December 20, 2024

Holcim - WCR, Inc.
1687 Cole Blvd., Suite 300
Golden, CO 80401

Attention: Mr. Kurt Thurman

Re: Geotechnical Addendum
Deer Creek Quarry Bi-Annual Report
Morrison, CO
KUE Project No. P-24079

Dear Mr. Thurman,

Kilduff Underground Engineering, Inc. (KUE) is pleased to submit this geotechnical addendum report for the Deer Creek Quarry in Morrison, Colorado. KUE's services were performed in accordance with the contract between KUE and Holcim dated July 8th, 2024.

This report presents a summary of the field investigations and photogrammetry survey data results concerning existing and evolving quarry conditions specifically at the Deer Creek Quarry. The data presented is based on the findings of our site-specific investigation and is subject to the provisions and requirements outlined in the Limitations section of this report.

We trust that our findings and recommendations outlined in this report will be responsive to your needs at this time. We thank you for this opportunity to be of service to you and your team on this exciting and interesting project. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Sincerely,

KILDUFF UNDERGROUND ENGINEERING, INC.

Nathaniel White, EIT
Staff Engineer

Ryan O'Connell, PE
Project Engineer

Mohamed Gamal, PhD, PE
Principal Engineer

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APPENDICES

1. EXECUTIVE SUMMARY

At the request of Holcim, a geotechnical field exploration of the on-site highwalls at the Deer Creek Quarry was conducted by KUE personnel in August 2024 and November 2024. The site is located in Jefferson County and is comprised of one main mining cell with an additional staging area and future reserves. Very little active mining has taken place in 2024, but additional subsurface investigations were performed identifying the possibility of future reserves at the site.

The goal of the field exploration and subsequent assessment was to identify possible areas of slope failure, the mode of failure, and the likelihood of risk of failure at the mine site. A desktop study of the local geology and previous geotechnical investigations conducted by HDR were used to identify previous problem areas and the inherent characteristics of the surficial and surrounding rock mass. Using this data, KUE walked the Quarry in August and November of 2024 to notate our observations and measurements of the site's foliations, fractures, and joints to determine kinematic risks later on. Flatirons survey was also retained to survey the site via drone and perform an aerial photo mosaic and photogrammetric mesh for later change detection analysis in August 2024.

The overall site geology is predominantly biotite / granitic gneiss with small, confined areas of magmatic intrusions, talc-gneiss, and pegmatite. Fractures and shear zones are visible throughout the site with weathering observed across the site because of low mining activity over recent years. Groundwater inflows are mostly limited to near-surface rock and are only anticipated following precipitation.

Consistent with previous geotechnical investigations, the overall rock mass of biotite / granitic gneiss was found to be competent with mainly small, localized failure due to raveling by weathering or sloughing of accumulated catch-rock or back-break. Change detection mapping found the largest movement from 2023 to 2024 in the Southwest Corner, the intersection of the Eastern and Northern Facing Slopes, and Eastern Facing Slope as the result of local raveling and sloughing at the bench crest.

Discontinuity data was collected and totaled 74 measurements taken of foliations, fractures, and joint sets across the mine site, which followed the trends set from previous investigations. Kinematic analyses were performed for several modes of failure: planar sliding, wedge sliding, flexural toppling, and direct toppling. The results followed close with KUE's visual observations, where the northern facing slope has the largest risk of failures compared to the southwest corner or the eastern facing slope.

With no significant change to the site, past recommendations are carried forward. Continued monitoring should be performed with both visual inspections and change detection mapping. Additionally, cleaning off all benches with caught debris would be effective in preventing local failure from falling beyond the bench below.

2. INTRODUCTION

This addendum report provides information concerning the existing and new geotechnical and geological conditions of the Deer Creek Quarry mine, operated by Holcim. This report, by Kilduff Underground Engineering (KUE), summarizes observations and measurements made by KUE field personnel, as well as photogrammetry taken by drone surveys. Flatirons Inc. was contracted to perform the survey, provide photogrammetry, and process the change detection model. This report is provided to meet the requirements of 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 mine.

2.1. Mine Location and Description

The Deer Creek Quarry is located along West Deer Creek Canyon Road, west of its intersection with Valley Road in Jefferson County.

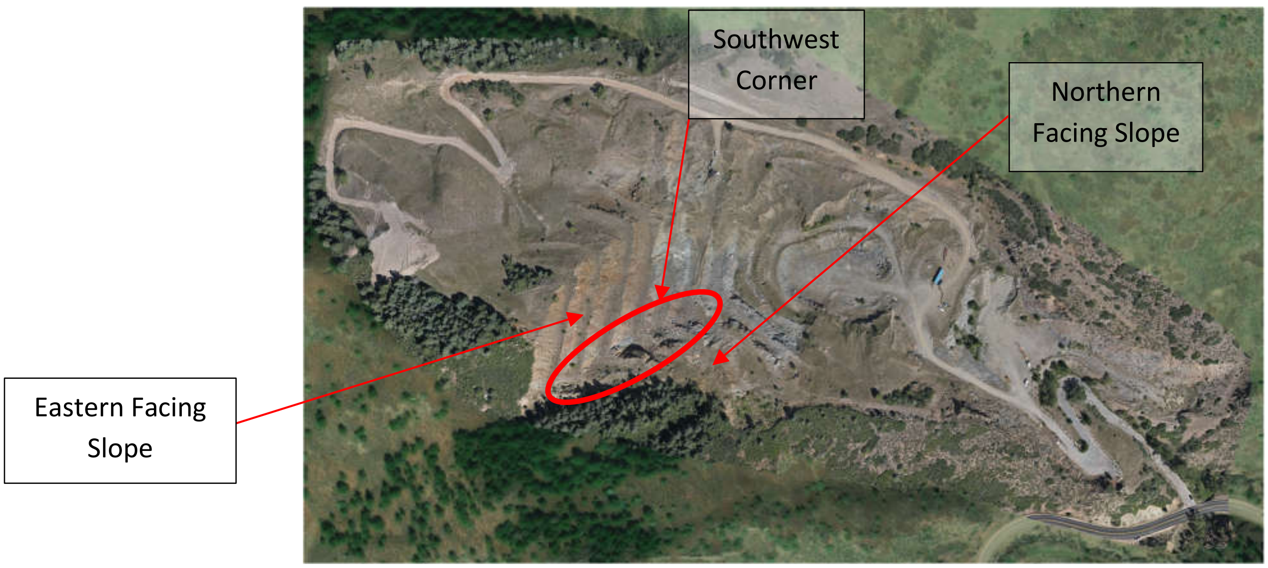

Figure 1: Deer Creek Quarry Site Map

KUE and Flatirons Inc. field personnel were on-site on August 29th to make observations and measurements. KUE then returned to the site November 26th, as summarized in the report.

2.2. Project Datum

For geologic mapping, KUE completed hand drawn plan and slope views of the exposed highwall. Joint planes, foliations, and fractures were drawn therein, with annotations on the profile views of the quarry walls demonstrating where strike and dip measurements were taken.

The drone survey had multiple temporary control points installed across the quarry, tied to a nearby control point provided to the Flatirons, Inc. team by Holcim's onsite surveyor. The 7 temporary control points were surveyed with a GPS rover and base station. Control points consisted of a white five-gallon bucket lid with a four-inch nail hammered in the center.

2.3. Quarry Activity Summary

No significant mining activity has occurred in this area since 2005. The access road leading to the western side of the site has been graded this past year, leaving clear access to the top of the quarry. Evidence of earthwork to create several working pads is found across the site to drill a few exploratory boreholes to assess the quality of the rockmass for the aggregate production. During the November site visit KUE observed several truck loads of material being taken off site from small stockpiles in the staging area east of the main pit.

3. GEOLOGIC CONDITIONS

3.1. Regional Geology and Geologic Setting

The Holcim Deer Creek Aggregate Quarry is situated near Deer Creek Canyon on Colorado's Front Range, part of the southern Rocky Mountains. This mountain range was formed by a vertical uplift that caused an upturning of the geological formations in the region. The formations, moving from west to east, include Precambrian Gneiss and Schist, Fountain Formation, Lyons Sandstone, Ralston Creek Formation, Dakota Sandstone, Benton Shale, Niobrara Formation, Pierre Shale, Fox Hills Sandstone, Laramie Formation, Arapahoe Formation, Denver Formation, and Green Mountain Conglomerate.

According to a geological map by Bryant, B., Miller, R.D., and Scott, G. R. (1973), several geological units are depicted in the area surrounding the Deer Creek Quarry. The primary unit shown is Biotite Gneiss from the Precambrian era. This material is described as gneiss-formed containing quartz, plagioclase, microcline, biotite, muscovite, schist, and sillimanite. It also includes some layers containing inconspicuous garnets and a few layers of biotite quartzite, calc-silicate granofels, amphibolite, and biotite-quartz-plagioclase gneiss. The rock is typically slightly weathered to moderately weathered, with higher a degree of weathering observed along benches that have been exposed for years or in areas with proximity to fractures and discontinuities.

Other notable units in the area include the Gneiss Quartz Monzonite and Granodiorite, Mafic Granodiorite and Quartz Diorite, and Piney Creek Alluvium. The Gneiss Quartz Monzonite and Granodiorite, from the Precambrian, contain inclusions of biotite gneiss and migmatite with local grades into mafic granodiorite. The Mafic Granodiorite and Quartz Diorite, from the Precambrian era, are described as well-foliated biotite-hornblende granodiorite and quartz diorite grading to biotite amphibolite. The Piney Creek Alluvium, from the Upper Holocene, is composed of a mixture of humus-rich silt, sand, and clay, with some alluvium ranges from less than 5 feet along small arroyos to about 12 feet along major drainages.

3.2. Groundwater and Hydrology

The upper 40 ft of bedrock generally consists of plentiful open fractures capable of conveying groundwater recharged from nearby precipitation (W.E. Hofstra & D.C. Hall, 1975). Below this zone, fractures are generally tighter and fewer until generally around a 400 ft depth where water-bearing fractures are scarce. Groundwater can seep through the pit walls following precipitation events through the exposed rock but year-round water flow in the main pit was not observed.

4. GEOTECHNICAL INVESTIGATION

4.1. Previous Geotechnical Investigation

HDR performed the previous report in December 2023 which discussed observations, change detection, and kinematic analyses. Their observations primarily focused on the un-reclaimed, exposed highwall which faces east and north.

The rock mass observed was fine to medium-grained granitic and biotitic gneiss with infrequent coarse-grained pegmatite. West-north-west upper benches have been almost entirely reclaimed with vegetation, while the southern benches exhibit build-up of talus and catch-rock. The access road, located on the southern facing slope to the top of the pit has limited to non-existent access to the upper benches due to slope failures.

Change detection mapping observed various amounts of rockfall across the exposed highwalls, with large rockfalls occurring near the southwest corner on the north-facing benches 6540 and 6640. Most of the rockfall was contained to the benches below. Structural features were taken into consideration in relation to bench configurations in order to determine potential failure mechanisms.

HDR identified three joint sets and one foliation set that were analyzed for kinematic risks. Joint sets were as follows in order of dip and dip direction: Set 1 at 20°,120°; Set 2 at 85°,45°; and Set 3 at 30°,320°. One prominent foliation set was noted at 70°,310°. Bear in mind that these sets are approximate and measured from a distance. The calculated kinematic risks of the exposed faces? were only prevalent for wedge sliding risk on the north facing slopes with rest having minimal risk of large-scale failure.

Recommendations included ongoing monitoring to track rockfall progression.

4.2. Data Collection and Field Explorations

KUE personnel walked the quarry to visually inspect the bench slopes and take strike and dip measurements of rock features at safe locations. The field measurements focused on measuring strike and dip for observed joints, fractures, faults, shear zones, and other notable features. Field measurements were collected during both site visits while photogrammetry change detection was only performed in August.

4.2.1. Eastern Facing Slope

The eastern facing slope has the majority of exposed highwalls on-site as the rest of the site has mostly been reclaimed. The rock shown here is typical of the site, with most faces having been weathered over the last twenty years. A distinct near-vertical dyke intersects some of the northern side benches showing alteration after deposition. This area shows some of the previously mentioned pegmatite inclusions from the desktop study.

Most of these benches exhibit confined rockfalls from raveling failure. Although sporadic across most of the eastern facing slope, there are a few higher areas with a greater density. Benches 6540, 6640, 6800 display regions of direct toppling failure along where a joint set is dipping into the face near the center of the bench. The crest of the slope has weathered to such an extent that it resembles a residuum soil reducing the width of the catch-bench 6840 to approximately ten feet. Small-scall sloughing and raveling is prevalent. Due to the quarry's inactive status, gauging the frequency of rockfall was not feasible at this time.

Figure 2: Central East-Facing Bench 6540 Showing Recent Raveling

4.2.2. Northern Facing Slopes

Most of these slopes had been reclaimed, leaving only a few exposed benches which intersect at right angles with previously introduced eastern facing slope. Both of these regions have large overhangs due to its geometry intersecting with a joint set and foliation of the rockmass as shown in Figure 3. This intersection has created large blocks that have fallen off as observed in the catch-rock.

Figure 3: Eastern Facing Bench 6500 Showing Overhang

Near the transitions between exposed and reclaimed slopes have shown comparably higher magnitude of movement as reflected by sloughing and raveling. Some recent movement was observed from afar and from the drone orthomosaic near the southwest corner of the quarry on slope. Failures in this area have led to little or no space left uncovered in catch-rock. Benches 6540, 6590, and 6640 have areas that are at capacity of large talus blocks from toppling failure above.

4.2.3. Southwest Corner

The intersection of the East and North Facing slopes creates the South West Corner. These corner is even more prominent with local wedge failure of two joint sets that run approximately parallel to the perpendicular slopes. Figure 4 shows an example of the wedge failure seen in the southwest corner of bench 6760, 6720, & 6680. The southwest corner has the greatest density of material caught on each bench from localized failures.

Figure 4: Southwest Corner, Photo taken from Bench 6460, Local Wedge Failure in Red.

4.3. Change Detection

The reclaimed slopes forming the majority of slopes present in the Quarry limited the change detection mapping analysis to the main pit looking southwest. The change detection process automatically identifies changes in surface features between two images collected over the same location at different points in time. LIDAR point cloud data surveyed in 2023 was converted into a mesh and then calculated and compared to the mesh file provided by the Photogrammetry survey performed by KUE and Flatirons, Inc. All change detection processing was conducted inside Trimble Business Center utilizing projected surfaces.

Change detection modeling from both UAV datasets allows for two primary functions of interest with respect to the Deer Creek Quarry: 1) indication of time-dependent changes to exposed highwalls and slope failures in areas of interest, and 2) the possibility of observing and evaluating small-scale failures on benches or areas of interest that are challenging to reach or simply inaccessible. Figures 4 and 5 detail a couple of oblique views of the exposed highwall.

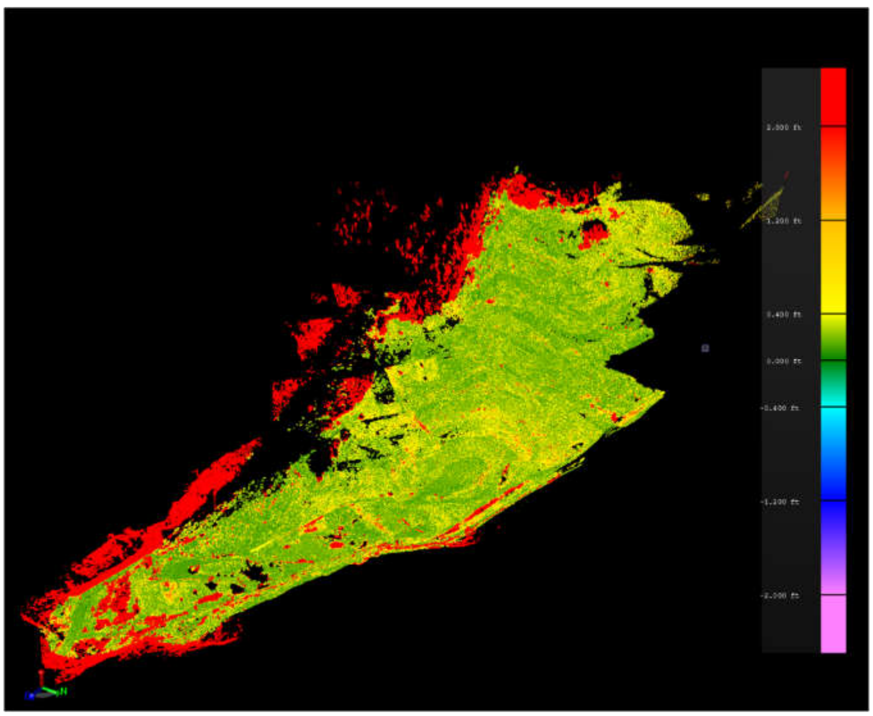

Figure 4: Change Detection Map, Oblique View Looking Southwest-South

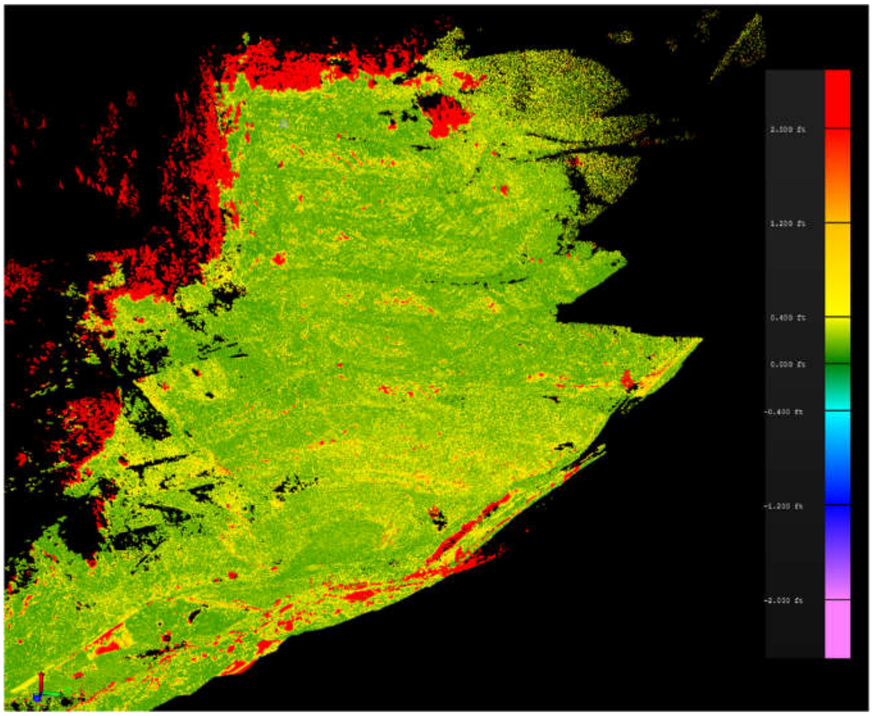

Figure 5: Change Detection Map, Oblique View Looking West

Most of the changes measured were less than 0.6 ft and can be attributed to noise generated from the limited points recorded in the 2023 UAV survey. Some notable areas of movement were noted, such as those noted in the previous Observations section. Both the southwest corner and middle of the eastern facing slope show small regions with changes between 1.2 and 2.0 ft and correlate with areas of relatively recent rockfall. No large changes were observed in the model. Changes greater than 2.0 ft are mostly attributed to foliage and vegetation.

4.4. Kinematic Analysis

Joint orientations were mapped by hand using a Brunton compass. 74 measurements were taken across the exposed highwall from safe locations. These measurements were then entered into Rocscience Dips (version 8.027) for development stereonet and kinematic analysis, where the granitic gneiss was evaluated. As KUE conducts future site visits and gathers more measurements in the future, the analyses performed will be more representative of the site as a whole. KUE assumed a 35° angle of friction for the biotitic gneiss. These two rock mass types form the majority of the rock in the Quarry and were the only types considered for analysis.

4.4.1. Discontinuity Data

KUE identified three joint sets, and one foliation set as shown in the stereonet below. HDR previous reports identified note their analysis was through remote means and are approximate. The data results from the HDR analysis are considered only somewhat characteristic of the general slope stability at the Quarry, as their visual observations did not line up with those found during KUE's site investigation. Still, the previous study in 2023 and the associated measurements provide an outline for the major joint and fracture sets existing at the site. As shown below, KUE's strike and dip measurements of rock features observed in the field generally agree with the discontinuity data approximations. For a detailed stereonet, please see Appendix B.

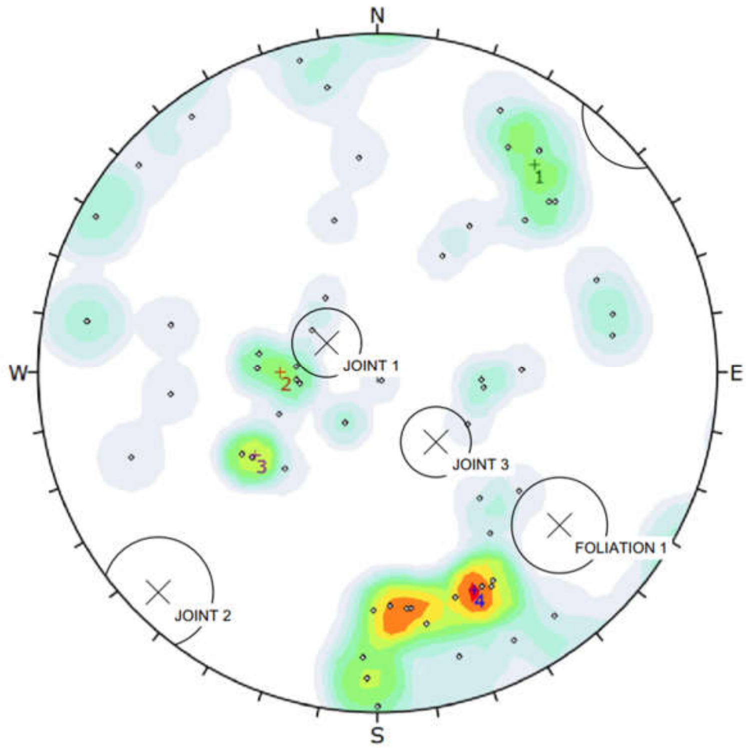

Figure 8: HDR Discontinuity Contours & Joint Sets Overlayed on KUE Field Measured Discontinuity Data

Table 1: KUE Field Measured Discontinuity Data Summary

Discontinuity	Average Dip (°)	Average Dip Direction (°)	Number of Measurements
Set 1	75	217	8
Set 2	32	90	8
Set 3	47	56	3
Set 4	70	336	21

5. RESULTS AND RECOMMENDATIONS

5.1. Summary of Results

The main observed failure modes were small, local raveling and sloughing of rock on the benches around areas where the joint site dip into the face creating toppling failure and localized wedge failure on multiple benches in the southwest corner of the pit. In general, the high persistence of joints and fractures in the rockmass has resulted in smaller scale raveling and sloughing failures where no large-scale failure risks were observed. Local wedge failure appears far less persistent than the local reveling and sloughing of rock onto the benches.

The highest risk of kinematic failures was calculated in the exposed northern facing slopes, wherein there are two on-site. This validates KUE's previous observations where large overhangs are present on these walls form the intersections of the joint sets in the rock face and large catches of rock. Further detailed analyses are provided in Appendices B2 and B3. The below table summarizes the risks of failure for different failure modes of each slope direction observed in the Quarry.

Table 2: Distribution of Kinematic Analyses Results

Failure Mode	Northern Facing Slope Risk (%)	Eastern Facing Slope Risk (%)	Southern Facing Slope Risk (%)	Western Facing Slope Risk (%)
Planar Sliding	26.5	19.1	10.3	7.35
Wedge Sliding	0	0	0	0
Flexural Toppling	10.3	5.88	27.9	16.2
Direct Toppling	39.7	29.4	14.7	11.8

Light Yellow: Extremely Low Likelihood of Failure (<5%), Yellow: Low Likelihood of Failure (5%-20%)
Orange: Moderate Likelihood of Failure (20%-35%), Red: High likelihood of Failure (>35%)

In general, areas of unfavorable joint orientations and bench geometries were observed to be small-scale and localized to primarily direct toppling failures. Exposed foliation and joint set orientations observed were quite variable with changes in orientation vertically due to the orogenic nature of its formation. Unfavorable foliation and joint orientations will likely change if reclaimed slopes are brought back into production and will require investigation at that time. However small-scale failure conditions are likely to persist throughout the site.

5.2. Recommendations

Ongoing monitoring is recommended for the site to further evaluate rock mass conditions if reclaimed slopes are mined and to track rockfalls for problem areas. Generally, for the entire site benches should be cleared of catch-rock to prevent rockfall from traveling down multiple benches and possibly causing harm.

5.2.1. Eastern Facing Highwall Areas of Concern

The previously identified center benches 6540, 6640, 6800 have been observed and measured to exhibit more extensive raveling than other regions of the eastern facing slopes. Personnel and equipment should stay clear of these areas to mitigate harm and damage, respectively. The dyke on the northern side appears to be a relatively weaker zone of rock mass due to its more extensive weathering of the slope to match that of the overall pit slope. This area should be avoided due to rockfall being able to gain energy by bypassing several catch benches.

Kinematic risk analysis indicates the direct toppling is the most likely mode of failure on these benches, which may cause large blocks to fall below. KUE will continue to monitor the identified areas for further movement.

5.2.2. Northern Facing Highwall Areas of Concern

Large overhangs in this area are the largest risk in the area, correlating to the largest risk of direct toppling failure in the quarry, and of the failure modes in general. If reclaimed slopes are removed and mined, care should be taken to prevent disturbance of the buried highwalls to prevent future large direct toppling failure as mining operations are started.

5.2.3. Southwestern Highwall Corner of Concern

KUE has also identified the previously identified area of movement in the 2023 report to continue progressing. However, with change detection mapping showing changes between 0.6 and 1.2 ft for most of these raveling areas. The corner slope is considered to be relatively unchanged and movements negligible. KUE will further monitor this location for movement during future site visits.

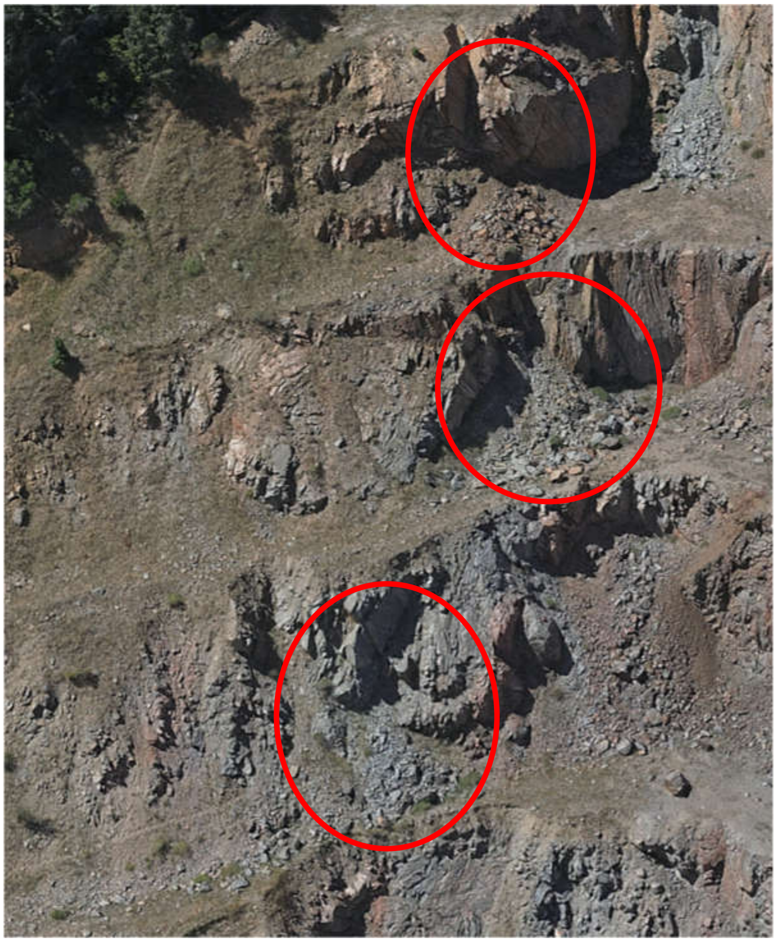

Figure 9: Southwestern Corner, Catch-Rock Areas of Concern Circled

6. LIMITATIONS

This report has been drafted specifically for the Bi-Annual Geotechnical Addendum concerning existing and evolving quarry conditions specifically at the Morrison Quarry for Holcim – WCR, Inc. This report will not be applicable for any other project and/or client. KUE has not attempted to interpolate or extrapolate any of the presented geotechnical/geological data and is not liable for variations between data measurements and survey results. Recommendations submitted in this report are based upon collected data at the time of this report. Should information presented be superseded or conditions in field be different than anticipated, please reach out to our office for us to re-evaluate our recommendations. KUE has attached an advisory on the limitations and how to interpret this report, presented in Appendix C.

7. REFERENCES

Crotsley, Hume, & Brandenberger, December 2023, Geotechnical Addendum, 2023 Annual Report: HDR.

Colton, Roger, 1978, Geologic map of the Boulder-Fort Collins-Greeley area, Colorado: USGS Miscellaneous Investigations Series Map I-855-G, scale 1:100,000. [USE THIS AS CITATION STRUCTURE EXAMPLE

Bryant, B., Miller, R.D., & Scott, G. R. 1973, Geologic Map of the Indian Hills Quadrangle, Jefferson County, Colorado: USGS IMAP Series 1073, scale 1:24,000.

W.E. Hofstra & D.C. Hall, 1975, Geologic Control of Supply and Quality of Water in the Mountainous Part of Jefferson County, Colorado: Bulletin 36.

Attachment A

Quarry Change Detection Inspection Report

Project file data		User information		Coordinate System	
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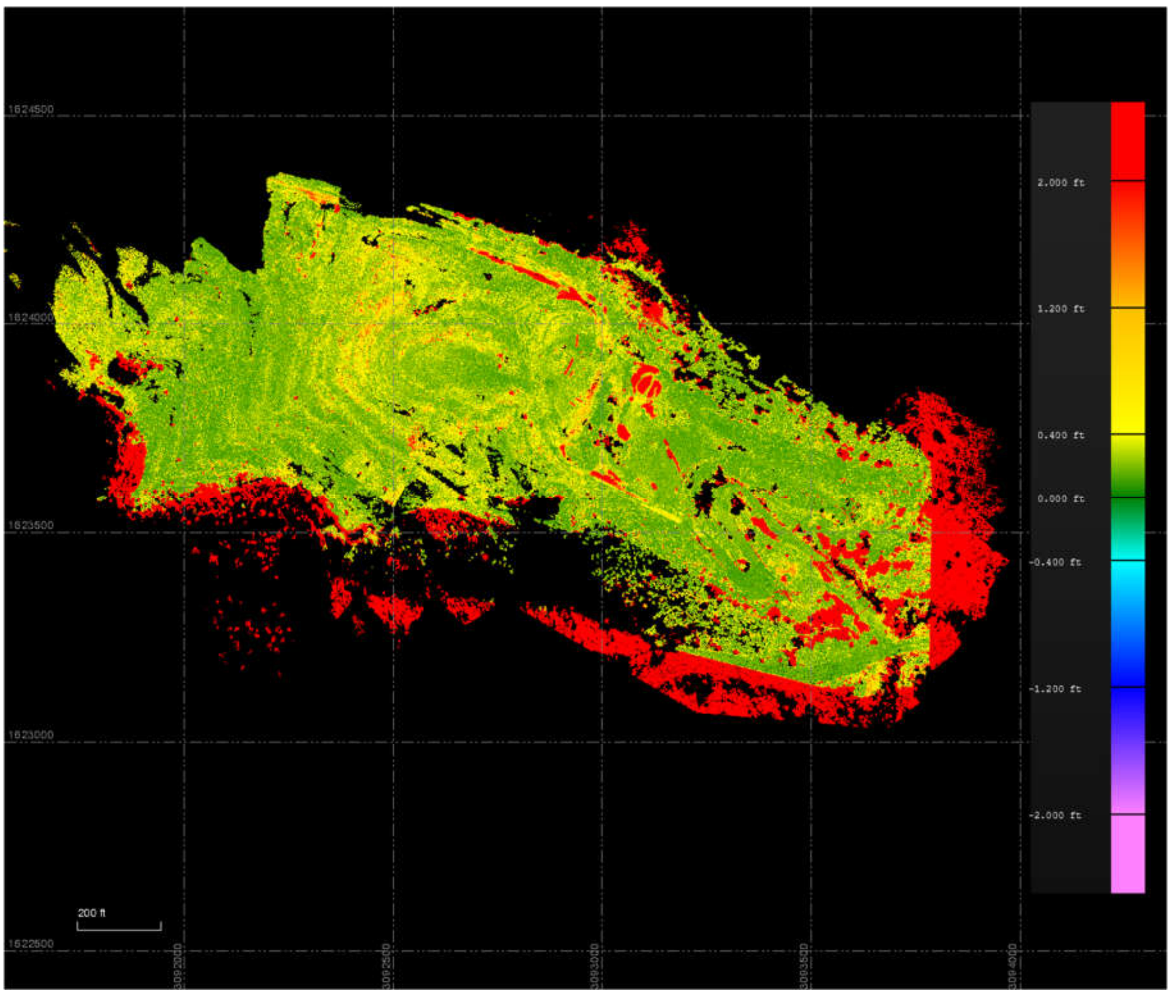
		Office operator:		Zone:	Colorado Central 0502
Size:	58 KB			Datum:	NAD83(2011)
Modified:	9/16/2024 10:24:15 AM (UTC:-5)			Global reference datum:	NAD83(2011)
Time zone:	Central Standard Time			Global reference epoch:	2010
Reference number:				Geoid:	GEOID18 (Conus)
Description:				Vertical datum:	
Comment 1:					
Comment 2:					
Comment 3:					



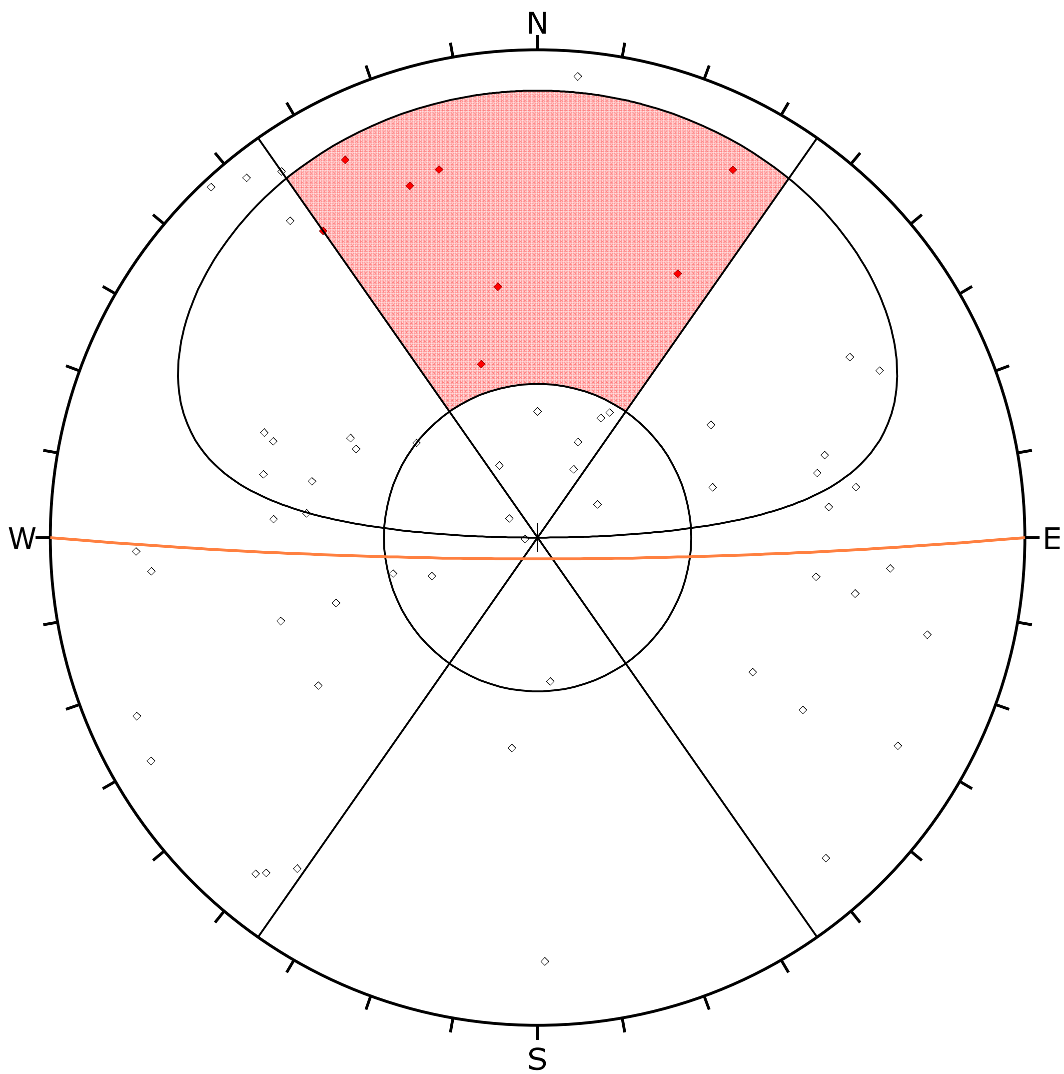
Scan Inspection Report

ID	Northing (US survey foot)	Easting (US survey foot)	Elevation (US survey foot)	Deviation (US survey foot)
Ground1	1623887.313	3092378.366	6447.345	0.197

9/16/2024 3:44:31 PM	C:\Users\mlund\Documents\Working Files\DEER CREEK QUARRY\81281-DEER CREEK QUARRY.vce	Trimble Business Center

Attachment B1

Discontinuity Stereonet



Symbol	Feature
◇	Pole Vectors
◆	Critical Vectors

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

	Critical	Total	%
Planar Sliding (All)	8	62	12.90%

Plot Mode	Pole Vectors
Vector Count	62 (62 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.027

Project	Geotech Inspection - Morrison Quarry		
Analysis Description	Kinematics		
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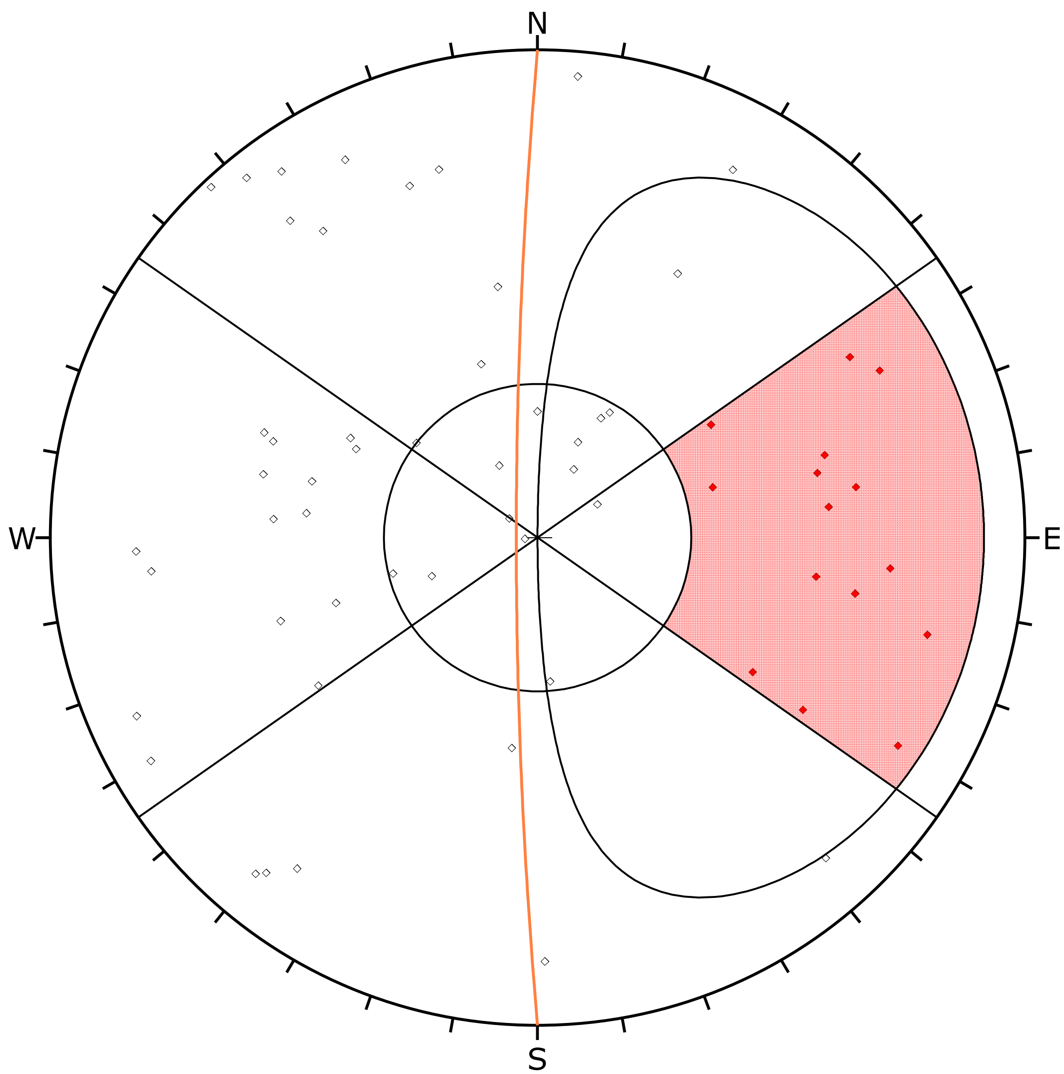

Symbol	Feature
◇	Pole Vectors
◆	Critical Vectors

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

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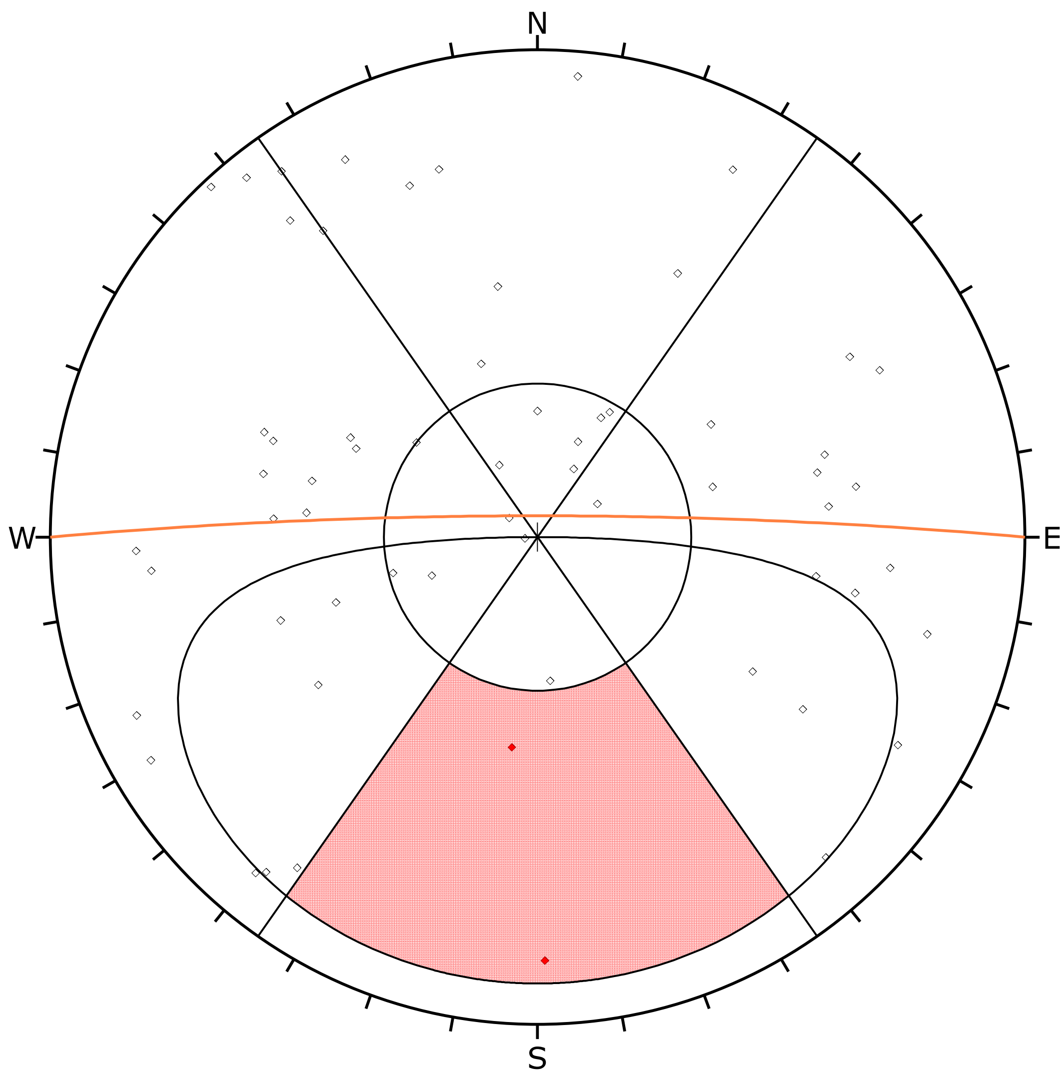
Planar Sliding (All)	15	62	24.19%

Plot Mode	Pole Vectors
Vector Count	62 (62 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project* Geotech Inspection - Morrison Quarry		
	Analysis Description Kinematics		
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
DIPS 8.027	*Date* 9/3/2024, 2:40:05 PM	*File Name* SouthQuarry.dips8	



Symbol	Feature
◇	Pole Vectors
◆	Critical Vectors

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

	Critical	Total	%
Planar Sliding (All)	2	62	3.23%

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Vector Count	62 (62 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project* Geotech Inspection - Morrison Quarry		
	Analysis Description Kinematics		
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
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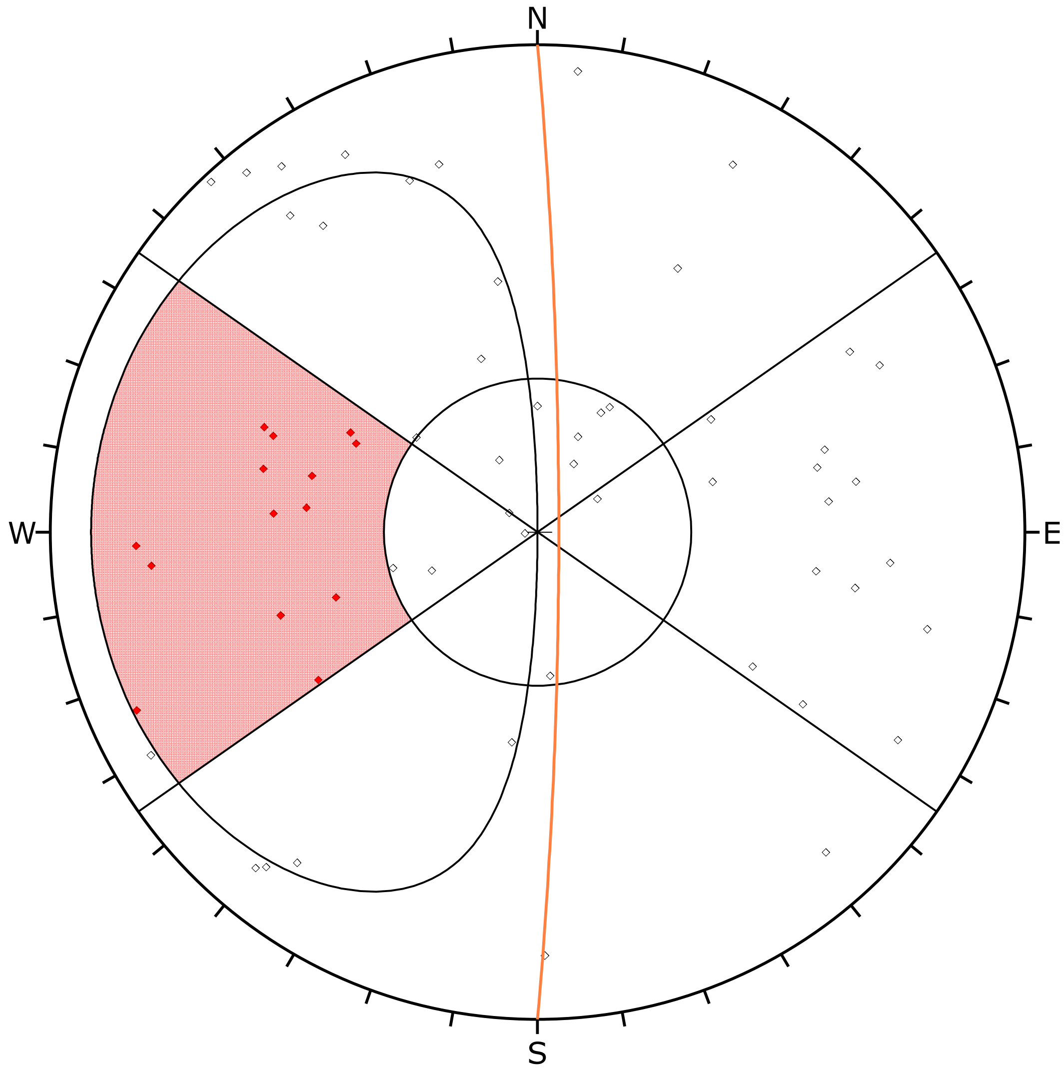

Symbol	Feature
◇	Pole Vectors
◆	Critical Vectors

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

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Planar Sliding (All)	14	62	22.58%

Plot Mode	Pole Vectors
Vector Count	62 (62 Entries)
Hemisphere	Lower
Projection	Equal Angle

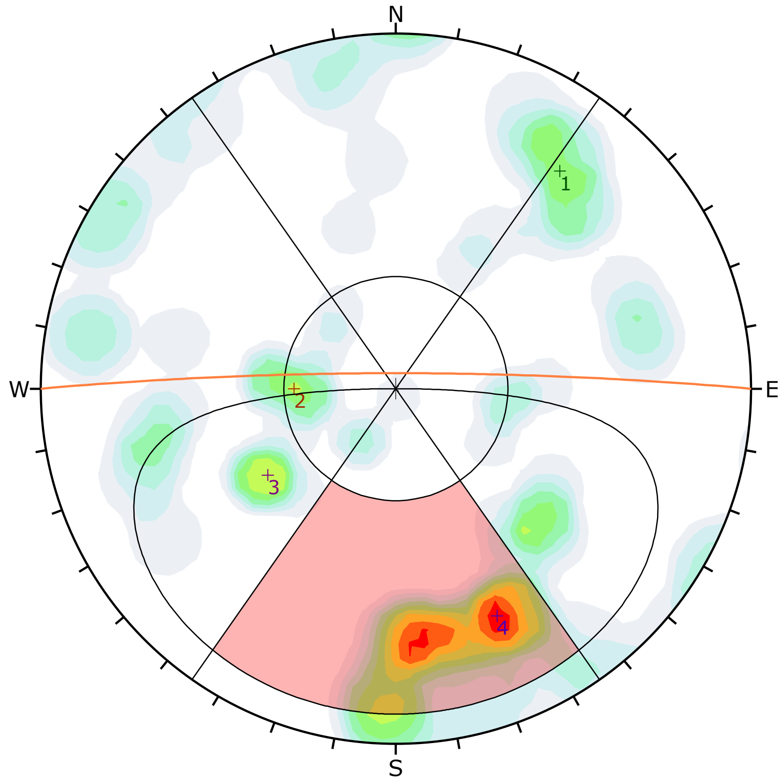
rocscience

DIPS 8.027

Project	Geotech Inspection - Morrison Quarry		
Analysis Description	Kinematics		
Drawn By	NW, RS	*Company*	Kilduff Underground Engineering
Date	9/3/2024, 2:40:05 PM	*File Name*	SouthQuarry.dips8

Attachment B2

Kinematic Analyses



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	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

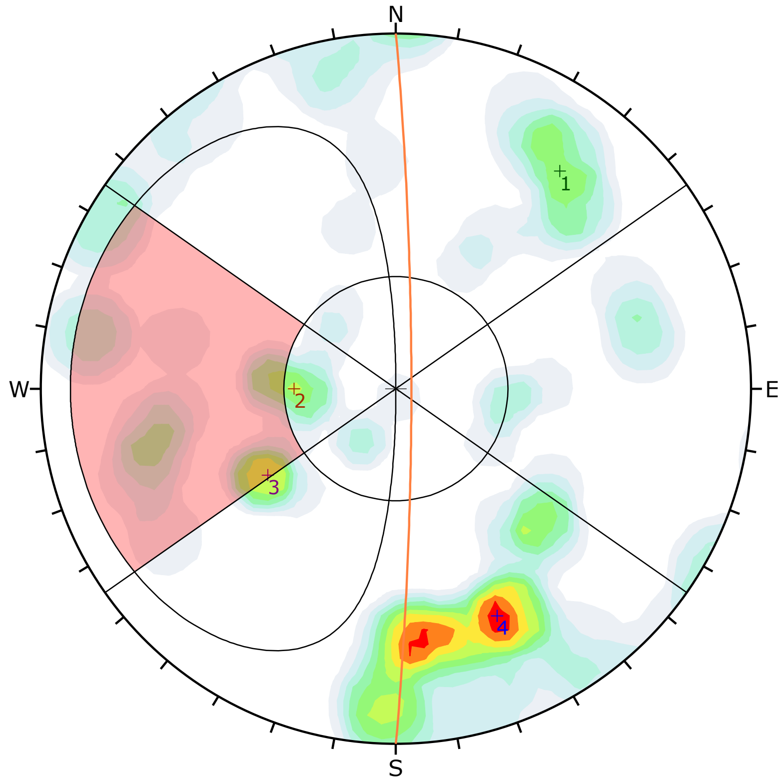
Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

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

	Critical	Total	%
Planar Sliding (All)	18	74	24.32%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project*	Geotech Inspection - Deer Creek Quarry	
	Analysis Description	Kinematics	
	Drawn By	NW, RS	*Company* Kilduff Underground Engineering
DIPS 8.028	*Date*	12/19/2024	*File Name* DeerCreek_November update.dips8



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	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

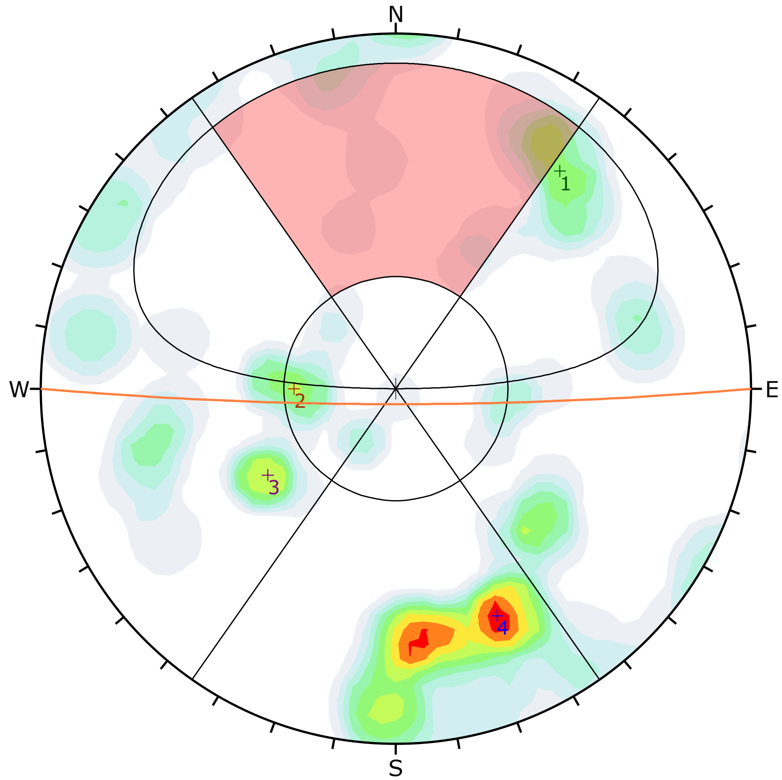
Kinematic Analysis	Planar Sliding		
Slope Dip	85		
Slope Dip Direction	90		
Friction Angle	35°		
Lateral Limits	35°		
	Critical	Total	%
Planar Sliding (All)	16	74	21.62%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project	Geotech Inspection - Deer Creek Quarry
Analysis Description	Kinematics
Drawn By	NW, RS
Company	Kilduff Underground Engineering
Date	12/19/2024
File Name	DeerCreek_November update.dips8



Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.64%
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°

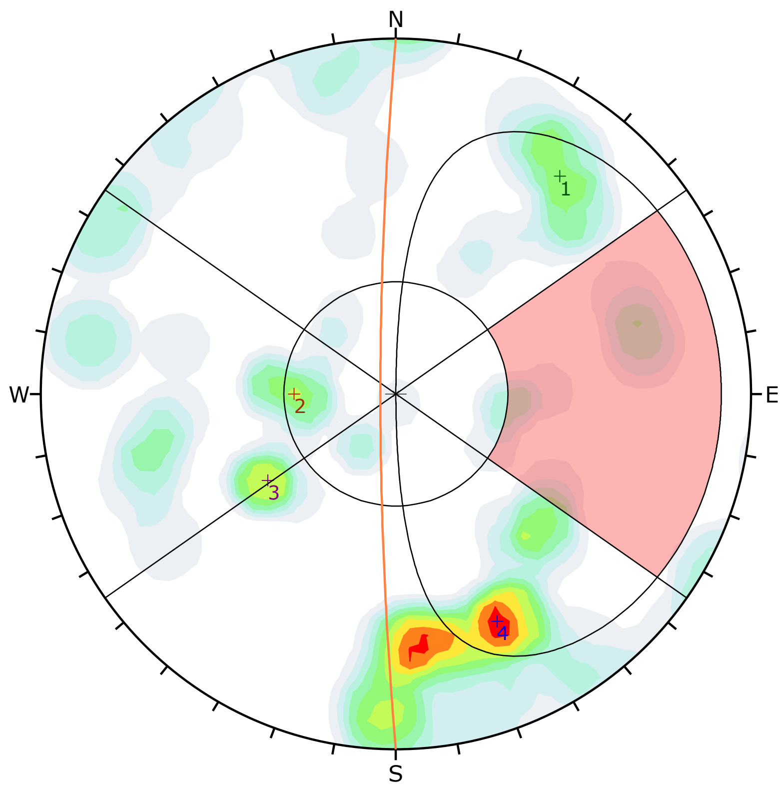
	Critical	Total	%
Planar Sliding (All)	7	74	9.46%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project	Geotech Inspection - Deer Creek Quarry
Analysis Description	Kinematics
Drawn By	NW, RS
Company	Kilduff Underground Engineering
Date	12/19/2024
File Name	DeerCreek_November update.dips8



Color	Density Concentrations
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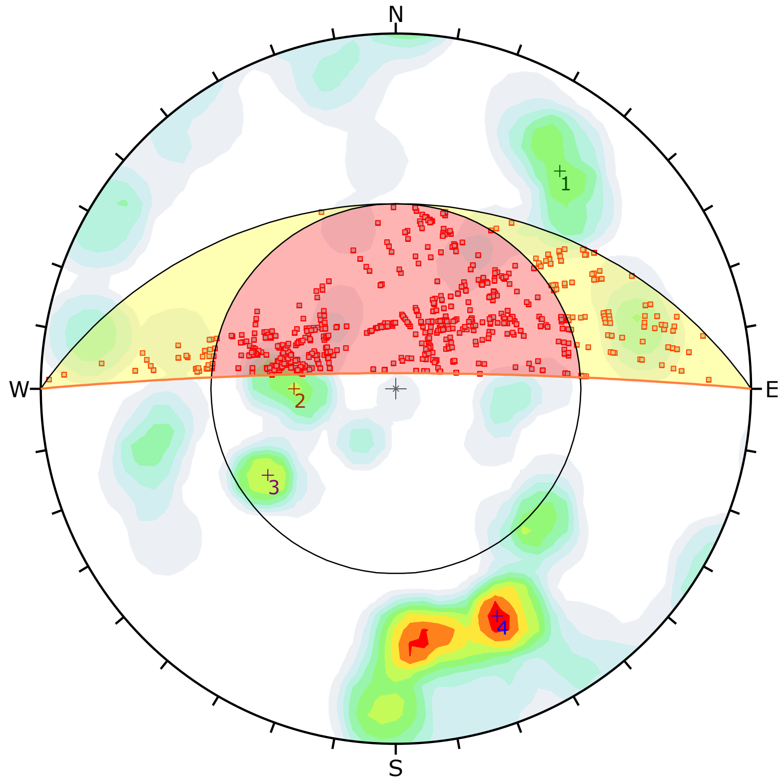
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding		
Slope Dip	85		
Slope Dip Direction	270		
Friction Angle	35°		
Lateral Limits	35°		
	Critical	Total	%
Planar Sliding (All)	6	74	8.11%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project*	Geotech Inspection - Deer Creek Quarry	
	Analysis Description	Kinematics	
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
DIPS 8.028	*Date* 12/19/2024	*File Name* DeerCreek_November update.dips8	



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
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	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

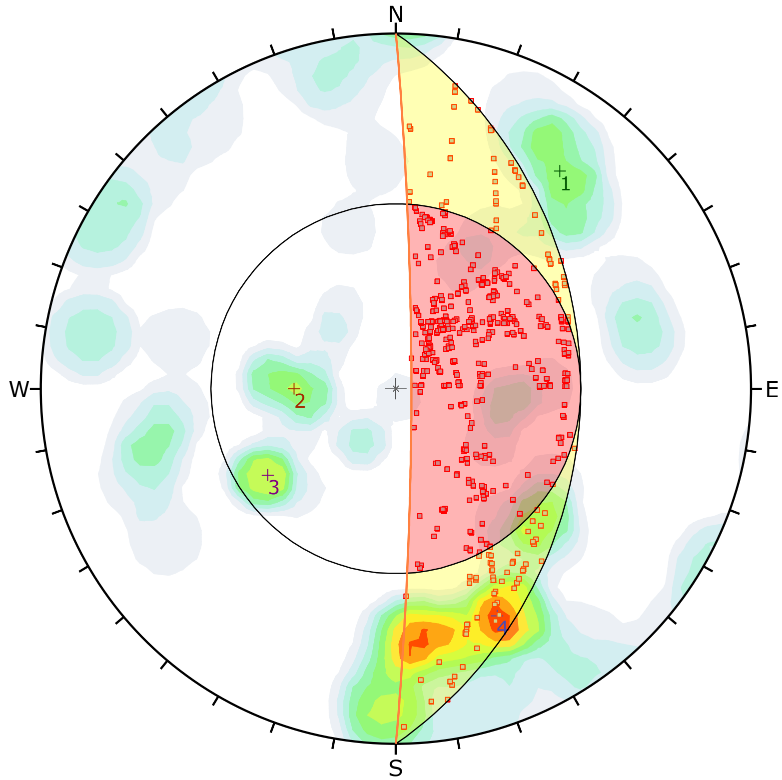
Kinematic Analysis	Wedge Sliding		
Slope Dip	85		
Slope Dip Direction	0		
Friction Angle	35°		
	Critical	Total	%
Wedge Sliding	1070	2689	39.79%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project	Geotech Inspection - Deer Creek Quarry		
Analysis Description	Kinematics		
Drawn By	NW, RS	*Company*	Kilduff Underground Engineering
Date	12/19/2024	*File Name*	DeerCreek_November update.dips8



Symbol	Feature
◻	Critical Intersection

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

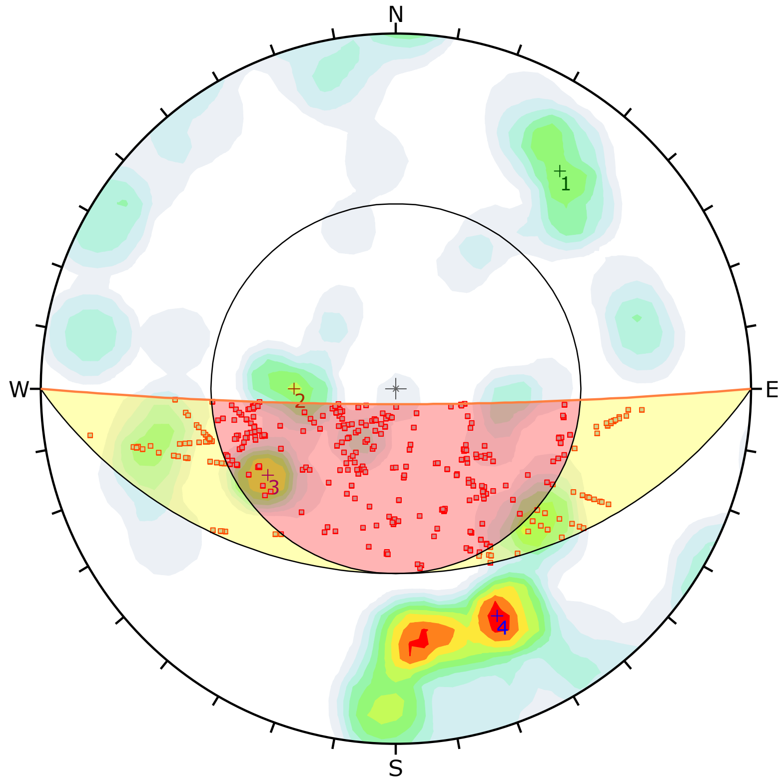
Kinematic Analysis	Wedge Sliding		
Slope Dip	85		
Slope Dip Direction	90		
Friction Angle	35°		
	Critical	Total	%
Wedge Sliding	828	2689	30.79%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project	Geotech Inspection - Deer Creek Quarry		
Analysis Description	Kinematics		
Drawn By	NW, RS	*Company*	Kilduff Underground Engineering
Date	12/19/2024	*File Name*	DeerCreek_November update.dips8



Symbol	Feature
▫ (red)	Critical Intersection

Color	Density Concentrations
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	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
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	433	2689	16.10%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project
Geotech Inspection - Deer Creek Quarry

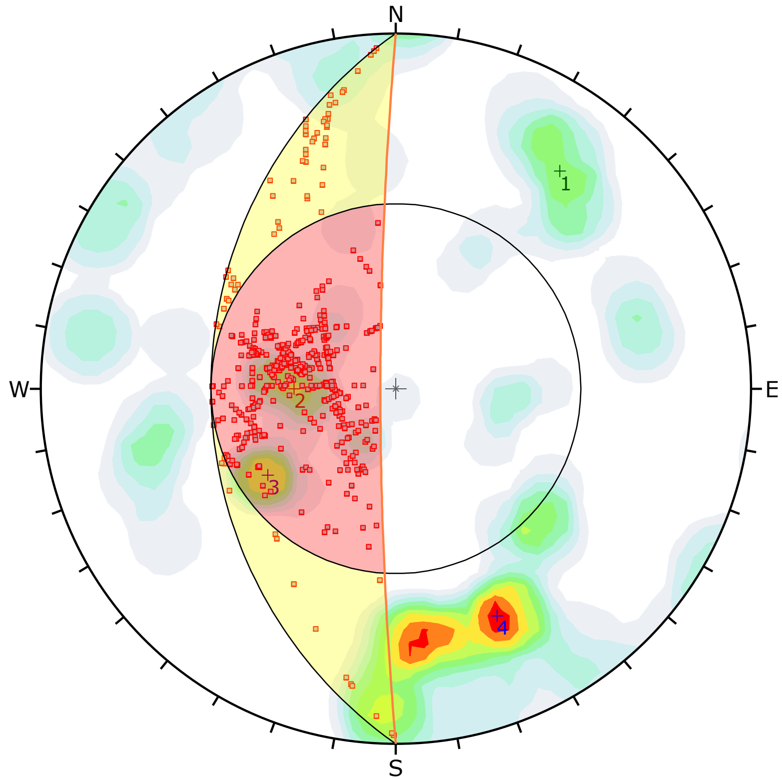
Analysis Description
Kinematics

Drawn By NW, RS

Company Kilduff Underground Engineering

Date 12/19/2024

File Name DeerCreek_November update.dips8



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

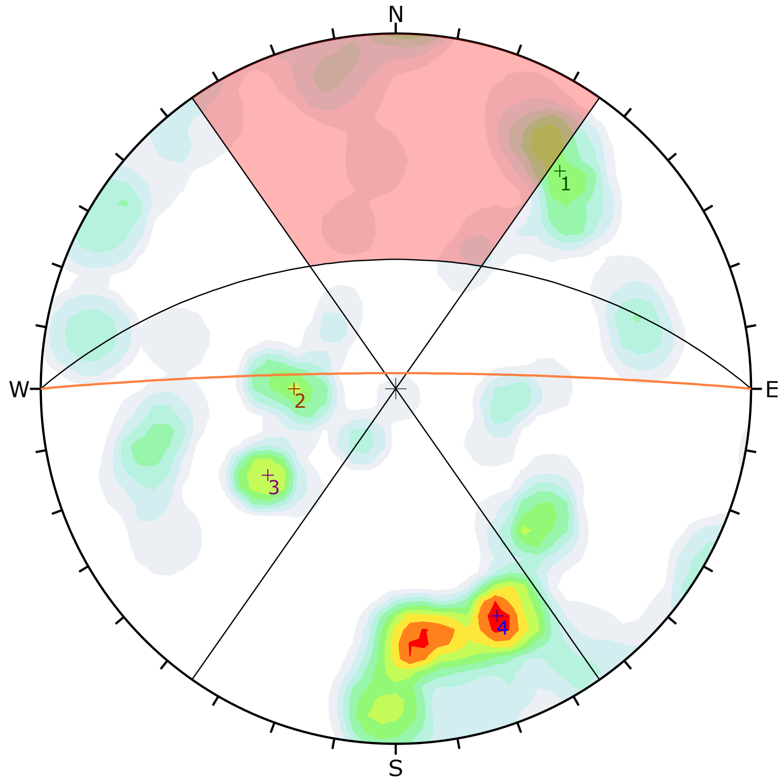
Kinematic Analysis	Wedge Sliding		
Slope Dip	85		
Slope Dip Direction	270		
Friction Angle	35°		
	Critical	Total	%
Wedge Sliding	696	2689	25.88%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project	Geotech Inspection - Deer Creek Quarry		
Analysis Description	Kinematics		
Drawn By	NW, RS	*Company*	Kilduff Underground Engineering
Date	12/19/2024	*File Name*	DeerCreek_November update.dips8

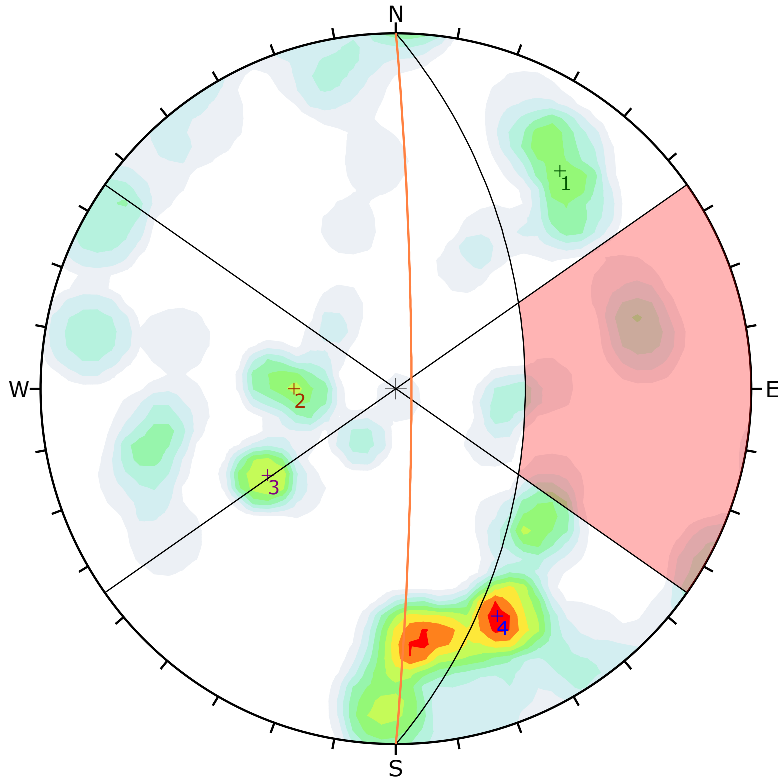


Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Flexural Toppling		
Slope Dip	85		
Slope Dip Direction	0		
Friction Angle	35°		
Lateral Limits	35°		
	Critical	Total	%
Flexural Toppling (All)	7	74	9.46%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project* Geotech Inspection - Deer Creek Quarry	
	Analysis Description Kinematics	
	Drawn By NW, RS	*Company* Kilduff Underground Engineering
DIPS 8.028	*Date* 12/19/2024	*File Name* DeerCreek_November update.dips8



Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
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°

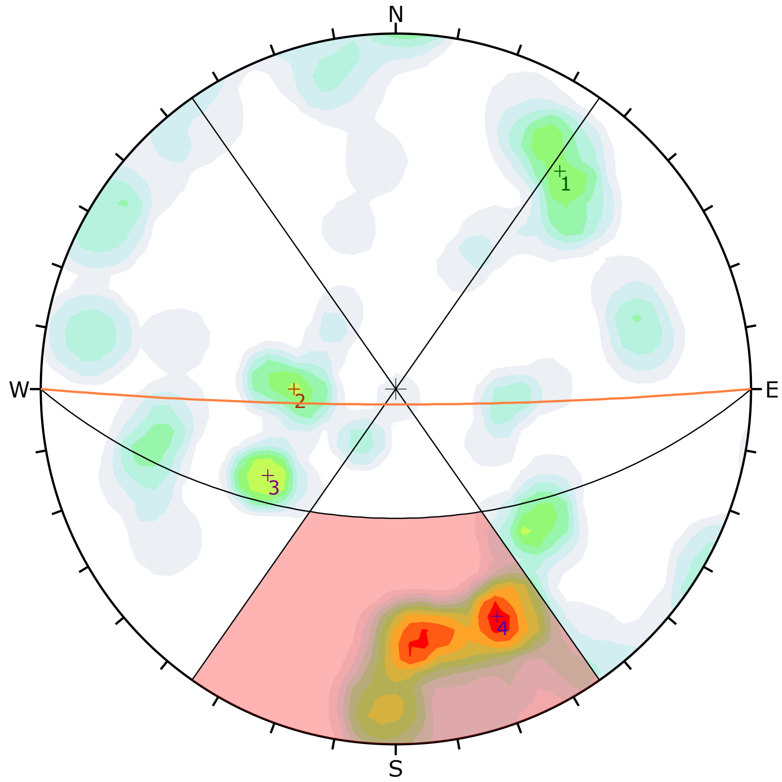
	Critical	Total	%
Flexural Toppling (All)	5	74	6.76%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project	Geotech Inspection - Deer Creek Quarry		
Analysis Description	Kinematics		
Drawn By	NW, RS	*Company*	Kilduff Underground Engineering
Date	12/19/2024	*File Name*	DeerCreek_November update.dips8



Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.64%
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°

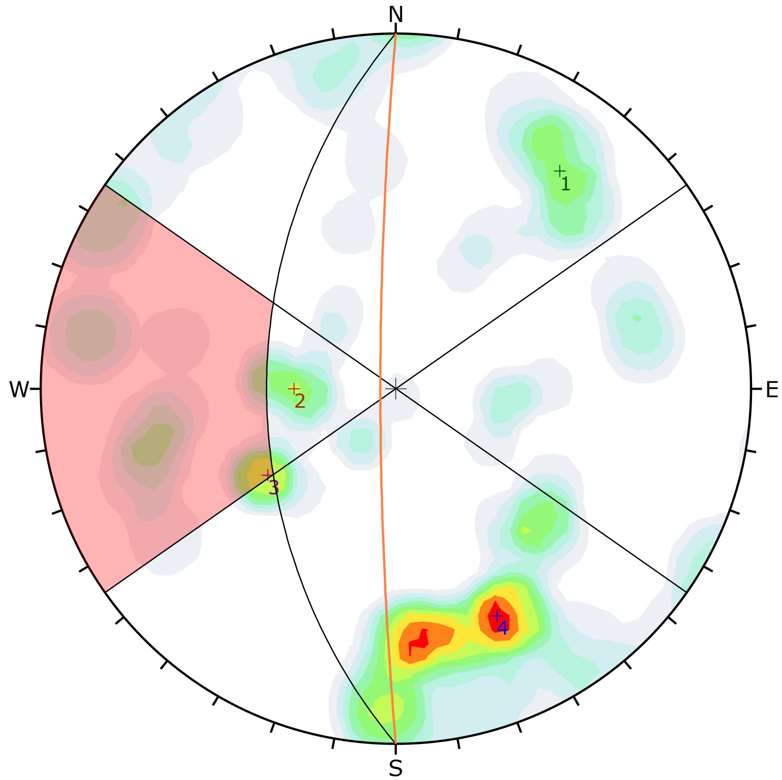
	Critical	Total	%
Flexural Toppling (All)	19	74	25.68%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience

DIPS 8.028

Project	Geotech Inspection - Deer Creek Quarry		
Analysis Description	Kinematics		
Drawn By	NW, RS	*Company*	Kilduff Underground Engineering
Date	12/19/2024	*File Name*	DeerCreek_November update.dips8



Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

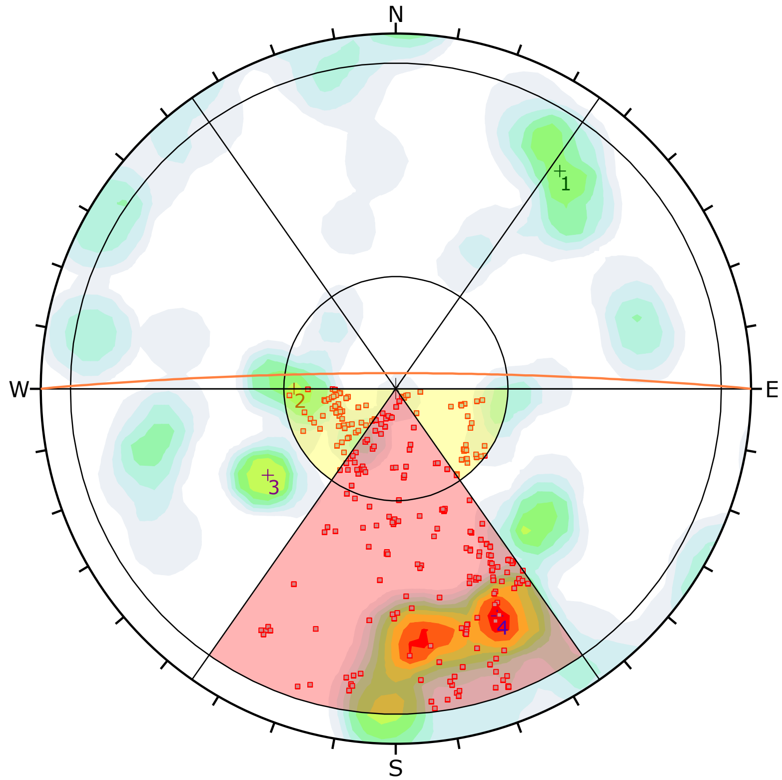
Contour Data	Pole Vectors
Maximum Density	7.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

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

	Critical	Total	%
Flexural Toppling (All)	14	74	18.92%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project*	Geotech Inspection - Deer Creek Quarry	
	Analysis Description	Kinematics	
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
DIPS 8.028	*Date* 12/19/2024	*File Name* DeerCreek_November update.dips8	



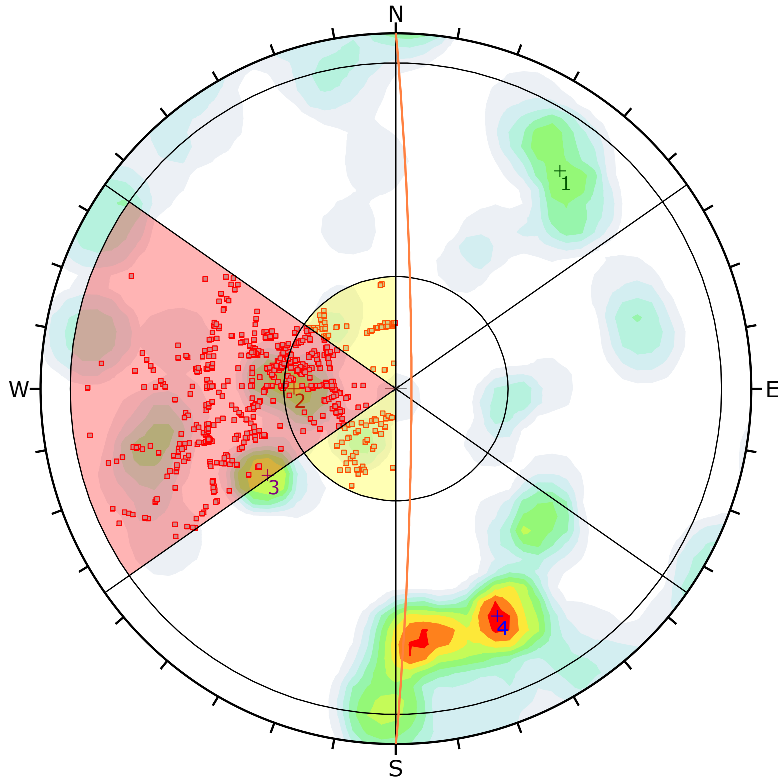
Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
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)	244	2689	9.07%
Oblique Toppling (Intersection)	105	2689	3.90%
Base Plane (All)	27	74	36.49%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project* Geotech Inspection - Deer Creek Quarry		
	Analysis Description Kinematics		
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
DIPS 8.028	*Date* 12/19/2024	*File Name* DeerCreek_November update.dips8	



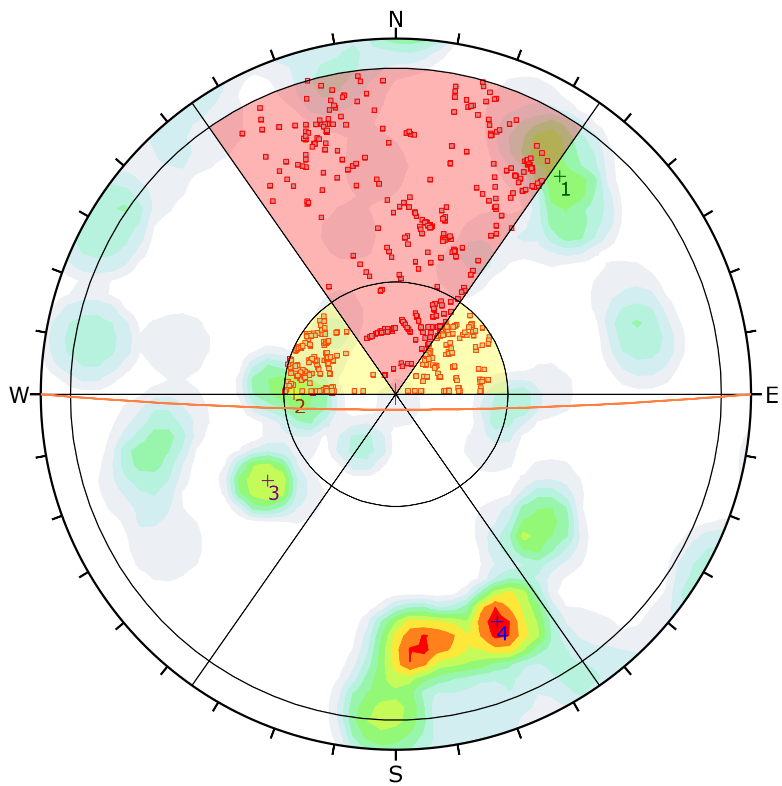
Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00
Contour Data	Pole Vectors
Maximum Density	7.64%
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)	706	2689	26.26%
Oblique Toppling (Intersection)	147	2689	5.47%
Base Plane (All)	23	74	31.08%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience DIPS 8.028	*Project* Geotech Inspection - Deer Creek Quarry		
	Analysis Description Kinematics		
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
	Date 12/19/2024	*File Name* DeerCreek_November update.dips8	



Symbol	Feature
▫	Critical Intersection

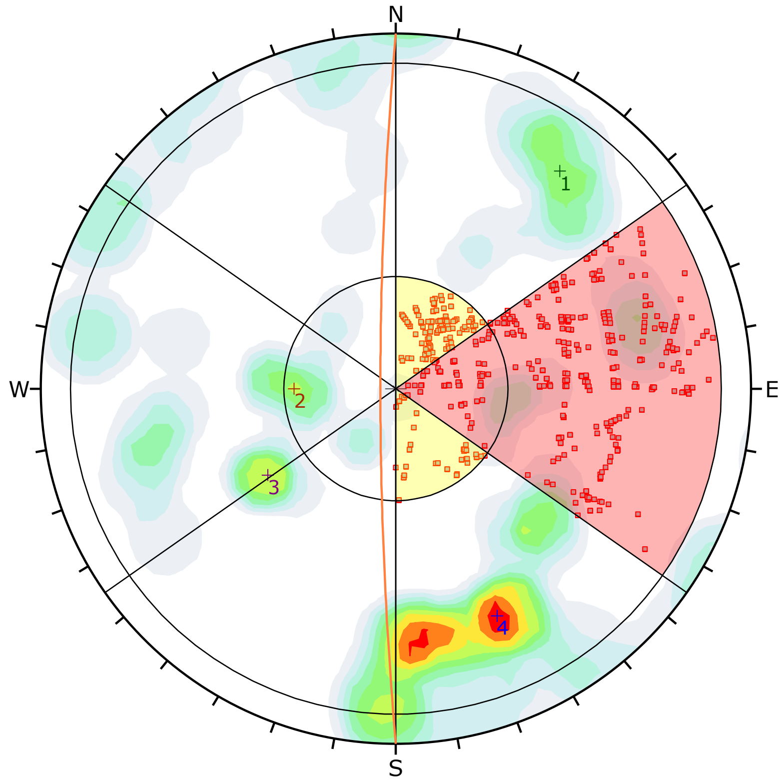
Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.64%
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)	510	2689	18.97%
Oblique Toppling (Intersection)	368	2689	13.69%
Base Plane (All)	10	74	13.51%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project* Geotech Inspection - Deer Creek Quarry		
	Analysis Description Kinematics		
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
DIPS 8.028	*Date* 12/19/2024	*File Name* DeerCreek_November update.dips8	



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.64%
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)	517	2689	19.23%
Oblique Toppling (Intersection)	227	2689	8.44%
Base Plane (All)	9	74	12.16%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	2689
Hemisphere	Lower
Projection	Equal Angle

rocscience	*Project*	Geotech Inspection - Deer Creek Quarry	
	Analysis Description	Kinematics	
	Drawn By NW, RS	*Company* Kilduff Underground Engineering	
DIPS 8.028	*Date* 12/19/2024	*File Name* DeerCreek_November update.dips8	

Attachment C

Geotechnical Report Advisory

KILDUFF UNDERGROUND ENGINEERING, INC.

Geotechnical Report Advisory

Consulting Services are Performed for Specific Purposes, Clients, and Projects

This geotechnical-engineering study administered by KUE will not likely be sufficient for a civil construction contractor or even a different civil engineer. Because this study is unique, thus this geotechnical engineering report is unique being prepared exclusively for the client. No one except the authorized parties should rely on this geotechnical-engineering report without first conferring with the consultant. No party should apply this report for any purpose or project except the one originally contemplated.

This Report is Based on Project-Specific Factors

A geotechnical report based on a subsurface exploration plan is designed to consider a unique set of project-specific factors. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Your report should not be used when the nature of the proposed project is changed, when the size, elevation, or configuration of the proposed project is altered; when the location or orientation of the proposed project is modified; when there is a change of ownership; or for application to an adjacent site unless your consultant says otherwise. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

Subsurface Conditions Can Change

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally. Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

Most Recommendations are Professional Judgements

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. These date points were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface condition. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

535 16th STREET, SUITE 605 | DENVER, CO 80202 | (303) 732-3692 | WWW.KILDUFFUNDERGROUND.COM

This Report's Recommendations are Preliminary and Dependent upon Confirmation

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

The Consultant's Report is Subject to Misinterpretation

When other design professionals develop their plans based on misinterpretation of a geotechnical report, costly problems can occur. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

Boring Logs and Monitoring Well Data Should Not be Separated from the Report

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

Read Responsibility Clauses Closely

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

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