### APPENDIX C

**Akron Quarry Blast Reports and Locations** 



Figure C-1

Hilltop Energy MSHA Shot 41, 2021	BLAST R GENERAL INFORM Blast Report Number	EPORT INTION 22-CL-41/15291		illtop nergy inc.
Permittee	Raff R	Date / T	ime 8/1/2022	11:06am
Customer County Line Ston	e	Permit	No. 902704	
Location of Blast Akron, NY	L	at 42° 58'	3.7 N	- X
Blasting Company Hilltop Er	nergy LeRoy NY Lor	ng 78° 28'	19.2 W	- Y
Nearest Protected Structure	Rosies		Method Hand	held GPS -
Nearest Protected Lat 42	58 22.5 Long 78°28	3 39.8 SD to near	rest protected	/191.0 /458.0
Distance and Direction Est. PPV 0.04 ips	2,619 ft NW, 3	12° Type of	Material Blaste	d Limestone
Other Protected Structure	West Shurr Rd gate		Total Tor	s 21060
Other Protected Lat 42	ິ58່35.3 <b>່ Long</b> 78 <sup>°</sup> 28	3`30.7	Total YI	0 <sup>3</sup> 9360
Distance and Direction Est. PPV 0.02 ips	3,554 ft N, 3	40 <sup>°</sup>	PF: tons/l	b 2.0
Weather Conditions Clou	dy / Calm 75° F		lbs/yo	1 <sup>3</sup> 1.1
Wind out of the SW @	3-8 mph Blast Informatio	Matts or	Protection Use	d None used
Total Weight and Type(s) of	f Explosives used: see a	ttachment E	last Type Produ	iction
0.00 9,519.0	FO Emulsion 00 lbs. 0.00 lbs.	Packaged 1,180.00 lbs.	<b>59 Primers</b> 59.00 lbs.	Total Weight 10,758.00 lbs.
Total Holes 59 An	igle 0 ° Drill			
Depth (ft) 27	Burden (ft)	13 - 14	Backfill (ft)	0
Face Height (ft) 27	Spacing (ft)	13	Stemming (ft)	5.5 - 24
Sub Drill (ft) 0	Diameter (in)	5.250 5.250	Stem Type	#1 Stone

Maximum Weight of Explosives Allowed per 8ms Period (lbs) : 2268 as determined by SD of : 55 Maximum Weight of Explosives detonated per 8ms (lbs) : 188 in 1.00 Holes

		INITIATION PRODUCT	INFORMATION				
<b>Delay Type</b> UNITRONIC 600 30FT	Date Code 18AP22	Qty 59 Delay Type Blasting	Date Code	Qty	Booster Type 1Lb.	Date Cod 22MA22	e Qty 59
		Drilling	cost:		Accessory Typ Duplex 500' Unitronic HARNE	pe ESS WIRE	<b>Qty</b> 1 2
Firing Method : Electric Blasting Unit : Unitroni	Circu cs 310 Initia	it Type : Echelon ated by : Electronic	Timer (ms) : NA Circuits :				
Face checked / shot	cleared	Сомме	NTS				1

Operation Permit Number	County Line Stone 902704	Blast Number Blast Type	22-CL-41/15291 Production	Date	8/1/2022
		Timing Patte	ərn		
	24	open faci			
	480 456 432 608 584 560 1	108 384 360 336 312 288 264 240 536 512 488 484 440 418 392 365	* GPS * 216 192 168 144 58 48 72 120 344 320 295 272 224 176 200 248		
	736 712 688 6	184 840 818 592 588 544 520 498 SOLID	472 448 424 400 352 304 328 376		
		Seismograph Informa	TION		
Blast Reco Seis SN_Lo	ording Locations 8/1, cation Dist (ft) D	/2022 11:06 / ir. SD T PPV T F	AM Hz VPPV VHz LPF	<u>PVLHzAird</u> B	Air Hz

Reading(s) taken by :CLS

Analyzed by :CLS

BLASTER I	NFORMATION	
Blaster Name and Certification Number: Crew:	Don F	<b>Customer Signature :</b>
Ken Rymer	Scott C	
00-4660	Jim H	
BlastdataG4 Blast Plan Page	2.0	Blast Plan Number 22-CL

BLAST I HOLE	NUMBE Desci	R 22-C	N				1	TYPICA	L HOLE		Blast Hole Loading Diagram Face Height (FT) 27
Hole Number	Depth (FT)	Angle (Deg)	Subdrill (FT)	Burden (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd³	PF tons/lb		Hole Dia (in) 5.250
1-19	27	0	0	14.0	13.0	5.5	182	1.0	2.2	-	5.5 'Stemming
				** To	otal Holes	s loade	ed san	ne: 19			
EXPLO Prod 1 POW 2 ANF( 3 4	OSIVES duct Nar /ERAN O	ne 1 500 -	4 X 20				Pound 20.0 167.0	s 10 10			19 ' ANFO,0.85g/cc @ 5.5 '
				Total I	bs. / hole		187.0	00			
PRIME Pri 1 1Lb. 2	RS imer Na	ne		Qty 1	E> Tot Per	(PLOS al Prim Hole	IVES T er Qty **	TOTALS	5 19 pe**		
	Prin	ner Ibs /	hole.	1.00	188	.00	;	3572.0	00	(i-i)	2在5POWERAN 500 4 X 20,1.34g/cc @
				/L							







8450 Circular Hill Rd. Leroy, NY 14482 (585) 768-4860

## 

 
 SOLD TO:
 \_\_\_\_\_\_\_
 FED. LIC. #\_\_\_\_\_\_

 TRUCK NO.
 \_\_\_\_\_\_\_
 DRIVER \_\_\_\_\_\_\_
 NO WARRANTY EXCEPT MERCHANTABILITY SHALL APPLY TO THIS MATERIAL. ANY SUGGESTION BY SELLER OR MANUFACTURER AS TO THE USE OR APPLICATION OF THIS MATERIAL IS A STATEMENT OF OPINION ONLY AND LOCATION: IS NOT WARRANTY OF THE RESULTS TO BE OBTAINED. MAGAZINE: Mineral City \_\_\_\_\_\_Vanlue \_\_\_\_\_\_Lisbon \_\_\_\_\_Leroy \_\_\_\_\_ Gouverneur (330) 424-1401 (585) 768-4860 (315) 782-6826 (419) 387-7713 (330) 859-2108 UNITS UNITS UNITS DATE BATF PRODUCT UNITS LOC. PRODUCT DESCRIPTION LOADED RETURNED USED ORDERED CLASS CODE CODE PD F 121 num to C (CM) N NIA

I have been offered 4 placards properly identifying this shipment as specified in 49 CFR subpart F of part 172.
I have received the above goods in apparent good order and condition, SIGN



## **Blaster's Daily Workplace Examination Record**

Mine Location: County LINE STONE

- D Haul Road
- Dia Bench Access Road
- D Highwalls
- Bench
- D Back Break

- Weather
- D PPE
- Equipment Parked Safely/Chocked/Brakes Set

Date:8 -1 - 22

- Dirst Aid Supplies Available
- D Loading Procedures Discussed

Comments: CLOMBY - DRY - PIT LOADER ON BENCH WORTH

DRILL ON UPPER BENCH NORTH

Print		Signature	Shot Tie In
Crew: James Had Donald Field	1/4	DAM	V
		0 1/	
Blaster in Charge: KENNETH	Print	Signatur	e



## **Event Report**

 Date/Time
 Vert at 11:05:04 August 1, 2022

 Trigger Source
 Geo: 0.030 in/s

 Range
 Geo: 10.000 in/s

 Record Time
 4.0 sec at 2048 sps

 Job Number:
 8

Serial NumberBE5206 V 10.72-4.32 MiniMate PlusBattery Level6.5 VoltsUnit CalibrationJanuary 20, 2022 by InstantelFile Name\_\_TEMP.EVT



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.100 in/s/div Mic: 0.001 psi(L)/div Trigger =

Sensor Check



Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Extended Note N42.96916W78.47730 Post Event Notes No text to be displayed.

Geophone Peak Particle Velocity Zero Crossing Frequency Time (Relative to Trigger) Peak Acceleration Peak Displacement Sensor Check Frequency **Overswing Ratio** 

#### **Peak Vector Sum**

**ISEE Linear Microphone** Peak Sound Pressure Level **Peak Sound Pressure Level** Time (Relative to Trigger) **Zero Crossing Frequency** Sensor Check Frequency Test Amplitude

Long at August 1, 2022 11:06:52 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Old Entrance.mmb Operator

Vert 0.0379 in/s

66.1 Hz

0.063 g

0.000 in

3.7

V Passed 7.3 Hz

0.722 sec

89.0 Hz

0.059 g

0.000 in

7.3 Hz

3.8

0.0494 in/s at 0.722 sec

Passed

0.196 sec

**Old Entrance** 

IGS, Inc.

Tran 0.0469 in/s

70.6 Hz

0.086 g

0.000 in

7.3 Hz

3.7

V Passed

0.002849 psi

119.8 dB(L)

1.230 sec

9.8 Hz

20.5 Hz 1376 mv

0.451 sec

**County Line Stone** Akron, NY

Serial Number Model Number Battery Level Unit Calibration **Event File Name USB Sensor Support** 

UM8727 Micromate ISEE 10.90GC 3.8 volts January 20, 2022 by Instantel UM8727\_20220801110652.IDFW Disabled

ocation: Old Ent Dist: 1,512 ft

0.2

0.1

0.05

0.0394



ø øø 1 5 10 20 50 100 2 Frequency (Hz) x Vert Ø Long

Sensor Check









Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Extended Note N42.96916W78.47730 Post Event Notes No text to be displayed.

Long at August 1, 2022 11:06:52 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Old Entrance.mmb Operator Serial Number Model Number Battery Level Unit Calibration Event File Name USB Sensor Support INTEGRATED GEOTECHNICAL SOLUTIONS, INC.

UM8727 Micromate ISEE 10.90GC 3.8 volts January 20, 2022 by Instantel UM8727\_20220801110652.IDFW Disabled

Tran - Dominant Frequency 85.0 Hz, Amplitude 0.0009 in/s (Peak Particle Velocity: 0.0469 in/s)

IGS, Inc.

**Old Entrance** 

County Line Stone Akron, NY



Vert - Dominant Frequency 40.6 Hz, Amplitude 0.0009 in/s (Peak Particle Velocity: 0.0379 in/s)



Long - Dominant Frequency 46.9 Hz, Amplitude 0.0015 in/s (Peak Particle Velocity: 0.0465 in/s)



Mic - Dominant Frequency 3.1 Hz, Amplitude 0.00012 psi (Peak Sound Pressure Level: 0.002849 psi)



Shot 41, 2022

Employee Locker Room Dist: 1,036 ft .375 mls 114 dB Old Entrance Dist: 1,512 ft 04 ink 119 dB



Santon Balance	F	AST R	FPORT	miller	
Hilltop Energy	1.00000	GENERAL INFORM	MATION		ltop ergy inc.
MSHA Sh	104 4 2, 2022 Blas	t Report Numb	er 22-CL-42/15293	~11/2	
Permittee			Date / 7	Fime 8/1/2022	11:16am
Customer Count	y Line Stone		Permi	it No. 902704	· · · · ·
Location of Blast	Akron, NY	1	_at 42° 58'	42.8 N	- X
Blasting Compan	y Hilltop Energy LeF	Roy NY Lo	ng 78° 28'	27.6 W	- Y
Nearest Protected	d Structure West	Shurr Rd gate		Method Handhe	ld GPS -
Nearest Protected	d Lat 42°58'35.3	Long 78°2	8 30.7 SD to nea	rest protected 2/6	5.7 154.7
Distance and Dire Est. PPV 0.20 ip	ection 85	52ft S, 2	202° Type o	f Material Blasted	Limestone
Other Protected \$	Structure Brine Lin	e		Total Tons	11700
Other Protected	Lat 42°58'39.9	<b>Long</b> 78°2	7 48.4	Total YD <sup>3</sup>	5200
Distance and Dire	ection 3,13	32ft E,	94 <sup>°</sup>	PF: tons/lb	2.2
Weather Conditio	ons Cloudy / Calm	75° F		lbs/yd <sup>3</sup>	1.0
Wind out of the	SW @ 3-8 mph	BLAST INFORMATIC	Matts o	r Protection Used	None used
Total Weight and	Type(s) of Explosi	ves used: see a	attachment	Blast Type Product	ion
0.00	<b>ANFO</b> 5,344.00 lbs.	Emulsion 0.00 lbs.	Packaged 0.00 lbs.	<b>32 Primers</b> 32.00 lbs.	Fotal Weight 5,376.00 lbs.
<b>Total Holes</b>	32 Angle 0°	Drill			
Depth (ft)	25	Burden (ft)	13.5	Backfill (ft)	0
Face Height (ft)	25	Spacing (ft)	13	Stemming (ft)	6
Sub Drill (ft)	0	Diameter (in)	5.250 5.250	Stem Type #1	Stone
Maximum Weight	t of Explosives Allo	wed per 8ms P	'eriod (lbs): 240	) as determined	by SD of : 55
Maximum Weigh	t of Explosives deto	onated per 8ms	( <b>Ibs)</b> : 168 in	1.00 Holes	
		ATION PRODUCT INFOR	MATION	Oti Deseter Tune	Data Cada Oty
Delay Type UNITRONIC 600 30FT	Date Code Qty 18AP22 7	Delay Type	Date Code	aty Booster Type 1Lb.	22MA22 32
UNITRONIC 600 30FT	02MY22 25	Blasting (	iost'		
		Drillinez (	: 120,	Accessory Ty Duplex 500' Unitronic HARNI	pe Qty 1 ESS WIRE 1
Firing Method : Electr Blasting Unit : Unitro	ic Circuit Type mics 310 Initiated by	: Echelon T : Electronic	Гіmer (ms) : NA Circuits :		
Face checked / sho	t cleared	Comments			

BlastdataG4 Blast Plan

Operation County Line Stone Permit Number 902704 Blast Number 22-CL-42/15293

8/1/2022

Date

Blast Type Production



BLAST I HOLE	NUMBE DESCI	R 22-C	N N							Blast Hole Loading Diagram Face Height (FT) 25
Hole Number	Depth (FT)	Angle (Deg)	Subdrill (FT)	Burden (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd³	PF tons/lb	Hole Dia (in) 5.250
1-32	25	0	0	13.5	13.0	6	163	1.0	2.2	6' Stemming
				** To	otal Holes	loade	ed san	ne: 32		
EXPLO Proc	SIVES	ne					Pound	s		
1 ANF	0					3	167.0	0		
2										
3										19',ANFO,0.85g/cc @ 6 '
4										
				Total I	bs. / hole		167.0	00		
Prime Pri	ERS imer Na	ne		Qty	E> Tot	(PLOS	IVES 7	otals	32	
1 1Lb.				1					02	
2					Per	Hole	**	Per Ty	pe**	
	Prin	er Ibs /	hole.	1.00	168	.00	4	5376.	00	
		_								



SOLD TO:

FED. LIC. #

TRUCK NO.

8450 Circular Hill Rd. Leroy, NY 14482 (585) 768-4860

DRIVER

#### NWD A SHESEMART OF B. W. DICILIT & SOA, BC.

DELIVERY TICKET NO. HTY 15293 DATE SHIPPED

- A

P.O. NO. \_\_\_\_\_ TRAILER OUT: \_\_\_\_\_ IN:

NO WARRANTY EXCEPT MERCHANTABILITY SHALL APPLY TO THIS MATERIAL. ANY SUGGESTION BY SELLER OR MANUFACTURER AS TO THE USE OR APPLICATION OF

LOCATION:	N:			267	J. in	THIS MATERIAL IS A STATEMENT OF OPINION ONLY AND			
MAGAZINE:	Mineral City (330) 859-2	y 2108	Vanlue (419) 387-7713	Lisbon (330) 424-1401	Leroy (585) 768-4860	Gouverneur (315) 782-6826		IT OF THE RESULT	S TO DE OBTAINED.
	BATF CLASS	LOC.	PRODUCT DE	SCRIPTION	PRODUCT CODE	DATE CODE	UNITS LOADED	UNIT'S RETURNED	UNITS
	BR		Sulle AI	pc	MTE	BI AULL			5344 165
	R		EAGINT	Bouster	Dustin	ZZMIAZZ			3200
	N		30 Marine	Wic Goo	QUILA	18 RP ZZ			700
	~		se carigi	pris ore	UTICII	player			dista
	NR		HARRESSL	vire	Scound	MA			1- rell
	NIN		5th Jup /c	· hora	Contract	144			10121
							- Anna		
					parameter		1		

I have been offered 4 placards properly identifying this shipment as specified in 49 CFR subpart F of part 172. I have received the above goods in apparent good order and condition. SIGN



Waveform Trigger Source Trigger Level(s) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Long at August 1, 2022 11:17:18 Adv 0.02 0.25 sec/3.00 sec (Fixed) 32768 sps County Line - N Treeline Analysis.nsa **Operator 1** 

North Treeline

**County Line Stone** 

Serial Number **Model Number Battery Level Unit Calibration Sensor Callbration Event File Name** 

Location: N, of

Dist: 650 ft

Face



MP14241 Minimate Pro 4 10.75 4.1 volts September 16, 2021 by Instantel SD13737, September 16, 2021 by Instantel MP14241\_20220801111718.IDFW

Notes Location Client Company **General Notes** 







Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Extended Note N42.976432,,W-78.475634 Post Event Notes No text to be displayed.

Geophone Peak Particle Velocity Zero Crossing Frequency Time (Relative to Trigger) Peak Acceleration Peak Displacement Sensor Check Frequency **Overswing Ratio** 

Peak Vector Sum

**ISEE Linear Microphone** Peak Sound Pressure Level Peak Sound Pressure Level Time (Relative to Trigger) **Zero Crossing Frequency** Sensor Check Frequency Test Amplitude



Vert 0.0838 in/s

47.6 Hz

0.095 g

0.000 in Passed 7.3 Hz

4.6

0.1618 in/s at 0.096 sec

0.088 sec

Long 0.1431 in/s 45.5 Hz

0.095 sec

0.115 g 0.001 in

4.6

Passed 7.3 Hz

**Yellow House** 

Akron, NY

Tran 0.1216 in/s

33.6 Hz 0.244 sec

0.122 g

0.001 in

7.1 Hz 4.9

**Passed** 

0.001870 psi

116.2 dB(L)

0.731 sec 16.5 Hz Passed

20.5 Hz 1332 mv

IGS, Inc.

**County Line Stone** 

Serial Number Model Number Battery Level Unit Calibration **Event File Name USB Sensor Support** 



UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220801111719.IDFW Disabled

Location: yellow Hurse

Dist: 815 ft



Frequency (Hz) x Vert Ø Long Sensor Check



Created by version 1.3.0.12.



Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Extended Note N42.976432,,W-78.475634 Post Event Notes No text to be displayed.

Vert at August 1, 2022 11:17:19 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Yellow House.mmb Operator Serial Number Model Number Battery Level Unit Calibration Event File Name USB Sensor Support INTEGRATED GEOTECHNICAL SOLUTIONS, INC.

UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220801111719.IDFW Disabled

Tran - Dominant Frequency 41.1 Hz, Amplitude 0.0023 in/s (Peak Particle Velocity: 0.1216 in/s)

IGS, Inc.

Yellow House

County Line Stone Akron, NY



Vert - Dominant Frequency 40.6 Hz, Amplitude 0.0013 in/s (Peak Particle Velocity: 0.0838 in/s)



Long - Dominant Frequency 40.2 Hz, Amplitude 0.0025 in/s (Peak Particle Velocity: 0.1431 in/s)







Created by version 1.3.0.12.

# Shot 42, 2022

North of Face Dist: 650 ft .39 mls, NIA dB yullow House Dist: 815 ft .14 mls, 116 dB



Hilltop Energy	UZ 207	Blast Re	AST RE General Informatic		<b>RT</b>		illtop 1ergy inc
Permittee	45,000	Juast Ne		Da	ite / Time	8/5/2022	11:02am
Customer Count	y Line Stone				Permit No	. 902704	THOEGHT
Location of Blast	Akron, NY		Lat	42°	58 40	8 N	v
Blasting Compan	v Hilltop Ener	av LeRov N	JY Long	78°	28' 28	8'w	- X
Nearest Protecte	d Structure	West Shur	r Rd gate	10	20 20. M	ethod Handh	- Y
Nearest Protecte	d Lat $42^{\circ}51$	3 35.3 Lo	ng 78°28'?	30 7 SD	to nearest	protected 2/	47.2 /111.4
Distance and Dire	ection	617 ft	S. 199	,	io nouroot	biorooroa //	V.
Est. PPV 0.34 ip	)\$		0, 100	Т	ype of Ma	terial Blaster	d Limestone
Other Protected \$	Structure Bri	ne Line		1.2		Total Tons	s 18416
Other Protected	Lat 42 58	3 39.9 Lo	ng 78 27 4	8.4		Total YD	3 8185
Est. PPV 0.02 ip	ection	3,213 ft	E, 91			PF: tons/lk	2.0
Weather Conditio	ons Cloudy	' Calm	82° F			lbs/yd	<sup>3</sup> 1.1
Wind out of the	N@ 2-5	mph BL	AST INFORMATION	Ma	atts or Pro	etection Used	None used
<b>Total Weight and</b>	Type(s) of Ex	plosives u	used: see atta	chment	Blast	Type Produc	ction
0.00	ANFO 8,100.00 II	os.	Emulsion 0.00 lbs.	Packa 1,080.00	iged 54 0 lbs.	Primers 54.00 lbs.	Total Weight 9,234.00 lbs.
<b>Total Holes</b>	54 Angle	0° Drill	6				
Depth (ft)	25	Bur	rden (ft) 1	3 - 1	4 E	Backfill (ft)	0
Face Height (ft)	25	Spa	acing (ft) 1	3	Ster	nming (ft)	5.5
Sub Drill (ft)	0	Dian	neter (in) 5.2	250 5.2	250 S	tem Type #	1 Stone
Maximum Weight	of Explosive	s Allowed	per 8ms Peric	od (lbs)	: 126 as	s determined	by SD of : 55
Maximum Weight	of Explosive	s detonate	d per 8ms (lb	s): 171	in 1.00	Holes	
		INITIATION P	RODUCT INFORMATIC	ON			
Delay Type UNITRONIC 600 30FT	Date Code 18AP22	Qty Dela 24	у Туре	Date	Code Qty	Booster Type 1Lb.	Date Code Qty 29MA22 54
UNITRONIC 600 30FT	02MY22	30				1.000	

Blasting Cost: Drilling Cost:

Accessory Type Qty Duplex 500' 1

Firing Method : Electric	Circuit Type : Echelon	Timer (ms) : NA	
Blasting Unit : Unitronics 310	Initiated by : Electronic	Circuits :	
ace checked / shot cleared	Comments	3	

BlastdataG4 Blast Plan

F

Operation County Line Stone Permit Number 902704

Blast Number 22-CL-43/15304 Blast Type Production

Date

8/5/2022

	Timing Pattern	
	OPEN FACE	)
432 40	18 384 380 338 312 288 284 240 216 192 168 144 120	95 <b>4</b> 8 <b>9 24 7</b> 2
584 50	0 538 512 468 484 440 416 392 368 344 320 298 272	248 200 152 176 224
733 71.	2 658 664 640 618 592 565 544 520 496 472 448 424	400 352 304 328 378
	SOLID	
	SEISMOCHARL INFORMATION	
Plant Pasarding Lasations	9/5/2022 11:02 AM	
Seis SN_Location Dist (ft)	_Dir, SD_TPPV_THz_VPP	V V Hz L PPV L Hz Air dB Air Hz
Reading(s) taken by :CLS	Analyz	zed by :CLS
Blaster Name and Certification N	BLASTER INFORMATION	0
Ken Rymer	Scott C	Customer Signature :
00-4660	JIM H	
BlastdataG4 Blast Plan	Page 2.0	Blast Plan Number 22-CL

BLAST NUMBER 22-CI HOLE DESCRIPTION TYPICAL HOLE								Blast Hole Loading Diagram Face Height (FT) 25		
Hole Depth Angle Subdrill Burder Number (FT) (Deg) (FT) (FT)				Burden (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd³	PF tons/lb	Hole Dia (in) 5.250
1-19	25	0	0	14.0	13.0	5.5	169	1.0	2.2	5.5 ' Stemming
EXPLC Prod 1 POW 2 ANF 3 4	OSIVES duct Nar VERAN O	ne 1 500 4	4 X 20	Total	lbs. / hole		Pound 20.0 150.0	s )0 )0 )0		17 ' ANFO,0.85g/cc @ 5.5 '
Prime Pr 1 1Lb.	ERS fimer Na	me		Qty 1	E Tot	XPLOS tal Prin	IVES Ther Qty	TOTALS	5 19 ///////////////////////////////////	
2	Prir	ner lbs	/ hole.	1.00	Per 17	1.00		3249.	<b>00</b>	2255POWERAN 500 4 X 20,1.34g/cc @

BLAST NUMBER 22-CI HOLE DESCRIPTION TYPICAL HOLE									Blast Hole Loading Diagram Face Height (FT) 25	
Hole Number	Depth (FT)	Angle (Deg)	Subdrill (FT)	Burden (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd <sup>3</sup>	PF tons/lb	Hole Dia (in) 5.250
20-54	25	0	0	13.0	13.0	5.5	156	1.1	2.1	5.5 ' Stemming
				** To	otal Holes	s loade	ed san	ne: 35		
EXPLO Proc 1 POW 2 ANF( 3	SIVES luct Nar /ERAN O	ne   500 -	4 X 20				Pound 20.0 150.0	s 0 0		17 ' ANFO,0.85g/cc @ 5.5 '
4										
				Total I	bs. / hole		170.0	00		
Prime Pri 1 1Lb.	RS mer Na	me		Qty 1	E: Tot	(PLOS al Prim	IVES 7 Ier Qty	OTALS	3 35	
2	Prin	ner Ibs /	hole.	1.00	Per <b>171</b>	Hole .00	**	Per Ty 5985.	pe** 00	2255POWERAN 500 4 X 20,1.34g/cc @



8450 Circular Hill Rd. Leroy, NY 14482 (585) 768-4860

## DELIVERY TICKET NO. HTY 15304

A SERVICIANT OF & M. DICITI & SOIL INC.

DATE SHIPPED P.O. NO. \_\_\_\_\_

TRAILER OUT: \_\_\_\_\_ IN: \_\_\_\_

SOLD TO: _	12212	L.L.	Calls Int NOVALS	FED, LIC,	#		NO WARRANTY EXCEPT MERCHANTABILITY SHALL APPLY TO THIS MATERIAL. ANY SUGGESTION BY SELLER OR MANUFACTURER AS TO THE USE OR APPLICATION OF THIS MATERIAL IS A STATEMENT OF ORIMION ONLY AND			
		The second		TRUCK NO	р. <u>7 / /</u> р	RIVER				
MAGAZINE:	Mineral City Vanlue				Lerov	0	IS NOT WARRANTY OF THE RESULTS TO BE OBTAINED.			
	(330) 859-2108		(419) 387-7713	(330) 424-1401	(585) 768-4860	(315) 782-6826				
	BATF CLASS	LOC.	PRODUCT DE	SCRIPTION	PRODUCT CODE	DATE CODE	UNITS		UNITS	
	Lt-		States A	N F. D	ME	95 KG4 22			81 00 160	
			0							
	las-		Care and the second second	<u>- 4x-9-</u>	41.0	LOMY			1080 -	
	A		Ellate 120	Render	no stad	20000107			-0	
					Real II	de TANG CL			S. V. S. Streemen	
	A		36 Luste	1 jeber	Oricon	182222			2.400	
	19		201 Laite	million	Driver	0211922			20 era	
	6.10									
	ZVN.		t-11-1-1-1-9-05	Edd Comment	SQL 1 PERLE	N.I.			1- 7.9.11	
	NE		way of all	a later					247	
						1 day				
		_								
			4							
1										
							200			

I have been offered 4 placards properly identifying this shipment as specified in 49 CFR subpart F of part 172. I have received the above goods in apparent good order and condition. SIGN



## **Blaster's Daily Workplace Examination Record**

Mine Location: COUNTY LINE STONE

- 🔟 Haul Road
- <sup>2</sup> Bench Access Road
- D Highwalls
- D Bench
- D Back Break

- **Weather**
- Equipment Parked Safely/Chocked/Brakes Set

Date: 8-5-22

- **J** First Aid Supplies Available
- D Loading Procedures Discussed

Comments: CLOWDY - DRY - STURMS IN AREA - NO PIT ACTIVITY

NEAR SHOTS

	Print	Signature	Shot Tie In
Crew:	James Hurd	Att	<u>~</u> ,
	Donald Riedle-	Null Clar	
	201 Clark	SCAT CUMA	
	Jemes DUL brak	for allight	<u> </u>
		1	
Blaste	r in Charge: KENNETH L Ryr	nrr	
	Print	Signatu	re



Vert at August 5, 2022 11:02:53 Geo 0.0200 in/s

County Line - Yellow House.mmb

Vert 0.4214 in/s

73.1 Hz

Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed)

4096 sps

Operator

**Yellow House** 

Akron, NY

Tran 0.6051 in/s

43.6 Hz

IGS, Inc.

**County Line Stone** 

Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Geophone

**Peak Particle Velocity** 

Extended Note N42.976432,,W-78.475634 Post Event Notes No text to be displayed.

Zero Crossing Frequency Time (Relative to Trigger) Peak Acceleration 0.206 sec 0.161 sec 0.321 sec 1 1 1 1 1 1 1 Lini 10 0.441 g 0.444 g 0.530 g Peak Displacement 0.002 in 0.001 in 0.002 in Sensor Check Passed Passed Passed Frequency 7.3 Hz 7.3 Hz 5 7.1 Hz **Overswing Ratio** 4.6 4.6 4.9 0.6929 in/s at 0.161 sec Peak Vector Sum 2 **ISEE Linear Microphone** Peak Sound Pressure Level 0.001483 psi Peak Sound Pressure Level 114.2 dB(L) Velocity (in/s) 1 0.565 sec 14.8 Hz Passed Time (Relative to Trigger) **Zero Crossing Frequency** Sensor Check 0.5 19.7 Hz Frequency Test Amplitude 1304 mv 0.2 0.1 0.05 ø 0.0394 5 10 20 50 100 2 Frequency (Hz) Sensor Check x Vert 0.8 0.6 0.4 0.2 -0.2 -0.4 Velocity(in/s) WWWW Tran -0.6 2 3 4 5 0 1 Passed Time(sec) 0.8 0.4 0.2 0 -0.2 -0.4 -0.6 Velocity(in/s) Malanhala adding -----Vert -0.8 2 3 4 5 0 1 V Passed Time(sec) 0.8 0.6 0.4 0.2 -0.2 -0.4 -0.6 -0.8 Velocity(in/s) Long 2 3 4 5 C 1 V Passed Time(sec) Pressure(psi) Mic 4 5 1 2 3 0 V Passed Time(sec)

INTEGRATED GEOTECHNICAL SOLUTIONS, INC.

Serial Number Model Number **Battery Level Unit Calibration Event File Name USB Sensor Support** 

Location: yellow House

Dist: 571 ft

Long 0.5089 in/s

52.5 Hz

UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220805110253.IDFW Disabled

**USBM RI8507 And OSMRE** 

Velocity versus Frequency (Zero Crossing)



Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Extended Note N42.976432,,W-78.475634 Post Event Notes No text to be displayed.

Vert at August 5, 2022 11:02:53 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Yellow House.mmb Operator Serial Number Model Number Battery Level Unit Calibration Event File Name USB Sensor Support INTEGRATED GEOTECHNICAL SOLUTIONS, INC.

UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220805110253.IDFW Disabled

Tran - Dominant Frequency 39.2 Hz, Amplitude 0.0258 in/s (Peak Particle Velocity: 0.6051 in/s)

Yellow House

Akron, NY

IGS, Inc.

**County Line Stone** 



Vert - Dominant Frequency 39.9 Hz, Amplitude 0.0104 in/s (Peak Particle Velocity: 0.4214 in/s)



Long - Dominant Frequency 40.1 Hz, Amplitude 0.0168 in/s (Peak Particle Velocity: 0.5089 in/s)



Mic - Dominant Frequency 2.9 Hz, Amplitude 0.00007 psi (Peak Sound Pressure Level: 0.001483 psi)





Instantel Waveform Trigger Source Trigger Level(s) Pre-Trigger/Record Time Sample Rate **Setup File Name** Operator

Notes Location

Client

123

Company

**General Notes** 

Long at August 5, 2022 11:02:53 Adv 0.02 0.25 sec/3.00 sec (Fixed) 32768 sps County Line - N Treeline Analysis.nsa Operator 1

North Treeline County Line Stone Akron, NY

IGS, Inc.

Serial Number Model Number **Battery Level Unit Calibration Sensor Calibration Event File Name** 

N. of Face

f+

MP14241 Minimate Pro 4 10.75 4.1 volts September 16, 2021 by Instantel SD13737, September 16, 2021 by Instantel MP14241\_20220805110253.IDFW

Extended Note N 42.98073, W -78.47496 Post Event Notes No text to be displayed. Units Peak Peak Time **Trigger Level** Range Channel Name 10 10 10 in/s in/s in/s 0.0934 0.170 0.02 Tran 0.02 0.0611 0.379 Vert 0.02 0.0878 0.173 Long 0.12 0.1 0.08 0.06 0.04 0.02 Tran Tran(in/s) 0 -0.02 -0.04 -0.06 -0.08 -0.1 -0.12 2.5 1 1.5 2 0.5 0 Time(sec) 0.07 0.06 0.05 0.04 0.03 0.02 Vert Vert(in/s) 0.01 0 -0.01 -0.02 -0.03 -0.04 -0.05 -0.06 -0.07 2.5 2 0 0.5 1 1.5 Time(sec) 0.12 0.1 0.08 0.06 0.04 0.02 (s/u) Suor -0.02 -0.04 -0.06

Dist: 911

#### Created by version 1.3.0.12.

0

0.5

-0.08 -0.1 -0.12

Time(sec)

1

1.5

2

3

2.5

3

3



Hilltop Energy BLAST F			litop
MSHA Shot 44,2022 Blast Report Numb	er 22-CL-44/15305		lergy inc
Permittee	Date / Time	8/5/2022	11:10am
Customer County Line Stone	Permit No	. 902704	
Location of Blast Akron, NY	Lat 42° 58' 44.	9 'N	- X
Blasting Company Hilltop Energy LeRoy NY	ong 78° 28' 24.	5'w	
Nearest Protected Structure West Shurr Rd gate	M	ethod Handhe	eld GPS -
Nearest Protected Lat 42°58 35.3 Long 78°2	8 30.7 SD to nearest	protected 27	9.0 193.5
Distance and Direction 1,155 ft SW, 2	213°	• · · · · · · · · · · · · · · · · · · ·	and W
Est. PPV 0.15 ips	Type of Ma	terial Blasted	Limestone
Other Protected Structure Brine Line		<b>Total Tons</b>	23256
Other Protected Lat 42 58 39.9 Long 78 2	7 48.4	Total YD <sup>3</sup>	10336
Est. PPV 0.03 ips 2,920 ft E,	98	PF: tons/lb	1.8
Weather Conditions Cloudy / Calm 82° F		lbs/vd <sup>3</sup>	1.4
Wind out of the N @ 2-5 mph BLAST INFORMATION	Matts or Pro	tection Used	None used
Total Weight and Type(s) of Explosives used: see a	attachment Blast	Type Product	tion
POWERAN 2500 ANFO Emulsion	Packaged 74	Primers	Total Weight
12,660.00 0.00 lbs. 0.00 lbs.	560.00 lbs.	74.00 lbs.	13,294.00 lbs
Total Holes 37 Angle 0 ° Drill			
Depth (ft) 48 - 54 Burden (ft)	12 - 14 E	Backfill (ft)	0
Face Height (ft) 48 - 54 Spacing (ft)	12 Ster	nming (ft)	6 - 22.5
Sub Drill (ft) 0 Diameter (in)	5.250 5.250 \$	tem Type #1	Stone
Maximum Weight of Explosives Allowed per 8ms P	eriod (Ibs): 441 as	determined	by SD of : 55
Maximum Weight of Explosives detonated per 8ms	(lbs): 214 in 0.50	Holes Decke	d Blast)
INITIATION PRODUCT INFORM	MATION		
Delay TypeDate CodeQtyDelay TypeUNITRONIC 600 30FT02MY2237	Date Code Qty	Booster Type 1Lb.	Date Code Qty 29MA22 74
UNITRONIC 600 65FT 04AP22 37 Blasting Co	st \$11,959.00		
Dulling Co	st:\$ 5,661.00	Accessory Typ Unitronic HARNE	oe Qty SSWIRE 1
Firing Method : Electric       Circuit Type : Echelon       T         Blasting Unit : Unitronics 310       Initiated by : Electronic	imer (ms) : NA Circuits :	1	
ace checked / shot cleared COMMENTS		I	
BlastdataG4 Blast Plan Page 1.0		Blast Plan Nu	mber 22-CL

Operation County Line Stone Permit Number 902704 Blast Number 22-CL-44/15305 Blast Type Production Date 8

8/5/2022

ermit Number 902704	Blast Type Production	
	Timing Pattern	
	OPEN FACE	
	592 580 528 495 484 432 400 388 338 304 272 240 208 176 144 1 576 544 512 480 448 418 384 352 320 288 256 224 192 160 128 6 760 728 695 684 632 600 585 538 504 472 440 408 376 344 280 2	GPS GPS
	744 712 680 648 618 584 552 520 488 456 424 392 380 328 264 2 SOLID	00 232 298
	Seismograph Information	
Blast Recording Lo Seis SN Location	cations 8/5/2022 11:10 AM Dist (ft) Dir. SD T PPV T Hz V PPV	V Hz L PPV L Hz Air dB Air H
Reading(s) taken by	CLS Analyze	d by :CLS
laster Name and Ce Ken Rymer 0-4660	ertification Number: Crew: Don F Scott C Jim H	Customer Signature :
BlastdataG4 Blast Plan	Page 2.0	Blast Plan Number 22-(





BLAST NUMBER 22-CI HOLE DESCRIPTION TYPICAL HOLE										Blast Hole Loading Diag Face Height (FT) 54		
Hole Number	Depth (FT)	Angle (Deg)	Subdrill (FT)	Burden (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd³	PF tons/lb		Hole Dia (in) 5.250	
20-29	54	0	0	12.0 ** To	12.0 stal Holes	6 s loade	288 ed san	1.5 ne: 10	1.5		6 ' Stemming	
EXPLO Proc 1 POW 2 POW 3 POW 4	SIVES Juct Nar (ERAN (ERAN (ERAN	ne   500 4   2500   2500	4 X 20				Pound 20.0 190.0 215.0	s 0 0 0			21.5 ' POWERAN 2500,1.17g/cc @ 6 '	
				Total II	bs. / hole		425.0	0				
PRIME Prin 1 1Lb.	RS mer Nar	ne		Qty 2	E> Tota	(PLOSI al Prim	∨ES T er Qty*	OTALS	; 20		5 ' Cr. Stone @ 27.5 ' 19 ' POWERAN 2500,1.17g/cc @ 32.5 '	
2	Prim	er Ibs /	hole.	2.00	Per   <b>427</b>	Hole .00	**	Per Ty <b>1270.(</b>	pe** <b>)0</b>		₿.₺₽OWERAN 500 4 X 20,1.34g/cc @	

-
BLAST I HOLE	NUMBE Desci	R 22-C	l N				٦	YPICA	l Hole	1	Blast Hole Loading Diagram Face Height (FT) 48
Hole Number	Depth (FT)	Angle (Deg)	Subdrill (FT)	Burden (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd³	PF tons/lb		Hole Dia (in) 5.250
30-37	48	0	0	12.0	12.0	6	256	1.4	1.6	1	6' Stemming
				** To	tal Holes	loade	ed san	ne: 8			
EXPLO Proc 1 POW 2 POW 3 POW 4	OSIVES duct Nar /ERAN /ERAN /ERAN	me   500 /   2500   2500	4 X 20				Pound 20.0 160.0 185.0	s 0 0 0		-	18,5 ' POWERAN 2500,1.17g/cc @ 6 '
				Total I	bs. / hole		365.0	0			
Prime Pri 1 1Lb.	RS imer Na	me		Qty 2	E> Tota	(PLOS al Prim	IVES T	OTALS	5 16		5 ' Cr. Stone @ 24.5 ' 16 ' POWERAN 2500,1.17g/cc @ 29.5 '
2	Prin	ier Ibs /	hole.	2.00	Per <b>367</b>	Hole .00	**	Per Ty 2936.0	pe** <b>)0</b>		දණුPOWERAN 500 4 X 20,1.34g/cc @



SOLD TO:

FED. LIC. #\_\_\_\_

8450 Circular Hill Rd. Leroy, NY 14482 (585) 768-4860

DRIVER

# DELIVERY TICKET NO. HTY 15305

 DATE SHIPPED \_\_\_\_\_\_\_ P.O. NO. \_\_\_\_\_\_ TRAILER OUT: \_\_\_\_\_\_ IN: \_\_\_\_\_\_

NO WARRANTY EXCEPT MERCHANTABILITY SHALL APPLY TO THIS MATERIAL. ANY SUGGESTION BY SELLER OR MANUFACTURER AS TO THE USE OR APPLICATION OF THIS MATERIAL IS A STATEMENT OF OPINION ONLY AND IS NOT WARRANTY OF THE RESULTS TO BE OBTAINED.

LOCATION:	177	- NCA		· · · · · · · · · · · · · · · · · · ·		THIS MATERIAL I	S A STATEMENT OF	OPINION ONLY AND
MAGAZINE:	Mineral Cit	у	VanlueLisbon	Leroy	Gouverneur	IS NOT WARHAN	TY OF THE RESULTS	TO BE OBTAINED.
	(330) 859-2	2108	(419) 387-7713 (330) 424-1401	(585) 768-4860	(315) 782-6826			
ORDERED	CLASS	LOC.	PRODUCT DESCRIPTION	PRODUCT CODE	DATE			UNITS
	11		Represent 2500	25E	05 h1679	LONDLD		USED
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L						//	A	

TRUCK NO. \_\_\_\_\_\_

I have been offered 4 placards properly identifying this shipment as specified in 49 CFR subpart F of part 172. I have received the above goods in apparent good order and condition. SIGN







Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company

**General Notes Extended** Note N42.976432,,W-78.475634

Post Event Notes No text to be displayed.

Geophone **Peak Particle Velocity Zero Crossing Frequency** Time (Relative to Trigger) Peak Acceleration Peak Displacement Sensor Check Frequency **Overswing Ratio** 

#### Peak Vector Sum

**ISEE Linear Microphone** Peak Sound Pressure Level Peak Sound Pressure Level Time (Relative to Trigger) Zero Crossing Frequency Sensor Check Frequency Test Amplitude

Long at August 5, 2022 11:11:03 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Yellow House.mmb Operator

Vert 0.0329 in/s

50.0 Hz

0.036 g

0.000 in

Passed 7.3 Hz

4.6

4.6

0.0651 in/s at 0.595 sec

0.383 sec

Yellow House County Line Stone

Akron, NY

Tran 0.0438 in/s 28.8 Hz

0.358 sec

0.043 g

0.000 in

Passed 7.1 Hz

0.005599 psi

125.7 dB(L)

0.905 sec 5.5 Hz Passed 19.7 Hz

1304 mv

4.9

IGS, Inc.

Serial Number Model Number **Battery Level Unit Calibration Event File Name USB Sensor Support** 

UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220805111103.IDFW Disabled

W

INTEGRATED

GEOTECHNICAL SOLUTIONS, INC.

Location: yellow those bist : 1,135 ft





Created by version 1.3.0.12.



Extended Note N42.976432,,W-78.475634 Post Event Notes No text to be displayed.

Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes Long at August 5, 2022 11:11:03 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Yellow House.mmb Operator

Yellow House County Line Stone Akron, NY IGS, Inc. Serial Number Model Number Battery Level Unit Calibration Event File Name USB Sensor Support



UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220805111103.IDFW Disabled



Vert - Dominant Frequency 30.5 Hz, Amplitude 0.0021 in/s (Peak Particle Velocity: 0.0329 in/s)



Long - Dominant Frequency 30.6 Hz, Amplitude 0.0051 in/s (Peak Particle Velocity: 0.0540 in/s)



Mic - Dominant Frequency 3.1 Hz, Amplitude 0.00017 psi (Peak Sound Pressure Level: 0.005599 psi)





Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company **General Notes** 

Extended Note N42.97776W78.46345 Post Event Notes No text to be displayed.

Geophone **Peak Particle Velocity** Zero Crossing Frequency Time (Relative to Trigger) Peak Acceleration Peak Displacement Sensor Check Frequency **Overswing Ratio** 

Peak Vector Sum

**ISEE Linear Microphone** Peak Sound Pressure Level Peak Sound Pressure Level Time (Relative to Trigger) Zero Crossing Frequency Sensor Check Frequency Test Amplitude

Long at August 5, 2022 11:11:02 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Brine Pipeline.mmb Operator

Vert

0.0152 in/s

21.8 Hz

0.020 g

0.000 in

Passed 7.3 Hz

3.8

0.0226 in/s at 0.004 sec

0.423 sec

**Brine Pipeline** 

Akron, NY

Tran 0.0220 in/s

32.5 Hz

0.026 g

0.000 in

3.8

Passed 7.5 Hz

0.001017 psi

110.9 dB(L)

3.650 sec 3.5 Hz Passed 20.5 Hz

1329 mv

0.267 sec

IGS, Inc.

**County Line Stone** 

Serial Number **Model Number** Battery Level Unit Calibration **Event File Name USB Sensor Support**  UM7485 Micromate ISEE 10.90GC 3.8 volts January 20, 2022 by Instantel UM7485\_20220805111102.IDFW Disabled

5

INTEGRATED

GEOTECHNICAL SOLUTIONS, INC.

Location: Brine Line Dist: 2,521 44

#### Long 0.0214 in/s Velocity versus Frequency (Zero Crossing) 15.2 Hz 0.001 sec i i liiiil 1 1 1 1 1 1 10 0.023 g 0.000 in No velocity above 0.0394 in/s Passed 7.3 Hz 5 3.8 2 Velocity (in/s) 1 -0.5 0.2 0.1 0.05 0.0394 100 50 2 5 10 20

Frequency (Hz) x Vert ø Long

**USBM RI8507 And OSMRE** 

Sensor Check





Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Extended Note N42.97776W78.46345 Post Event Notes No text to be displayed.

Long at August 5, 2022 11:11:02 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Brine Pipeline.mmb Operator

Brine Pipeline County Line Stone Akron, NY IGS, Inc. Serial Number Model Number Battery Level Unit Calibration Event File Name USB Sensor Support



UM7485 Micromate ISEE 10.90GC 3.8 volts January 20, 2022 by Instantel UM7485\_20220805111102.IDFW Disabled

Tran - Dominant Frequency 18.5 Hz, Amplitude 0.0007 in/s (Peak Particle Velocity: 0.0220 in/s)



Vert - Dominant Frequency 6.0 Hz, Amplitude 0.0008 in/s (Peak Particle Velocity: 0.0152 in/s)



Long - Dominant Frequency 17.8 Hz, Amplitude 0.0007 in/s (Peak Particle Velocity: 0.0214 in/s)



Mic - Dominant Frequency 5.0 Hz, Amplitude 0.00009 psi (Peak Sound Pressure Level: 0.001017 psi)



yellow House Dist: 1,135 A North of Face Shot 44,2022 Dest: 734 ft \*05 mls 125 dB . 51 m/s

Brine Line. Seismograph

Dist: Z,SZIA .OZINS 110 dB

Hilltop Energy	BLAST REP GENERAL INFORMATION	ORT	ene	isy top irgy inc.
MSHA Shot 45,2022	Blast Report Number 22-C	L-45/15317	2 - 11 X -	
Permittee		Date / Time 8	/11/2022	11:05am
Customer County Line Stone		Permit No. 9	02704	
Location of Blast Akron, NY	Lat	42 <sup>°</sup> 58 3.3	N	- X
Blasting Company Hilltop Energy	y LeRoy NY Long	78 <sup>°</sup> 28′ 18.7′	W	- Y
Nearest Protected Structure	Rosies	Meth	hod Handhel	d GPS -
Nearest Protected Lat 42°58	22.5 <b>Long</b> 78 28 39.8	SD to nearest pr	rotected 2/19	5.3 468.3
Distance and Direction Est. PPV 0.03 ips	2,678 ft NW, 312°	Type of Mater	rial Blasted	Limestone
Other Protected Structure We	est Shurr Rd gate	_	Total Tons	21,060
Other Protected Lat 42°58	3'35.3 <b>' Long</b> 78 <sup>°</sup> 28'30.7	7	Total YD <sup>3</sup>	9360
Distance and Direction	3,607 ft N, 339°		PF: tons/lb	2. 🕼
Est. PPV 0.02 lps	20m 75° F		lbs/yd <sup>3</sup>	1.2
Wind out of the NW @ 4-12	mph BLAST INFORMATION	Matts or Prote	ection Used	None used
Total Weight and Type(s) of Ex	plosives used: see attach	ment Blast T	ype Producti	on
0.00 10,319.00 I	Emulsion bs. 0.00 lbs.	Packaged         57 I           340.00 lbs.         5	Primers T 7.00 lbs.	<b>otal Weight</b> 10,716.00 lbs.
Total Holes 57 Angle	o <sup>°</sup> Drill			
Depth (ft) 27	Burden (ft) 13	- 14 Ba	nckfill (ft)	0
Face Height (ft) 27	Spacing (ft) 13	Stem	ming (ft)	5.5
Sub Drill (ft) 0 Maximum Weight of Explosive	Diameter (in) 5.25 s Allowed per 8ms Period	0 5.250 Sta (Ibs): 2371 as	em Type #1 determined l	Stone by SD of: 55
Maximum Weight of Explosive	es detonated per 8ms (lbs)	:188 in 1.00	Holes	
Delay TypeDate CodeUNITRONIC 600 30FT02MY22	INITIATION PRODUCT INFORMATION Qty Delay Type 57	Date Code Qty	Booster Type 1Lb.	Date Code Qty 29MA22 57
	Blasting Cos Drilling Cos	+.49,096.82 +.54,617.00	Accessory Ty Unitronic HARNE	<b>pe Qt</b> ESS WIRE 2
Firing Method : Electric       Circl         Blasting Unit : Unitronics 310       Init	uit Type : Echelon Timer iated by : Electronic Circ	(ms) : NA :uits :		
Face checked / shot cleared	Comments			
BlastdataG4 Blast Plan	Page 1.0		Blast Plan N	umber 22-C



Blast N Hole	NUMBEI DESCF	R 22-C	l N		Blast Hole Loading Diagram Face Height (FT) 27					
Hole Number	Depth (FT)	Angle (Deg)	Subdrill (FT)	Burden (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd³	PF tons/lb	Hole Dia (in) 5.250
1-19	27	0	0	14.0	13.0	5.5	182	1.0	2.2	5.5 ' Stemming
				** To	tal Holes	s loade	ed san	ne: 19	: 	
EXPLO Proc	SIVES duct Nar	ne					Pound	s		
1 ANFO	С						187.0	0		
2										
3										21.5',ANFO,0.85g/cc @ 5.5 '
4						-				
				Total I	bs. / hole		187.0	00		
PRIME	RS				E	XPLOS	IVES 7	TOTALS	6	
Pri	imer Na	ne		Qty	Tot	al Prim	er Qty	**	19	
1 1Lb.				1					-	
2					Per	Hole	**	Per Ty	pe**	
	Prin	ner lbs /	hole.	1.00	188	3.00	į.	3572.	00	1.

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BLAST NUMBER 22-CI HOLE DESCRIPTION				T	- YPICA	l Hole	Blast Hole Loading Diagram Face Height (FT) 27
Hole Depth Angle Subo Number (FT) (Deg) (F1	Irill Burden ) (FT)	Spacing (FT)	Stem (FT)	BCY Hole	PF lb/yd³	PF tons/lb	Hole Dia (in) 5.250
20-40 27 0 0	13.0 ** To	13.0	5.5	169	1.1	2.0	5.5 ' Stemming
EXPLOSIVES Product Name 1 ANFO 2 3 4	Total I	bs. / hole		Pound 187.0 187.0	s 00 00		21.5',ANFO,0.85g/cc @ 5.5 '
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### BlastdataG4 Blast Plan



8450 Circular Hill Rd. Leroy, NY 14482 (585) 768-4860

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I have been offered 4 placards properly identifying this shipment as specified in 49 CFR subpart F of part 172. I have received the above goods in apparent good order and condition. SIGN



# **Blaster's Daily Workplace Examination Record**

Mine Location: COMMTY LINE STONE

- Haul Road
- Bench Access Road
- Highwalls
- Bench
- Back Break

- 2 Weather
- D PPE
- D Equipment Parked Safely/Chocked/Brakes Set

Date: 8 -11-22

- First Aid Supplies Available
- Discussed

Comments: SHNNY - DRY -NO ACTIVITY NEAR SHOT

Print Crew:

Signature

Shot Tie In

Blaster in Charge: \_ KENNETH INGO

Print

Signature



Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company **General Notes** 

Extended Note N42.96916W78.47730 Post Event Notes No text to be displayed.

USBM RI8507 And OSMRE Long 0.0537 in/s 47.6 Hz 0.133 sec Vert Tran Geophone Velocity versus Frequency (Zero Crossing) 0.0317 in/s 0.0444 in/s **Peak Particle Velocity** 81.9 Hz 68.3 Hz Zero Crossing Frequency 0.406 sec 0.457 sec 1 1 1 1 1 Luu Time (Relative to Trigger) 10 0.053 g 0.000 in 0.063 g 0.000 in 0.063 g Peak Acceleration Peak Displacement 0.000 in Passed 7.3 Hz Passed 7.3 Hz 3.7 V Passed Sensor Check 7.3 Hz 5 Frequency 3.8 3.7 **Overswing Ratio** 0.0550 in/s at 0.133 sec Peak Vector Sum 2 **ISEE Linear Microphone** 0.002838 psi 119.8 dB(L) Peak Sound Pressure Level Peak Sound Pressure Level 1 Velocity (in/s) 1.286 sec Time (Relative to Trigger) 11.2 Hz Zero Crossing Frequency Passed Sensor Check 0.5 20.5 Hz Frequency 1388 mv **Test Amplitude** 0.2 0.1 ø 0.05 0.0394 100 10 20 50 2 5 Sensor Check Frequency (Hz) + Tran x Vert & Long 0.06 0.04 Velocity(in/s) 0.02 0 Tran -0.02 -0.04 -0.06 4 5 2 3 V Passed 1 Time(sec) 0.06 0.04 Velocity(in/s) all all all all 0.02 0 /ert -0.02 -0.04 -0.06 4 <sup>5</sup> Ø Passed 2 3 1 0 Time(sec) 0.06 0.04 Velocity(in/s) 0.02 0 Long -0.02 -0.04 -0.06 5 4 2 3 V Passed 0 1 Time(sec) 0.004 0.003 0.002 0.001 Pressure(psi) Ċ Mic

á

Vert at August 11, 2022 11:06:17

4096 sps County Line - Old Entrance.mmb

Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed)

Geo 0.0200 in/s

Operator

**Old Entrance** 

Akron, NY

IGS, Inc.

**County Line Stone** 

Serial Number

Model Number

Battery Level Unit Calibration

**Event File Name** 

Location: Old Ent

**USB Sensor Support** 

Distance: 1,546 ft

INTEGRATED W GEOTECHNICAL SOLUTIONS, INC.

UM8727 Micromate ISEE 10.90GC 3.8 volts January 20, 2022 by Instantel UM8727\_20220811110617.IDFW Disabled

Time(sec)

2

3

4

5 🕢 Passed

Created by version 1.3.0.12.

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-0.001 -0.002 -0.003 -0.004



Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes

Extended Note N42.96916W78.47730 Post Event Notes No text to be displayed.

Vert at August 11, 2022 11:06:17 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Old Entrance.mmb Operator Ĵ.

4

Old Entrance County Line Stone Akron, NY IGS, Inc. Serial Number Model Number Battery Level Unit Calibration Event File Name USB Sensor Support INTEGRATED GEOTECHNICAL SOLUTIONS, INC.

UM8727 Micromate ISEE 10.90GC 3.8 volts January 20, 2022 by Instantel UM8727\_20220811110617.IDFW Disabled

Tran - Dominant Frequency 40.1 Hz, Amplitude 0.0013 in/s (Peak Particle Velocity: 0.0444 in/s)



Vert - Dominant Frequency 40.6 Hz, Amplitude 0.0007 in/s (Peak Particle Velocity: 0.0317 in/s)



Long - Dominant Frequency 38.9 Hz, Amplitude 0.0013 in/s (Peak Particle Velocity: 0.0537 in/s)



Mic - Dominant Frequency 2.5 Hz, Amplitude 0.00014 psi (Peak Sound Pressure Level: 0.002838 psi)





Long at August 11, 2022 11:06:18 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L)

County Line - Yellow House.mmb

0.25 sec/5.0 sec (Fixed)

Yellow House County Line Stone Akron, NY IGS, Inc.

4096 sps

Operator

Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate **Setup File Name** Operator

#### Notes Location Client Company **General Notes**

Extended Note N42.976432,,W-78.475634 Post Event Notes No text to be displayed.



Serial Number

Model Number

Battery Level Unit Calibration

**Event File Name** 

**USB Sensor Support** 

Locotion: yellow those Dist: 3,363ft



UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220811110618.IDFW Disabled



Waveform Trigger Source Trigger Level(s) Trigger Level (Mic) Pre-Trigger/Record Time Sample Rate Setup File Name Operator

Notes Location Client Company General Notes Long at August 11, 2022 11:06:18 Geo 0.0200 in/s Mic 0.01029 psi, 131 dB(L) 0.25 sec/5.0 sec (Fixed) 4096 sps County Line - Yellow House.mmb Operator

w House.mmb

2

t.

Serial Number Model Number Battery Level Unit Calibration Event File Name USB Sensor Support UM7144 Micromate ISEE 10.90GC 3.8 volts February 2, 2022 by Instantel UM7144\_20220811110618.IDFW Disabled

W

INTEGRATED

GEOTECHNICAL SOLUTIONS, INC.

Extended Note N42.976432,,W-78.475634 Post Event Notes No text to be displayed.

### Tran - Dominant Frequency 39.6 Hz, Amplitude 0.0014 in/s (Peak Particle Velocity: 0.0214 in/s)

**Yellow House** 

Akron, NY

IGS, Inc.

**County Line Stone** 



### Vert - Dominant Frequency 40.6 Hz, Amplitude 0.0003 in/s (Peak Particle Velocity: 0.0093 in/s)



Long - Dominant Frequency 39.2 Hz, Amplitude 0.0014 in/s (Peak Particle Velocity: 0.0245 in/s)



Mic - Dominant Frequency 8.6 Hz, Amplitude 0.00003 psi (Peak Sound Pressure Level: 0.000745 psi)



Created by version 1.3.0.12.



### **APPENDIX D**

Seismograph Records from the Lamont-Doherty Cooperative Seismographic Network (LCSN)

# **CCNY - Canisius College, Buffalo, NY**

~15 seconds ~100 km



Notes:

- Recording of a seismic event at approximately 16:25 on 8/6/2022.

# **PRNY** - Ithaca



Notes:

- Recording of a seismic event at approximately 16:25 on 8/6/2022.

# MCVT - Middlebury College, VT



Notes:

- Recording of a seismic event at approximately 16:25 on 8/6/2022.

# **KSCT - Kent School CT**



Notes:

- Recording of a seismic event at approximately 16:25 on 8/6/2022.

### **APPENDIX E**

Report by John Hellert on Sinkholes near the Akron Quarry



# CONTINENTAL PLACER INC.

September 21, 2010

II Winners Circle Albany, NY 12205 (518) 458-9203 Fax (518) 458-9206 www.continentalplacer.com

Bruce M. Buyers County Line Stone Co., Inc. 4515 Crittenden, PO Box 150 Akron, New York 14001

### RE: Heiman Sinkholes

### Bruce:

As requested, I have summarized my findings concerning sink hole development on the Heiman property along Steiner Road.

The site was visited on Thursday, September 16, 2010 by myself and Bob Greathouse of County Line Stone. During the field inspection, several small sinkholes were observed which appeared to have been recently developed. The following photos were taken of two sinkholes. They were roughly 6 to 10 feet in diameter and four to six feet deep, adjacent to a cornfield.

### Sinkhole Development

Onondaga bedrock, which underlies the region, is prone to solutioning and karst development and sinkholes do occur in the area. The formation of sinkholes is a complex interaction of rock, soil and groundwater. Zisman (2001) provides a concise analysis.

"In general, the formation of a sinkhole begins with the progressive dissolving of limestone and the eventual collapse of the weakened solution rock or by the raveling of overburden soils into solution cavities. Raveling is the downward erosion of soil material carried by water flowing through a pervious zone or erosion pipe that extends to a cavity in the limestone (Frank and Beck, 1991).

Solution activity within the limestone is greatest along localized fractures, joints or bedding planes since these features represent preferential paths that concentrate the flow of water in the formation. Solution activity is accelerated where the volume or velocity of flow increases.

The location of limestone cavities, their sizes and their influence on the ground surface is exceedingly difficult to predict. Furthermore, the location of sinkholes is dependent not only on the size of the limestone cavity but also on the thickness of overburden and type of overburden soil and in particular the type of soil directly above the limestone surface.

Combinations of these factors make prediction of the occurrence of sinkholes difficult.

The cover-collapse sinkhole occurs when a solution cavity extends to a size that can no longer support the weight of the overlying material and collapses. Collapse is generally abrupt and can be catastrophic. Collapse sinkholes provide dramatic local changes in topography. They may occur in any area of soluble rock; however they are less likely to occur in areas of deeply buried limestone. Collapse sinkholes generally occur in areas where the limestone is near the surface and the limestone aquifer is under water-table conditions.

The cover subsidence sinkholes occur as surface expressions of soil material that has slowly migrated downward into voids in the underlying limestone. A thin zone of low-density soil material typically characterizes the sinkhole area.

Causes of Ground Subsidence

Ground subsidence can be triggered by the lowering of the water table during dry periods, by raising the water table during the rainy season or during exceptionally high water table conditions during prolonged storms. During dry periods the lowered water table causes an increase in soil unit weight (difference between buoyant soil weight and dry or moist soil weight). This increase in effective soil weight can be sufficient to cause collapse or settlement of weakened soil zones. Particularly good candidates for soil distress are in zones where soil arching has occurred and in areas where the thin roof of a limestone cavern or void supports a relatively thin mantle of soil cover.

Conditions distinctively favorable for formation of sinkholes are during wet periods and, in particular, during sudden rain events following a prolonged dry period when a large difference exists between the piezometric surface in the water table or surficial aquifer. The larger gradient can drive overburden soils through solution paths into voids in the limestone accelerating the formation of sinkholes.



Figure 1: Formation of cover subsidence and cover collapse sinkholes (from Culshaw and Waltham, 1987) \* from Zisman

Staubitz and Miller (1987) report that there is a "channellike-depression area" between one and two miles west of the CLS quarry which is a zone of high permeability containing sink holes and swallets.

Bruce M. Buyers Heiman Sinkholes September 21, 2010 Page 3



Sinkholes observed on the Heiman Farm.

### Blasting

There has been concern that blasting at the quarry promotes the development of sinkholes by some unspecified manner, presumably vibration and resulting displacement of the bedrock mass. Blasting vibrations were specifically studied at the quarry in 1999 by Vibra-Tech Engineers, Inc. The bottom line of the study was this; ground movement beyond 500 feet from blasting is non-significant. This is shown on the following graph which was developed during this study. The sinkholes developed on the Heiman farm are approximately 3500 feet from the quarry. Ground vibrations at that distance are basically non-measurable.

#### Summary

Blasting does not cause sinkholes or exacerbate the processes which create them. The sinkhole development is most likely a result of a low regional groundwater table during a dry summer resulting in cover collapse of the overlying glacial till.

If there are additional questions, please contact us.

Best regards

John R. Hellert Senior Geologist

### **APPENDIX F**

Hydrographs for Residential Wells



-Residential Well Spring 2022 Groundwater Level Data, County Line Stone Co., Inc., prepared by Continental Placer Inc.



Scribner Road Project **County Line Stone** Town of Pembroke Genesee County, New York



-Residential Well Spring 2022 Groundwater Level Data, County Line Stone Co., Inc., prepared by Continental Placer Inc.



Scribner Road Project County Line Stone Town of Pembroke Genesee County, New York

300 Cohocton Road Well Hydrograph



-Residential Well Spring 2022 Groundwater Level Data, County Line Stone Co., Inc., prepared by Continental Placer Inc.



Scribner Road Project **County Line Stone** Town of Pembroke Genesee County, New York



### Cariba

GEOSCIENCE

Proj. no. 22119

Source:

328 Cohocton Road Well Hydrograph

-Residential Well Spring 2022 Groundwater Level Data, County Line Stone Co., Inc.,

prepared by Continental Placer Inc.

Scribner Road Project County Line Stone Town of Pembroke Genesee County, New York



-Residential Well Spring 2022 Groundwater Level Data, County Line Stone Co., Inc., prepared by Continental Placer Inc.



Scribner Road Project County Line Stone Town of Pembroke Genesee County, New York

390 Cohocton Road Well Hydrograph

Z:\projects\2022\22100-22120\22119 - County Line Stone\9\_0 Data Analysis\Hydrographs\Hydrographs.GRF


Source:

-Residential Well Spring 2022 Groundwater Level Data, County Line Stone Co., Inc., prepared by Continental Placer Inc.



Scribner Road Project **County Line Stone** Town of Pembroke Genesee County, New York



Notes:

-No permission to collect measurements after Spring 2013.

Source:

-Residential Well Spring 2022 Groundwater Level Data, County Line Stone Co., Inc., prepared by Continental Placer Inc.



Scribner Road Project County Line Stone Town of Pembroke Genesee County, New York

374 Cohocton Road Well Hydrograph

## APPENDIX G

Water Level Data for Scribner Road from Norm Gardner of Clark Patterson Lee

### Scribner Road Water Levels

				8/15/2022		8/18/2022		8/25/2022		8/31/2022						
	Top of															
	Casing	Total	Depth to	Elevation												
Well ID	Elevation	Depth	Water (Ft)	(Ft)												
Private Well #1	839.64	96.0	30.00	809.64	29.97	809.67	29.98	809.66	29.97	809.67						
Private Well #2	839.29	36.5	33.42	805.87	33.57	805.72	33.75	805.54	33.77	805.52						
SB-4	836.44	29.3	14.00	822.44	14.04	822.40	14.16	822.28	12.75	823.69						
USGS - Batavia	896.94	75.0	32.88	864.06	33.05	863.89	33.42	863.52	33.65	863.29						

Elevation Datum referenced to NAD83

USGS Well - USGS Groundwater Monitoring Station #425913078085501, Batavia, NY . Provisional data



## **APPENDIX H**

Soil Boring Logs SB-1 through SB-4 provided by Norm Gardner of Clark Patterson Lee









D/ PF	ATE: ROJE	e CT:	191	27		orfn	Hole Number: BZ	E	LEVATION:
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-	-								









## **APPENDIX I**

Examples of Cracks forming around Developing Sinkholes

# Froggy Bottom, Avery Island, LA

Mape: 50



Retsof Mine, Cuylerville, NY

## **APPENDIX J**

Illustration of Pop-up Modes from Ghasemi, 2021, page 4269

## Table 5Buckling casesdatabase summary of data

Geographic jurisdiction	Cases	Max. length <sup>a</sup> (m)	Min. length <sup>a</sup> (m)	Max. height <sup>b</sup> (m)	Min. height <sup>b</sup> (m)
Ontario	208	3000	1.5	1.5	0.3
Quebec	51	100	2	1.5	0.01 - 0.025
New York*	102	-	-	-	-

<sup>a</sup>Number of cases with recorded buckling length is 23 and 32 for ON and QC respectively <sup>b</sup>Number of cases with recorded buckling height is 14 and 32 for ON and QC respectively

\*There is no recorded buckling length and height for NY

surface features or an open, surface-parallel discontinuity. Under high stress, these features can begin to buckle forming what is sometimes referred to as a rock "blister." The process can sometimes continue to advance until a full buckle of the detached rock slab develops. The mechanism can be progressive forming subsequent fractures parallel to the initial, ground-surface parallel feature. This mode of failure is referred to here as exfoliation buckling (EXB). Figure 11 shows an example of an exfoliation feature with some minor buckling developing. Other well-known examples of exfoliation features can be observed at Yosemite park and other locations where they sometimes form "exfoliation domes," such as the Twain Harte Dome. These features have also been attributed to thermal loading (cyclic), ice jacking freeze thaw cycles, chemical weathering (oxidation), and the release of "locked-in" residual stress (Holzhausen and Johnson 1979; Savage 1978).

Brittle failure mechanisms in rock has been a focus of attention for rock engineering researchers for many decades. Predicting the onset of brittle spalling, and in the extreme, rock bursting, is an important safety and operations issue for underground mining. This topic has received much less attention with respect to near-surface engineering projects. The formation and propagation of brittle spalling fractures has been associated with the crack initiation threshold observed in laboratory compression testing (Martin 1997). This threshold typically corresponds to a compressive stress level (deviatoric:  $\sigma_1 - \sigma_3$ ) somewhere between 1/3 and 2/3 of  $\sigma_c$  (Hoek and Martin 2014).

Currently, the primary means of evaluating brittle failure potential is by comparing elastic stress analysis predictions obtained from continuum numerical modelling to crack initiation threshold. An example of this approach for underground excavation is presented by Martin and

Buckling class	Buckling mode	Typical conditions	Typical examples				
Massive rock buckling (MRB)	Brittle fracture formation and exfoliation (EXB)	<ul> <li>High S<sub>H</sub></li> <li>Massive, brittle rock</li> </ul>	Void SH SH				
	Euler-like buckling (EUB)	<ul> <li>High S<sub>H</sub></li> <li>Stiff/strong rock</li> <li>Long layers</li> <li>Infrequent cross joints</li> </ul>	S <sub>H</sub> S <sub>H</sub>				
Single layer buckling (SLB)	Three hinge buckling (THB)	<ul> <li>High S<sub>H</sub></li> <li>Stiff/strong rock</li> <li>Short blocks</li> <li>Frequent cross joints</li> <li>Symmetrical configuration</li> </ul>	S <sub>H</sub>				
	Blocky SLB (BSLB)	<ul> <li>High S<sub>H</sub></li> <li>Stiff/strong rock</li> <li>Multiple layers and blocks</li> <li>Asymmetrical configuration</li> </ul>	S <sub>H</sub> S <sub>H</sub>				
Multi-layer buckling (MLB)	Complex (may consist of sub-modes)	<ul> <li>Softening/weakening rock (often time-dependent)</li> <li>Multiple layers and cross joints</li> </ul>	(a) water (b) S <sub>H</sub>				

A trigger mechanism often initiates buckling of all modes

Fig. 10 Buckling failure mode summary and classification chart based on failure modes observed in the field

## APPENDIX K

Location of Pop-ups along the Clarendon-Linden Fault System from Fakundiny et al., 1978, page 171 various branches of the Clarendon-Linden fault system. Pop-ups are concentrated along these open folds (Figure 21) and may be formed, in some localities at least, by stresses arising from the compression of beds in the local, appropriate, compressional regions of these folds.



Figure 21 - Map of the region showing instability structures and the traces of the Clarendon-Linden fault system.

## **APPENDIX L**

Documentation of Pop-ups from Wallach, 1993, pages 68, 71 and 73

in northern Québec, Canada (Lamontagne, personal communication; Adams et al. 1991a, 1991b, 1992a, 1992b). Unfortunately such fault scarps in eastern North America are either very rare, or have not been recognized for what they are during the normal course of geological mapping. Other surficial geological indicators of paleoseismicity are liquefaction features, such as those documented in the region of the Saguenay, Québec earthquake (Tuttle et al. 1990), near the M≈5.0-5.5, Newburyport, Massachusetts earthquake (Tuttle & Seeber 1991), and in the vicinity of the m =7.0, Charleston, South Carolina earthquake (Amick & Gelinas 1991). At the present time, though, unless there is some very obvious indicator at the surface, recognition of various liquefaction features usually requires trenching in areas of documented, major earthquakes. However, there are other features which are more readily accessible, easily recognized and indicate geologically recent movement, such as offset boreholes and pop-ups. The latter are the subject of this paper, but before discussing their potential usefulness in assessing seismic hazard in eastern North America it is necessary to establish the neotectonic framework as manifested by stress conditions, seismicity and neotectonic structures.

### Neotectonic framework

#### **Stress conditions**

Stress conditions have been measured throughout many parts of eastern North America by several different researchers, examples of which are summarized here to help set the current tectonic framework. Around Lake Ontario, one of the five Great Lakes of North America, the maximum principal stress is oriented generally east-northeast (Lindner 1985). However, trends of 310°, 325°, and 350° were measured at depths of 8 to 22 m in western New York State, adjacent to the lake (Dames & Moore 1973; 1974a). On the north shore of western Lake Ontario, about 30 km east of metropolitan Toronto, stress tests were conducted in both Ordovician sedimentary rocks and Precambrian gneiss in a single borehole 303 m deep (Haimson & Lee 1980). In the sedimentary sequence the orientation of the maximum horizontal compressive stress, designated by the authors as  $\sigma_{\!_{Hmax}}$  , ranges from 070°, at a depth of 74.7 m, to 032°, at a depth of 207.4 m. In the underlying Precambrian basement, through a depth interval from 228 to 299.5 m,  $\sigma_{Hmax}$ orientations of 021°, 025° and 024° were measured.



Figure 1. Distribution of pop-ups and earthquakes. The symbols are emphasized where the two co-exist. The numbers 1-5 refer to locations where offset boreholes were recognized (please see text). C-Cornwall, CH-Charlevoix, L-Leroy, M-Miramichi, Mtl-Montréal, Sa-Saguenay, Sh-Sharpsburg, NM-New Madrid. The Ungaya, Grand Banks and Charleston earthquakes are respectively north, east and south of the map area. (Sources of earthquake locations: Smith 1962, 1966; Kim & Smith 1980; Burke 1984; Bollinger & Sibol 1985; Weston Geophysical 1986; Johnston & Nava 1987; Du Berger *et al.* (1991)



**Figure 3.** Open field pop-ups. (A) In sandstone in the 1000 Islands Region, just east of the eastern end of Lake Ontario. Upper surface is glacially striated thus this structure is clearly post-glacial in age. (B) and (C) Both are in limestone and located in southern Ontario, Canada. The change in lithology across the hinge in (C) is due to the presence of a normal fault inferred to pre-date, and serve as a zone of stress concentration for the development of, the pop-up.



**Figure 4.** Examples of pop-ups which have formed in quarries. (A) This structure is located just northwest of the western edge of Lake Ontario (Canada) and is composed of segments oriented 020°, in the background, and 055°, in the foreground. Surficial relief is just under 2 m. (B) Located in metropolitan Québec City (Canada), this structure shows two segments which, from foreground to background respectively, are oriented 005° and 328°. (C) This pop-up is located near Niagara Falls, New York (USA) and is oriented 007°.

## **APPENDIX M**

Photographs of Open Field Pop-Up by Mr. Tom Harmon of CLS





