FINAL PLANS

STATE	JOB NO.	J8P0622E	SHEET NO.
MO			11
DIST. NO	PROJECT NO.	ACSTP-465-1 (5)	ROUTE
8	COUNTY	TANEY/STONE	465

CONTRACT I.D. 990618 (802)

FINAL PLANS

I certify that this plan sheet accurately depicts the configuration and location of the roadway and all its appurtenant features, to the best of my knowledge, as I and my staff have observed the contractor's construction of this project. I specifically disclaim any responsibility for the design of this project, except as I and my staff may have modified or authorized the modification of the project design during construction; and I disclaim responsibility for the contractor's actual construction of the project, except as I or my staff may have directed or ordered the project be constructed.

11-6-01

STATE OF MISSOURI PROFESSIONAL ENGINEER

RAMP S-76 CURVE DATA

P.I. STA. 3+03.89 △ = 23°06'37" Rt. D = 8°00'00" R = 716.20' T = 146.43' L = 288.88' S.E.= 0.053'/FT.

P.I. STA. 14+27.42 △ = 34°11'50" Lt. D = 6°00'00" R = 954.93' T = 293.75' L = 569.95' S.E.= 0.062'/FT.

RTE. 465 CURVE DATA

P.I. STA. 489+82.05 △ = 7°35'55" Lt. D = 1°00'00" R = 5729.58' T = 380.49' L = 759.86' S.E.= 0.025'/FT.

RAMP 76-N CURVE DATA

P.I. Sta. 3+13.93 △ = 36°23'48" Lt. D = 6°00'00" R = 954.93' T = 313.93' L = 606.61' S.E.= 0.062'/FT.

P.I. Sta. 11+51.73 △ = 31°42'22" Rt. D = 6°30'00" R = 881.47' T = 250.31' L = 487.79' S.E.= 0.046'/FT.

RAMP 76-S CURVE DATA

P.I. Sta. 4+57.36 △ = 39°15'28" Lt. D = 13°19'29" R = 430.00' T = 153.36' L = 294.63' S.E.= 0.07'/FT.

P.I. Sta. 12+22.61 △ = 28°24'11" Rt. D = 6°00'00" R = 954.93' T = 241.66' L = 473.39' S.E.= 0.062'/FT.

RAMP N-76 CURVE DATA

P.I. Sta. 11+96.09 △ = 14°39'20" Rt. D = 4°00'00" R = 1432.40' T = 188.44' L = 374.72' S.E.= VAR.

P.I. Sta. 11+49.32 △ = 139°37'26" Rt. D = 20°19'04" R = 282.00' T = 766.95' L = 687.20' S.E.= 0.08'/FT.

P.I. Sta. 11+41.11 △ = 21°46'12" Rt. D = 15°24'08" R = 372.00' T = 71.83' L = 141.34' S.E.= VAR.

NE 1/4-SE 1/4-21 23-22

NW 1/4-SE 1/4-21 23-22

SW 1/4-SE 1/4-21 23-22

SE 1/4-SW 1/4-21 23-22

EXISTING R/W MARKER +00.53 RELOC. RTE. 76 147.28'

EXISTING R/W MARKER +55.00. 623.92' (EXST. R/W)

EXISTING R/W MARKER +84.61. 182.40' (EXST. R/W)

EXISTING R/W MARKER +41.82. 272.76' (EXST. R/W)

EXISTING R/W MARKER +75.00. 252.90' (EXST. R/W)

EXISTING R/W MARKER +72.18, 230.75' RELOC. RTE. 76 +80.00, 340' RTE. 465

EXISTING R/W MARKER +11.17, 826.76' RTE. 465 +84.22, 232.80' RELOC. RTE. 76

EXISTING R/W MARKER +37.17 RTE. 465 776.98'

EXISTING R/W MARKER +00.00 559.95'

EXISTING R/W MARKER +25.00 275'

EXISTING R/W MARKER +20.00 925'

S-405 STA. 8+51 76-N DA=3 AC. Q50=15 cfs 30" X 203' RCP

S-404 STA. 5+55 76-N DA=10 AC. Q50=54 cfs 42" X 171' RCP

S-406 STA. 5+63 N-76 DA=12 AC. Q50=64 cfs 48" X 121' RCP

P-474 STA. 6+20 N-76 DA=0.9 AC. Q10=6 cfs 18" X 19' RCP

P-455 STA. 503+00 DA=1.9 AC. Q10=10 cfs 18" X 98' RCP

P-475 18" X 50' RCP

P-456 18" X 121' RCP

P-457 STA. 507+26.3 DA=2.4 AC. Q10=12 cfs 24" X 84' RCP

S-407 STA. 12+38 76-S DA=21 AC. Q50=125 cfs 48" X 189' RCP

S-408 54" X 232' RCP

S-409 66" X 138' RCP

S-410 STA. 504+51.20 DA=30 AC. Q50=471 cfs 78" X 133' RCP

P-473 STA. 5+90 76-S DA=0.3 AC. Q10=2 cfs 18" X 72' RCP

P.C. 13+89.20

P.C. 9+01.42

P.C. 1+57.46

P.T. 4+46.34

P.T. 6+06.61

P.C. 11+33.67

P.C. 9+80.95

P.C.C. 3+82.37

P.C. STA. 0+07.65 ℄ N-76 = STA. 495+49.92 , 66' RT ℄ RTE. 465

P.C.C. 10+69.58

P.C. 486+01.56

P.T. 493+61.43

P.T. 492+00.00 END GRADING TEMPLATE (MATCH EXISTING)

P.T. 14+54.34 SPECIAL STRUCTURE 410A

P.T. 12+10.92

P.T. 5+98.65

P.C. 3+04.00

STA. 488+39.92.54' RT. BEGIN TAPER

STA. 490+89.92.66' RT. END TAPER

STA. 494+84.92 RTE. 465 STA. 232+97.66 RELOC. RTE. 76

STA. 9+65.00 END GRADING TEMPLATE (MATCH EXISTING)

STA. 3+50.00 BEGIN GRADING TEMPLATE (MATCH EXISTING)

STA. 497+50.00 BEGIN GRADING TEMPLATE (MATCH EXISTING)

STA. 503+97.30.54' LT. BEGIN TAPER

STA. 507+57.30.66' LT. END TAPER

STA. 1+75.00 ℄ 76-S= STA. 13+39.92 ℄ N-76 BEGIN GRADING TEMPLATE (MATCH EXISTING)

STA. 508+50

GUARD RAIL STA. 480+05. 205' RT. (TYPE IV OBJECT MARKERS BY OTHERS)

GUARD RAIL STA. 484+00. 190' RT. (TYPE IV OBJECT MARKERS BY OTHERS)

S12°02'49"W

S16°39'33"E

S16°44'15"W

S09°08'20"W

S07°39'14"W 177.94'

S07°19'59"E

S24°02'36"E 249.01'

S35°09'26"W

S84°28'43"E

S80°51'40"E 530.72'

93°37'03"

N05°31'17"E

S05°31'17"W

S34°44'11"E

1/4 1/4 SECTION LINE

℄ RTE. 465

℄ RELOC. RTE. 76

℄ 76-N

℄ 76-S

℄ N-76

S.L.

USED ROCK DITCH LINER

ELIMINATED PAVED DITCH - USED ROCK DITCH LINER

R/W & A.C.

EXISTING R/W

N.W. ELEC. CO.

EMPIRE DIST. ELEC. CO.

SILVER DOLLAR CITY INC. 113.90 AC. L.A. R/W 3.90 AC. NON LA R/W 0.65 AC. TEMP. ESMT.(CONST.) 153.73 AC. SCENIC ESMT. 215.17 AC. REM. LT. 189.07 AC. REM. RT.

(27)

(26) WARREN REAL ESTATE DEVELOPMENT CO., INC. SEE SHEET NO. 9

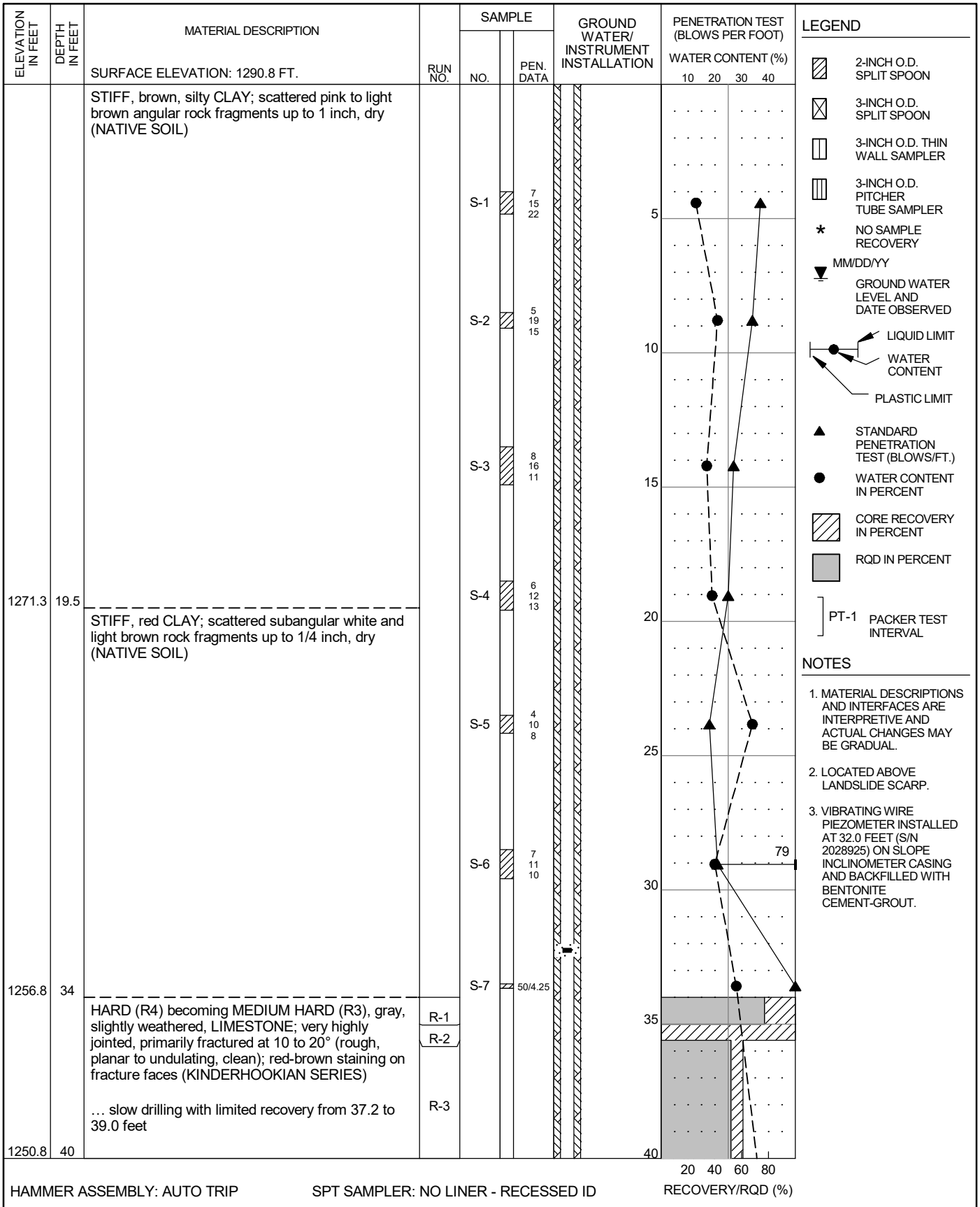
SW COR., SE 1/4 SEC. 21, T-23-N-R-22 WITNESSED BY MICHAEL D. GRAY REG. L.S. #1994

STONE

LAND TIE

SCALE IN FEET 100 0 100 200

HNTB



HAMMER ASSEMBLY: AUTO TRIP
SPT SAMPLER: NO LINER - RECESSED ID
DRILL ROD USED: AWJ
BOREHOLE DIAM.: 6" 0 - 34.0'; 3.75" 34.0' - 55.0'

DRILLER: GEOTECHNOLOGY
DATE START: 8/28/2020 FINISH: 8/29/2020
DRILLING TECHNIQUE: HOLLOW STEM AUGER/HQ CORING

LANDSLIDE TECHNOLOGY
10250 S.W. Greenburg Road, Suite 111
Portland, Oregon 97223
Phone 503-452-1200 Fax 503-452-1528

SUMMARY BORING LOG LT-1 (1 of 2)

HWY. 465 SLIDE MONITORING
BRANSON, MO

NOV 2022

PROJ 2846

FIG.

ELEVATION IN FEET	DEPTH IN FEET	MATERIAL DESCRIPTION	RUN NO.	SAMPLE NO.	SAMPLE PEN. DATA	GROUND WATER/ INSTRUMENT INSTALLATION
		SURFACE ELEVATION: 1290.8 FT.				
		(continued from previous sheet)				
1249.3	41.5	STIFF red CLAY; moist (NATIVE SOIL/INFILL)	R-4			
1247.2	43.6	MEDIUM HARD (R3) becoming HARD (R4), gray, slightly weathered LIMESTONE; very highly jointed, primarily fractured at 10 to 20° (rough, planar to undulating, clean); numerous red-brown stain on fracture faces (KINDERHOOKIAN SERIES)	R-5			
		… numerous light brown, SOFT sandstone layers up to 1/2 inch thick from 44.0 to 47.7 feet	R-6			
		… gray, HARD gray, 1-mm thick fracture infill below 47.7 feet	R-7			
			R-8			
1235.8	55	Bottom of Boring: 55 FT				

PENETRATION TEST (BLOWS PER FOOT)

WATER CONTENT (%)

10 20 30 40

45 50 55 60 65 70 75 80

20 40 60 80

RECOVERY/RQD (%)

LEGEND

- 2-INCH O.D. SPLIT SPOON
- 3-INCH O.D. SPLIT SPOON
- 3-INCH O.D. THIN WALL SAMPLER
- 3-INCH O.D. PITCHER TUBE SAMPLER
- * NO SAMPLE RECOVERY
- MM/DD/YY GROUND WATER LEVEL AND DATE OBSERVED
- LIQUID LIMIT
- WATER CONTENT
- PLASTIC LIMIT
- STANDARD PENETRATION TEST (BLOWS/FT.)
- WATER CONTENT IN PERCENT
- CORE RECOVERY IN PERCENT
- RQD IN PERCENT
- PT-1 PACKER TEST INTERVAL

NOTES

1. MATERIAL DESCRIPTIONS AND INTERFACES ARE INTERPRETIVE AND ACTUAL CHANGES MAY BE GRADUAL.
2. LOCATED ABOVE LANDSLIDE SCARP.
3. VIBRATING WIRE PIEZOMETER INSTALLED AT 32.0 FEET (S/N 2028925) ON SLOPE INCLINOMETER CASING AND BACKFILLED WITH BENTONITE CEMENT-GROUT.

HAMMER ASSEMBLY: AUTO TRIP

DRILL ROD USED: AWJ

SPT SAMPLER: NO LINER - RECESSED ID

BOREHOLE DIAM.: 6" 0 - 34.0'; 3.75" 34.0' - 55.0'

DRILLER: GEOTECHNOLOGY

DATE START: 8/28/2020 FINISH: 8/29/2020

DRILLING TECHNIQUE: HOLLOW STEM AUGER/HQ CORING

LANDSLIDE TECHNOLOGY
10250 S.W. Greenburg Road, Suite 111
Portland, Oregon 97223
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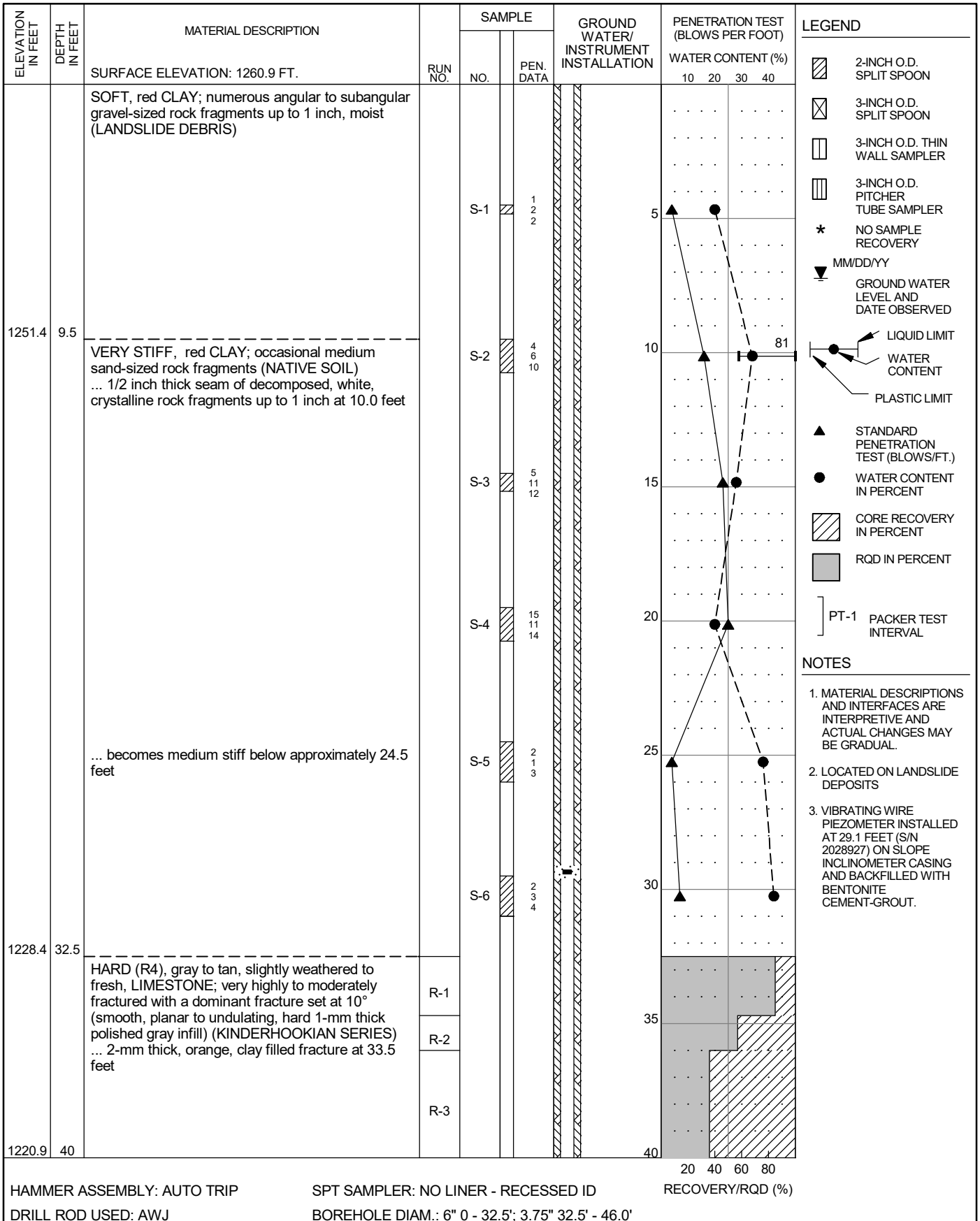
SUMMARY BORING LOG LT-1 (2 of 2)

HWY. 465 SLIDE MONITORING
BRANSON, MO

NOV 2022

PROJ 2846

FIG.



HAMMER ASSEMBLY: AUTO TRIP
SPT SAMPLER: NO LINER - RECESSED ID
DRILL ROD USED: AWJ
BOREHOLE DIAM.: 6" 0 - 32.5'; 3.75" 32.5' - 46.0'

DRILLER: GEOTECHNOLOGY
DATE START: 8/26/2020 FINISH: 8/27/2020
DRILLING TECHNIQUE: HOLLOW STEM AUGER/HQ CORING

LANDSLIDE TECHNOLOGY
10250 S.W. Greenburg Road, Suite 111
Portland, Oregon 97223
Phone 503-452-1200 Fax 503-452-1528

SUMMARY BORING LOG LT-2 (1 of 2)

HWY. 465 SLIDE MONITORING
BRANSON, MO

NOV 2022

PROJ 2846

FIG.

ELEVATION IN FEET	DEPTH IN FEET	MATERIAL DESCRIPTION	RUN NO.	SAMPLE NO.	SAMPLE PEN. DATA	GROUND WATER/ INSTRUMENT INSTALLATION
		SURFACE ELEVATION: 1260.9 FT.				
		(continued from previous sheet)				
		... minor vesicularity below 42.4 feet	R-4			
		... major quartz infilling up to 3 inches thick below 44.0 feet	R-5			
1214.9	46	Bottom of Boring: 46 FT				

PENETRATION TEST (BLOWS PER FOOT)

WATER CONTENT (%)

10 20 30 40

45 50 55 60 65 70 75 80

20 40 60 80

RECOVERY/RQD (%)

LEGEND

- 2-INCH O.D. SPLIT SPOON
- 3-INCH O.D. SPLIT SPOON
- 3-INCH O.D. THIN WALL SAMPLER
- 3-INCH O.D. PITCHER TUBE SAMPLER
- * NO SAMPLE RECOVERY
- MM/DD/YY GROUND WATER LEVEL AND DATE OBSERVED
- LIQUID LIMIT
- WATER CONTENT
- PLASTIC LIMIT
- STANDARD PENETRATION TEST (BLOWS/FT.)
- WATER CONTENT IN PERCENT
- CORE RECOVERY IN PERCENT
- RQD IN PERCENT
- PT-1 PACKER TEST INTERVAL

NOTES

1. MATERIAL DESCRIPTIONS AND INTERFACES ARE INTERPRETIVE AND ACTUAL CHANGES MAY BE GRADUAL.
2. LOCATED ON LANDSLIDE DEPOSITS
3. VIBRATING WIRE PIEZOMETER INSTALLED AT 29.1 FEET (S/N 2028927) ON SLOPE INCLINOMETER CASING AND BACKFILLED WITH BENTONITE CEMENT-GROUT.

HAMMER ASSEMBLY: AUTO TRIP

DRILL ROD USED: AWJ

SPT SAMPLER: NO LINER - RECESSED ID

BOREHOLE DIAM.: 6" 0 - 32.5'; 3.75" 32.5' - 46.0'

DRILLER: GEOTECHNOLOGY

DATE START: 8/26/2020 FINISH: 8/27/2020

DRILLING TECHNIQUE: HOLLOW STEM AUGER/HQ CORING

LANDSLIDE TECHNOLOGY
10250 S.W. Greenburg Road, Suite 111
Portland, Oregon 97223
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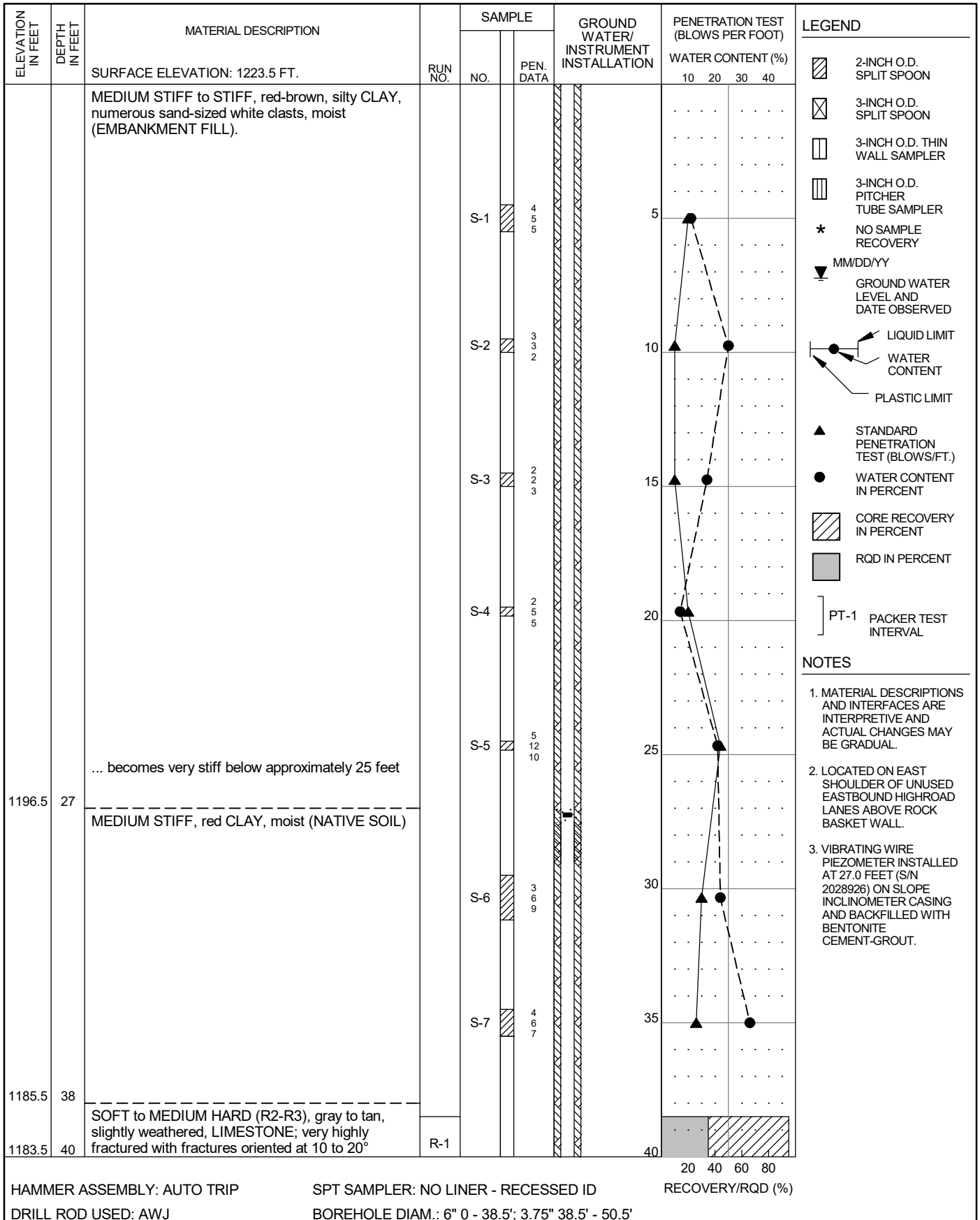
SUMMARY BORING LOG LT-2 (2 of 2)

HWY. 465 SLIDE MONITORING
BRANSON, MO

NOV 2022

PROJ 2846

FIG.



HAMMER ASSEMBLY: AUTO TRIP
SPT SAMPLER: NO LINER - RECESSED ID
DRILL ROD USED: AWJ
BOREHOLE DIAM.: 6" 0 - 38.5'; 3.75" 38.5' - 50.5'

DRILLER: GEOTECHNOLOGY
DATE START: 8/24/2020 FINISH: 8/25/2020
DRILLING TECHNIQUE: HOLLOW STEM AUGER/HQ CORING

LANDSLIDE TECHNOLOGY
10250 S.W. Greenburg Road, Suite 111
Portland, Oregon 97223
Phone 503-452-1200 Fax 503-452-1528

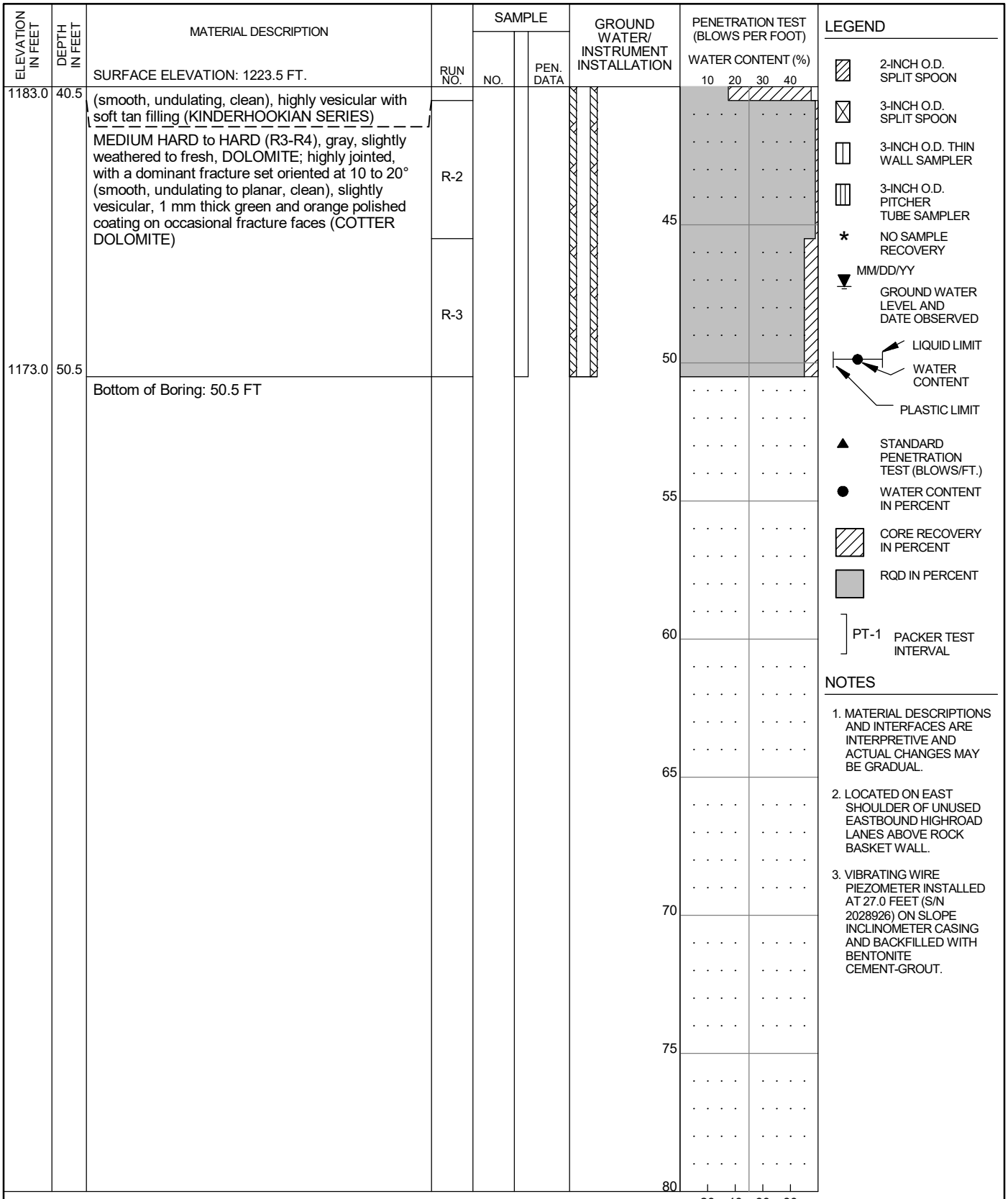
SUMMARY BORING LOG LT-3 (1 of 2)

HWY. 465 SLIDE MONITORING
BRANSON, MO

NOV 2022

PROJ 2846

FIG.



HAMMER ASSEMBLY: AUTO TRIP
DRILL ROD USED: AWJ
SPT SAMPLER: NO LINER - RECESSED ID
BOREHOLE DIAM.: 6" 0 - 38.5'; 3.75" 38.5' - 50.5'

DRILLER: GEOTECHNOLOGY
DATE START: 8/24/2020 FINISH: 8/25/2020
DRILLING TECHNIQUE: HOLLOW STEM AUGER/HQ CORING

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Portland, Oregon 97223
Phone 503-452-1200 Fax 503-452-1528

SUMMARY BORING LOG LT-3 (2 of 2)

HWY. 465 SLIDE MONITORING
BRANSON, MO

NOV 2022

PROJ 2846

FIG.

GEOKON®

GEOKON
48 Spencer Street
Lebanon, New Hampshire
03766 · USA

www.geokon.com
p: +1·603·448·1562
f: +1·603·448·3216

CERTIFICATE OF QUALITY, CONFORMITY & CALIBRATION

WE HEREBY CERTIFY that the manufactured materials listed below (SCHEDULE A)
Furnished to: Cornforth Consu/Landslide Tech
Reference Geokon Job No.: 20074711

order no.: 2846, contract no.: N/A in all aspects
In the amount specified in Schedule A, identified by our label "GEOKON"
Complies/Conforms to, or exceeds the requirements and specifications of your purchase order no: contract no: N/A in all aspects.

Country(s) of Origin: United States of America

WE FURTHER CERTIFY that the product supplied has been inspected, tested and calibrated as applicable, in conformance to the relevant specifications and drawings of the GEOKON registered ISO 9001:2015 Quality Management System, Revision 17. Calibration and testing standards are calibrated by ISO 17025 Accredited Laboratories, are maintained per ANSI/NCSL Z540-1 and are traceable to the N.I.S.T.

SCHEDULE A

MODEL NO.	QUANTITY	TYPE OF INSTRUMENT	SERIAL NO.
4500S-350KPA	3	VW Piezometer, unvented, 350 kPa (51psi)	2028925~2028927
02-250V6-E	320ft	Blue PVC Cable, 0.250", 2 twisted pairs	N/A
02-250V6-E	250ft	Blue PVC Cable, 0.250", 2 twisted pairs	N/A

Signed by:

Adam Webster

Quality Assurance Manager

Date: July 29, 2020

OFFICIAL CORPORATE SEAL
GEOKON
48 SPENCER ST
LEBANON, NH
USA

Ref: 20074711

GEOKON®

LT-3 @ 27 ft BGS

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-350 kPa

Date of Calibration: July 27, 2020

This calibration has been verified/validated as of 07/29/2020

Serial Number: 2028926

Temperature: 23.20 °C

Calibration Instruction: CI-Pressure Transducers 7 kPa~3.5 MPa

Barometric Pressure: 987.3 mbar

Cable Length: 60 feet

Technician:

Applied Pressure (kPa)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	9022	9023	9023	0.054	0.02	0.074	0.02
70.0	8379	8379	8379	69.84	-0.05	69.83	-0.05
140.0	7731	7732	7732	140.1	0.02	140.0	0.01
210.0	7085	7085	7085	210.2	0.05	210.1	0.04
280.0	6441	6443	6442	279.9	-0.03	279.9	-0.03
350.0	5795	5796	5796	350.0	0.00	350.0	0.01

(kPa) Linear Gauge Factor (G): -0.1084 **(kPa/ digit)**

Polynomial Gauge factors: **A:** 1.399E-08 **B:** -0.1087 **C:**

Thermal Factor (K): -0.08918 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gauge Factor (G): -0.01573 **(psi/ digit)**

Polynomial Gauge Factors: **A:** 2.029E-09 **B:** -0.01576 **C:**

Thermal Factor (K): -0.01293 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)^*$

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

Factory Zero Reading: 9021 **Temperature:** 21.3 °C **Barometer:** 992.4 mbar

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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GEOKON®

LT-2 @ 29.1 ft BGS

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-350 kPa

Date of Calibration: July 27, 2020

This calibration has been verified/validated as of 07/29/2020

Serial Number: 2028927

Temperature: 23.20 °C

Calibration Instruction: CI-Pressure Transducers 7 kPa~3.5 MPa

Barometric Pressure: 987.3 mbar

Cable Length: 60 feet

Technician:

Applied Pressure (kPa)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8991	8991	8991	-0.109	-0.03	-0.140	-0.04
70.0	8346	8346	8346	70.29	0.08	70.24	0.07
140.0	7706	7707	7707	140.1	0.02	140.0	0.01
210.0	7066	7067	7067	209.9	-0.02	209.9	-0.03
280.0	6425	6425	6425	279.9	-0.02	279.9	-0.03
350.0	5782	5782	5782	350.1	0.04	350.1	0.03

(kPa) Linear Gauge Factor (G): -0.1091 **(kPa/ digit)**

Polynomial Gauge factors: **A:** 9.646E-09 **B:** -0.1093 **C:**

Thermal Factor (K): -0.07490 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gauge Factor (G): -0.01583 **(psi/ digit)**

Polynomial Gauge Factors: **A:** 1.399E-09 **B:** -0.01585 **C:**

Thermal Factor (K): -0.01086 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures: **Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)$***

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)$*

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

Factory Zero Reading: 8991 **Temperature:** 20.5 °C **Barometer:** 992.4 mbar

The above instrument was found to be in tolerance in all operating ranges
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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GEOKON®

LT-1 @ 32 ft BGS

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-350 kPa

Date of Calibration: July 27, 2020

This calibration has been verified/validated as of 07/29/2020

Serial Number: 2028925

Temperature: 23.20 °C

Calibration Instruction: CI-Pressure Transducers 7 kPa~3.5 MPa

Barometric Pressure: 987.3 mbar

Cable Length: 100 feet

Technician:

Applied Pressure (kPa)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	9065	9065	9065	0.114	0.03	0.022	0.01
70.0	8450	8450	8450	69.94	-0.02	70.01	0.00
140.0	7835	7835	7835	139.8	-0.07	139.9	-0.03
210.0	7218	7217	7218	209.9	-0.04	210.0	0.01
280.0	6599	6600	6600	280.0	0.01	280.1	0.03
350.0	5983	5983	5983	350.0	0.01	349.9	-0.02

(kPa) Linear Gauge Factor (G): -0.1135 **(kPa/ digit)**

Polynomial Gauge factors: **A:** -1.04E-07 **B:** -0.1120 **C:**

Thermal Factor (K): -0.08886 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gauge Factor (G): -0.01647 **(psi/ digit)**

Polynomial Gauge Factors: **A:** -1.509E-08 **B:** -0.01624 **C:**

Thermal Factor (K): -0.01289 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)^*$

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

Factory Zero Reading: 9069 **Temperature:** 21.3 °C **Barometer:** 992.4 mbar

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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GEOKON®

LT-3 20 to 25 ft BGS

Vibrating Wire Tilt Sensor Calibration

Model Number: 6300-1

Serial Number: 2110115

Calibration Instruction: CI-6300

Calibration Date: June 02, 2021

This calibration has been verified/validated as of 06/09/2021

Temperature: 22.4 °C

Technician:

Inclination (sin)	Inclination (degrees)	*Reading 1st Cycle (digits)	*Reading 2nd Cycle (digits)	*Average Reading (digits)	Linear Error (%FS)	Polynomial Error (%FS)
0.1737	10.001	11867	11867	11867	-0.59	0.05
0.1392	8.002	11024	11023	11024	-0.34	0.00
0.1045	6.000	10174	10174	10174	-0.16	-0.03
0.0698	4.002	9320	9320	9320	-0.03	-0.05
0.0349	2.002	8460	8459	8460	0.02	-0.04
0.0175	1.001	8027	8026	8027	0.02	-0.01
0.0087	0.500	7810	7810	7810	0.01	-0.01
0.0000	0.000	7592	7593	7593	0.00	0.01
-0.0087	-0.500	7378	7377	7378	0.01	-0.01
-0.0175	-1.001	7162	7161	7162	0.02	-0.01
-0.0349	-2.002	6722	6722	6722	-0.06	0.05
-0.0698	-4.002	5851	5851	5851	-0.13	0.06
-0.1045	-6.000	4978	4978	4978	-0.22	0.04
-0.1392	-8.002	4104	4103	4104	-0.33	0.00
-0.1737	-10.001	3226	3226	3226	-0.48	-0.05

*Readings displayed in GK-401 Position B .

Linear Gauge Factor (G): 0.002312 **(degrees/ digit)**

Polynomial Gauge Factors: **A:** 5.804E-09 **B:** 0.002224 **C:** -17.225

Calculated Angle (degrees): **Linear,** $q = G (R_1 - R_0) + K (T_1 - T_0)$

Polynomial, $q = AR^2 + BR + C$

Wiring Code: Red and Black: Gage White and Green: Thermistor Bare: Shield

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

Campbell Scientific Inc
815 West 1800 North • Logan, Utah 84321-1784
Phone 435.227.9092 • Fax 435.227.9091
Fed. I.D. #87-0305157 • DUNS#06-798-0730

P.O. Number	2846
Invoice Number	273505
Shipment Number	357056-1
Invoice / Ship Date	11 Aug 2020
Due Date	10 Oct 2020
Customer Number	74962
Page	1

Invoice

BILL TO

Darren Beckstrand
Cornforth Consultants Inc
10250 SW Greenburg Rd Ste 111
Portland, OR 97223

SHIP TO

Darren Beckstrand
Cornforth Consultants Inc
10250 SW Greenburg Rd Ste 111
Portland, OR 97223

Buyer Contact	Darren Beckstrand	Payment Terms	N60
Phone	503-452-1100	Ship Via	FEDEX GROUND
Email	dbeckstrand@cornforthconsult	Freight Terms	PP&A
User Name	Darren Beckstrand	Incoterms	FOB Logan, UT

Li	Model	Part/UID	Description	CO	Qty	UM	Unit Price	Ext. Price
1	ClimaVUE50 -10-PT	34331-1	Compact Digital SDI-12 Weather Sensor -10 w/10ft per sensor -PT w/Tinned Wires	US	1	EA	1,784.37	1,784.37
2	CRVW3-RF40 7-RC-SM	31706-19	3-Channel Vibrating-Wire Datalogger -RF407 w/900MHz Radio -RC w/Rechargeable Batt -SM w/Standard Mounting	US	1	EA	1,426.08	1,426.08
3	CR6-RF407- ST-SW-CC	28385-14	Measurement & Control Datalogger -RF407 w/900MHz Radio -ST -40 to +70C -SW Standard 3yr Warranty -CC Campbell Calibration	US	1	EA	2,344.66	2,344.66
4		21847	Cellular Phone Antenna	US	1	EA	91.35	91.35

Continued

Total

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815 West 1800 North • Logan, Utah 84321-1784
Phone 435.227.9092 • Fax 435.227.9091
Fed. I.D. #87-0305157 • DUNS#06-798-0730

P.O. Number	2846
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Invoice

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Cornforth Consultants Inc
10250 SW Greenburg Rd Ste 111
Portland, OR 97223

Buyer Contact	Darren Beckstrand	Payment Terms	N60
Phone	503-452-1100	Ship Via	FEDEX GROUND
Email	dbeckstrand@cornforthconsult	Freight Terms	PP&A
User Name	Darren Beckstrand	Incoterms	FOB Logan, UT

Li	Model	Part/UID	Description	CO	Qty	UM	Unit Price	Ext. Price
			Cable Type N Male to SMA, 12ft					
5		32262	4G/3G Omni 2dBd Antenna w/Type N Female & CSI Mounting Hardware	US	1	EA	99.47	99.47
6		14204	900MHz 0dBd Omni 1/2 Wave Whip Antenna w/Right Angle & RPSMA Male	US	2	EA	24.87	49.74
7	CELLPROV-V -25-Y2	33855-26	Cellular Data Modem Provisioning for User Supplied modem -V Verizon US -25 25MB/Mon Data Plan For 2 Year(s) NOT CANCELABLE OR	US	1	EA	332.92	332.92
							Continued	
							Total	

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AUG 14 2020

Campbell Scientific Inc
815 West 1800 North • Logan, Utah 84321-1784
Phone 435.227.9092 • Fax 435.227.9091
Fed. I.D. #87-0305157 • DUNS#06-798-0730

P.O. Number	2846
Invoice Number	273505
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Invoice

BILL TO	SHIP TO
Darren Beckstrand Cornforth Consultants Inc 10250 SW Greenburg Rd Ste 111 Portland, OR 97223	Darren Beckstrand Cornforth Consultants Inc 10250 SW Greenburg Rd Ste 111 Portland, OR 97223

Buyer Contact	Darren Beckstrand	Payment Terms	N60
Phone	503-452-1100	Ship Via	FEDEX GROUND
Email	dbeckstrand@cornforthconsult	Freight Terms	PP&A
User Name	Darren Beckstrand	Incoterms	FOB Logan, UT

Li	Model	Part/UID	Description	CO	Qty	UM	Unit Price	Ext. Price
			RETURNABLE PRODUCT					
8	KONECTPBRO UTER	34612	Konect PakBus Router, 2-Year Subscription NOT CANCELABLE OR RETURNABLE PRODUCT	GB	1	EA	142.10	142.10
							Subtotal	6,270.69
							Sales Tax	0.00
							Freight	23.56
							Total	6,294.25

JOB # 2846 APPROVAL DB CODE 690

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amazon.com

Details for Order #114-2206881-8029000

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Order Placed: July 22, 2020
Amazon.com order number: 114-2206881-8029000
Order Total: $140.89

2846

Not Yet Shipped

Items Ordered	Price
1 of: *Solar Panel Pole Mount Kit Single Arm Pole-Wall Mounting Brackets Support Solar Panels from 5W to 50W* Sold by: Link Solar (seller profile) Condition: New	$49.99
1 of: *NOCO NCP2 CB104S 4 Oz Oil-Based Battery Corrosion Preventative Brush-On* Sold by: Amazon.com Services LLC Condition: New	$13.95
1 of: *NOCO NCP2 MC303S Oil-Based Battery Anti-Corrosion Terminal Preventative Protector Pads (Pack of 2)* Sold by: Amazon.com Services LLC Condition: New	$0.97
1 of: *ACOPOWER 20 Watt 20W Mono Solar Panel for 12 V Battery Charging, Off Grid* Sold by: Amazon.com Services LLC Condition: New	$44.70
1 of: *ACOPOWER HY010-12M 10 Watt 10W Mono Solar Panel for 12V Battery Charging RV Boat, Off Grid* Sold by: Amazon.com Services LLC Condition: New	$31.28

Shipping Address:
Darren Beckstrand
Cornforth Consultants
10250 SW Greenburg Rd. Suite 111
Portland, Oregon 97223
United States

Shipping Speed:
Amazon Day Delivery

Payment information

Payment Method:
Amazon.com Visa | Last digits: 6534

Billing address
Darren Beckstrand
1221 NE Kinney St.
Hillsboro, OR 97124
United States

Item(s) Subtotal:	$140.89
Shipping & Handling:	$0.00
Total before tax:	$140.89
Estimated tax to be collected:	$0.00
Grand Total:	**$140.89**

To view the status of your order, return to Order Summary.

2846

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Search

ENCLOSURE HUB

Account

Cart (0)

Fiberglass | Painted Steel | Polycarbonate | Stainless Steel | Waterproof Protective Cases | Control Stations | Wireway & Trough | Enclosure Dimension Search | Data Communication Infastructure | Small Plastic Enclosures | Extruded Aluminum Enclosures

Return to Account Details

Order 5229

Placed on July 22, 2020

Billing Address

Payment Status: Authorized

Darren Beckstrand
1221 NE Kinney St
Hillsboro, Oregon
United States 97124
5038445913

Shipping Address

Fulfillment Status: Fulfilled

Darren Beckstrand
Cornforth Consultants
10250 SW Greenburg Rd, Suite 111
Portland, Oregon
United States 97223
(503) 452-1100

Product	Quantity	Total
ELITE-HFLL Series - Polycarbonate Enclosures with Opaque Hinged Cover, Locking Latch, and FLANGES - 16x14x7 - TYPICALLY SHIPS IN 5-7 BUSINESS DAYS Fulfilled July 28, 2020 UPS #1Z7Y768F0346458355	2	$234.96
Non Metallic- N4X-FG - BP Series Inner Mounting Panels - 14x12 - TYPICALLY SHIP IN ESTIMATED 3-5 DAYS Fulfilled July 28, 2020 UPS #1Z7Y768F0346458355	2	$43.12
Subtotal:		$278.08
Shipping (Free Shipping):		$0.00
Total:		$278.08 USD

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amazon.com

Final Details for Order #114-5132915-9751402

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Order Placed: June 1, 2020
Amazon.com order number: 114-5132915-9751402
Order Total: $567.90

Shipped on June 4, 2020

Items Ordered	Price
1 of: *Sierra Wireless AirLink Raven RV50 Industrial LTE Gateway with Ethernet/Serial/USB/GPS - North America - AC Adapter* Sold by: Olympian LED (seller profile) | Product question? Ask Seller Condition: New	$567.90

Shipping Address:
Darren Beckstrand
1221 NE Kinney St.
Hillsboro, OR 97124
United States

Job No. 2846

Shipping Speed:
One-Day Shipping

Payment information

Payment Method:
Amazon.com Visa | Last digits: 6534

Billing address
Darren Beckstrand
1221 NE Kinney St.
Hillsboro, OR 97124
United States

Item(s) Subtotal:	$567.90
Shipping & Handling:	$0.00
Total before tax:	$567.90
Estimated tax to be collected:	$0.00
Grand Total:	**$567.90**

Credit Card transactions

Visa ending in 6534: June 4, 2020: $567.90

To view the status of your order, return to Order Summary.

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Final Details for Order #112-0486674-1459431

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Order Placed: August 13, 2020
Amazon.com order number: 112-0486674-1459431
Order Total: $21.00

Shipped on August 14, 2020

Items Ordered	Price
1 of: *Sierra Wireless DC Power Cable ES/GX/MP/RV/LX* Sold by: Olympian LED (seller profile) | Product question? Ask Seller Condition: New	$21.00

Shipping Address:
Darren Beckstrand
Cornforth Consultants
10250 SW Greenburg Rd. Suite 111
Portland, Oregon 97223
United States

Shipping Speed:
One-Day Shipping

Payment information

Payment Method:
Amazon.com Visa | Last digits: 6534

Billing address
Darren Beckstrand
1221 NE Kinney St.
Hillsboro, OR 97124
United States

Item(s) Subtotal:	$21.00
Shipping & Handling:	$0.00
Total before tax:	$21.00
Estimated tax to be collected:	$0.00
Grand Total:	**$21.00**

Credit Card transactions

Visa ending in 6534: August 14, 2020: $21.00

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Details for Order #114-0163508-0170617

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2846

Order Placed: July 22, 2020
Amazon.com order number: 114-0163508-0170617
Order Total: $89.99

Preparing for Shipment

Items Ordered	Price
1 of: *Interstate Batteries 12V 35AH Sealed Lead Acid (SLA) AGM Deep Cycle Battery (DCM0035) Insert Terminals* Sold by: Interstate Batteries (seller profile) Condition: New	$89.99

Shipping Address:
Darren Beckstrand
Cornforth Consultants
10250 SW Greenburg Rd. Suite 111
Portland, Oregon 97223
United States

Shipping Speed:
Two-Day Shipping

Payment information

Payment Method:
Amazon.com Visa | Last digits: 6534

Billing address
Darren Beckstrand
1221 NE Kinney St.
Hillsboro, OR 97124
United States

Item(s) Subtotal:	$89.99
Shipping & Handling:	$0.00
Total before tax:	$89.99
Estimated tax to be collected:	$0.00
Grand Total:	**$89.99**

To view the status of your order, return to Order Summary.

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GEOKON®

48 Spencer Street
Lebanon, NH 03766 USA
Tel: 603-448-1562
Fax: 603-448-3216
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www.geokon.com

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Schedule B
No 9015.80.8040
Geotechnical Instruments

Invoice

Invoice #	Invoice Date
00073927	7/29/2020
Page 1 of 1	

Bill To:
Cornforth Consu/Landslide Tech
10250 SW Greenburg Rd
Suite 111

Portland, OR 97223
UNITED STATES

Ship To:
Landslide Technology / Michael Bunn C/O
Todd W. Lowrance / MO DOT Southwest District
275 A Southwest Outer Road

Branson, MO 65616
UNITED STATES

CUSTOMER PO NUMBER	TERMS	SHIP VIA	TRADE TERMS
2846	Net 30 Days	FedEx Ground	FCA-Lebanon,NH

ORDERED BY	SALES REPRESENTATIVE	ORDER DATE	OUR ORDER #	CUSTOMER ID
Darren Beckstrand	Chris Brun	7/23/2020	20074711	1367

LN	DL	ORDERED	SHIPPED	PART IDENTIFIER	DESCRIPTION	UNIT	UNIT PRICE	EXTENDED PRICE
01	01	3.00	3.00	4500S-350KPA	VW Piezometer, unvented, 350 kPa (51psi) *Attach 02-250V6-E signal cable in FEET as follows: 2 @ 60 ft 1 @ 100 ft	EA	400.00	US 1200.00
02	01	320.00	320.00	02-250V6-E	Blue PVC Cable, 0.250", 2 twisted pairs	FT	0.79	US 252.80
03	01	250.00	250.00	02-250V6-E	Blue PVC Cable, 0.250", 2 twisted pairs *Spare cable - continuous length in ft*	FT	0.79	US 197.50
							Sales Tax	0.00

JOB # 2846 APPROVAL DB CODE

LINE ITEM TOTALS	DISCOUNT	SUB TOTAL	FREIGHT	TAXABLE AMOUNT	TAX	MISC	INVOICE TOTAL
1650.30	0.00	1650.30	22.09	0.00	0.00	0.00	US 1672.39

E-mail Invoices to: cseverdia@cornforthconsultants.com

All Amounts in US Dollars

To pay this invoice using a credit card, please visit: www.geokon.com/payinvoice

SED ITN #	Weight:	Package Count:	Tracking Numbers:
	25	1	911104081015

Citizens, NA | 1 Citizens Drive Riverside, RI 02915 USA
SWIFT No: CTZIUS33 | Account No: 3311337060
International ABA No: 011500120 | Domestic EFT ABA No: 011401533

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Authorized Signature for Geokon, LLC.

Made in the USA

GEOKON®

48 Spencer Street
Lebanon, NH 03766 USA
Tel: 603-448-1562
Fax: 603-448-3216
e-mail: geokon@geokon.com
www.geokon.com

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Schedule B
No 9015.80.8040
Geotechnical Instruments

Invoice

Invoice #	Invoice Date
00078518	6/9/2021
Page 1 of 1	

Bill To:

Cornforth Consu/Landslide Tech
10250 SW Greenburg Rd
Suite 111

Portland, OR 97223
UNITED STATES

Ship To:

Cornforth Consu/Landslide Tech
10250 SW Greenburg Rd
Suite 111

Portland, OR 97223
UNITED STATES

CUSTOMER PO NUMBER	TERMS	SHIP VIA	TRADE TERMS
2846	Net 30 Days	UPS Ground	FCA-Lebanon,NH

ORDERED BY	SALES REPRESENTATIVE	ORDER DATE	OUR ORDER #	CUSTOMER ID
Michael Bunn	Chris Brun	5/20/2021	20078758	1367

LN	DL	ORDERED	SHIPPED	PART IDENTIFIER	DESCRIPTION	UNIT	UNIT PRICE		EXTENDED PRICE
01	01	1.00	1.00	6300-1	VW In-Place Inclinometer, uniaxial *Attach 02-187P6-E signal cable in FEET: 1 @ 50 ft	EA	687.00	US	687.00
02	01	50.00	50.00	02-187P6-E	Blue Polyurethane Cable, 0.187", 2 twisted pairs	FT	0.85	US	42.50
03	01	1.00	1.00	6300-4A	Connecting Tube, 0 to 1.5m	EA	81.00	US	81.00
04	01	1.00	1.00	6300-5-3	Suspension Bracket w/ wheel assembly and cable attachment	EA	282.00	US	282.00
05	01	25.00	25.00	07-125SS-E	Stainless Steel Aircraft Cable, 1/8" Specify lengths required 1 @ 25 ft	FT	2.56	US	64.00
06	01	1.00	1.00	6300-5	Bottom Wheel Assembly	EA	139.00	US	139.00
07	01	40.00	40.00	6300-6E	Support Cable for in-place inclinometer *Specify lengths* 1 @ 40 ft	FT	0.63	US	25.20
08	01	1.00	1.00	6300-10	Installation Kit for 6300 series inclinometers (1 kit per 25 inclinometers)	EA	0.00	US	0.00
							Sales Tax		0.00

LINE ITEM TOTALS	DISCOUNT	SUB TOTAL	FREIGHT	TAXABLE AMOUNT	TAX	MISC	INVOICE TOTAL
1320.70	0.00	1320.70	26.40	0.00	0.00	0.00	US 1347.10

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All Amounts in US Dollars

To pay this invoice using a credit card, please visit: www.geokon.com/payinvoice

SED ITN # | Weight: | Package Count: | Tracking Numbers:

Citizens, NA | 1 Citizens Drive Riverside, RI 02915 USA
SWIFT No: CTZIUS33 | Account No: 3311337060
International ABA No: 011500120 | Domestic EFT ABA No: 011401533

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Authorized Signature for Geokon, LLC.

Made in the USA

```
'CR6 Series
'Created by M Bunn

'History
'2020-09-06 DLB Changed the depth calculations to depth below ground surface
            'and changed the elevation values in the variable array to sensor install depth.
            'Result variable array label adjusted to add 'BGS' as a name suffix.  ie. LT-1_DepthBGS
'2021-06-25 DLB added displacement calculations for the LT-3 IPI
'2022-10-26 DLB Changed VWP table interval to 4 hours and turned off SW12 to the modem remotely.
'    Remove quotes from lines 338 to 342 and add to line 442 to get modem powered again.

'PakBus Addresses
'MoDOT Branson Base Station, Area 40
'LT-3 CRVW3 PakBus Address: 401

'////////////////////////  VWP Summary  ////////////////////////////////
'Boring    SN            Depth
'All GEOKON VWPs.
'LT-01     2028925      32.0
'LT-02     2028927      29.1
'LT-03     2028926      27.0
'LT-03 IPI 2110115     20-25'

'////////////////////  Declare Variables  ////////////////////////////
'Constants

'Dim Count
Public LT3_Result
  Const A = 1.40304E-3  'For Thermistor Calcs
  Const B = 2.37318E-4
  Const C = 9.0E-8

'Variables for CRVW3 at LT-3
Public LT3_Batt_Volt
Public LT3_CPU_Temp
Public LT3_Freq
Public LT3_Amp
Public LT3_SigNoisR
Public LT3_NoisFreq
Public LT3_DecayRat
Public LT3_Freq_Ch2
Public LT3_Amp_Ch2
Public LT3_SigNoisR_Ch2
Public LT3_NoisFreq_Ch2
Public LT3_DecayRat_Ch2
Public R1(4)  'these were all 3's
Public T1(4)
Public Depth(3) 'still a three since the new IPI isn't a depth
Public LT3_IPI_Disp
Public VWFreq(4)
Public Sig2Noise(4)
Public  DecayRatio(4)
```

```
Public  FreqOfNoise(4)
Public  Amp(4)
'Declare Other Variables
 Dim PSI
 Dim i,j
 Dim Coef(4,5) 'these were all 3's
 Dim GF(4), K(4), T0(4), R0(4), E(4), Therm(4)

Alias R1(1) = LT1_R
Alias R1(2) = LT2_R
Alias R1(3) = LT3_R 'Remote VWP
Alias R1(4) = LT3_R_IPI 'Remote VWP

Alias T1(1) = LT1_T
Alias T1(2) = LT2_T
Alias T1(3) = LT3_T  'Remote VWP
Alias T1(4) = LT3_T_IPI   'Remote VWP

Alias Depth(1) = LT1_DepthBGS
Alias Depth(2) = LT2_DepthBGS
Alias Depth(3) = LT3_DepthBGS  'Remote VWP

Public BattV
Public PTemp_C
Public VW(2,6)

Units BattV=Volts
Units PTemp_C=Deg C
Units VWFreq=Hz
Units Amp=mV RMS


'Declare Variables for Weather Station
'The constant 4.66778 is for adjusting the barometric pressure measurement to sea level. This
'value is for a site altitude of 400 m.

Const SeaLevelAdj=4.66778
'Declare Variables and Units
Public CVData(14)
Public SlrTF_MJ
Public CVMeta As String * 40
Public WSprev
Public WindDirprev
Public MaxWSprev
Public Invalid_Wind As Long

Alias CVData(1)=SlrFD_kW
Alias CVData(2)=Rain_mm
Alias CVData(3)=Strikes
Alias CVData(4)=Dist_km
Alias CVData(5)=WS_ms
Alias CVData(6)=WindDir
```

```
105  Alias CVData(7)=MaxWS_ms
106  Alias CVData(8)=AirT_C
107  Alias CVData(9)=VP_hPa
108  Alias CVData(10)=BP_hPa
109  Alias CVData(11)=RH
110  Alias CVData(12)=RHT_C
111  Alias CVData(13)=TiltNS_deg
112  Alias CVData(14)=TiltWE_deg
113
114  Units SlrTF_MJ=MJ/m^2
115  Units SlrFD_kW=kW/m^2
116  Units Rain_mm=mm
117  Units Strikes=count
118  Units Dist_km=kilometers
119  Units WS_ms=meters/second
120  Units WindDir=degrees
121  Units MaxWS_ms=meters/second
122  Units AirT_C=Deg C
123  Units VP_hPa=hPa
124  Units BP_hPa=hPa
125  Units RH=%
126  Units RHT_C=Deg C
127  Units TiltNS_deg=degrees
128  Units TiltWE_deg=degrees
129
130  '////////////// DATA TABLE DEFINITIONS FROM CRVW3 LOGGERS  ///////////
131  DataTable (LT3_VW_Data,1,-1)
132      DataInterval (0,4,Hr,10)
133      Average (1,LT3_Freq,IEEE4,False)
134      Maximum (1,LT3_Freq,IEEE4,False,False)
135      Minimum (1,LT3_Freq,IEEE4,False,False)
136      Average (1,LT3_Amp,IEEE4,False)
137      Maximum (1,LT3_Amp,IEEE4,False,False)
138      Minimum (1,LT3_Amp,IEEE4,False,False)
139      Average (1,LT3_SigNoisR,IEEE4,False)
140      Maximum (1,LT3_SigNoisR,IEEE4,False,False)
141      Minimum (1,LT3_SigNoisR,IEEE4,False,False)
142      Average (1,LT3_NoisFreq,IEEE4,False)
143      Maximum (1,LT3_NoisFreq,IEEE4,False,False)
144      Minimum (1,LT3_NoisFreq,IEEE4,False,False)
145      Average (1,LT3_DecayRat,IEEE4,False)
146      Maximum (1,LT3_DecayRat,IEEE4,False,False)
147      Minimum (1,LT3_DecayRat,IEEE4,False,False)
148      Average (1,LT3_T,IEEE4,False)
149      Maximum (1,LT3_T,IEEE4,False,False)
150      Minimum (1,LT3_T,IEEE4,False,False)
151      Average (1,LT3_R,IEEE4,False)
152      Maximum (1,LT3_R,IEEE4,False,False)
153      Minimum (1,LT3_R,IEEE4,False,False)
154      StdDev  (1,LT3_R,IEEE4,False)
155      Average (1,LT3_Freq_Ch2,IEEE4,False)
156      Maximum (1,LT3_Freq_Ch2,IEEE4,False,False)
```

```
157       Minimum (1,LT3_Freq_Ch2,IEEE4,False,False)
158       Average (1,LT3_Amp_Ch2,IEEE4,False)
159       Maximum (1,LT3_Amp_Ch2,IEEE4,False,False)
160       Minimum (1,LT3_Amp_Ch2,IEEE4,False,False)
161       Average (1,LT3_SigNoisR_Ch2,IEEE4,False)
162       Maximum (1,LT3_SigNoisR_Ch2,IEEE4,False,False)
163       Minimum (1,LT3_SigNoisR_Ch2,IEEE4,False,False)
164       Average (1,LT3_NoisFreq_Ch2,IEEE4,False)
165       Maximum (1,LT3_NoisFreq_Ch2,IEEE4,False,False)
166       Minimum (1,LT3_NoisFreq_Ch2,IEEE4,False,False)
167       Average (1,LT3_DecayRat_Ch2,IEEE4,False)
168       Maximum (1,LT3_DecayRat_Ch2,IEEE4,False,False)
169       Minimum (1,LT3_DecayRat_Ch2,IEEE4,False,False)
170       Average (1,LT3_T_IPI,IEEE4,False)
171       Maximum (1,LT3_T_IPI,IEEE4,False,False)
172       Minimum (1,LT3_T_IPI,IEEE4,False,False)
173       Average (1,LT3_R_IPI,IEEE4,False)
174       Maximum (1,LT3_R_IPI,IEEE4,False,False)
175       Minimum (1,LT3_R_IPI,IEEE4,False,False)
176       StdDev  (1,LT3_R_IPI,IEEE4,False)
177     EndTable
178
179     DataTable (VWP_Results,1,-1)
180       DataInterval (0,4,Hr,10)
181       Minimum (1,BattV,IEEE4,False,False)
182       Minimum (1,PTemp_C,IEEE4,False,False)
183       Average (3,Depth(),IEEE4,False)
184       Average (1, LT3_IPI_Disp,IEEE4,False)
185       Average (4,T1(),IEEE4,False)
186       Minimum (1,LT3_Batt_Volt,IEEE4,False,False)
187       Minimum (1,LT3_CPU_Temp,IEEE4,False,False)
188     EndTable
189
190     DataTable (VWP_Raw,1,-1)
191       DataInterval (0,4,Hr,10)
192       Average (4,R1(),IEEE4,False)
193       Average (4,T1(),IEEE4,False)
194     EndTable
195
196     '////DATA TABLES FOR WEATHER STATION////////////////
197     'Define Data Tables
198     DataTable(Hourly,True,-1)
199      DataInterval(0,60,Min,10)
200      Average(1,SlrFD_kW,FP2,False)
201      Totalize(1,SlrTF_MJ,IEEE4,False)
202      Totalize(1,Rain_mm,FP2,False)
203      WindVector(1,WS_ms,WindDir,FP2,False,0,0,0)
204      FieldNames("WS_ms_S_WVT,WindDir_D1_WVT,WindDir_SD1_WVT")
205      Maximum(1,MaxWS_ms,FP2,False,True)
206      Totalize(1,Invalid_Wind,FP2,False)
207      Average(1,AirT_C,FP2,False)
208      Maximum(1,AirT_C,FP2,False,True)
```

```
  Minimum(1,AirT_C,FP2,False,True)
  Average(1,VP_hPa,IEEE4,False)
  Sample(1,BP_hPa,IEEE4)
  Maximum(1,BP_hPa,IEEE4,False,True)
  Minimum(1,BP_hPa,IEEE4,False,True)
  Sample(1,RH,FP2)
  Average(1,RHT_C,FP2,False)
  Average(1,TiltNS_deg,FP2,False)
  Average(1,TiltWE_deg,FP2,False)
  Totalize(1,Strikes,FP2,False)
  Minimum(1,Dist_km,FP2,False,True)
  Sample(1,CVMeta,String)
 EndTable

 DataTable(Daily,True,-1)
  DataInterval(0,1,Day,10)
  Totalize(1,Rain_mm,FP2,False)
  Average(1,SlrFD_kW,FP2,False)
  Totalize(1,SlrTF_MJ,IEEE4,False)
  WindVector(1,WS_ms,WindDir,FP2,False,0,0,1)
  Totalize(1,Invalid_Wind,FP2,False)
  FieldNames("WS_ms_S_WVT,WindDir_D1_WVT")
  Maximum(1,MaxWS_ms,FP2,False,True)
  Average(1,AirT_C,FP2,False)
  Maximum(1,AirT_C,FP2,False,True)
  Minimum(1,AirT_C,FP2,False,True)
  Average(1,VP_hPa,IEEE4,False)
  Maximum(1,BP_hPa,IEEE4,False,True)
  Minimum(1,BP_hPa,IEEE4,False,True)
  Maximum(1,RH,FP2,False,False)
  Minimum(1,RH,FP2,False,False)
  Maximum(1,RHT_C,FP2,False,False)
  Minimum(1,RHT_C,FP2,False,False)
  Maximum(1,TiltNS_deg,FP2,False,True)
  Minimum(1,TiltNS_deg,FP2,False,True)
  Maximum(1,TiltWE_deg,FP2,False,True)
  Minimum(1,TiltWE_deg,FP2,False,False)
  Sample(1,CVMeta,String)
 EndTable

 'Calibration history table
 'DataTable(CalHist,NewFieldCal,10)
 '    SampleFieldCal
 'EndTable

 'Main Program
 BeginProg

 '////////////////////  Table of Values for Instruments  ////////////////////
 ' "0.01" "10", "9000", and "100" numbers are fake
 '         GF         K         T0      R0       E          SN      Station #
 Data -0.01647,  -0.01289,  21.3,  9069,  32.0  '20####   LT-1 (E is sensor install depth)
```

```
Data -0.01583,  -0.01086,  20.5,  8991,  29.1   '20####   LT-2 (E is sensor install depth)
Data -0.01573,  -0.01293,  21.3,  9021,  27.0   '20####   LT-3 Remote Station (E is sensor install depth)

  For i = 1 To 3
    For j = 1 To 5
      Read Coef(i,j)
    Next j
  Next i

  For i = 1 To 3
    GF(i) = Coef(i,1)
    K(i)  = Coef(i,2)
    T0(i) = Coef(i,3)
    R0(i) = Coef(i,4)
    E(i)  = Coef(i,5)
  Next i

Scan (1,Min,0,0)  '**** SET SCAN INTERVAL  ****

    'Get ClimaVUE 50 Compact Digital Weather Sensor metadata 'CVMeta' every day at midnight in
    'case sensor is swapped or OS is updated
    If TimeIntoInterval(0,1,Day) Then
        SDI12Recorder(CVMeta,C1,0,"I!",1,0)
    EndIf
    'ClimaVUE 50 Compact Digital Weather Sensor measurements
    'SlrFD_kW', 'Rain_mm', 'Strikes', 'Dist_km', 'WS_ms', 'WindDir',
    'MaxWS_ms', 'AirT_C', 'VP_hPa', BP_hPa', 'RH', 'RHT_C',
    'TiltNS_deg', and 'TiltWE_deg'
    'Get data from ClimaVUE 50 Compact Digital Weather Sensor
    SDI12Recorder(CVData(),C1,0,"R7!",1,0,-1)
    'High winds with rain can temporarily interfere with sonic wind measurements causing the
    'sensor to output invalid winds of -9999 OR -9990.
    'The following instructions set all wind measurements less than 0 to the previous valid
    'wind measurements. This will "flat-line" the measurements until the sensor is able to
    'make good readings again. The Invalid_Wind variable will be set to 1 when a wind
    'measurement is invalid. For troubleshooting purposes, it is highly recommended that you
    'Totalize the Invalid_Wind variable in any output tables you define that include wind
    'speed AND/OR direction data from the ClimaVUE 50.
    If WS_ms < 0 Then
        WS_ms = WSprev
        WindDir = WindDirprev
        MaxWS_ms = MaxWSprev
        Invalid_Wind = 1
    Else
        Invalid_Wind = 0
    EndIf
    WSprev = WS_ms
    WindDirprev = WindDir
    MaxWSprev = MaxWS_ms
    'Correct barometric pressure in kPa to sea level
    BP_hPa=BP_hPa+SeaLevelAdj
    'Convert fractional relative humidity into percent relative humidity
```

```
313       RH=RH*100
314       'Calculate total solar flux in MJ/m^2 from flux density in W/m^2
315       'The multiplier to calculate total flux assumes
316       'the program execution rate (scan rate) is 60 s.
317       'If you change the program execution rate,
318       'you will need to recalculate this multiplier.
319       SlrTF_MJ=SlrFD_kW*6E-05
320       'Convert solar flux density in W/m^2 to kW/m^2
321       SlrFD_kW=SlrFD_kW*0.001
322       'Convert vapor pressure in kPa to hPa
323       VP_hPa=VP_hPa*10
324       'Convert barometric pressure in kPa to hPa
325       BP_hPa=BP_hPa*10
326       'Call Data Tables and Store Data
327       CallTable Hourly
328       CallTable Daily
329
330    PanelTemp (PTemp_C,60)
331    Battery (BattV)
332
333    '////////////////////  Cell modem power control  ////////////////////////////
334     'SW12 Timed Control
335     'Turn ON SW12 between 0800 hours and 1700 hours
336     'remove second asterick for 15 minutes every 60 minutes
337
338    ' If TimeIsBetween(7,18,24,Hr) Then
339    'SW12 (SW12_1,1 )
340    '  Else
341    ' SW12(SW12_1,0)
342    ' EndIf
343
344
345    '////////////////////  Retrieve Variable From Local CR6 ////////////////
346    VibratingWire (VW(),2,U1,1400,3500,1,0.01,"",60,A,B,C)
347
348    For i = 1 To 2
349       Amp(i)        = VW(i,2)
350       T1(i)         = VW(i,6)
351       VWFreq(i)     = VW(i,1)
352       Sig2Noise(i)  = VW(i,3)
353       DecayRatio(i) = VW(i,5)
354       FreqOfNoise(i) = VW(i,4)
355
356       R1(i) = VWFreq(i)^2 / 1000              'Current Reading in Digits
357     Next i
358    Delay (0,10,Sec)
359
360    '////////////////////  Retrieve Variable From Remote Dataloggers  ///////////////
361    'VARIABLES FROM LT-3
362    GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Batt_Volt",LT3_Batt_Volt,1)
363    GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","CPU_Temp",LT3_CPU_Temp,1)
364    GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_Freq",LT3_Freq,1)
```

```
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_Amp",LT3_Amp,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_SigNoisR",LT3_SigNoisR,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_NoisFreq",LT3_NoisFreq,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_DecayRat",LT3_DecayRat,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_Therm",Therm(3),1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_Temp",T1(3),1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan1_Digits",R1(3),1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_Freq",LT3_Freq_Ch2,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_Amp",LT3_Amp_Ch2,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_SigNoisR",LT3_SigNoisR_Ch2,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_NoisFreq",LT3_NoisFreq_Ch2,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_DecayRat",LT3_DecayRat_Ch2,1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_Therm",Therm(4),1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_Temp",T1(4),1)
GetVariables (LT3_Result,COMRF,0,401,0,0,"VW_Data","Chan2_Digits",R1(4),1)
'GetDataRecord(LT3_Result,COMRF,0,401,0,0,1,1,LT3_VW_Data,1)

For i = 1 To 3
   PSI = (GF(i) * (R1(i) - R0(i))) + K(i)*(T1(i) - T0(i)) 'Calculate Pressure in psi
   If PSI < 0.04 Then
      Depth(i) = "NAN"   'NAN" will be returned in the table rather than a negative number
    Else             'depth at sensor or below the tip.
      Depth(i) = (E(i) - ((PSI) * 2.31))*(-1)              'Calculate Depth in Feet BGS, returning a negative number to solve Konec
   EndIf
 Next i

For i = 4 To 4
   LT3_IPI_Disp = 0.10+(1.20*( 60 * ( SIN (0.002312 * ( (LT3_R_IPI - 7800) * (3.14159265359/180)))))) 'Calculate Displacem
      '0.10 is the total displacement from 20' to 33' as of April 20, 2021 even though IPI is only 20 to 25'
      '1.20 is the factor to increase the 20 to 25' displacement to esitmate total displacement 20 to 33'... The total 0.10" include
      '60 is the gauge length in inches
      '0.002312 is the gauge factor in degrees per digit
      '7800 is the R0 for the installed IPI tilt sensor
  Next i

   'Get ClimaVUE50 Compact Digital Weather Sensor metadata 'CVMeta' every day at midnight in case sensor is swapped or
   If IfTime(0,1,Day) Then'1 Day
      SDI12Recorder(CVMeta,C1,"0","!",1,0)
   EndIf
   'ClimaVUE50 Compact Digital Weather Sensor measurements
   'SlrFD_W', 'Rain_mm', 'Strikes', 'Dist_km', 'WS_ms', 'WindDir',
   'MaxWS_ms', 'AirT_C', 'VP_mbar', BP_mbar', 'RH', 'RHT_C',
   'TiltNS_deg', and 'TiltWE_deg'
   'The datalogger program execution rate (scan rate) is less than ten seconds. The ClimaVUE50 Compact Digital Weather S
   'measurements. The following SDI12Recorder instruction will only be executed/measured every ten seconds because of th
   'SlrTF_MJ', 'Rain_mm', and 'Strikes' must be zeroed every scan so old/stale measurements are not included multiple times
   'Average, maximum, minimum, and other outputs will not be statistically impacted by the old/stale measurements of other C
   SlrTF_MJ=0
   Rain_mm=0
   Strikes=0
   If TimeIntoInterval(0,10,Min) Then'10 Min
      'Get data from ClimaVUE50 Compact Digital Weather Sensor
```

```
417         SDI12Recorder(CVData(),C1,"0","R7!",1,0,-1)
418         'Convert fractional relative humidity into percent relative humidity
419         RH=RH*100
420         'Calculate total solar flux in MJ/m^2 from flux density in W/m^2
421         'The multiplier to calculate total flux was calculated by Short Cut
422         'and based on a program execution rate (scan rate) of 5 Seconds.
423         'If you change the program execution rate outside of Short Cut with the CRBasic Editor
424         'you will need to recalculate this multiplier. See the sensor manual for more details.
425
426         'High winds with rain can temporarily interfere with sonic wind measurements causing the sensor to output -9999 or -99
427         'to the previous valid wind measurements. This will 'flat-line' the measurements until the sensor is able to make good re
428         'a wind measurement is invalid. For troubleshooting purposes, it is highly recommended that you totalize the Invalid_Wi
429         'wind speed and/or direction data from the ClimaVUE50.
430         If WS_ms<0 Then
431             WS_ms=WSPrev
432             WindDir=WindDirPrev
433             MaxWS_ms=MaxWSprev
434             Invalid_Wind=1
435         Else
436             WSPrev=WS_ms
437             WindDirPrev=WindDir
438             MaxWSprev=MaxWS_ms
439             Invalid_Wind=0
440         EndIf
441       EndIf
442    SW12(SW12_1,0)
443       'Call Data Tables and Store Data
444
445    '        CallTable CalHist
446       CallTable LT3_VW_Data
447      CallTable VWP_Raw
448      CallTable VWP_Results
449    NextScan
450    EndProg
```

Notes of Ongoing Maintenance of Branson Landslide Project

Slope Inclinometers

SIs were read using a GeoKon MEMs SI on a two-foot interval. The A0 direction is marked on the casing. The depth of the bottom reading from the top of the casing is written on the SI cap and in the table below. The probe used for LT's research readings references depths from the middle of the SI probe. Other probes may reference depths from the bottom wheel (1 foot lower). If using a probe that measures from the bottom wheel, read the SI with a 1-foot extension at the top of the casing

Instrument	Top Reading	Bottom Reading	Enclosure	Notes
LT-1	0'	56'	Above Ground – Combo Lock (1821)	N/A
LT-2	0'	46'	Above Ground – Combo Lock (1821)	N/A
LT-3	0'	48'	Flush Mount - 9/16? socket	IPI Installed from 20 to 25 BGS, do not read manually

Access LT-01 is from old 76. Park where the road reaches the top of the new cut, then walk along the top of the cut, along the tree line, until you see the yellow above-ground monument.

LT-02 and LT-03 can be accessed from the Ozark Mountain High Road.

IPI Notes

When removing the IPI to install and use on another project, complete the following steps. **If these steps are not followed, the IPI will break during transport.**

1. Carefully remove the IPI from the casing.
2. Remove the Phillips head seal screw from the sensor assembly. Tape this screw to the side of the IPI, so it doesn't get lost. It will be reinstalled when the IPI is placed in a new casing, to keep the system waterproof.

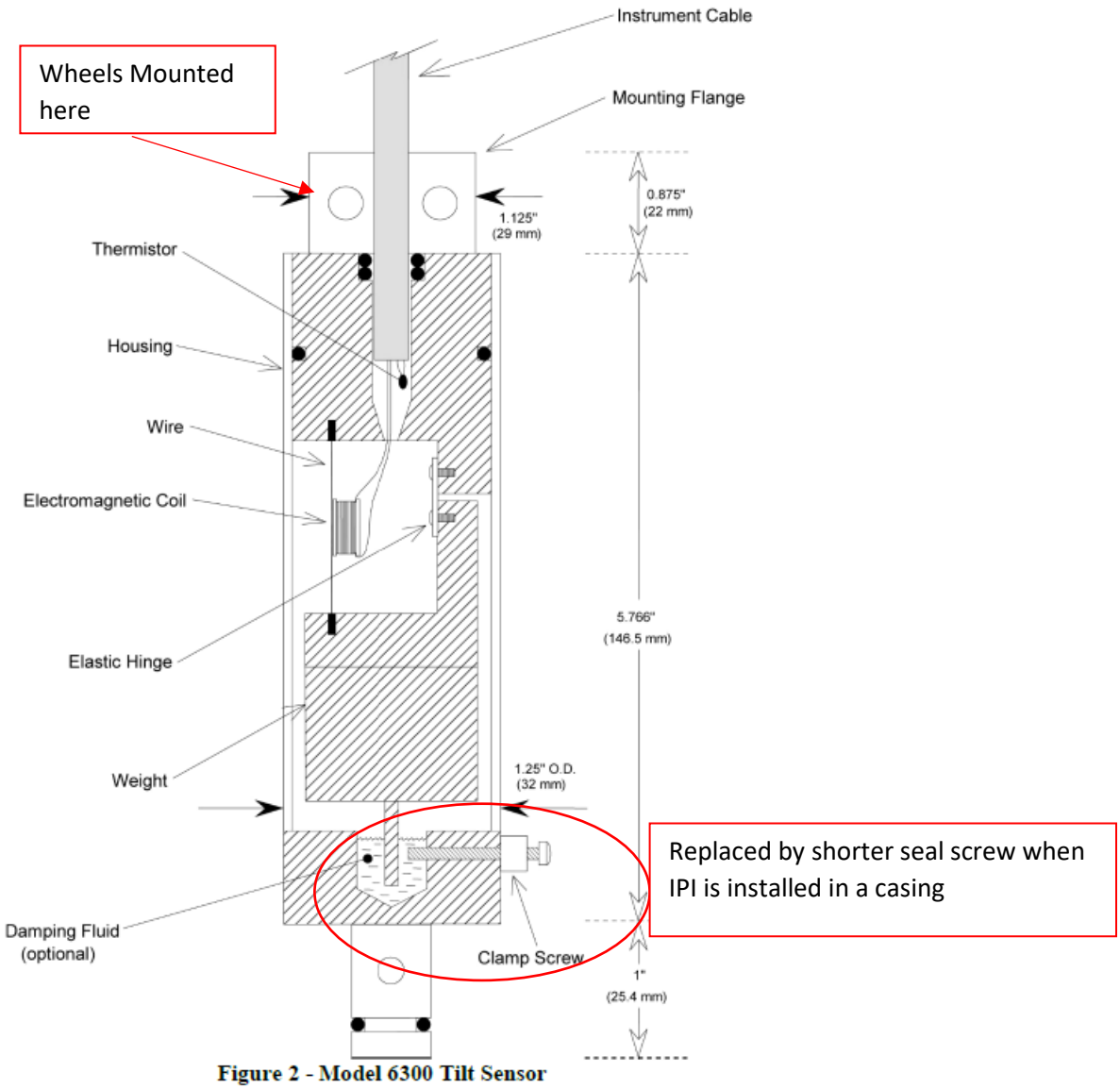
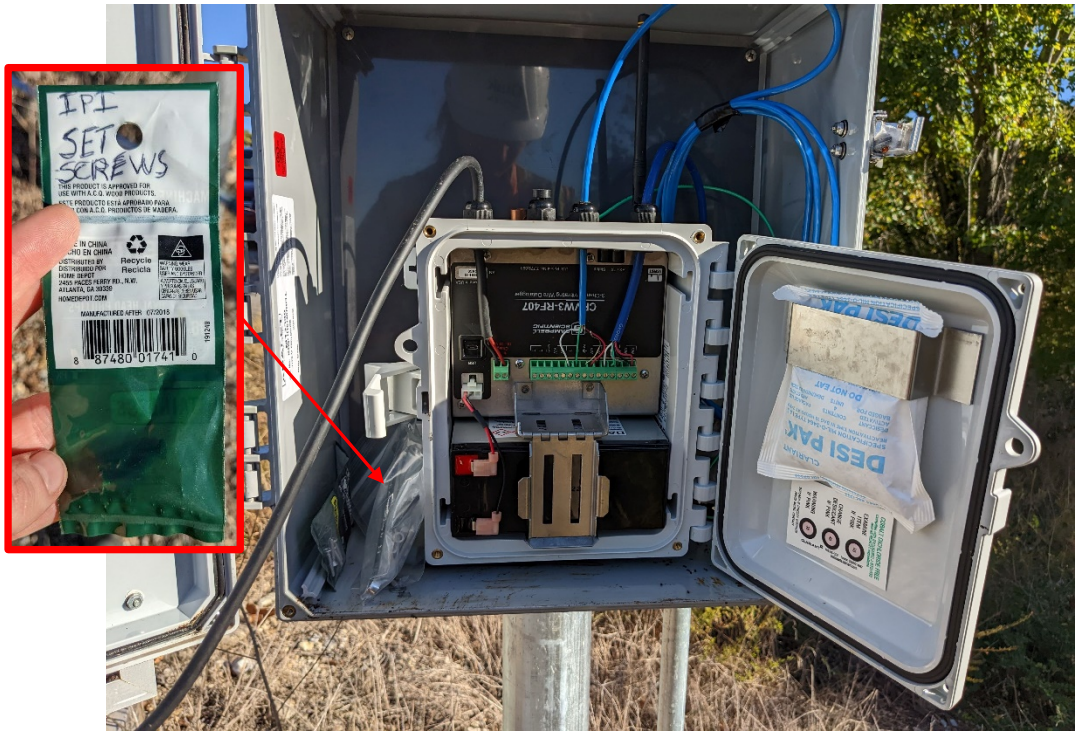


Figure 2 - Model 6300 Tilt Sensor

3. **Re-install the clamp screw immediately, prior to transport.** This screw prevents the internal pendulum from moving beyond the range of the suspension, breaking the sensor and making the IPI inoperable. The clamp screw is currently in the LT-3 logger enclosure site. See photo below for clamp screw location as of October 2022.



Enclosures and Data Loggers

- All enclosures are secured with combination locks. The lock combination is 1821 (the year of Missouri statehood)
- Loggers are Campbell Scientific CRW-series. **The DevConfig utility and a driver are required to communicate with the logger.** The utility is free to download from the Campbell Scientific website. The driver is also free to download, but locating it will require some help from IT, since it typically prompts the user to install the first time they connect to the logger in the field.
- For downloading the logger data, see the DevConfig quick guide at the end of this document
- A spare USB cable is located in the LT-3 enclosure for downloading the data logger information.
- Remove the weather station cap annually (see Figure 3) and wipe out with a damp paper towel to remove any debris that has collected in upper funnel of the rain gauge sensor. Unlatch the cap by twisting the upper portion counterclockwise. Lift the upper half off gently to avoid damaging the sensor cable (See Figure 3).
- Clear out any debris in the temperature and humidity sensor area (see Figure 4)
- Wipe down the solar panels at LT-3 and the main logger station with a damp paper towel to remove dust.
- 

Figure 1: Weather Station / Upper Enclosure

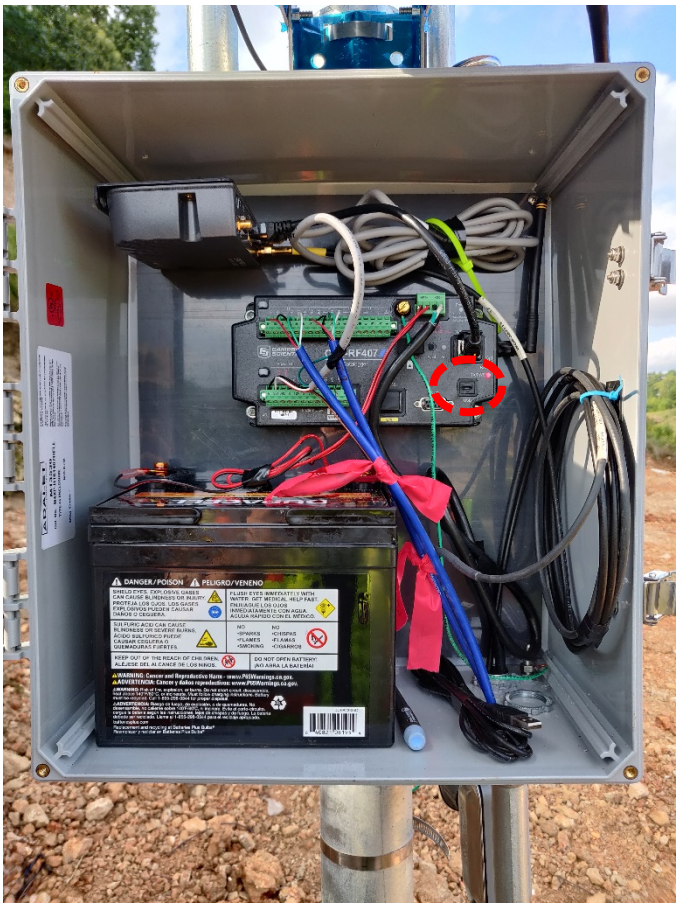


Figure 2: Inside of Upper Enclosure. The USB port for connecting to the laptop to download data is circled in red.

Figure 3: Weather Station at Upper Enclosure. Note cable running from logger to weather station.

Figure 4: Funnel (rain gauge) at top of weather station. Wipe out gently and remove any leaves. Clear out the temperature sensor area at the base of the weather station. Do not hit the temperature sensor (circled in red in the photo on the right).

DevConfig Guidance

This section includes a series of screen shots to improve user confidence when collecting data in the field. More detailed manuals are available from Campbell Scientific and the DevConfig Utility. These screenshots were taken while downloading logger data from the Branson dataloggers in October 2022.

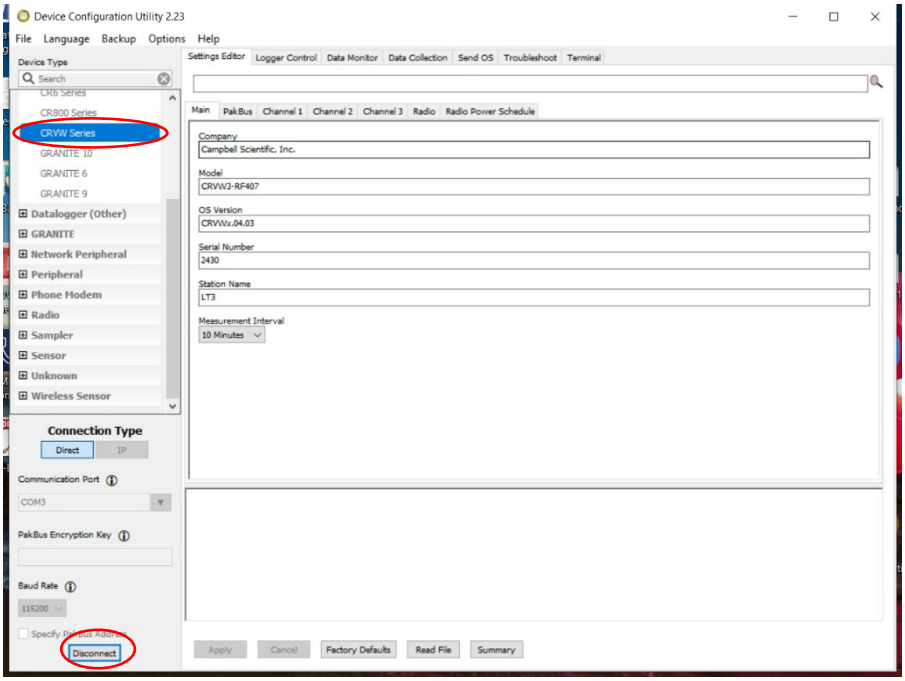


Figure 5: To connect to LT-3, select the "CRW Series" device type, then click "Connect" button. On first connecting with a new computer, the Communication Port may also need to be adjusted. The DevConfig should help identify the correct ComPort for the computer, and also suggest the correct Device Type if user selects the wrong one.

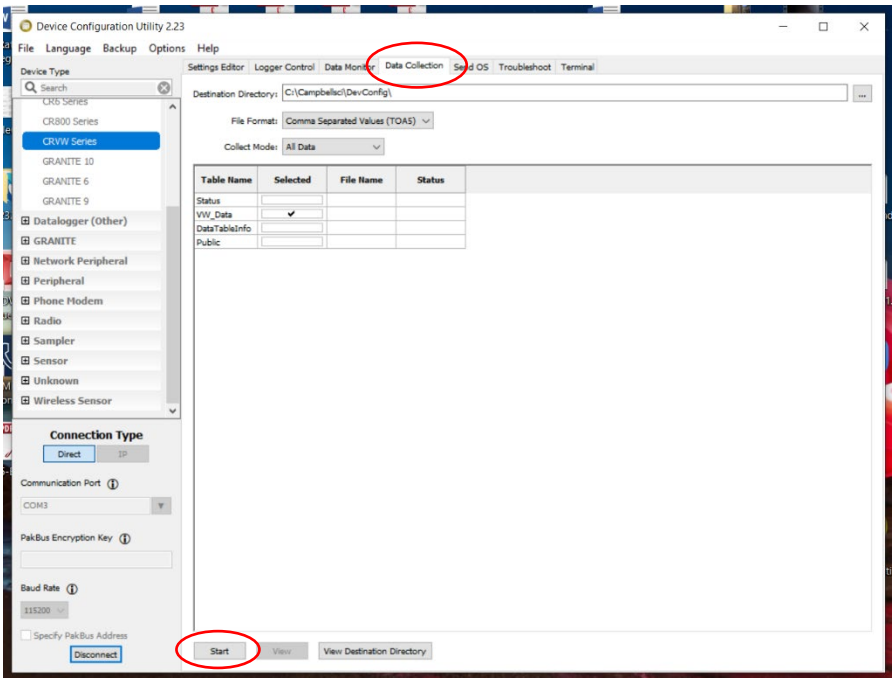


Figure 6: Click the data collection tab, then select Start to download data.

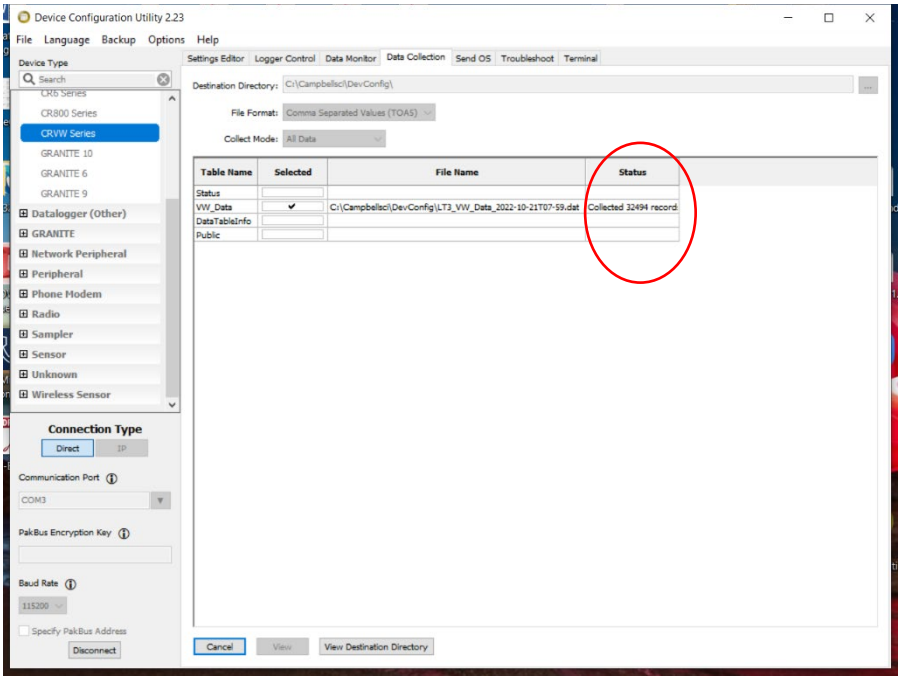


Figure 7: Once data collection starts, the Status column appears and shows how many readings have been collected. Data collection may take up to 10 minutes. Once all the data is collected, the status column entry will chance to "Complete with XXXX records."

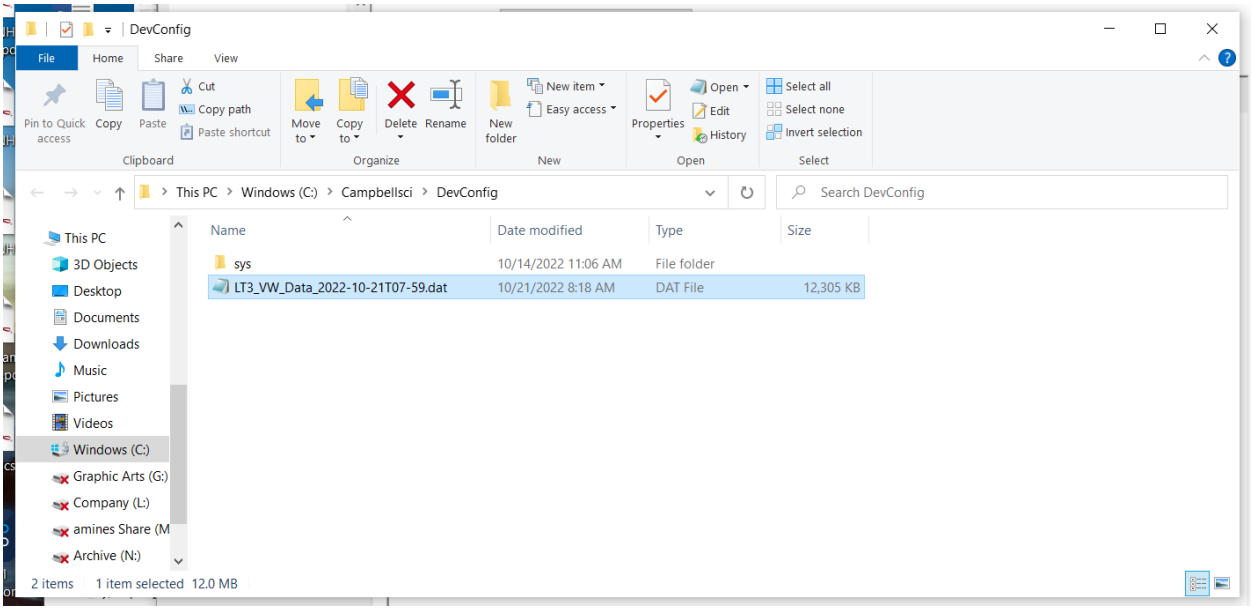


Figure 8: Click on the "View Destination Directory" button to view downloaded data, and confirm data is being collected properly. The .dat file can be copied into excel and then turned into a more approachable table using the Excel "Text to Column" function.

Things to check in the field after downloading the data:

- The time stamp for the last reading is from earlier that day
- Numbers in the last reading look "real," i.e., no NAN or 99999 entries, both of which are typical sensor error codes.

Notes:

The LT-3 logger collects raw data and sends it via the radio connection to the weather station base station. Groundwater depth and IPI displacement are calculated in the logger at that station.

After downloading the data, if there is a need to change the logger interval or other settings, use the Settings Editor tab (Figure 9) and update appropriate fields as necessary. Any changes will wipe the logger before restarting data collection, so do this AFTER downloading data.

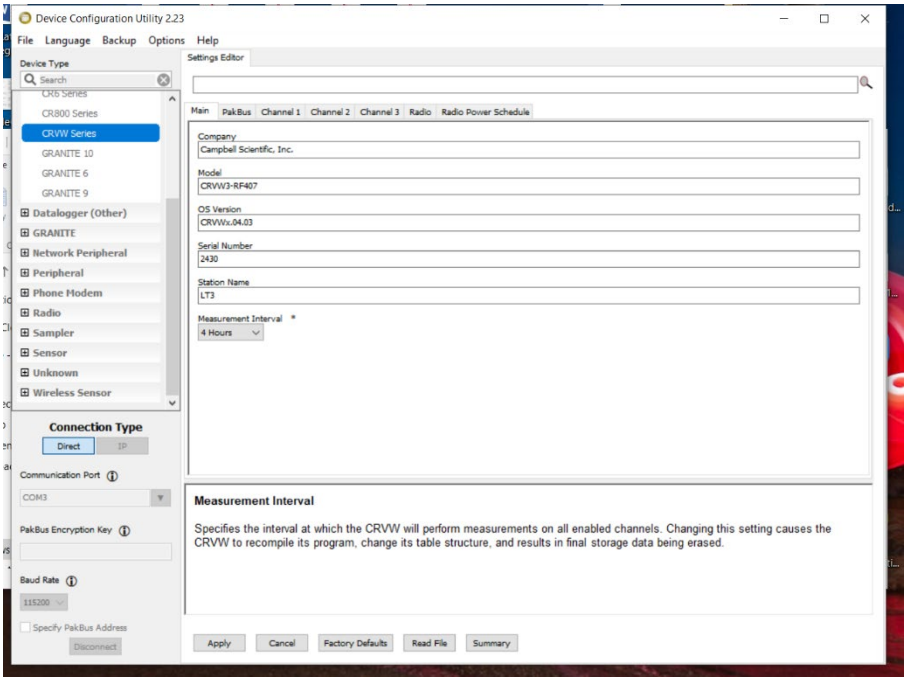


Figure 9: Settings editor screen, for updating logger interval, unit constants, etc.

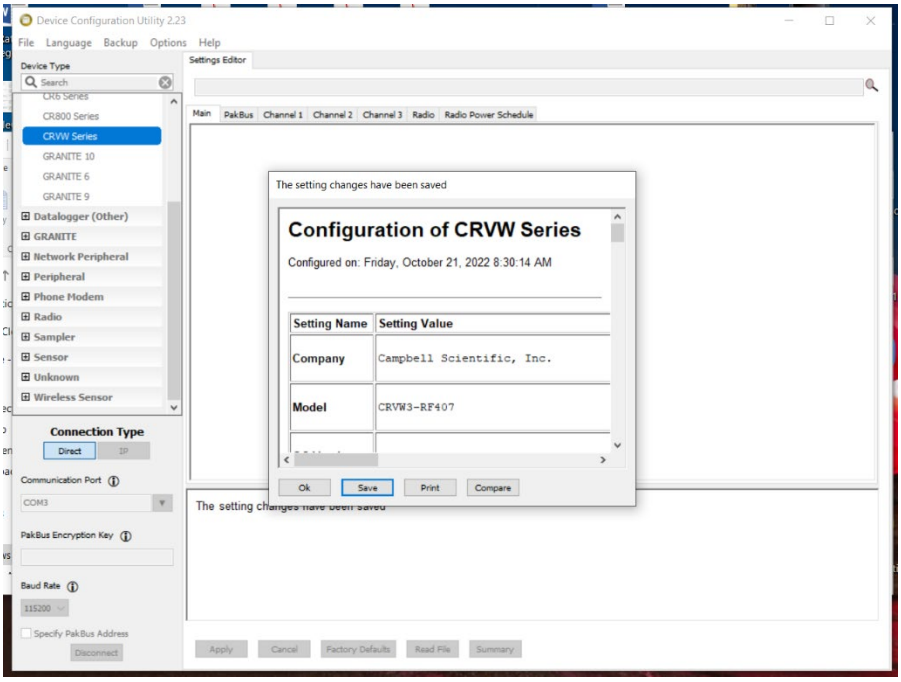


Figure 10: The "receipt" for any changes made to the settings. This can be saved for future reference.

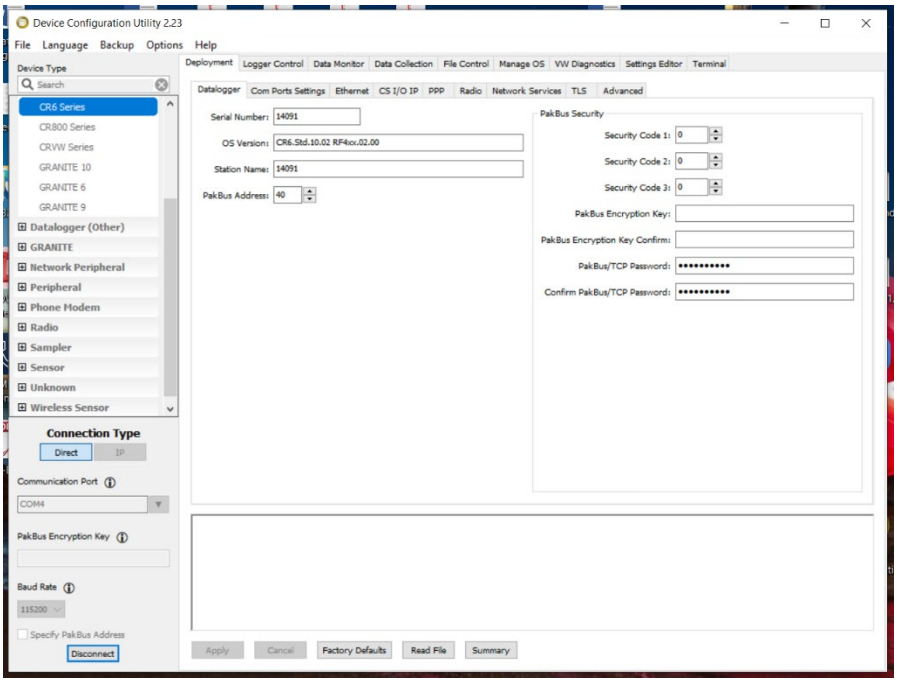


Figure 11: LT-2/Weather Station logger is a CR-6 series. Device type is different, but data collection is the same