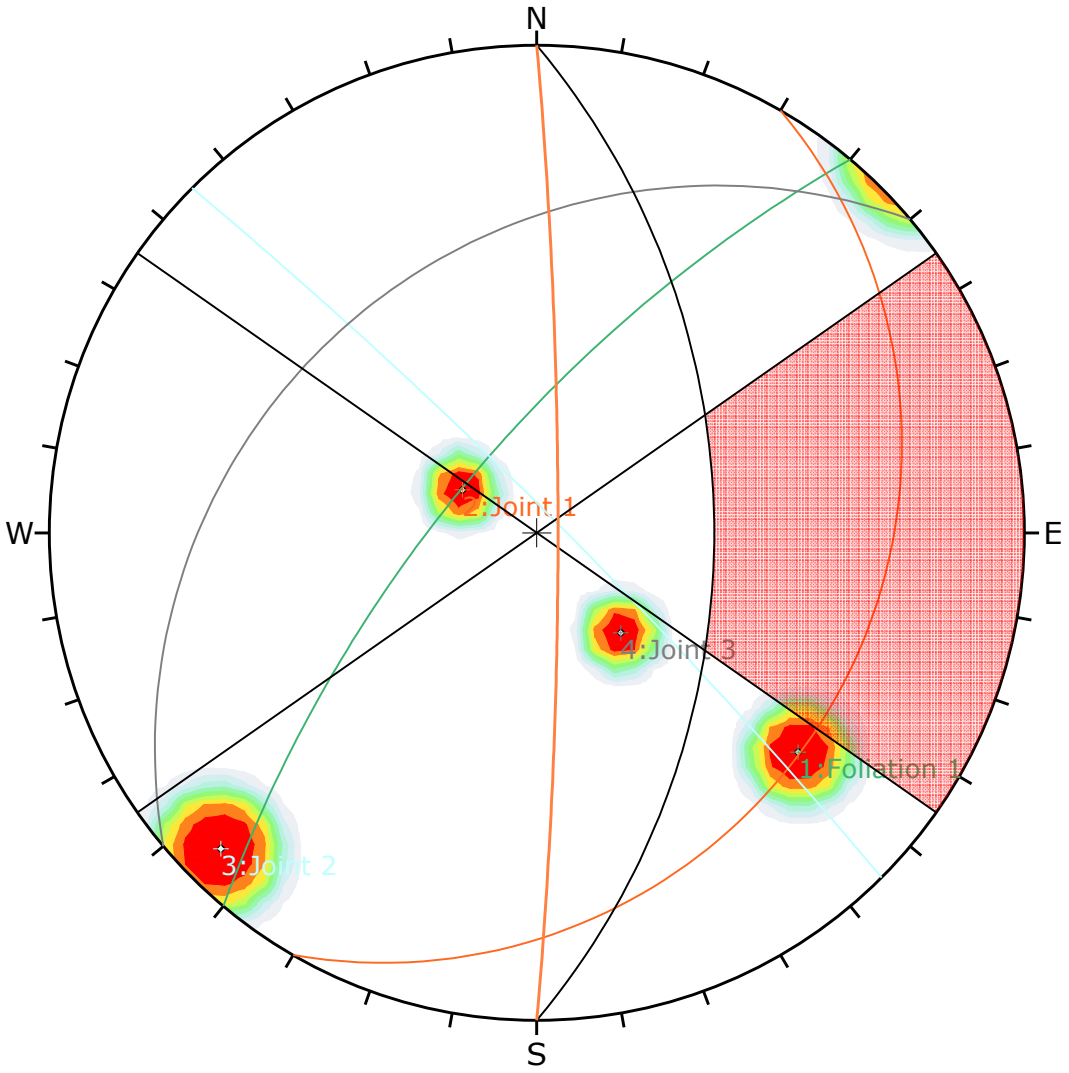
rocscience

DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

East Facing - Flexural Toppling

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Flexural Toppling
Slope Dip	85
Slope Dip Direction	90
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Flexural Toppling (All)	0	4	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

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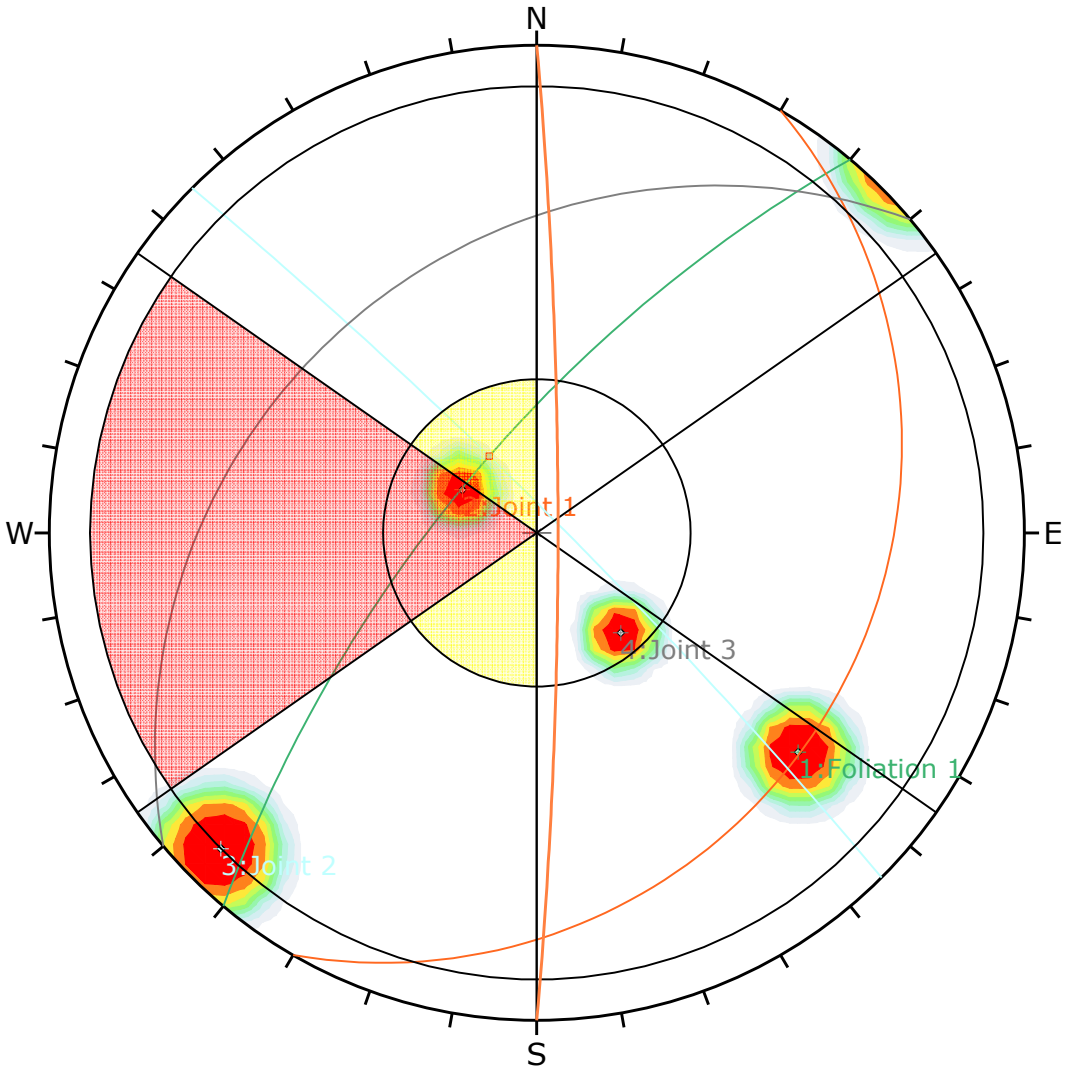
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

East Facing - Direct Toppling

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Direct Toppling
Slope Dip	85
Slope Dip Direction	90
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Direct Toppling (Intersection)	0	6	0.00%
Oblique Toppling (Intersection)	1	6	16.67%
Base Plane (All)	1	4	25.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

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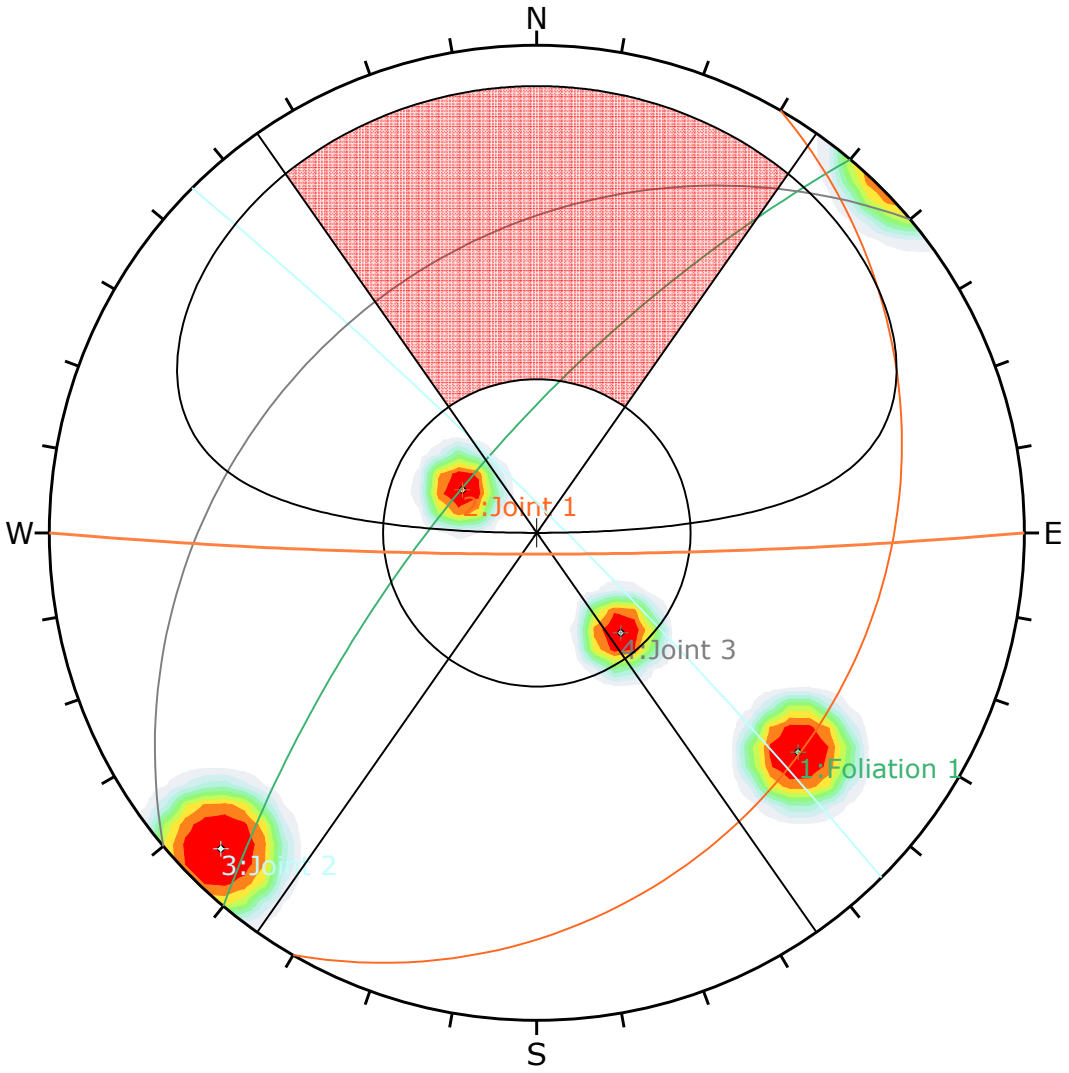
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	*Company*	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	*File Name*	20221213_Stereonets.dips8

South Facing - Planar Failure

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding
Slope Dip	85
Slope Dip Direction	180
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Planar Sliding (All)	0	4	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

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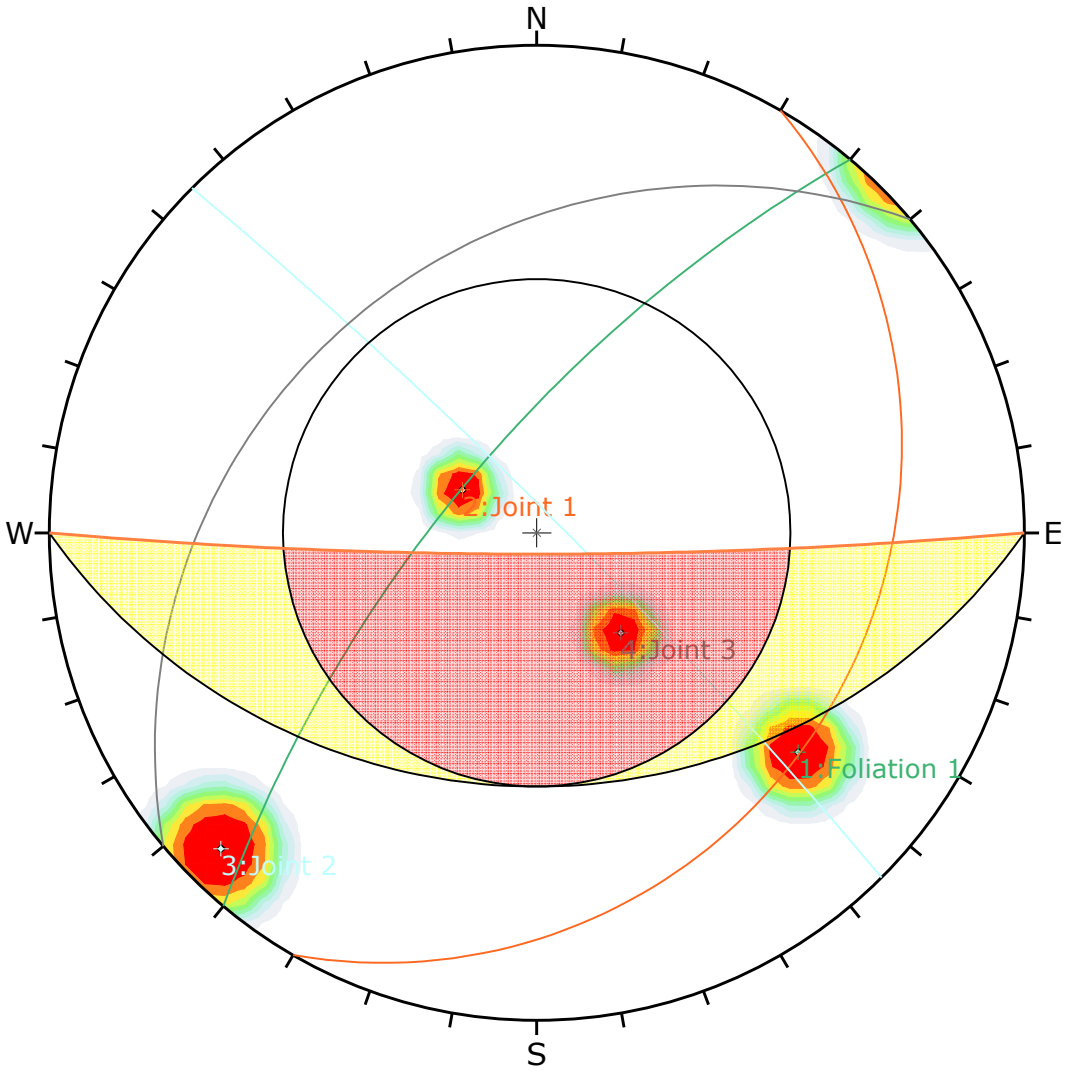
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

South Facing - Wedge Failure

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding
Slope Dip	85
Slope Dip Direction	180
Friction Angle	35°

	Critical	Total	%
Wedge Sliding	0	6	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

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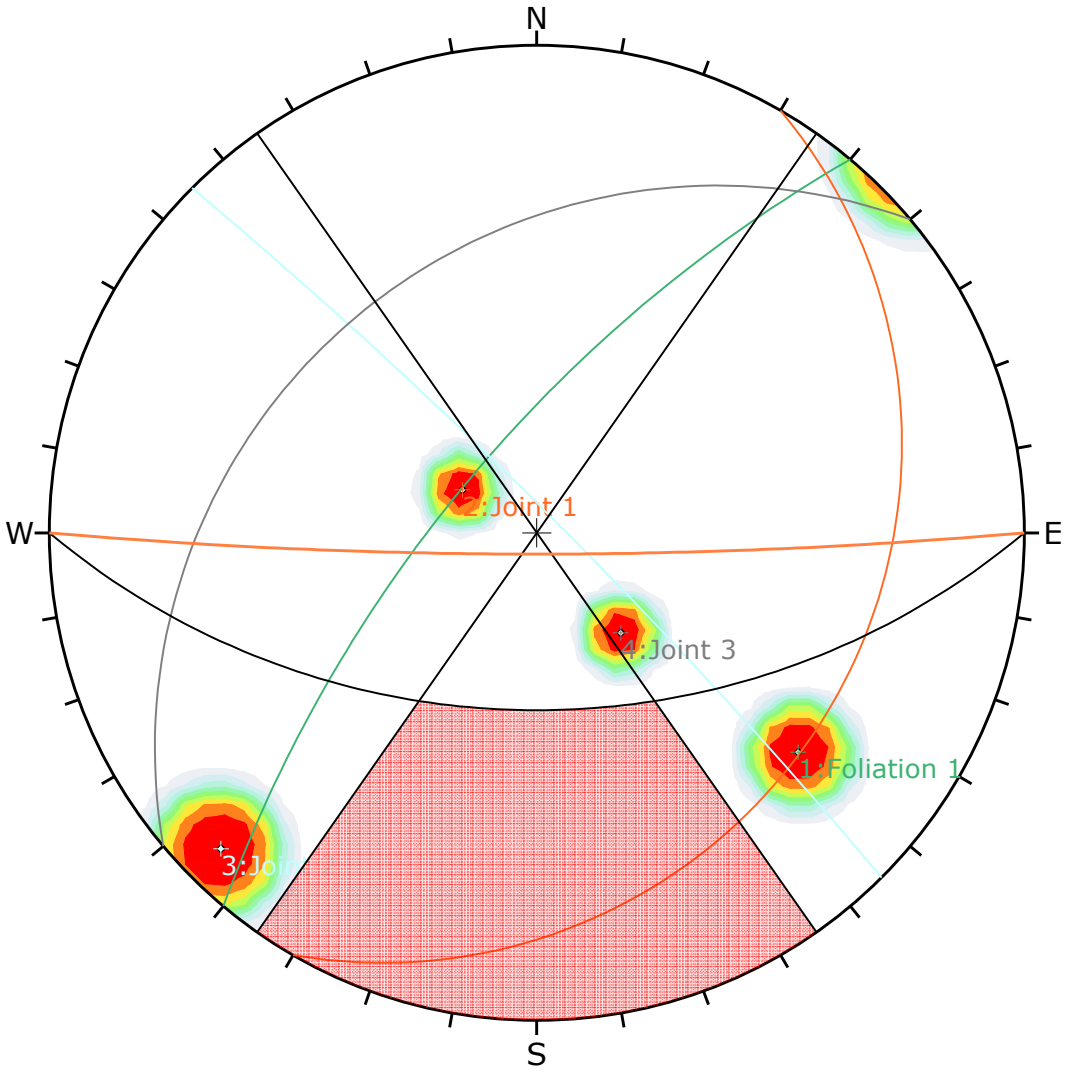
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

South Facing - Flexural Toppling

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Flexural Toppling
Slope Dip	85
Slope Dip Direction	180
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Flexural Toppling (All)	0	4	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

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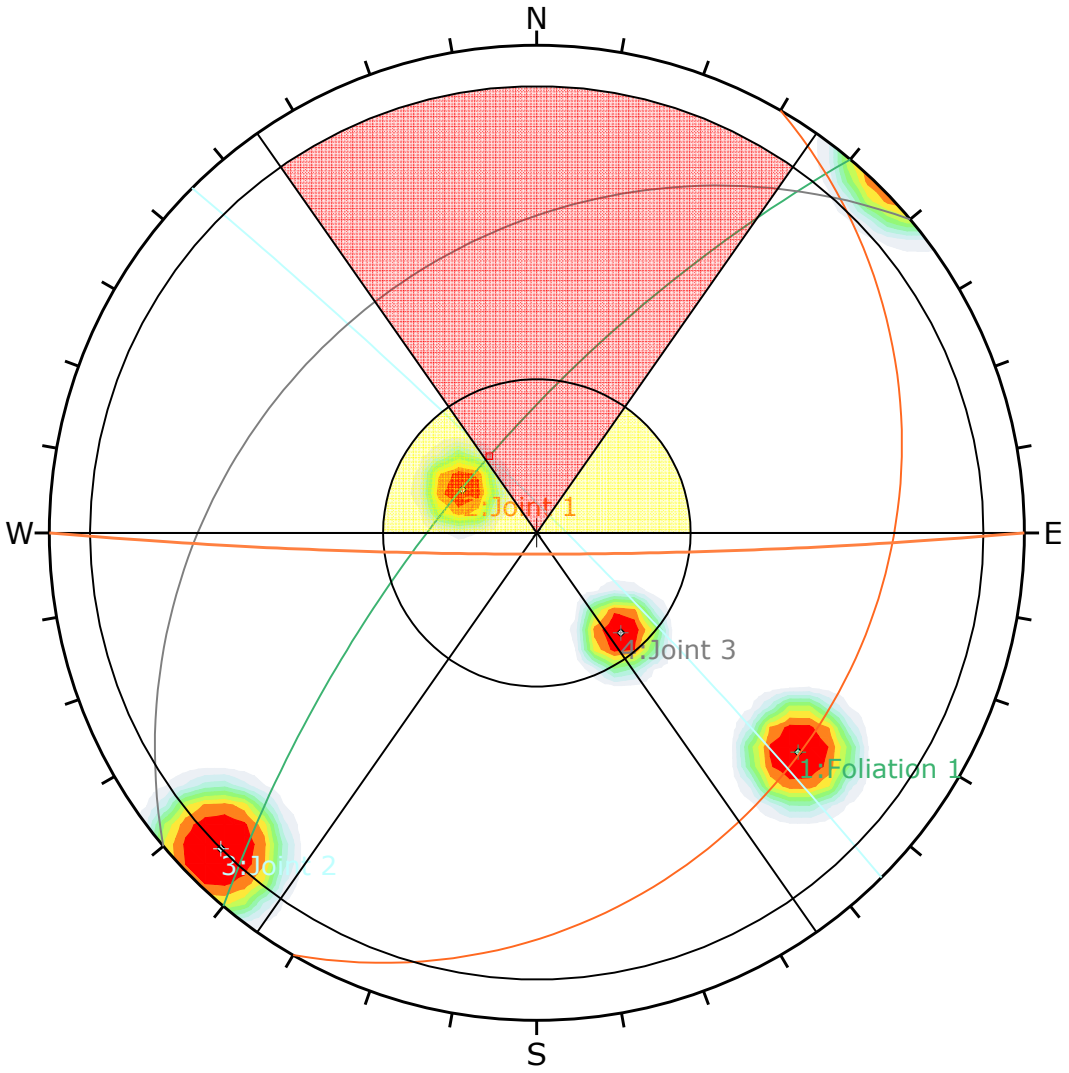
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

South Facing - Direct Toppling

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Direct Toppling
Slope Dip	85
Slope Dip Direction	180
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Direct Toppling (Intersection)	1	6	16.67%
Oblique Toppling (Intersection)	0	6	0.00%
Base Plane (All)	1	4	25.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

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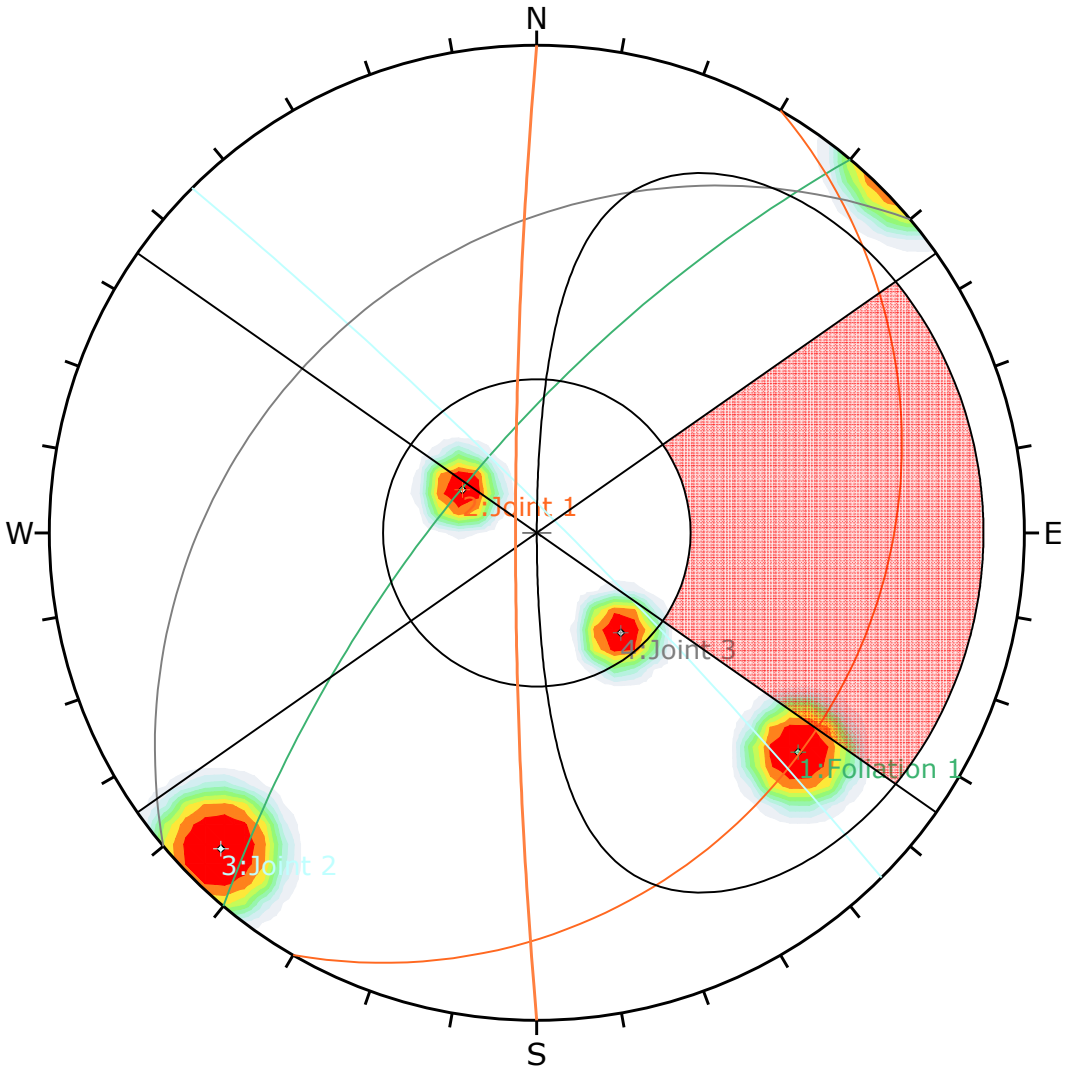
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	*Company*	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	*File Name*	20221213_Stereonets.dips8

West Facing - Planar Failure

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding
Slope Dip	85
Slope Dip Direction	270
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Planar Sliding (All)	0	4	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

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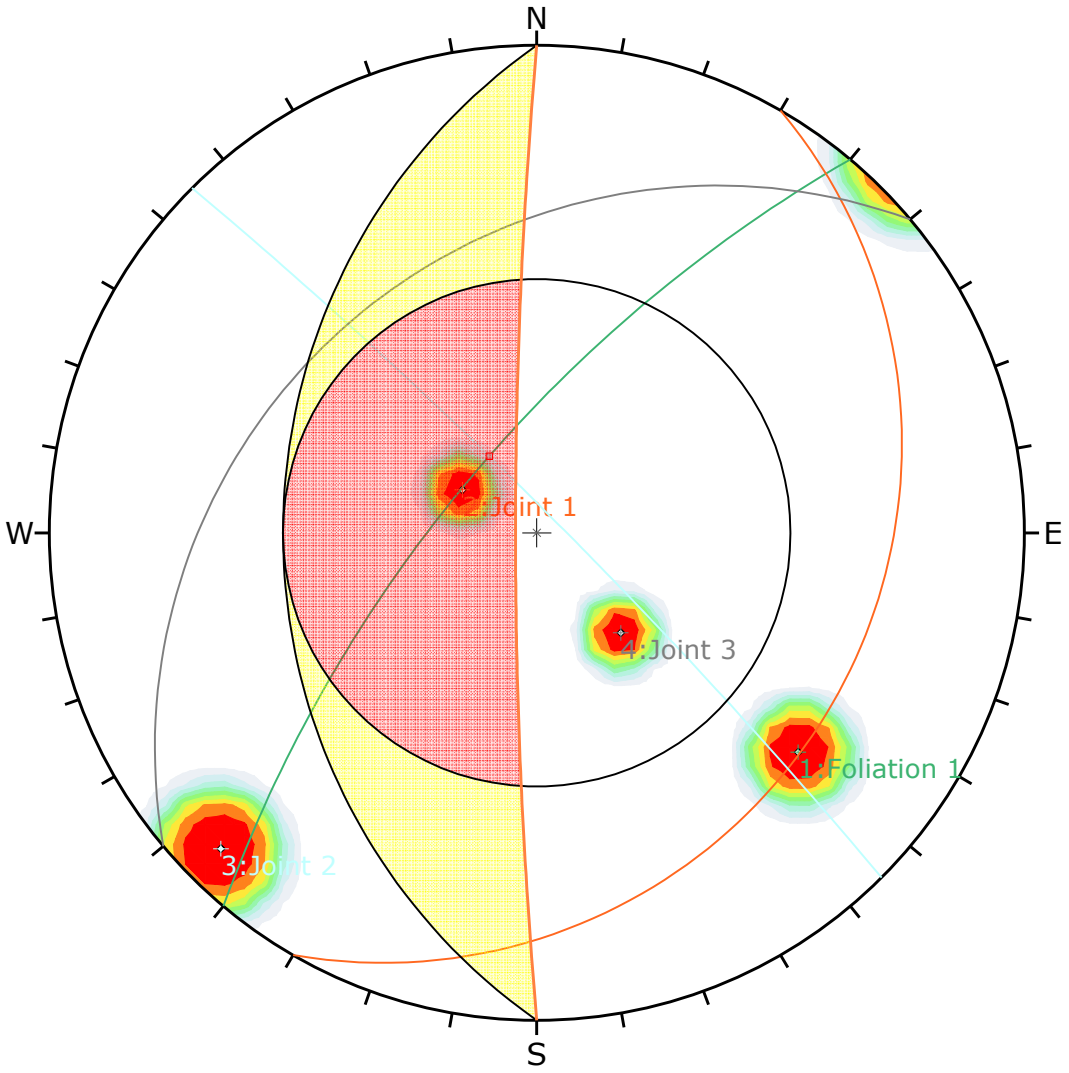
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

West Facing - Wedge Failure

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding		
Slope Dip	85		
Slope Dip Direction	270		
Friction Angle	35°		
	Critical	Total	%
Wedge Sliding	1	6	16.67%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

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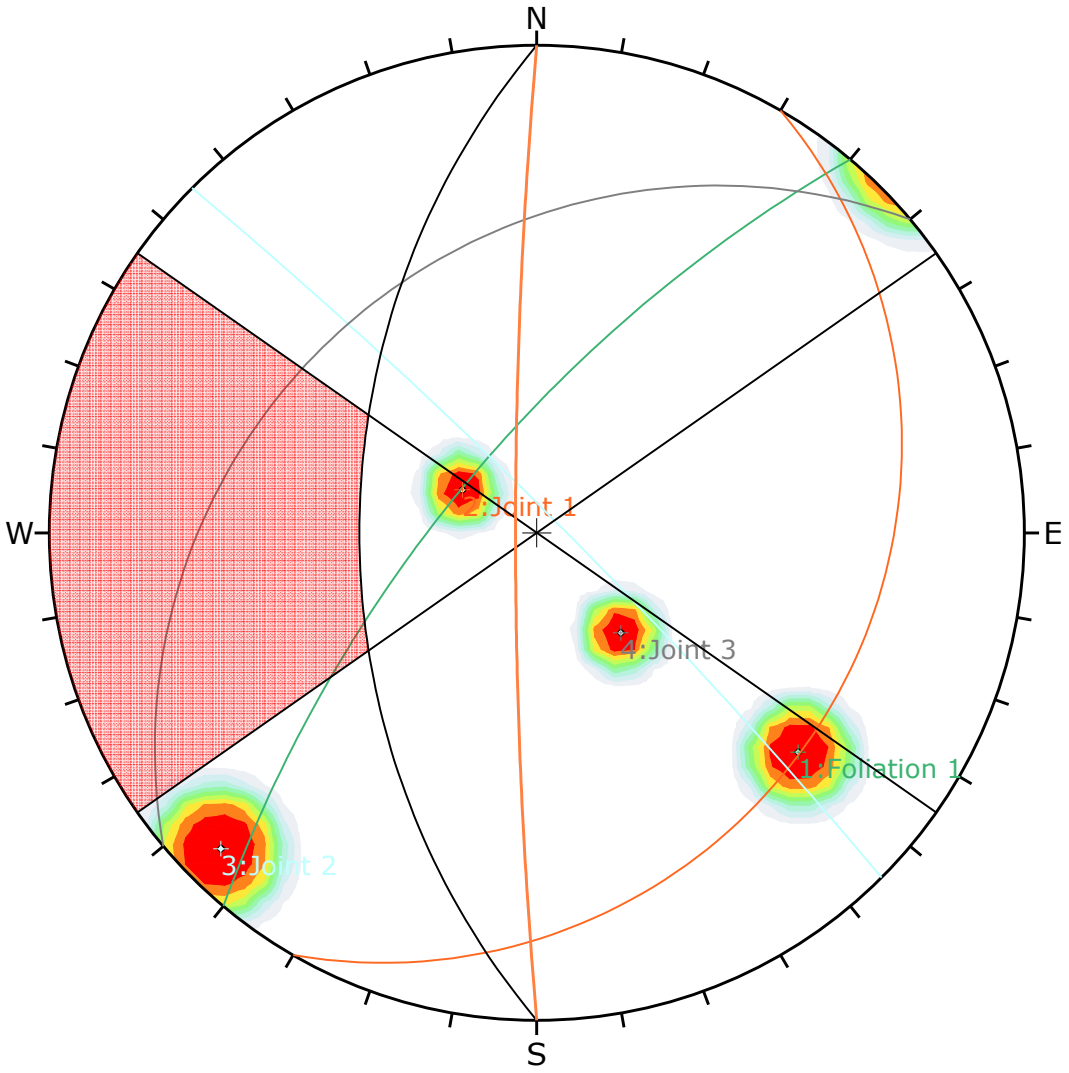
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

West Facing - Flexural Toppling

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
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	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
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Kinematic Analysis	Flexural Toppling
Slope Dip	85
Slope Dip Direction	270
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Flexural Toppling (All)	0	4	0.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

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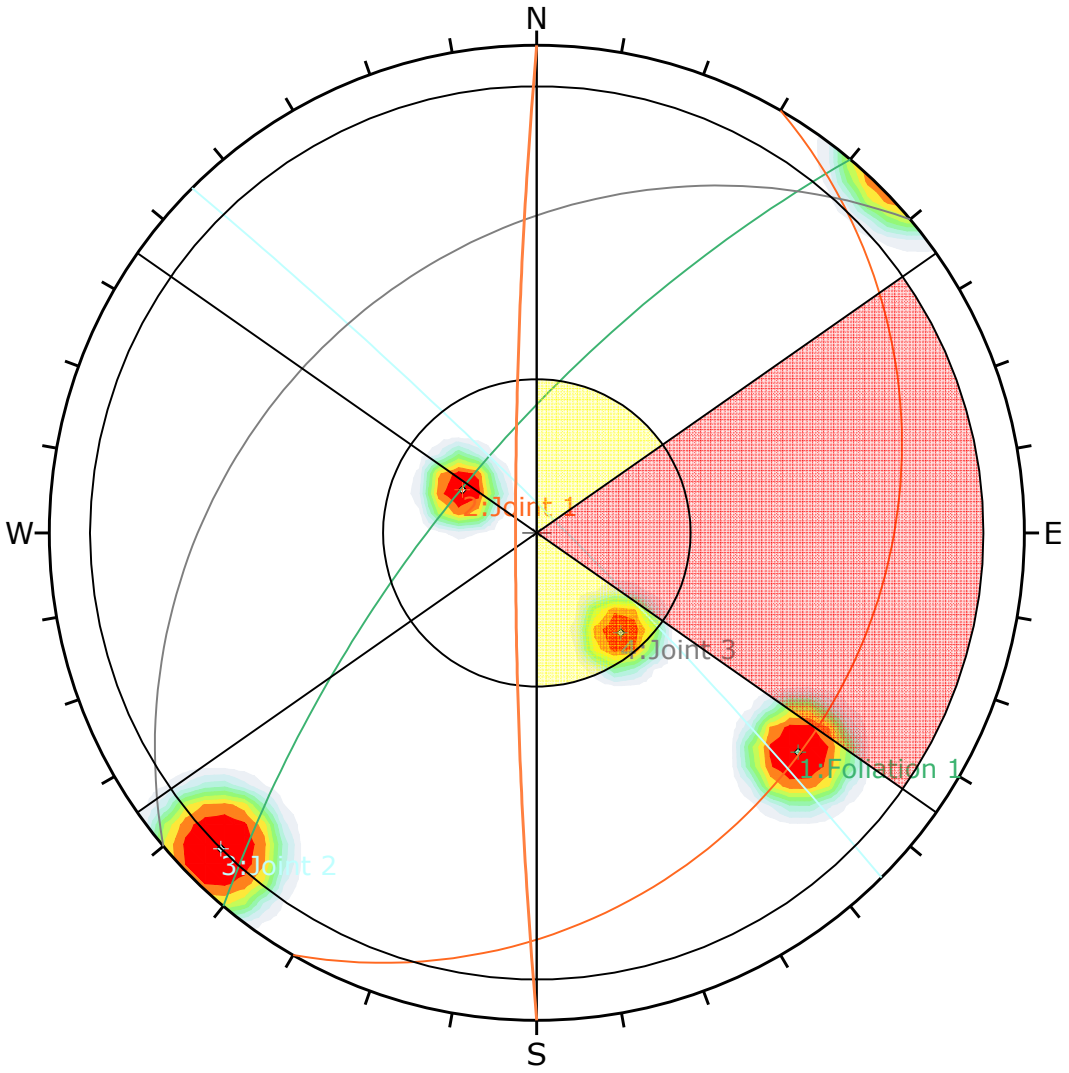
DIPS 8.018

Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	Company	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	File Name	20221213_Stereonets.dips8

West Facing - Direct Toppling

Des. By: DSC 12/14/20
Rev. By: WNB 12/20/20



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Direct Toppling
Slope Dip	85
Slope Dip Direction	270
Friction Angle	35°
Lateral Limits	35°

	Critical	Total	%
Direct Toppling (Intersection)	0	6	0.00%
Oblique Toppling (Intersection)	0	6	0.00%
Base Plane (All)	1	4	25.00%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	310	Foliation 1
2		20	120	Joint 1
3		85	45	Joint 2
4		30	320	Joint 3

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
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Project	Deer Creek Quarry		
Analysis Description	Joint and Foliations		
Drawn By	DSC	*Company*	HDR Engineering, Inc.
Date	12/13/2022, 2:01:43 PM	*File Name*	20221213_Stereonets.dips8