Miller Hydrogeologic Incorporated

P.O. Box 996 • 55 Main Street • Pine Bush, New York 12566 • (845)524-2059

May 28, 2019

Barry Medenbach, P.E.
Medenbach and Eggers Civil Engineering and Land Surveying, PC
4305 US Hwy 209
Stone Ridge, NY 12484

Re: Bedrock Well BW-1 Testing Final Report
850 Rt. 28, LLC
Town of Kinston
Ulster County, New York
MHI Project No. 151-019.1

Dear Mr. Medenbach:

Miller Hydrogeologic, Incorporated (**MHI**) is pleased to present this final well testing report related to evaluation of the ground water supply at the referenced facility in the Town of Kingston, New York. All work was conducted according to the guidelines of the New York State Department of Health (NYSDOH), Part 5, Subpart 5-D.

INTRODUCTION

850 Rt. 28, LLC is currently evaluating the development of a parcel of property located at 850 Rt. 28 in the Town of Kingston, NY. An existing six inch diameter bedrock well, labeled BW-1, installed on the site in December of 2012 is planned to supply the project requirements. The total design flow average daily usage for the projects proposed warehouse facility and employee usage is 2900 gallons per day (gpd), or 2.01 gallons per minute (gpm). The proposed well testing rate was 5.0 gpm (7200 gpd), or approximately 2 times the average daily usage.

AQUIFER TESTING

To meet the requirements of the NYSDOH and to better quantify the aquifer hydraulic characteristics and establish the long term safe yield of the bedrock consolidated aquifer a 24 hour aquifer test was conducted on the test production well BW-1 with a well driller's completion log indicating a well depth of depth of 273 feet. Attachment 1 presents the New York State Department of Environmental Conservation well driller's log.

Aquifer Testing Protocol

The aquifer test protocols were developed with the goal for the well to achieve a stabilized yield and drawdown for a specific withdrawal rate during the final six (6) hours of pumping as per the regulations described in the New York State Department of Health Appendix 5-B: Standards for Water Wells.

Aquifer Test

Aquifer testing was conducted on the test production well BW-1 for a total 24 hours of pumping from May 20-21, 2019. A pumping rate was determined for the pumping well with an inline pulse flow meter and confirmed with timing flow into a five (5) gallon graduated container. For the BW-1 test production well the average pumping rate was approximately 5.26 gpm. Table 1 presents the intermittent pumping rates determined during the pumping period. The variation in pumping over the entire test period, except for the first 45 seconds, was less than 3 percent of the average flow rate.

The discharge water from the test production well was piped to a discharge location toward the northwest of the well and approximately 200 feet downslope of the test production well into a natural surface water drainage area.

Precipitation for the aquifer test period was obtained from data collected on-site. No precipitation was recorded during the test pumping or recovery periods.

Figure 1 presents the hydrograph of water level drawdown, in feet, for the pumping well for the 24 hour pumping and recovery period. All water level data were collected with a calibrated pressure transducer. All drawdown water level data are presented in Attachment 2.

DATA ANALYSIS

As described above water level data were collected as part of the test production well testing. Analysis of the data can be used to describe the ground water flow in the vicinity of the pumping well and aid in the determination of the consolidated aquifer's potential long term yield.

NYSDOH Guidance

The NYSDOH guidance requires that during the last six (6) hours of pumping the water level in any pumping well should not exceed a drawdown of 0.5 feet of water for every 100 feet of water in the pumping well prior to pumping. For the BW-1 test production well the approximate total depth of water in the well was determined prior to testing. The drilled total well depth is approximately 273 feet and a depth to water of 14.69 feet (measured just prior to the start of pumping) for the BW-1 test production well equates to a NYSDOH maximum allowable drawdown of 1.29 feet. The total drawdown for the final six hours of pumping in the BW-1 well was 0.86 feet which meets the NYSDOH guidance values for maximum allowable drawdown. Table 1 summarizes calculation of the NYSDOH guidance value.

180 DAY EXTRAPOLATED DRAWDOWN DETERMINATION

Since the solution of groundwater flow to a pumping well can generally be described as a logarithmic function with a non-linear solution (Theis, 1935) theoretically the water level in a pumping well will always be lowering but at a logarithmically deceasing rate. Therefore it is possible to approximate drawdowns in an individual pumping well by plotting the time-drawdown in the well as

semi-logarithmic in time and extrapolating out the drawdown trend to any future time period. The predicted drawdown is termed approximate as it does not consider any other sources or sinks which may be in the vicinity of the pumping well and affect local groundwater levels and is also generally considered a worst case pumping scenario. Figures 2 presents a semi-logarithmic plot for the pumping well BW- 1 projected out to 180 days of continuous pumping at the 24 hour aquifer tested rate of 5.26 gpm. The well shows decreasing drawdown with time and estimates a total drawdown of approximately 45.5 feet after 180 days of continuous pumping. The projected extrapolated drawdown predicated for the bedrock test well at the tested rate is not considered excessive and within the well's total available drawdown.

SUMMARY

A 24 hour aquifer test was conducted on the BW-1 bedrock well located at 850 Rt. 28, Kingston, NY. The test well is six inches in diameter and is completed to a depth of approximately 273 feet. The testing was according to the guidelines of the New York State Department of Health (NYSDOH), Part 5, Subpart 5-D. The proposed average daily usage for the project is approximately 2900 gpd or 2.01 gpm. The final average pumping rate during testing was 5.26 gpm or approximately 2.6 times the proposed average daily usage rate. Drawdown water level data was collected during the test with a calibrated pressure transducer. The well meets the criteria of the NYSDOH based on the drawdown recorded during the final six hours of pumping and should easily meet the proposed projects water use requirements.

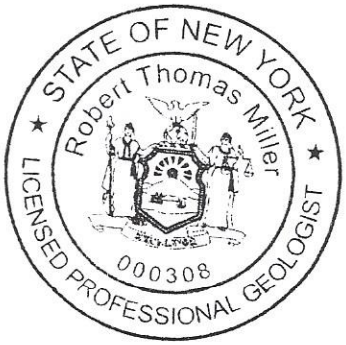
MHI thanks you for the opportunity to submit this final report for the successful completion of the project. If you should have any questions concerning our report please do not hesitate to contact me.

Very truly yours,

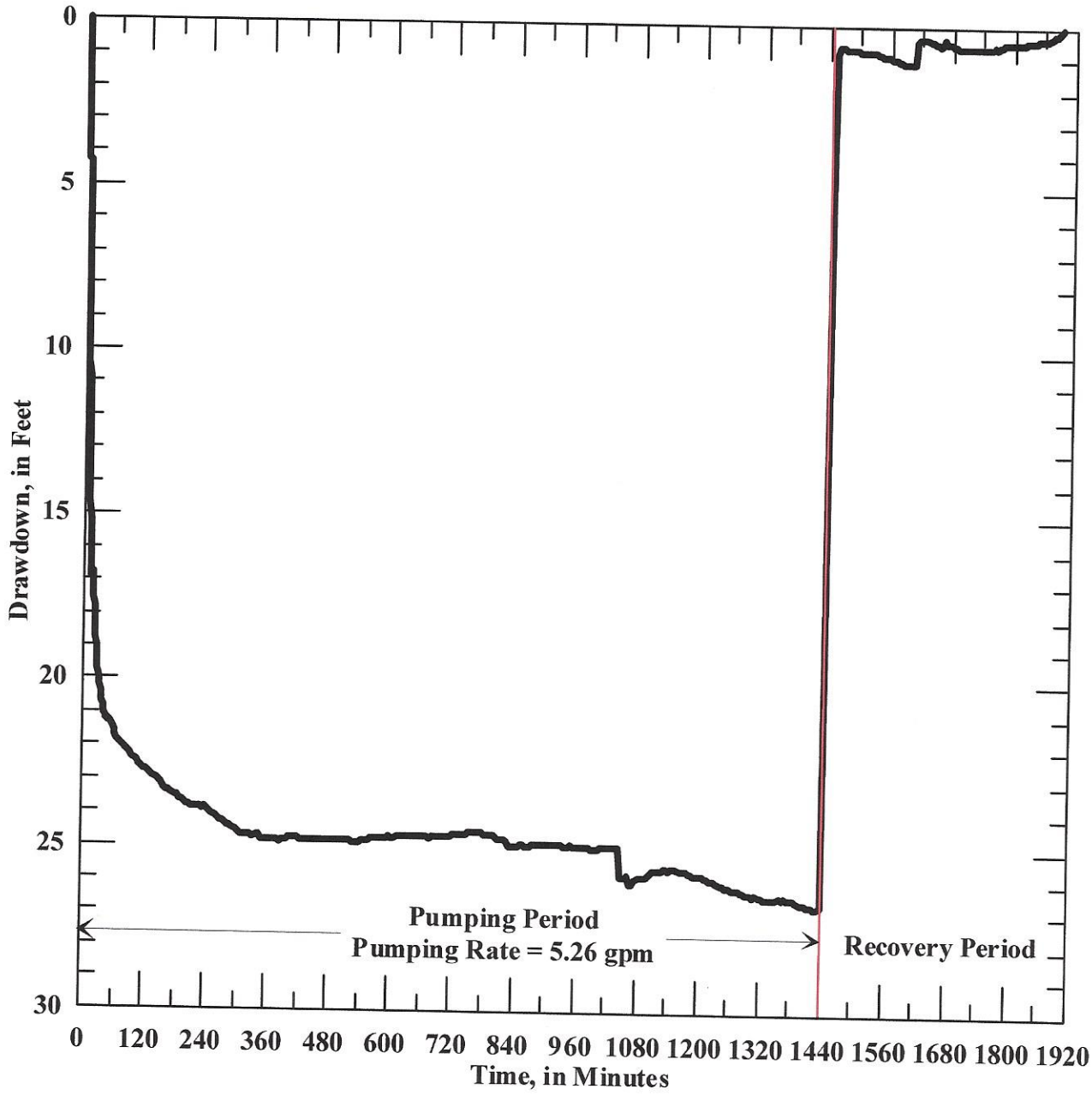
Miller Hydrogeologic Incorporated

Robert T. Miller, PG
Hydrogeologist
President

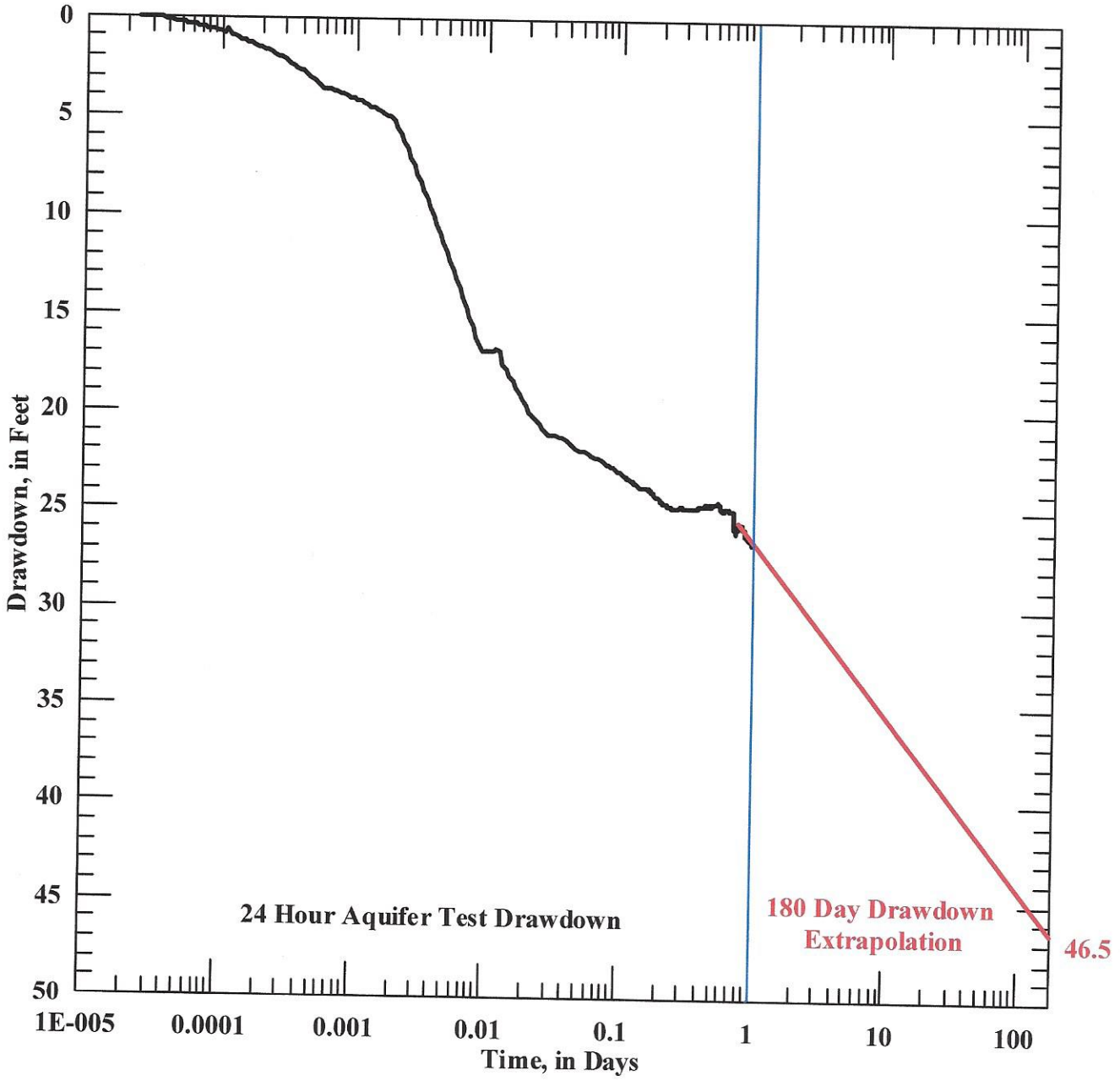
Attachments



FIGURES



Miller Hydrogeologic, Incorporated	Project No. *151-019*	FIGURE 1
	Date: *5/28/19*	**24 HOUR AQUIFER TEST DRAWDOWN AND RECOVERY FOR THE BW-1 BEDROCK TEST WELL.**
	Scale: *As Shown*	
	Drawn By: *RTM*	850 ROUTE 28, LLC TOWN OF KINSTON, ULSTER COUTY, NEW YORK



Miller Hydrogeologic, Incorporated

Project No.	*151-019*
Date:	*5/28/19*
Scale:	*As Shown*
Drawn By:	*RTM*

FIGURE 2

24 HOUR AQUIFER TEST DRAWDOWN AND 180 DAY DRAWDOWN EXTRAPOLATION FOR THE BW-1 BEDROCK TEST WELL.

850 ROUTE 28, LLC
TOWN OF KINSTON, ULSTER COUTY, NEW YORK

TABLES

TABLE 1

Pumping Rate for Well BW-1
850 Rt. 28, LLC Aquifer Test

Date	Time	Pumping Rate (GPM)
5/20/2019	11:05:00 AM	5.35
5/20/2019	11:51:00 AM	5.30
5/20/2019	12:15:00 PM	5.29
5/20/2019	12:55:00 PM	5.24
5/20/2019	2:35:00 PM	5.23
5/20/2019	4:15:00 PM	5.28
5/20/2019	6:17:00 PM	5.24
5/21/2019	8:00:00 AM	5.24
5/21/2019	9:17:00 AM	5.23
5/21/2019	10:20:00 AM	5.24
	Average Pumping Rate	5.26

TABLE 2

Summary Test Data for Well BW-1
850 Rt. 28, LLC Aquifer Test

Test Start	5/20/2019 11:05
Test Stop	5/21/2019 11:05
Test Duration	24 hours
Average Pumping Rate	5.26 gallons per minute
Initial Depth to water	14.69 feet
Total depth of well	273 feet
NYSDOH Guidance ((273-14.69)/100)* 0.5	1.29 feet
Water Level Drawdown at hour 18 (1080 minutes)	25.68 feet
Water Level Drawdown at hour 24 (1440 minutes)	26.54feet
Total Drawdown During Final 6 hours of Pumping	0.86 feet
Water Level Drawdown After 7.5 Hours of Recovery	0.33 feet
Percent Recovery After 24 Hours of Recovery	> 100 %

ATTACHMENTS

ATTACHMENT 1
WELL LOG

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

WATER WELL COMPLETION REPORT

(1) COUNTY Ulster

(2) TOWN Kingston

(3) DEC Well Number U7743

(4) OWNER Aargen Development

(5) ADDRESS P.O. Box 287 West Shokan N.Y. 12494

(6) LOCATION OF WELL (See Instructions On Reverse) 850 State Highway 28 Kingston N.Y. (Check here ☐ if address is same as above)

(7) LATITUDE/LONGTIUDE AND METHOD USED ☑ GPS ☐ Map 41° 58.830 74° 04.765

(8) TAX MAP NO.

(9) DEPTH OF WELL BELOW LAND SURFACE (feet) 273'

(10) DEPTH TO GROUNDWATER BELOW LAND SURFACE (feet) 25' DATE MEASURED 1/2/12

(45) WELL LOG

Depth to Bedrock 19 (ft. below land surface)

Ground Elevation 486' (ft. above sea level)

Top of Casing +1.5 (ft. above (+) or below (-) land surface)

CASINGS

(11) DIAMETER	6 in.	in.	in.	in.
(12) LENGTH	30 ft.	ft.	ft.	in.

(13) GROUT TYPE / SEALING Bentonite / Driveshoe

(14) GROUT / SEALING INTERVAL (feet) 20 FROM 28 TO 48

SCREENS

(15) MAKE & MATERIAL

(16) OPENINGS

(17) DIAMETER	in.	in.	in.	in.
(18) LENGTH	ft.	ft.	ft.	in.

(19) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet)

YIELD TEST

(20) DATE 1/2/12

(21) DURATION OF TEST 2 HRS

(22) LIFT METHOD ☐ Pump ☑ Air Lift ☐ Bailer

(23) STABILIZED DISCHARGE (GPM) 10

(24) STATIC LEVEL PRIOR TO TEST (feet/inches below top of casing)

(25) MAXIMUM DRAWDOWN (Stabilized) (feet/inches below top of casing)

(26) RECOVERY (Time in hours/minutes)

(27) Was the water produced during the test discharged away from immediate area? Yes ____ No X

PUMP INSTALLATION

(28) PUMP INSTALLED? YES ____ NO X

(29) DATE

(30) PUMP INSTALLER

(31) TYPE

(32) MAKE

(33) MODEL

(34) MAXIMUM CAPACITY (GPM)

(35) PUMP INSTALLATION LEVEL FROM TOP OF CASING (Feet)

DRILLER INFORMATION

(36) METHOD OF DRILLING ☐ Rotary ☐ Cable Tool ☑ Other Air Hammer

(37) USE OF WATER (See instructions for choices) Domestic

(38) DATE DRILLING WORK STARTED 1/2/12

(39) DATE DRILLING WORK COMPLETED 1/2/12

(40) DATE REPORT FILED 1/12/12

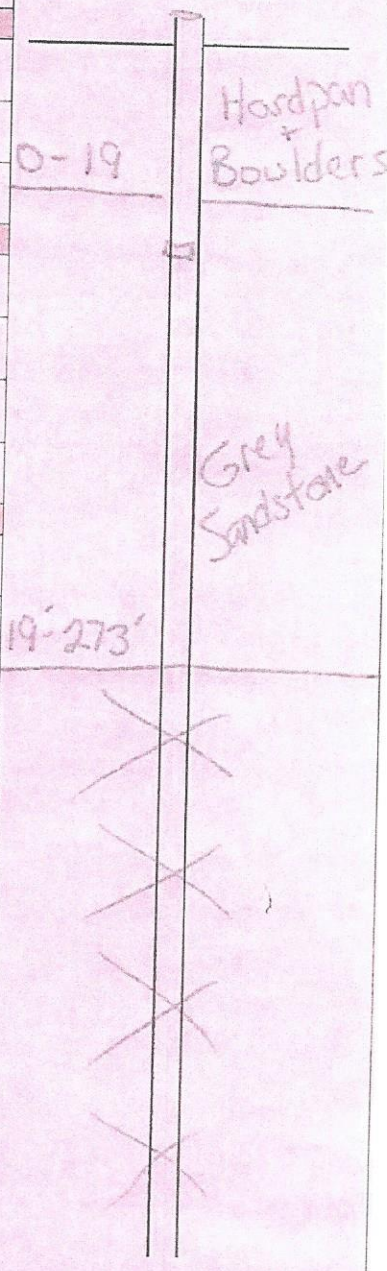
(41) REGISTERED COMPANY TITAN DRILLING

(42) DEC REGISTRATION NO. NYRD 0178

(43) CERTIFIED DRILLER (Print name) Troy Johnson

(44) CERTIFIED DRILLER SIGNATURE *

* By signing this document I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law 15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; (3) under the penalty of perjury the information provided in this Well Completion Report is true, accurate and complete, and I understand that any false statement made herein is punishable as a Class A Misdemeanor under Penal Law 210.45



ATTACHMENT 2
WATER LEVEL DRAWDOWN DATA

Time	Drawdown
Minutes	Feet
0	0.00
0.035	0.01
0.0398	0.05
0.045	0.09
0.05	0.09
0.0548	0.16
0.06	0.19
0.0648	0.23
0.07	0.27
0.075	0.29
0.0798	0.34
0.0848	0.39
0.09	0.41
0.095	0.45
0.1	0.45
0.1057	0.50
0.1118	0.55
0.1185	0.63
0.1255	0.66
0.1327	0.70
0.1405	0.75
0.1488	0.80
0.1578	0.61
0.167	0.98
0.1768	0.98
0.1875	1.09
0.1985	1.16
0.21	1.19
0.2225	1.26
0.2358	1.34
0.2498	1.39
0.2647	1.48
0.2803	1.55
0.297	1.64
0.3145	1.67
0.3333	1.78
0.3532	1.85
0.374	1.94
0.3963	1.99
0.4198	2.12
0.4445	2.21
0.4695	2.32
0.4963	2.41
0.5247	2.53

Time	Drawdown
Minutes	Feet
0.5547	2.64
0.5862	2.73
0.6213	2.87
0.6578	3.00
0.6963	3.16
0.738	3.30
0.7813	3.44
0.8278	3.57
0.8762	3.62
0.9278	3.65
0.9828	3.73
1.0412	3.78
1.103	3.84
1.1678	3.89
1.238	3.98
1.3113	4.03
1.3895	4.09
1.4728	4.18
1.5613	4.25
1.6547	4.32
1.753	4.39
1.858	4.50
1.9678	4.57
2.0845	4.66
2.2097	4.75
2.3412	4.86
2.4812	4.97
2.6297	5.05
2.7863	5.20
2.953	5.56
3.1297	5.91
3.3162	6.27
3.5145	6.65
3.7245	7.04
3.9463	7.42
4.1812	7.83
4.4295	8.21
4.6928	8.64
4.9728	9.07
5.2697	9.52
5.583	9.95
5.9145	10.40
6.2663	10.84
6.6395	11.34

Time	Drawdown
Minutes	Feet
7.0345	11.81
7.453	12.26
7.8962	12.73
8.3663	13.19
8.8645	13.69
9.3913	14.16
9.9497	14.66
10.5413	15.16
11.168	15.65
11.8312	16.15
12.5347	16.67
13.2795	16.90
14.0695	16.90
14.9062	16.88
15.7913	16.86
16.7295	16.81
17.723	16.86
18.7762	17.56
19.8913	17.85
21.073	18.11
22.3247	18.44
23.6497	18.74
25.0545	19.04
26.5428	19.37
28.1178	19.67
29.7863	19.96
31.5545	20.21
33.428	20.41
35.4112	20.64
37.513	20.84
39.7397	21.01
42.098	21.12
44.5963	21.20
47.2428	21.22
50.0463	21.27
53.0147	21.30
56.1595	21.39
59.4913	21.55
63.0195	21.70
66.758	21.86
70.7178	21.93
74.9113	22.00
79.3545	22.02
84.0613	22.11

Time	Drawdown
Minutes	Feet
89.0462	22.18
94.0462	22.27
99.0462	22.37
104.0462	22.48
109.0462	22.59
114.0462	22.66
119.0462	22.71
124.0462	22.77
129.0462	22.78
134.0462	22.87
139.0463	22.98
144.0463	23.01
149.0463	23.09
154.0463	23.19
159.0463	23.27
164.0463	23.35
169.0463	23.37
174.0463	23.42
179.0463	23.48
184.0463	23.53
189.0463	23.62
194.0463	23.67
199.0463	23.69
204.0463	23.76
209.0463	23.78
214.0463	23.85
219.0463	23.85
224.0463	23.85
229.0463	23.87
234.0463	23.89
239.0463	23.87
244.0463	23.89
249.0463	24.00
254.0463	24.07
259.0463	24.14
264.0463	24.23
269.0463	24.26
274.0462	24.26
279.0462	24.32
284.0462	24.39
289.0462	24.42
294.0462	24.50
299.0462	24.55
304.0462	24.60

Time	Drawdown
Minutes	Feet
309.0462	24.66
314.0462	24.67
319.0462	24.66
324.0462	24.67
329.0462	24.69
334.0462	24.75
339.0462	24.69
344.0462	24.69
349.0462	24.80
354.0462	24.85
359.0462	24.85
364.0462	24.85
369.0462	24.82
374.0462	24.84
379.0462	24.85
384.0462	24.87
389.0462	24.85
394.0462	24.83
399.0462	24.82
404.0462	24.78
409.0462	24.77
414.0462	24.77
419.0462	24.78
424.0462	24.82
429.0462	24.83
434.0462	24.83
439.0462	24.85
444.0462	24.85
449.0462	24.85
454.0462	24.85
459.0462	24.84
464.0462	24.84
469.0462	24.84
474.0462	24.80
479.0462	24.84
484.0462	24.82
489.0462	24.82
494.0462	24.82
499.0462	24.84
504.0462	24.82
509.0462	24.85
514.0462	24.85
519.0462	24.85
524.0462	24.85

Time	Drawdown
Minutes	Feet
529.0462	24.87
534.0462	24.87
539.0462	24.87
544.0462	24.84
549.0462	24.82
554.0462	24.82
559.0462	24.80
564.0462	24.78
569.0462	24.77
574.0462	24.78
579.0462	24.77
584.0462	24.77
589.0462	24.75
594.0462	24.73
599.0462	24.71
604.0462	24.73
609.0462	24.73
614.0462	24.71
619.0462	24.69
624.0462	24.71
629.0462	24.69
634.0462	24.68
639.0462	24.68
644.0462	24.69
649.0462	24.69
654.0462	24.68
659.0462	24.69
664.0462	24.68
669.0462	24.69
674.0462	24.69
679.0462	24.73
684.0462	24.71
689.0462	24.71
694.0462	24.71
699.0462	24.69
704.0462	24.68
709.0462	24.68
714.0462	24.69
719.0462	24.68
724.0462	24.64
729.0462	24.62
734.0462	24.62
739.0462	24.59
744.0462	24.60

Time	Drawdown
Minutes	Feet
749.0462	24.59
754.0462	24.57
759.0462	24.57
764.0462	24.57
769.0462	24.57
774.0462	24.55
779.0462	24.57
784.0462	24.59
789.0462	24.59
794.0462	24.62
799.0462	24.62
804.0462	24.64
809.0462	24.77
814.0462	24.78
819.0462	24.77
824.0462	24.77
829.0462	24.85
834.0462	24.93
839.0462	24.93
844.0462	24.93
849.0462	24.93
854.0462	24.91
859.0462	24.91
864.0462	24.94
869.0462	24.93
874.0462	24.93
879.0462	24.91
884.0462	24.89
889.0462	24.89
894.0462	24.89
899.0462	24.89
904.0462	24.87
909.0462	24.87
914.0462	24.87
919.0462	24.89
924.0462	24.89
929.0462	24.87
934.0462	24.89
939.0462	24.93
944.0462	24.94
949.0462	24.93
954.0462	24.91
959.0462	24.93
964.0462	24.93

Time	Drawdown
Minutes	Feet
969.0462	24.93
974.0462	24.94
979.0462	24.96
984.0462	24.98
989.0462	24.98
994.0462	25.00
999.0462	25.00
1004.046	25.00
1009.046	24.98
1014.046	24.98
1019.046	24.98
1024.046	24.94
1029.046	24.96
1034.046	24.96
1039.046	24.98
1044.046	24.94
1049.046	25.84
1054.046	25.87
1059.046	25.84
1064.046	25.77
1069.046	26.07
1074.046	26.04
1079.046	25.93
1084.046	25.87
1089.046	25.88
1094.046	25.86
1099.046	25.84
1104.046	25.78
1109.046	25.71
1114.046	25.68
1119.046	25.64
1124.046	25.64
1129.046	25.64
1134.046	25.61
1139.046	25.61
1144.046	25.62
1149.046	25.61
1154.046	25.61
1159.046	25.61
1164.046	25.64
1169.046	25.64
1174.046	25.66
1179.046	25.68
1184.046	25.71

Time	Drawdown
Minutes	Feet
1189.046	25.73
1194.046	25.77
1199.046	25.80
1204.046	25.82
1209.046	25.82
1214.046	25.86
1219.046	25.89
1224.046	25.91
1229.046	25.95
1234.046	25.96
1239.046	26.00
1244.046	26.05
1249.046	26.07
1254.046	26.11
1259.046	26.11
1264.046	26.12
1269.046	26.18
1274.046	26.20
1279.046	26.23
1284.046	26.27
1289.046	26.27
1294.046	26.32
1299.046	26.34
1304.046	26.36
1309.046	26.39
1314.046	26.37
1319.046	26.41
1324.046	26.45
1329.046	26.45
1334.046	26.46
1339.046	26.46
1344.046	26.50
1349.046	26.52
1354.046	26.46
1359.046	26.45
1364.046	26.46
1369.046	26.45
1374.046	26.48
1379.046	26.48
1384.046	26.50
1389.046	26.52
1394.046	26.55
1399.046	26.59
1404.046	26.61

Time	Drawdown
Minutes	Feet
1409.046	26.61
1414.046	26.66
1419.046	26.70
1424.046	26.70
1429.046	26.73
1434.046	26.74
1439.046	26.71
1444.046	13.81
1449.046	4.43
1454.046	0.87
1459.046	0.67
1464.046	0.67
1469.046	0.67
1474.046	0.69
1479.046	0.69
1484.046	0.71
1489.046	0.73
1494.046	0.75
1499.046	0.76
1504.046	0.78
1509.046	0.78
1514.046	0.78
1519.046	0.78
1524.046	0.82
1529.046	0.82
1534.046	0.85
1539.046	0.85
1544.046	0.91
1549.046	0.91
1554.046	0.92
1559.046	0.96
1564.046	0.98
1569.046	1.01
1574.046	1.05
1579.046	1.09
1584.046	1.12
1589.046	1.12
1594.046	1.14
1599.046	1.16
1604.046	1.16
1609.046	0.41
1614.046	0.37
1619.046	0.39
1624.046	0.39

Time	Drawdown
Minutes	Feet
1629.046	0.39
1634.046	0.41
1639.046	0.43
1644.046	0.48
1649.046	0.52
1654.046	0.57
1659.046	0.50
1664.046	0.39
1669.046	0.48
1674.046	0.53
1679.046	0.59
1684.046	0.59
1689.046	0.62
1694.046	0.62
1699.046	0.64
1704.046	0.64
1709.046	0.64
1714.046	0.66
1719.046	0.68
1724.046	0.66
1729.046	0.68
1734.046	0.64
1739.046	0.62
1744.046	0.62
1749.046	0.62
1754.046	0.62
1759.046	0.61
1764.046	0.62
1769.046	0.61
1774.046	0.57
1779.046	0.53
1784.046	0.53
1789.046	0.52
1794.046	0.50
1799.046	0.52
1804.046	0.52
1809.046	0.48
1814.046	0.48
1819.046	0.48
1824.046	0.46
1829.046	0.44
1834.046	0.43
1839.046	0.41
1844.046	0.39

Time	Drawdown
Minutes	Feet
1849.046	0.36
1854.046	0.36
1859.046	0.36
1864.046	0.34
1869.046	0.30
1874.046	0.25
1879.046	0.19
1884.046	0.14
1889.046	0.07
1894.046	0.03