

Technical Memorandum



Draft Technical Memorandum

Pumping Test Mountain Lake Test Well Big Sky, Montana

Introduction

This memo summarizes the test pumping program performed at the Mountain Lake test well.

Objectives

The objectives of the program include:

- Evaluate water supply capacity of the test well
- Evaluate water quality of the test well

Background

The test well was installed by Potts Drilling in February 2007. The draft driller's log for the well is provided as Attachment A. Key construction details of the well include:

Total Depth:	136 feet
Steel Casing:	8-inch to 56 feet
PVC Casing Diameter:	4 inches
Screen:	4 inch perforated PVC 131 to 136 feet

Geology

The test well was completed in Thermopolis Shale with Andesite sills present. The water source is assumed to be fractures in the Andesite sills and shales.

Eight-Hour Pumping Test

The eight hour pumping test was conducted on June 5 through 6, 2007. Key elements of the test program include:

Pump Depth: 130 feet
Discharge: 75 gpm (measured in 55 gallon drum with stop watch)
Pumping Period: 797 minutes (8.3 hours)
Recovery Period: 1026 minutes (17.1 hours)

Pumping Test Data: Figure 1 Drawdown versus Elapsed Time (Linear Scale)
Figure 2 Drawdown versus Elapsed Time (Log-Linear Scale)

Maximum Drawdown: 8.9 feet

Comments

Review of the pumping test data (Figures 1 and 2) showed an increased slope at about 490 minutes. This inflection is likely caused by interference from an adjacent well, but may have been indicative of an aquifer boundary condition. Therefore, an extended pumping period was recommended.

Review of the data also showed almost complete ground-water level recovery.

Twenty-Four Hour Pumping Test

The twenty four hour pumping test was conducted from June 11 through 13, 2007. Key elements of the test include:

Pump Depth: 130 feet
Discharge: 75 gpm (measured in 55 gallon drum with stop watch)
Pumping Period: 1446 minutes (24.1 hours)
Recovery Period: 1487 minutes (24.8 hours)

Pumping Test Data: Figure 3 Drawdown versus Elapsed Time (Linear Scale)
Figure 4 Drawdown versus Elapsed Time (Log-Linear Scale)

Scale)
Maximum Drawdown: 15.2 feet (10.7 feet when neglecting adjacent well interference)

Comments

Review of the pumping test data (Figures 3 and 4) shows interference from adjacent wells.

Review of the data also showed almost complete ground-water level recovery.

Figure 5 shows that the data from both tests are consistent.

Aquifer Parameter Evaluation

The AQTESOLV program was used to evaluate aquifer parameters. The raw data was adjusted to minimize impacts from adjacent well interference.

Diagnostic plots indicate bilinear fracture flow (See Attachment B).

Several solutions were evaluated, the Moench with Slab Blocks solution seemed to provide a reasonable fit to the data (See Attachment B). However, please note that the fracture flow solution require information or assumptions about the aquifer that are not well known

Water Quality

A sample was collected from the pumping well on June 5, 2007. The laboratory report showing the water quality of the sample is provided in Attachment C. Please note the non-detect for sulfide. Also, the results for the gross alpha parameter are not yet available.

Conclusions

Pump testing showed that the aquifer has more than adequate capacity to produce 75 gpm at Mountain Lake. It is quite likely that a well and pump could be designed to optimize yield greater than 75 gpm.

Further evaluation of the interferences and impacts to adjacent well(s) should be conducted.

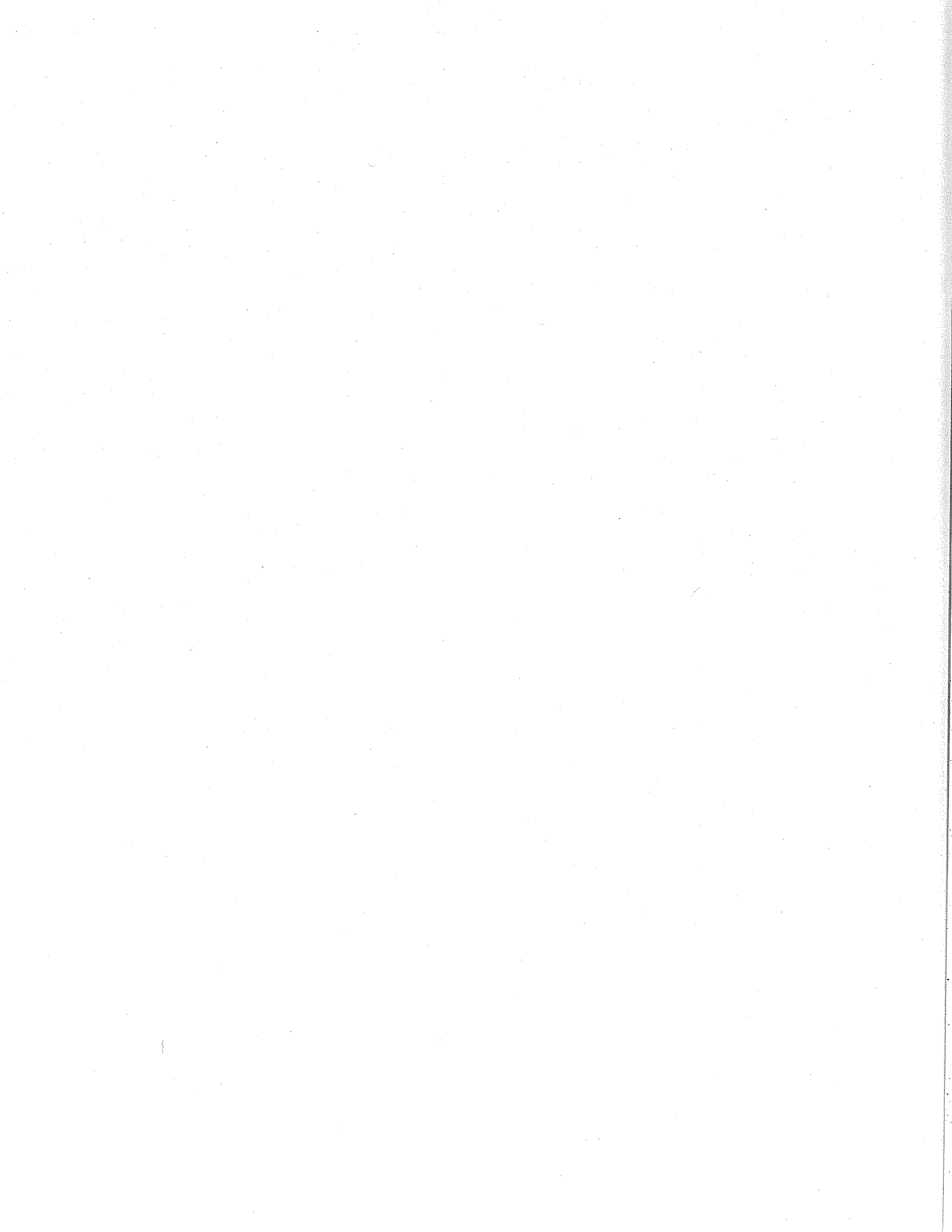


Figure 1
First Test Raw Data
Drawdown vs Elapsed Time
Linear Scale

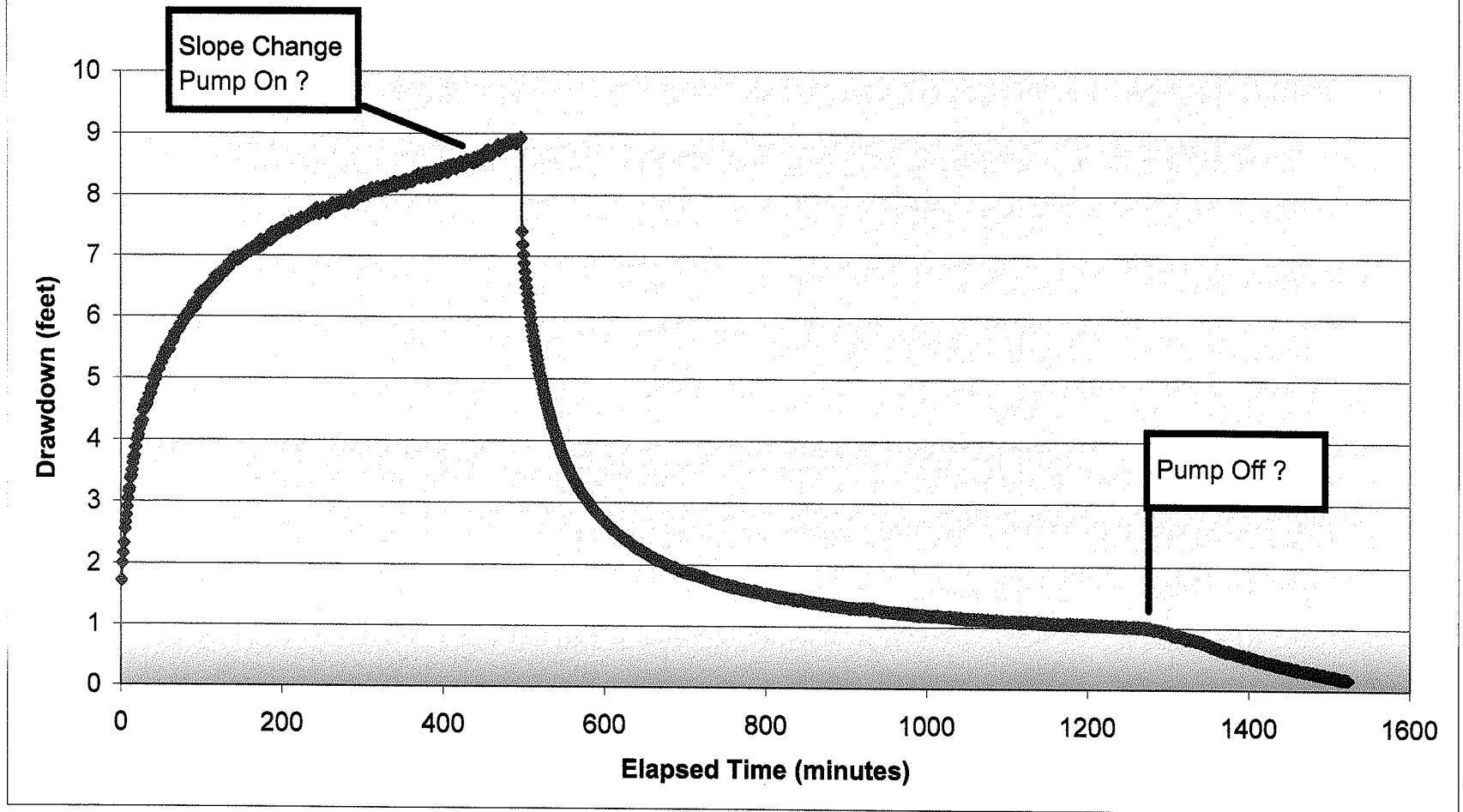


Figure 2
First Test Raw Data
Drawdown vs Elapsed Time
Log - Linear Scale

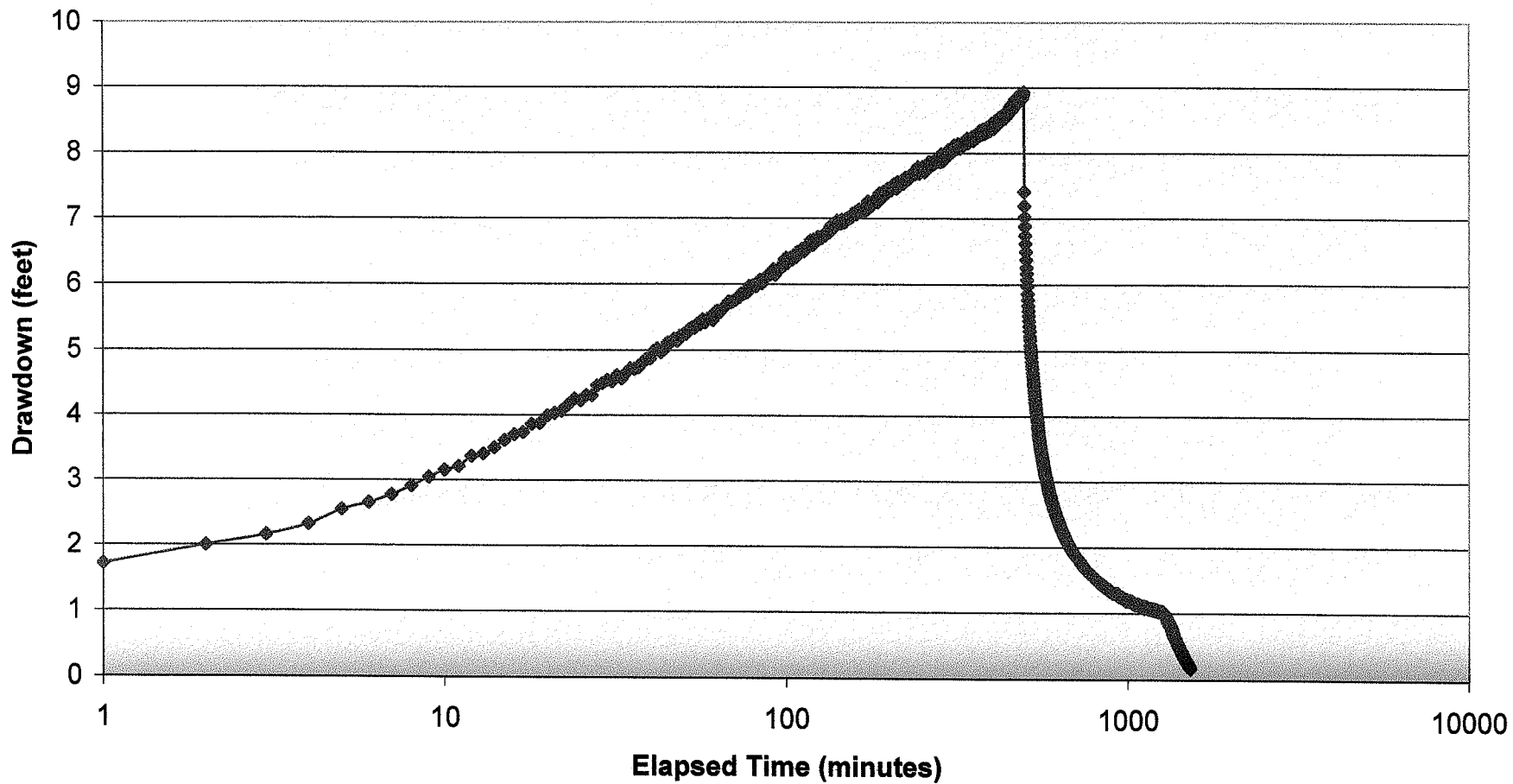


Figure 3
24-Hour Test Raw Data
Drawdown vs Elapsed Time
Linear Scale

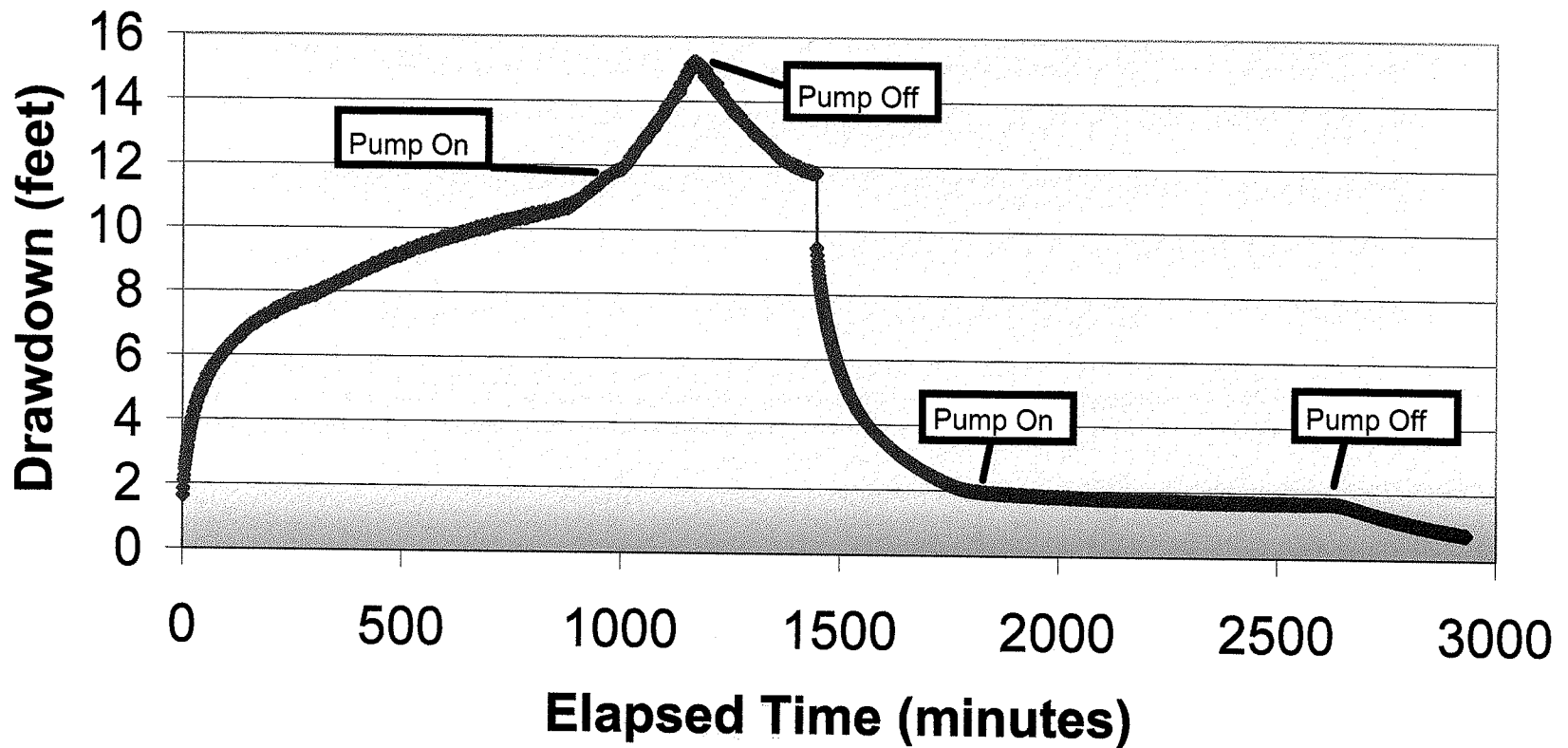


Figure 4
24-Hour Test Raw Data
Drawdown vs Elapsed Time
Log - Linear Scale

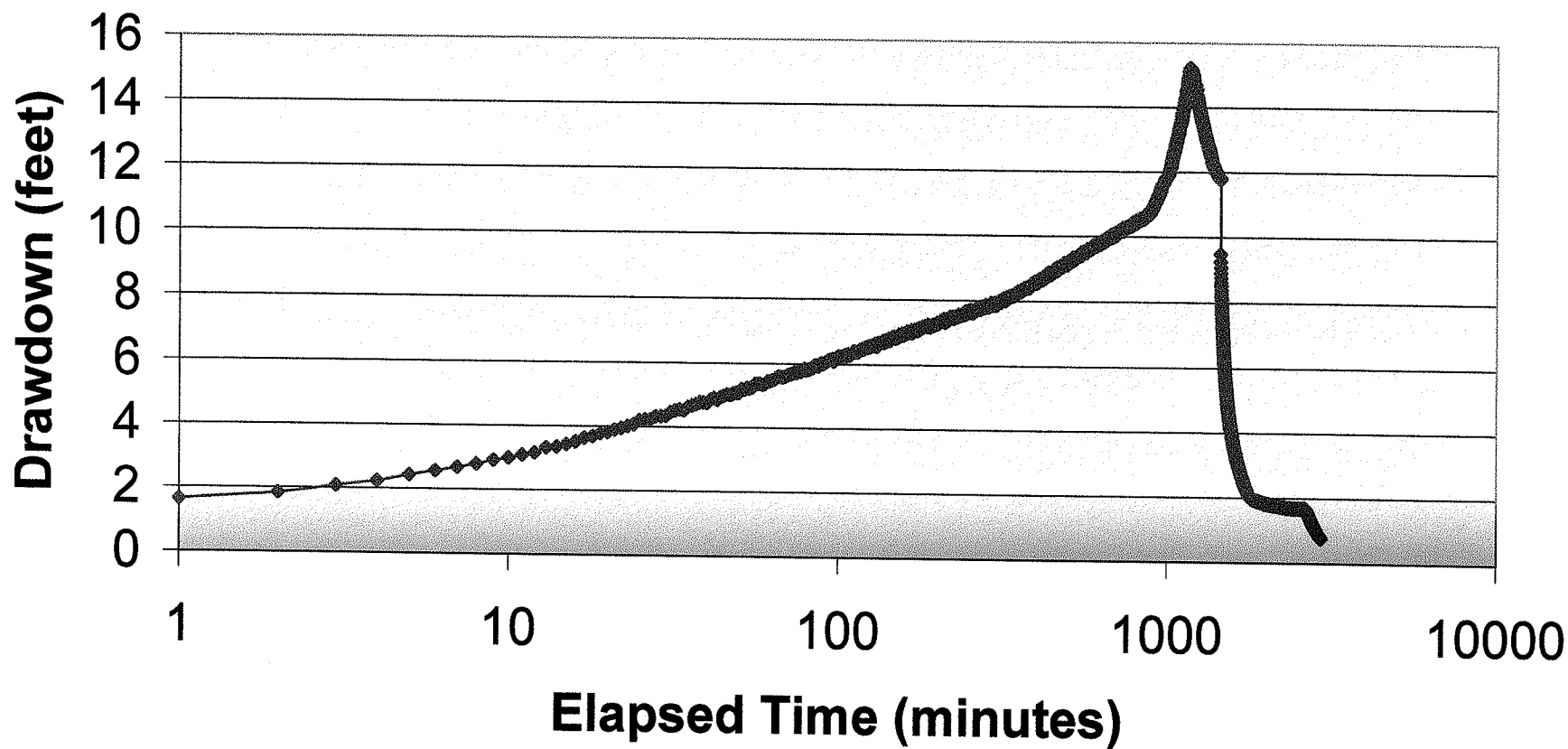
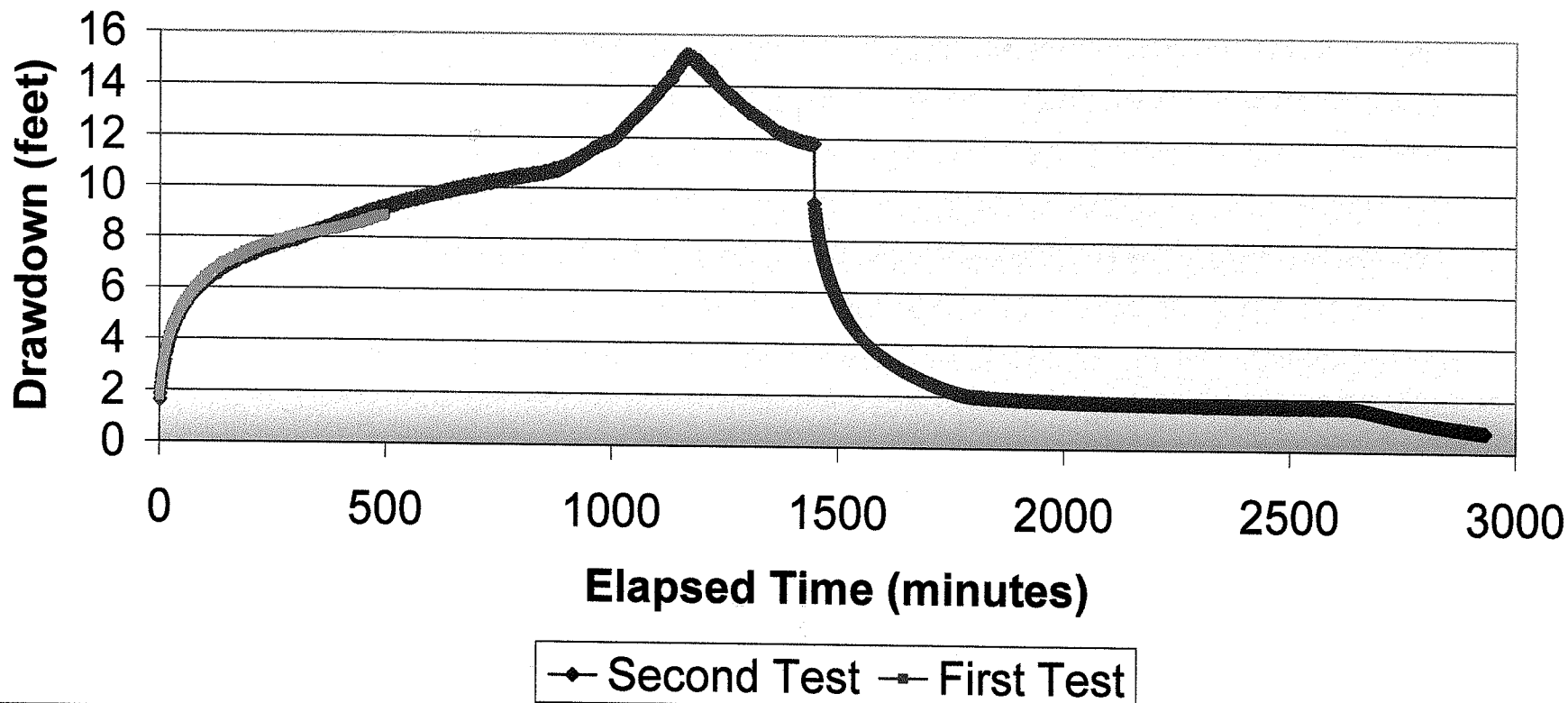


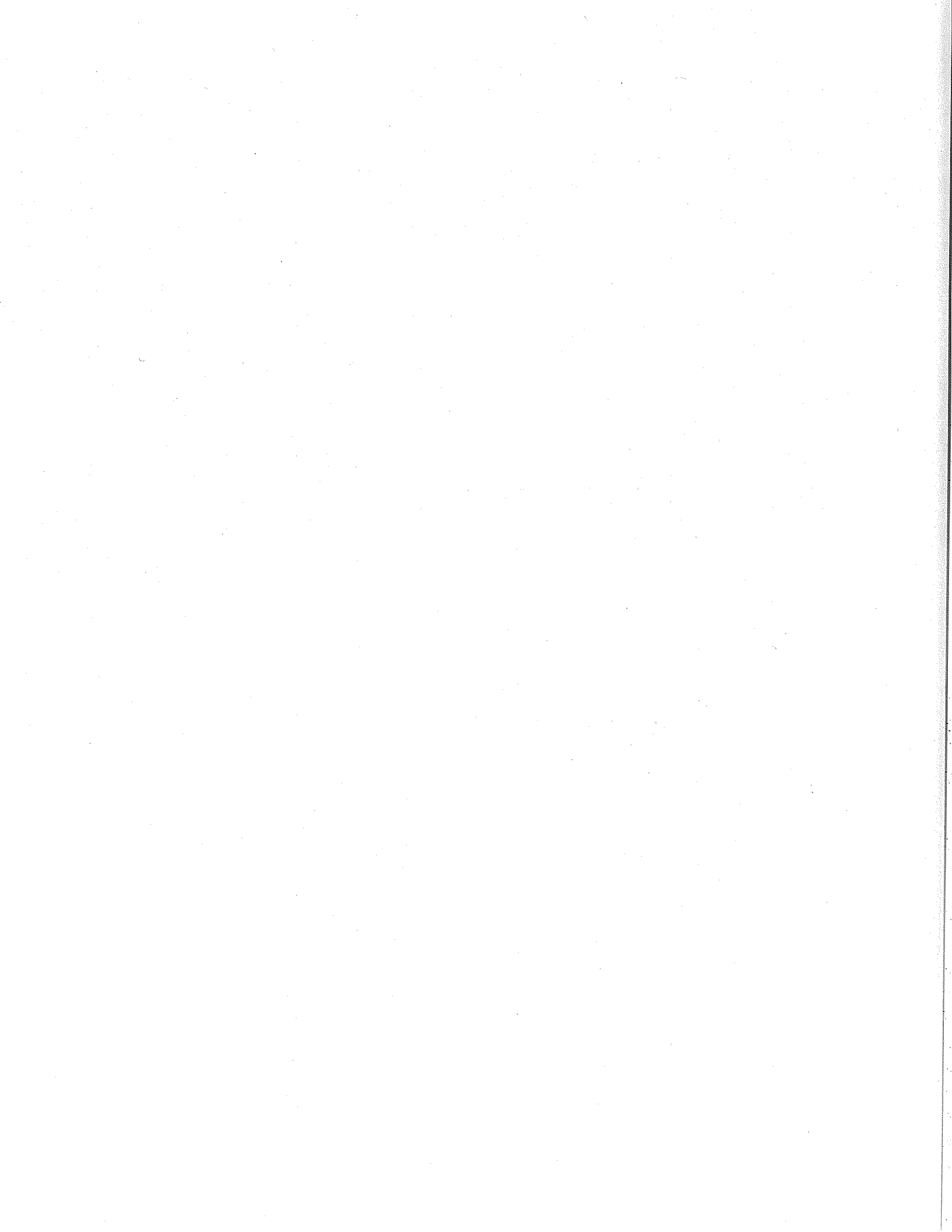
Figure 5
Comparison
8-Hour and 24-Hour Raw Data
Drawdown vs Elapsed Time
Linear Scale

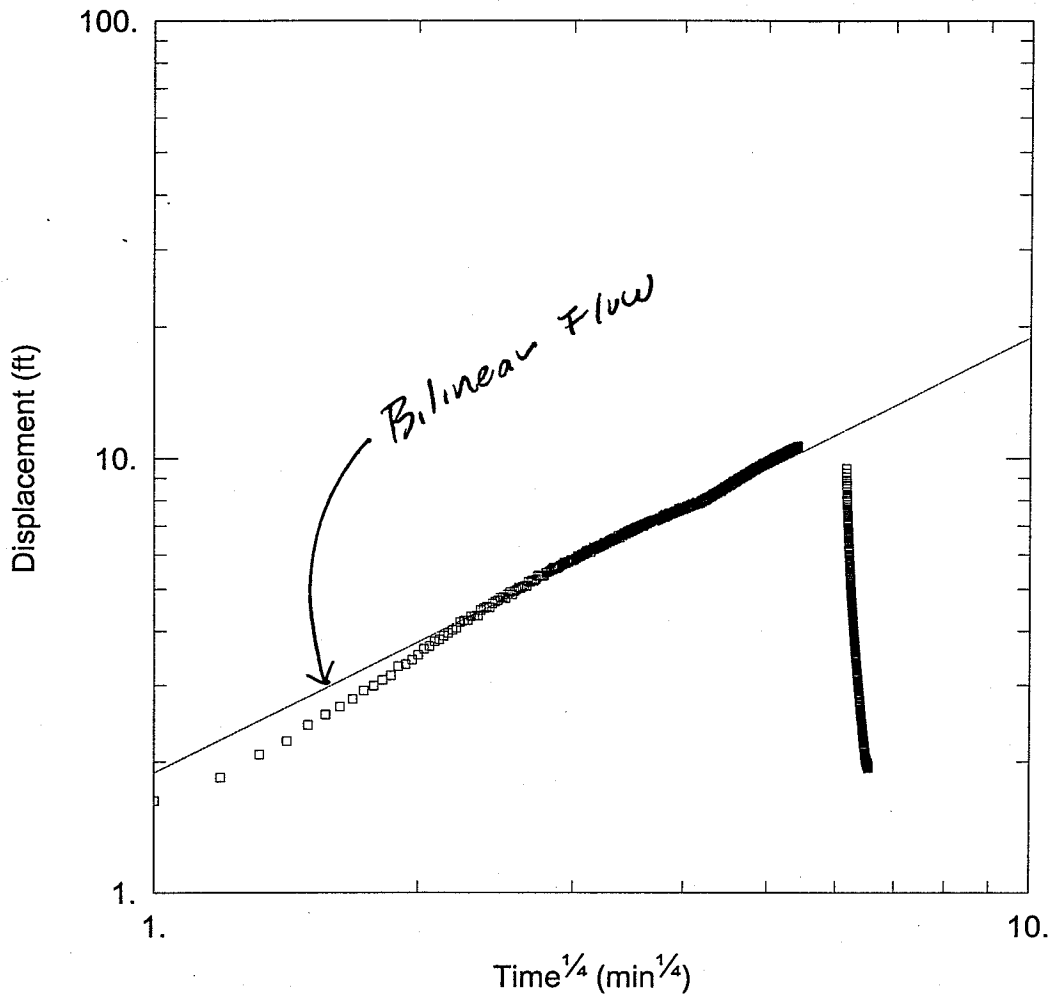




**Mountain Village at Big Sky
SFE Allocations per Acre**

Development	SFE's	Acreage	SFE's/Acre
Arrowhead	69.63	3.58	19.45
Beaverhead	147.4	6.85	21.52
Bighorn	108.6	5.6	19.39
Cedar Creek	72	2.73	26.37
Hill	180	4.02	44.78
Lake	74.43	5.26	14.15
Shoshone	100.3	2.64	37.99
Skycrest	50.05	3.02	16.57
Stillwater	63	3.7	17.03
Summit	205.61	2.1	97.91
	Average		31.52





WELL TEST ANALYSIS

Data Set: D:\mountain lake\ml tw pt 24.aqt

Date: 06/15/07

Time: 07:31:08

AQUIFER DATA

Saturated Thickness: 1.059 ft

Slab Block Thickness: 5. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW 1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ PW 1	0	0

SOLUTION

Aquifer Model: Fractured

Solution Method: Moench w/slab blocks

K = 645.4 ft/day

Ss = 0.008168 ft⁻¹

K' = 1500. ft/day

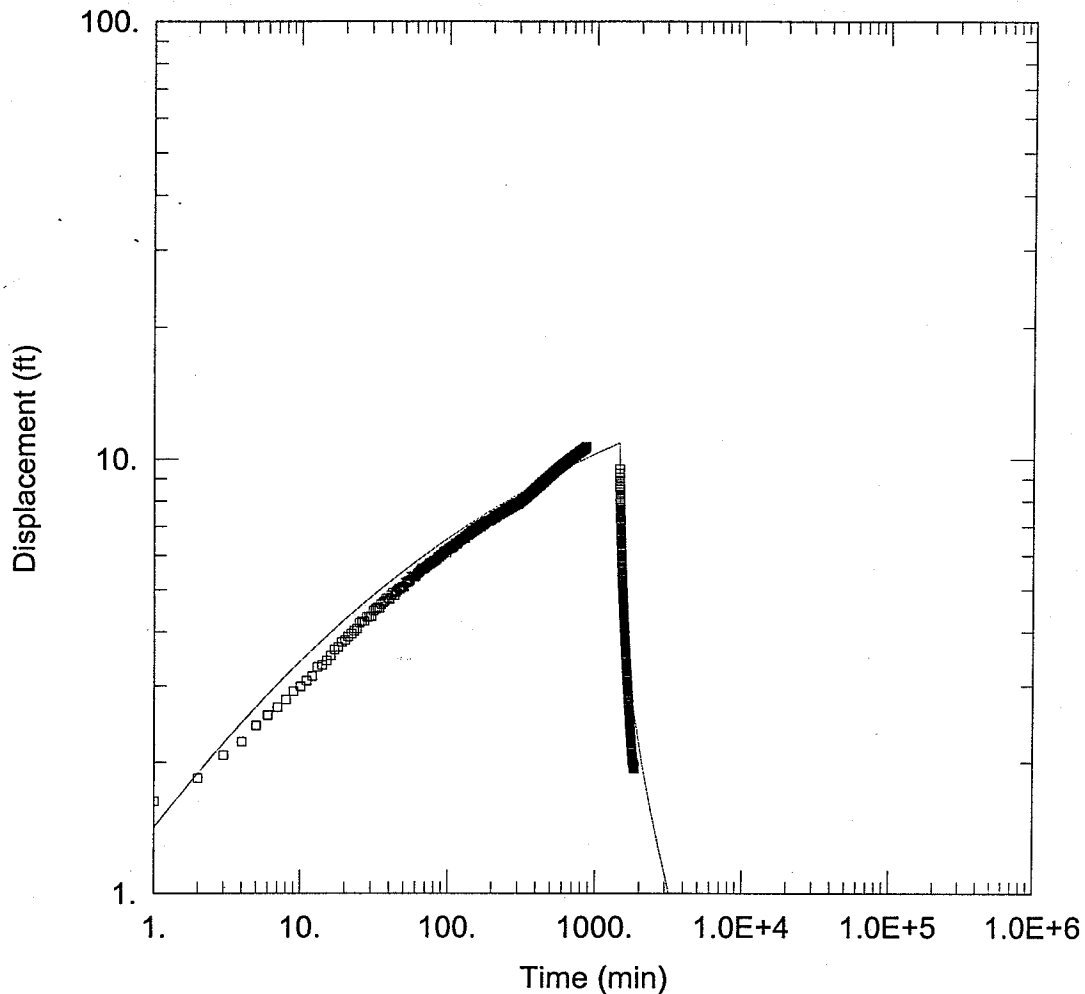
Ss' = 1.518E-5 ft⁻¹

Sw = -4.601

Sf = 0.

r(w) = 0.167 ft

r(c) = 0.33 ft



WELL TEST ANALYSIS

Data Set: D:\mountain lake\ml tw pt 24.aqt

Date: 06/15/07

Time: 07:25:58

AQUIFER DATA

Saturated Thickness: 1.059 ft

Slab Block Thickness: 5. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW 1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ PW 1	0	0

SOLUTION

Aquifer Model: Fractured

Solution Method: Moench w/slab blocks

K = 645.4 ft/day

Ss = 0.008168 ft⁻¹

K' = 1412.6 ft/day

Ss' = 1.387E-5 ft⁻¹

Sw = -4.601

Sf = 0.

r(w) = 0.167 ft

r(c) = 0.33 ft

AQTESOLV for Windows

Data Set: D:\mountain lake\ml tw pt 24.aqt
Date: 06/15/07
Time: 07:25:25

AQUIFER DATA

Saturated Thickness: 1.059 ft
Anisotropy Ratio (Kz/Kr): 1.
Slab Block Thickness: 5. ft
Spherical Block Diameter: 1. ft
Fracture Length: 28.08 ft
Fracture Radius: 39.55 ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: PW 1

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.33 ft
Well Radius: 0.167 ft

Fully Penetrating Well

No. of pumping periods: 2

<u>Pumping Period Data</u>	
<u>Time (min)</u>	<u>Rate (gal/min)</u>
0.	75.
1447.	0.

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: PW 1

X Location: 0. ft
Y Location: 0. ft

Radial distance from PW 1: 0. ft

Fully Penetrating Well

No. of Observations: 1254

<u>Observation Data</u>	
<u>Time (min)</u>	<u>Displacement (ft)</u>
1.	1.626
2.	1.84
3.	2.076
4.	2.231
5.	2.43
6.	2.565
7.	2.679
8.	2.792
9.	2.916
10.	2.991

<u>Time (min)</u>	<u>Displacement (ft)</u>
11.	3.084
12.	3.158
13.	3.319
14.	3.353
15.	3.433
16.	3.524
17.	3.643
18.	3.693
19.	3.786
20.	3.823
21.	3.899
22.	3.955
23.	4.018
24.	4.07
25.	4.195
26.	4.226
27.	4.227
28.	4.323
29.	4.33
30.	4.339
31.	4.465
32.	4.516
33.	4.549
34.	4.528
35.	4.631
36.	4.675
37.	4.712
38.	4.776
39.	4.78
40.	4.756
41.	4.854
42.	4.912
43.	4.854
44.	4.941
45.	4.984
46.	5.033
47.	5.015
48.	5.056
49.	5.084
50.	5.08
51.	5.203
52.	5.181
53.	5.236
54.	5.217
55.	5.265
56.	5.364
57.	5.372
58.	5.369
59.	5.343
60.	5.369
61.	5.442
62.	5.454
63.	5.478
64.	5.51
65.	5.552
66.	5.603
67.	5.588
68.	5.577
69.	5.596
70.	5.631

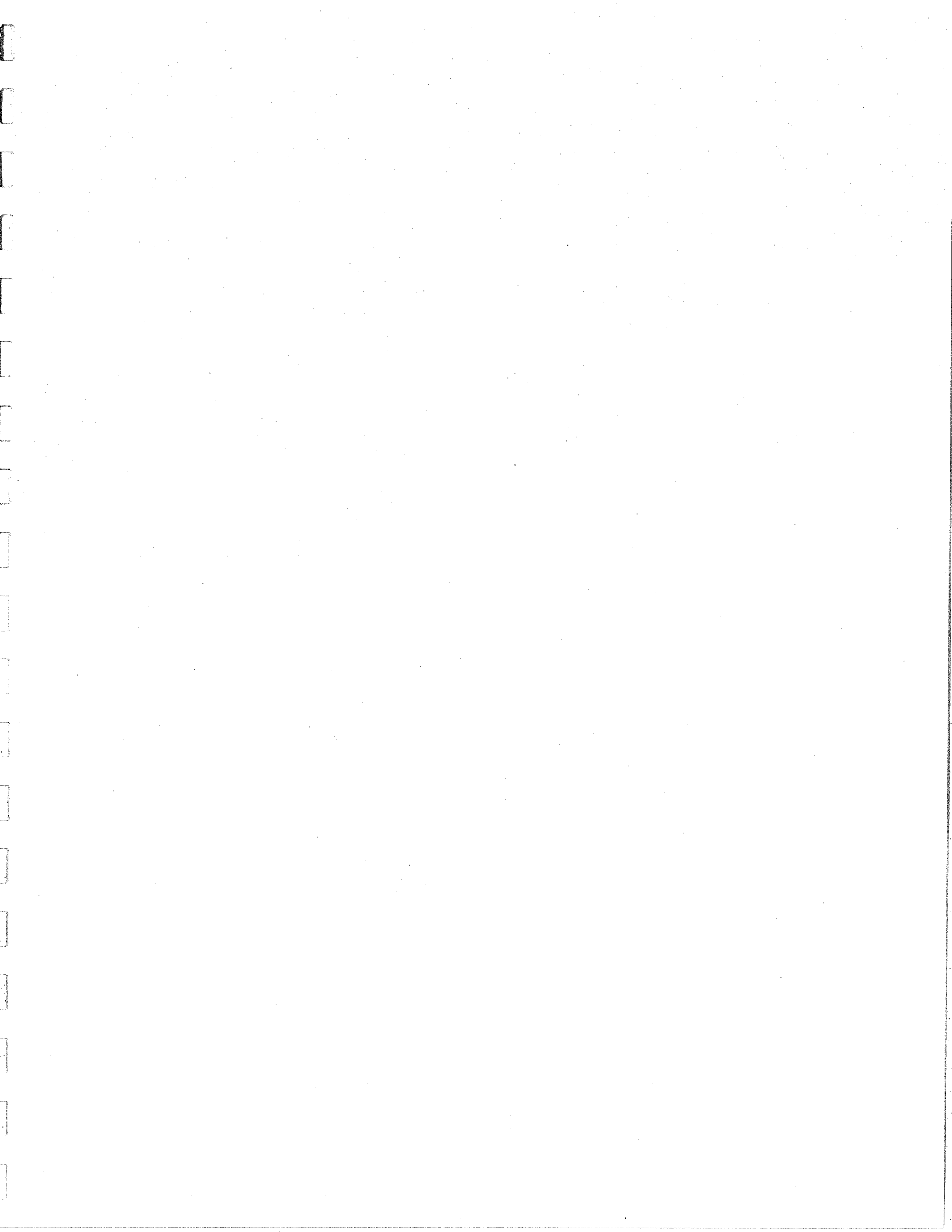
<u>Time (min)</u>	<u>Displacement (ft)</u>
71.	5.66
72.	5.683
73.	5.708
74.	5.758
75.	5.723
76.	5.779
77.	5.758
78.	5.793
79.	5.842
80.	5.809
81.	5.824
82.	5.836
83.	5.874
84.	5.887
85.	5.962
86.	5.95
87.	5.934
88.	5.999
89.	6.02
90.	6.015
91.	6.029
92.	6.067
93.	6.111
94.	6.125
95.	6.136
96.	6.157
97.	6.085
98.	6.165
99.	6.173
100.	6.235
101.	6.215
102.	6.229
103.	6.214
104.	6.262
105.	6.284
106.	6.237
107.	6.311
108.	6.271
109.	6.294
110.	6.335
111.	6.381
112.	6.401
113.	6.363
114.	6.374
115.	6.374
116.	6.428
117.	6.431
118.	6.475
119.	6.466
120.	6.5
121.	6.503
122.	6.538
123.	6.516
124.	6.551
125.	6.541
126.	6.571
127.	6.571
128.	6.571
129.	6.631
130.	6.635

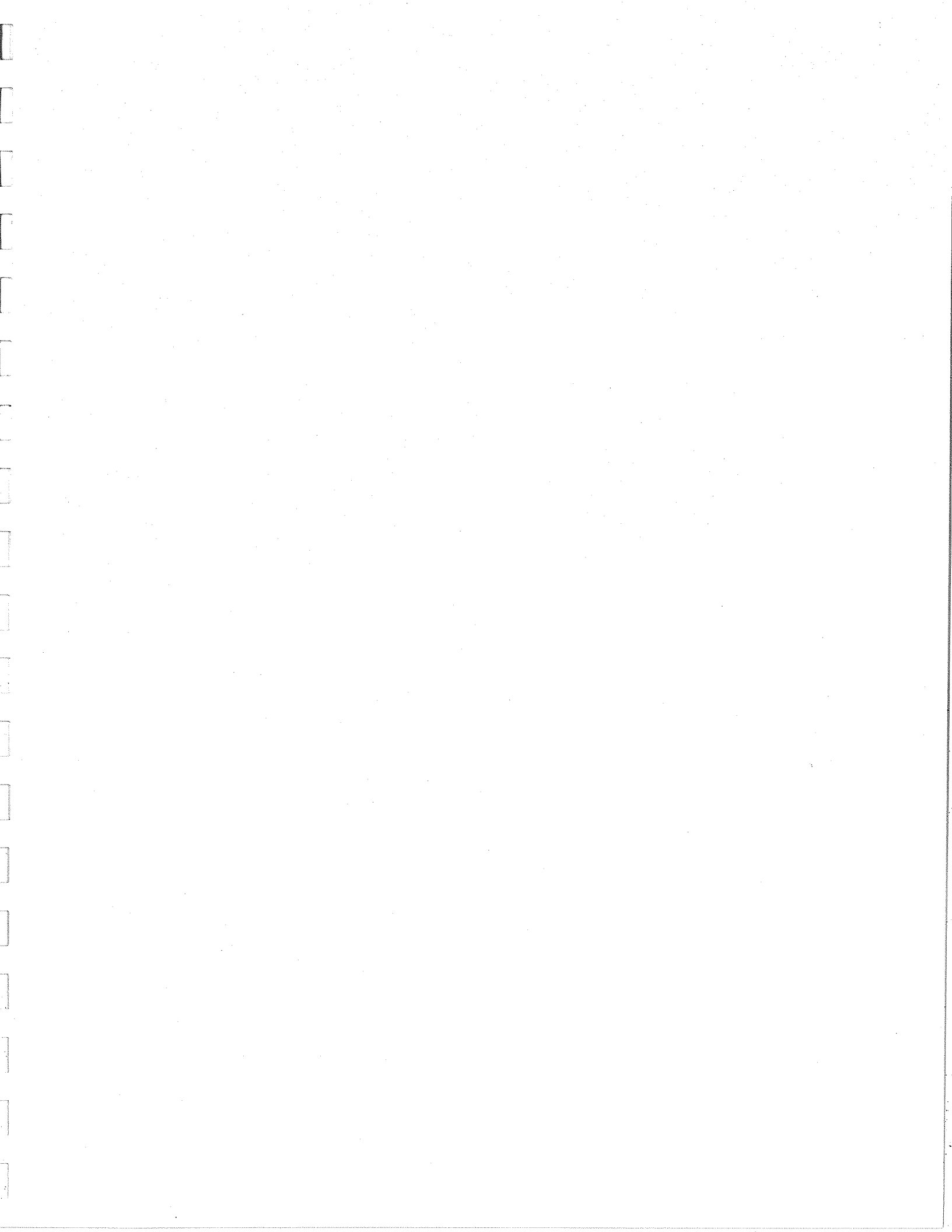
<u>Time (min)</u>	<u>Displacement (ft)</u>
131.	6.554
132.	6.655
133.	6.66
134.	6.671
135.	6.685
136.	6.703
137.	6.734
138.	6.682
139.	6.741
140.	6.719
141.	6.774
142.	6.751
143.	6.802
144.	6.756
145.	6.777
146.	6.844
147.	6.836
148.	6.856
149.	6.817
150.	6.842
151.	6.873
152.	6.846
153.	6.924
154.	6.878
155.	6.928
156.	6.964
157.	6.906
158.	6.919
159.	6.953
160.	6.945
161.	6.969
162.	7.012
163.	6.982
164.	7.016
165.	6.996
166.	6.992
167.	7.052
168.	6.984
169.	7.065
170.	7.07
171.	7.063
172.	7.072
173.	7.1
174.	7.053
175.	7.115
176.	7.137
177.	7.101
178.	7.145
179.	7.157
180.	7.143
181.	7.171
182.	7.188
183.	7.187
184.	7.199
185.	7.183
186.	7.181
187.	7.23
188.	7.216
189.	7.201
190.	7.179

<u>Time (min)</u>	<u>Displacement (ft)</u>
191.	7.191
192.	7.222
193.	7.246
194.	7.218
195.	7.242
196.	7.232
197.	7.272
198.	7.27
199.	7.304
200.	7.268
201.	7.295
202.	7.294
203.	7.302
204.	7.355
205.	7.35
206.	7.375
207.	7.357
208.	7.343
209.	7.424
210.	7.39
211.	7.312
212.	7.414
213.	7.395
214.	7.418
215.	7.372
216.	7.41
217.	7.414
218.	7.484
219.	7.444
220.	7.489
221.	7.481
222.	7.448
223.	7.475
224.	7.439
225.	7.455
226.	7.497
227.	7.499
228.	7.483
229.	7.48
230.	7.525
231.	7.558
232.	7.553
233.	7.514
234.	7.544
235.	7.524
236.	7.539
237.	7.573
238.	7.547
239.	7.556
240.	7.557
241.	7.567
242.	7.623
243.	7.668
244.	7.579
245.	7.599
246.	7.617
247.	7.636
248.	7.624
249.	7.698
250.	7.651

<u>Time (min)</u>	<u>Displacement (ft)</u>
251.	7.675
252.	7.712
253.	7.625
254.	7.695
255.	7.628
256.	7.652
257.	7.63
258.	7.664
259.	7.665
260.	7.696
261.	7.674
262.	7.752
263.	7.702
264.	7.734
265.	7.772
266.	7.763
267.	7.737
268.	7.755
269.	7.749
270.	7.729
271.	7.742
272.	7.768
273.	7.759
274.	7.801
275.	7.823
276.	7.79
277.	7.775
278.	7.8
279.	7.809
280.	7.864
281.	7.835
282.	7.817
283.	7.854
284.	7.823
285.	7.797
286.	7.844
287.	7.816
288.	7.853
289.	7.869
290.	7.889
291.	7.926
292.	7.867
293.	7.89
294.	7.857
295.	7.893
296.	7.888
297.	7.923
298.	7.869
299.	7.919
300.	7.912
301.	7.889
302.	7.866
303.	7.925
304.	7.899
305.	7.899
306.	7.982
307.	7.968
308.	7.994
309.	7.956
310.	8.003

<u>Time (min)</u>	<u>Displacement (ft)</u>
311.	7.946
312.	7.986
313.	8.006
314.	7.998
315.	8.024
316.	8.059
317.	8.068
318.	8.018
319.	8.035
320.	8.021
321.	8.032
322.	8.007
323.	8.066
324.	8.109
325.	8.05
326.	8.085
327.	8.082
328.	8.073
329.	8.082
330.	8.132
331.	8.148
332.	8.148
333.	8.141
334.	8.136
335.	8.128
336.	8.126
337.	8.168
338.	8.155
339.	8.15
340.	8.197
341.	8.179
342.	8.171
343.	8.198
344.	8.195
345.	8.23
346.	8.189
347.	8.263
348.	8.246
349.	8.244
350.	8.285
351.	8.263
352.	8.263
353.	8.276
354.	8.292
355.	8.292
356.	8.264
357.	8.303
358.	8.313
359.	8.34
360.	8.31
361.	8.345
362.	8.323
363.	8.333
364.	8.351
365.	8.34
366.	8.394
367.	8.354
368.	8.378
369.	8.384
370.	8.406





<u>Time (min)</u>	<u>Displacement (ft)</u>
311.	7.946
312.	7.986
313.	8.006
314.	7.998
315.	8.024
316.	8.059
317.	8.068
318.	8.018
319.	8.035
320.	8.021
321.	8.032
322.	8.007
323.	8.066
324.	8.109
325.	8.05
326.	8.085
327.	8.082
328.	8.073
329.	8.082
330.	8.132
331.	8.148
332.	8.148
333.	8.141
334.	8.136
335.	8.128
336.	8.126
337.	8.168
338.	8.155
339.	8.15
340.	8.197
341.	8.179
342.	8.171
343.	8.198
344.	8.195
345.	8.23
346.	8.189
347.	8.263
348.	8.246
349.	8.244
350.	8.285
351.	8.263
352.	8.263
353.	8.276
354.	8.292
355.	8.292
356.	8.264
357.	8.303
358.	8.313
359.	8.34
360.	8.31
361.	8.345
362.	8.323
363.	8.333
364.	8.351
365.	8.34
366.	8.394
367.	8.354
368.	8.378
369.	8.384
370.	8.406

<u>Time (min)</u>	<u>Displacement (ft)</u>
371.	8.395
372.	8.396
373.	8.415
374.	8.402
375.	8.419
376.	8.404
377.	8.421
378.	8.463
379.	8.459
380.	8.4
381.	8.465
382.	8.49
383.	8.476
384.	8.476
385.	8.523
386.	8.529
387.	8.481
388.	8.486
389.	8.515
390.	8.523
391.	8.579
392.	8.559
393.	8.584
394.	8.593
395.	8.564
396.	8.547
397.	8.58
398.	8.575
399.	8.546
400.	8.613
401.	8.62
402.	8.633
403.	8.593
404.	8.578
405.	8.598
406.	8.618
407.	8.671
408.	8.678
409.	8.681
410.	8.677
411.	8.648
412.	8.689
413.	8.664
414.	8.711
415.	8.69
416.	8.695
417.	8.654
418.	8.67
419.	8.747
420.	8.721
421.	8.703
422.	8.726
423.	8.762
424.	8.706
425.	8.758
426.	8.734
427.	8.805
428.	8.772
429.	8.753
430.	8.76

<u>Time (min)</u>	<u>Displacement (ft)</u>
431.	8.806
432.	8.865
433.	8.841
434.	8.811
435.	8.847
436.	8.801
437.	8.876
438.	8.839
439.	8.81
440.	8.86
441.	8.857
442.	8.856
443.	8.818
444.	8.896
445.	8.903
446.	8.888
447.	8.892
448.	8.856
449.	8.932
450.	8.901
451.	8.926
452.	8.972
453.	8.917
454.	8.945
455.	8.945
456.	8.951
457.	9.
458.	8.959
459.	8.995
460.	8.943
461.	8.981
462.	9.039
463.	8.972
464.	9.032
465.	8.96
466.	8.974
467.	9.023
468.	9.007
469.	9.008
470.	9.039
471.	9.087
472.	9.048
473.	9.039
474.	9.072
475.	9.051
476.	9.072
477.	9.093
478.	9.058
479.	9.059
480.	9.059
481.	9.118
482.	9.084
483.	9.09
484.	9.174
485.	9.114
486.	9.114
487.	9.146
488.	9.134
489.	9.13
490.	9.146

<u>Time (min)</u>	<u>Displacement (ft)</u>
491.	9.129
492.	9.174
493.	9.185
494.	9.173
495.	9.152
496.	9.122
497.	9.205
498.	9.199
499.	9.204
500.	9.223
501.	9.244
502.	9.233
503.	9.225
504.	9.228
505.	9.179
506.	9.221
507.	9.252
508.	9.268
509.	9.261
510.	9.244
511.	9.263
512.	9.263
513.	9.289
514.	9.334
515.	9.297
516.	9.247
517.	9.275
518.	9.301
519.	9.294
520.	9.303
521.	9.337
522.	9.335
523.	9.33
524.	9.29
525.	9.338
526.	9.366
527.	9.351
528.	9.371
529.	9.359
530.	9.38
531.	9.386
532.	9.406
533.	9.383
534.	9.428
535.	9.417
536.	9.382
537.	9.404
538.	9.383
539.	9.433
540.	9.435
541.	9.438
542.	9.412
543.	9.432
544.	9.457
545.	9.495
546.	9.443
547.	9.443
548.	9.418
549.	9.447
550.	9.46

<u>Time (min)</u>	<u>Displacement (ft)</u>
551.	9.466
552.	9.519
553.	9.518
554.	9.459
555.	9.496
556.	9.525
557.	9.53
558.	9.516
559.	9.512
560.	9.497
561.	9.534
562.	9.544
563.	9.524
564.	9.502
565.	9.545
566.	9.582
567.	9.503
568.	9.531
569.	9.558
570.	9.608
571.	9.58
572.	9.55
573.	9.576
574.	9.587
575.	9.586
576.	9.593
577.	9.592
578.	9.607
579.	9.586
580.	9.622
581.	9.616
582.	9.576
583.	9.599
584.	9.635
585.	9.619
586.	9.634
587.	9.665
588.	9.656
589.	9.621
590.	9.652
591.	9.719
592.	9.689
593.	9.649
594.	9.721
595.	9.658
596.	9.714
597.	9.738
598.	9.68
599.	9.687
600.	9.691
601.	9.696
602.	9.704
603.	9.752
604.	9.679
605.	9.74
606.	9.723
607.	9.722
608.	9.753
609.	9.752
610.	9.74

<u>Time (min)</u>	<u>Displacement (ft)</u>
611.	9.753
612.	9.744
613.	9.727
614.	9.767
615.	9.744
616.	9.771
617.	9.781
618.	9.767
619.	9.748
620.	9.814
621.	9.76
622.	9.764
623.	9.795
624.	9.801
625.	9.762
626.	9.822
627.	9.81
628.	9.814
629.	9.832
630.	9.859
631.	9.834
632.	9.806
633.	9.839
634.	9.828
635.	9.874
636.	9.876
637.	9.828
638.	9.819
639.	9.882
640.	9.857
641.	9.871
642.	9.842
643.	9.883
644.	9.902
645.	9.855
646.	9.871
647.	9.89
648.	9.878
649.	9.94
650.	9.919
651.	9.878
652.	9.89
653.	9.923
654.	9.907
655.	9.91
656.	9.899
657.	9.976
658.	9.966
659.	9.958
660.	9.951
661.	9.937
662.	9.93
663.	9.969
664.	9.984
665.	9.96
666.	9.954
667.	9.969
668.	9.965
669.	9.961
670.	10.04

<u>Time (min)</u>	<u>Displacement (ft)</u>
671.	10.03
672.	10.04
673.	10.02
674.	9.981
675.	10.01
676.	9.967
677.	10.03
678.	10.
679.	10.
680.	10.04
681.	10.02
682.	10.08
683.	10.03
684.	10.05
685.	10.02
686.	10.07
687.	10.
688.	10.03
689.	10.03
690.	10.09
691.	10.06
692.	10.04
693.	10.11
694.	10.07
695.	10.04
696.	10.09
697.	10.03
698.	10.1
699.	10.1
700.	10.11
701.	10.09
702.	10.08
703.	10.12
704.	10.11
705.	10.11
706.	10.13
707.	10.13
708.	10.14
709.	10.13
710.	10.11
711.	10.18
712.	10.15
713.	10.13
714.	10.18
715.	10.14
716.	10.14
717.	10.18
718.	10.19
719.	10.21
720.	10.19
721.	10.17
722.	10.18
723.	10.2
724.	10.21
725.	10.19
726.	10.24
727.	10.24
728.	10.18
729.	10.26
730.	10.22

<u>Time (min)</u>	<u>Displacement (ft)</u>
731.	10.2
732.	10.17
733.	10.23
734.	10.24
735.	10.2
736.	10.21
737.	10.25
738.	10.27
739.	10.26
740.	10.23
741.	10.24
742.	10.24
743.	10.28
744.	10.24
745.	10.27
746.	10.26
747.	10.26
748.	10.27
749.	10.3
750.	10.27
751.	10.27
752.	10.31
753.	10.31
754.	10.3
755.	10.32
756.	10.29
757.	10.28
758.	10.33
759.	10.31
760.	10.32
761.	10.31
762.	10.32
763.	10.31
764.	10.32
765.	10.37
766.	10.32
767.	10.35
768.	10.34
769.	10.32
770.	10.35
771.	10.37
772.	10.35
773.	10.39
774.	10.35
775.	10.35
776.	10.39
777.	10.41
778.	10.41
779.	10.37
780.	10.33
781.	10.36
782.	10.34
783.	10.44
784.	10.41
785.	10.42
786.	10.35
787.	10.44
788.	10.41
789.	10.44
790.	10.44

<u>Time (min)</u>	<u>Displacement (ft)</u>
791.	10.4
792.	10.42
793.	10.44
794.	10.4
795.	10.49
796.	10.42
797.	10.46
798.	10.4
799.	10.49
800.	10.45
801.	10.46
802.	10.44
803.	10.47
804.	10.47
805.	10.43
806.	10.45
807.	10.45
808.	10.48
809.	10.44
810.	10.48
811.	10.5
812.	10.52
813.	10.46
814.	10.49
815.	10.5
816.	10.52
817.	10.49
818.	10.51
819.	10.51
820.	10.52
821.	10.52
822.	10.55
823.	10.53
824.	10.52
825.	10.56
826.	10.5
827.	10.54
828.	10.5
829.	10.54
830.	10.55
831.	10.52
832.	10.51
833.	10.54
834.	10.51
835.	10.58
836.	10.56
837.	10.54
838.	10.56
839.	10.55
840.	10.57
841.	10.57
842.	10.58
843.	10.59
844.	10.61
845.	10.61
846.	10.54
847.	10.57
848.	10.6
849.	10.64
850.	10.65

<u>Time (min)</u>	<u>Displacement (ft)</u>
851.	10.64
852.	10.65
853.	10.61
854.	10.64
855.	10.61
856.	10.58
857.	10.59
858.	10.63
859.	10.62
860.	10.62
861.	10.65
862.	10.69
863.	10.64
864.	10.64
865.	10.64
866.	10.64
1447.	9.479
1448.	9.256
1449.	9.07
1450.	8.914
1451.	8.76
1452.	8.617
1453.	8.511
1454.	8.387
1455.	8.283
1456.	8.182
1457.	8.09
1458.	7.996
1459.	7.92
1460.	7.834
1461.	7.751
1462.	7.673
1463.	7.605
1464.	7.533
1465.	7.464
1466.	7.394
1467.	7.324
1468.	7.254
1469.	7.189
1470.	7.113
1471.	7.059
1472.	7.011
1473.	6.949
1474.	6.904
1475.	6.839
1476.	6.779
1477.	6.737
1478.	6.668
1479.	6.612
1480.	6.565
1481.	6.505
1482.	6.465
1483.	6.413
1484.	6.358
1485.	6.297
1486.	6.263
1487.	6.202
1488.	6.165
1489.	6.12
1490.	6.086

<u>Time (min)</u>	<u>Displacement (ft)</u>
1491.	6.027
1492.	5.987
1493.	5.944
1494.	5.901
1495.	5.86
1496.	5.83
1497.	5.787
1498.	5.747
1499.	5.706
1500.	5.656
1501.	5.635
1502.	5.587
1503.	5.55
1504.	5.499
1505.	5.473
1506.	5.438
1507.	5.403
1508.	5.371
1509.	5.334
1510.	5.299
1511.	5.265
1512.	5.244
1513.	5.199
1514.	5.171
1515.	5.136
1516.	5.107
1517.	5.086
1518.	5.058
1519.	5.015
1520.	4.995
1521.	4.952
1522.	4.923
1523.	4.897
1524.	4.87
1525.	4.839
1526.	4.813
1527.	4.804
1528.	4.773
1529.	4.75
1530.	4.724
1531.	4.688
1532.	4.673
1533.	4.638
1534.	4.626
1535.	4.603
1536.	4.579
1537.	4.546
1538.	4.534
1539.	4.497
1540.	4.488
1541.	4.454
1542.	4.441
1543.	4.419
1544.	4.398
1545.	4.365
1546.	4.342
1547.	4.333
1548.	4.316
1549.	4.293
1550.	4.272

<u>Time (min)</u>	<u>Displacement (ft)</u>
1551.	4.249
1552.	4.235
1553.	4.214
1554.	4.197
1555.	4.177
1556.	4.157
1557.	4.14
1558.	4.122
1559.	4.104
1560.	4.086
1561.	4.068
1562.	4.054
1563.	4.035
1564.	4.021
1565.	4.003
1566.	3.985
1567.	3.968
1568.	3.965
1569.	3.937
1570.	3.92
1571.	3.905
1572.	3.888
1573.	3.873
1574.	3.855
1575.	3.842
1576.	3.827
1577.	3.812
1578.	3.797
1579.	3.783
1580.	3.754
1581.	3.766
1582.	3.736
1583.	3.721
1584.	3.709
1585.	3.707
1586.	3.681
1587.	3.67
1588.	3.671
1589.	3.645
1590.	3.618
1591.	3.63
1592.	3.605
1593.	3.591
1594.	3.581
1595.	3.577
1596.	3.545
1597.	3.551
1598.	3.524
1599.	3.51
1600.	3.499
1601.	3.485
1602.	3.475
1603.	3.458
1604.	3.446
1605.	3.433
1606.	3.422
1607.	3.42
1608.	3.394
1609.	3.384
1610.	3.371

<u>Time (min)</u>	<u>Displacement (ft)</u>
1611.	3.359
1612.	3.359
1613.	3.334
1614.	3.325
1615.	3.312
1616.	3.313
1617.	3.287
1618.	3.278
1619.	3.265
1620.	3.257
1621.	3.242
1622.	3.243
1623.	3.221
1624.	3.209
1625.	3.197
1626.	3.199
1627.	3.188
1628.	3.165
1629.	3.151
1630.	3.138
1631.	3.131
1632.	3.133
1633.	3.11
1634.	3.099
1635.	3.102
1636.	3.08
1637.	3.069
1638.	3.059
1639.	3.049
1640.	3.039
1641.	3.028
1642.	3.015
1643.	3.009
1644.	3.011
1645.	2.988
1646.	2.979
1647.	2.968
1648.	2.959
1649.	2.95
1650.	2.952
1651.	2.934
1652.	2.936
1653.	2.913
1654.	2.904
1655.	2.905
1656.	2.887
1657.	2.888
1658.	2.868
1659.	2.867
1660.	2.86
1661.	2.841
1662.	2.843
1663.	2.825
1664.	2.813
1665.	2.818
1666.	2.811
1667.	2.789
1668.	2.793
1669.	2.785
1670.	2.763

<u>Time (min)</u>	<u>Displacement (ft)</u>
1671.	2.753
1672.	2.745
1673.	2.733
1674.	2.741
1675.	2.72
1676.	2.724
1677.	2.719
1678.	2.695
1679.	2.684
1680.	2.69
1681.	2.682
1682.	2.664
1683.	2.668
1684.	2.647
1685.	2.637
1686.	2.628
1687.	2.621
1688.	2.611
1689.	2.616
1690.	2.607
1691.	2.587
1692.	2.58
1693.	2.587
1694.	2.577
1695.	2.57
1696.	2.563
1697.	2.544
1698.	2.534
1699.	2.54
1700.	2.52
1701.	2.516
1702.	2.505
1703.	2.5
1704.	2.505
1705.	2.496
1706.	2.489
1707.	2.47
1708.	2.474
1709.	2.456
1710.	2.447
1711.	2.454
1712.	2.431
1713.	2.439
1714.	2.416
1715.	2.423
1716.	2.402
1717.	2.394
1718.	2.401
1719.	2.395
1720.	2.373
1721.	2.364
1722.	2.371
1723.	2.352
1724.	2.358
1725.	2.35
1726.	2.342
1727.	2.336
1728.	2.328
1729.	2.325
1730.	2.316

<u>Time (min)</u>	<u>Displacement (ft)</u>
1731.	2.296
1732.	2.293
1733.	2.299
1734.	2.292
1735.	2.286
1736.	2.281
1737.	2.261
1738.	2.266
1739.	2.256
1740.	2.239
1741.	2.237
1742.	2.227
1743.	2.232
1744.	2.229
1745.	2.224
1746.	2.215
1747.	2.21
1748.	2.194
1749.	2.189
1750.	2.194
1751.	2.188
1752.	2.184
1753.	2.177
1754.	2.173
1755.	2.155
1756.	2.161
1757.	2.154
1758.	2.148
1759.	2.142
1760.	2.137
1761.	2.133
1762.	2.114
1763.	2.124
1764.	2.118
1765.	2.113
1766.	2.095
1767.	2.099
1768.	2.096
1769.	2.087
1770.	2.087
1771.	2.081
1772.	2.075
1773.	2.072
1774.	2.054
1775.	2.063
1776.	2.06
1777.	2.054
1778.	2.049
1779.	2.047
1780.	2.033
1781.	2.041
1782.	2.036
1783.	2.036
1784.	2.031
1785.	2.026
1786.	2.026
1787.	2.023
1788.	2.02
1789.	2.015
1790.	2.016

<u>Time (min)</u>	<u>Displacement (ft)</u>
1791.	2.012
1792.	1.999
1793.	2.004
1794.	2.003
1795.	2.001
1796.	2.015
1797.	1.996
1798.	1.994
1799.	1.99
1800.	1.991
1801.	1.991
1802.	1.976
1803.	1.985
1804.	1.988
1805.	1.983
1806.	1.981
1807.	1.97
1808.	1.979
1809.	1.976
1810.	1.976
1811.	1.974
1812.	1.982
1813.	1.971
1814.	1.971
1815.	1.968
1816.	1.965
1817.	1.966
1818.	1.975
1819.	1.964
1820.	1.972
1821.	1.96
1822.	1.969
1823.	1.956
1824.	1.958
1825.	1.958
1826.	1.956
1827.	1.94
1828.	1.952
1829.	1.95
1830.	1.952
1831.	1.949
1832.	1.947
1833.	1.933
1834.	1.957

SOLUTION

Pumping Test
 Aquifer Model: Fractured
 Solution Method: Moench w/slab blocks

VISUAL ESTIMATION RESULTS

Estimated Parameters

<u>Parameter</u>	<u>Estimate</u>	
K	645.4	ft/day
Ss	0.008168	ft ⁻¹
K'	1412.6	ft/day
Ss'	1.387E-5	ft ⁻¹

Sw	-4.601	
Sf	0.	
r(w)	0.167	ft
r(c)	0.33	ft

K = 0.2277 cm/sec
 T = K*b = 683.6 ft²/day (7.35 sq. cm/sec)

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

<u>Parameter</u>	<u>Estimate</u>	<u>Std. Error</u>	<u>Approx. C.I.</u>
K	645.4	22.84	+/- 44.81
Ss	0.008168	61.71	+/- 121.1
K'	1500.	8.831E+8	+/- 1.733E+9
Ss'	1.518E-5	7.792	+/- 15.29
Sw	-4.601	3950.3	+/- 7750.6
Sf	0.	5.364E+5	+/- 1.052E+6
r(w)	0.167	not estimated	
r(c)	0.33	not estimated	

C.I. is approximate 95% confidence interval for parameter
 t-ratio = estimate/std. error
 No estimation window

K = 0.2277 cm/sec
 T = K*b = 683.6 ft²/day (7.35 sq. cm/sec)

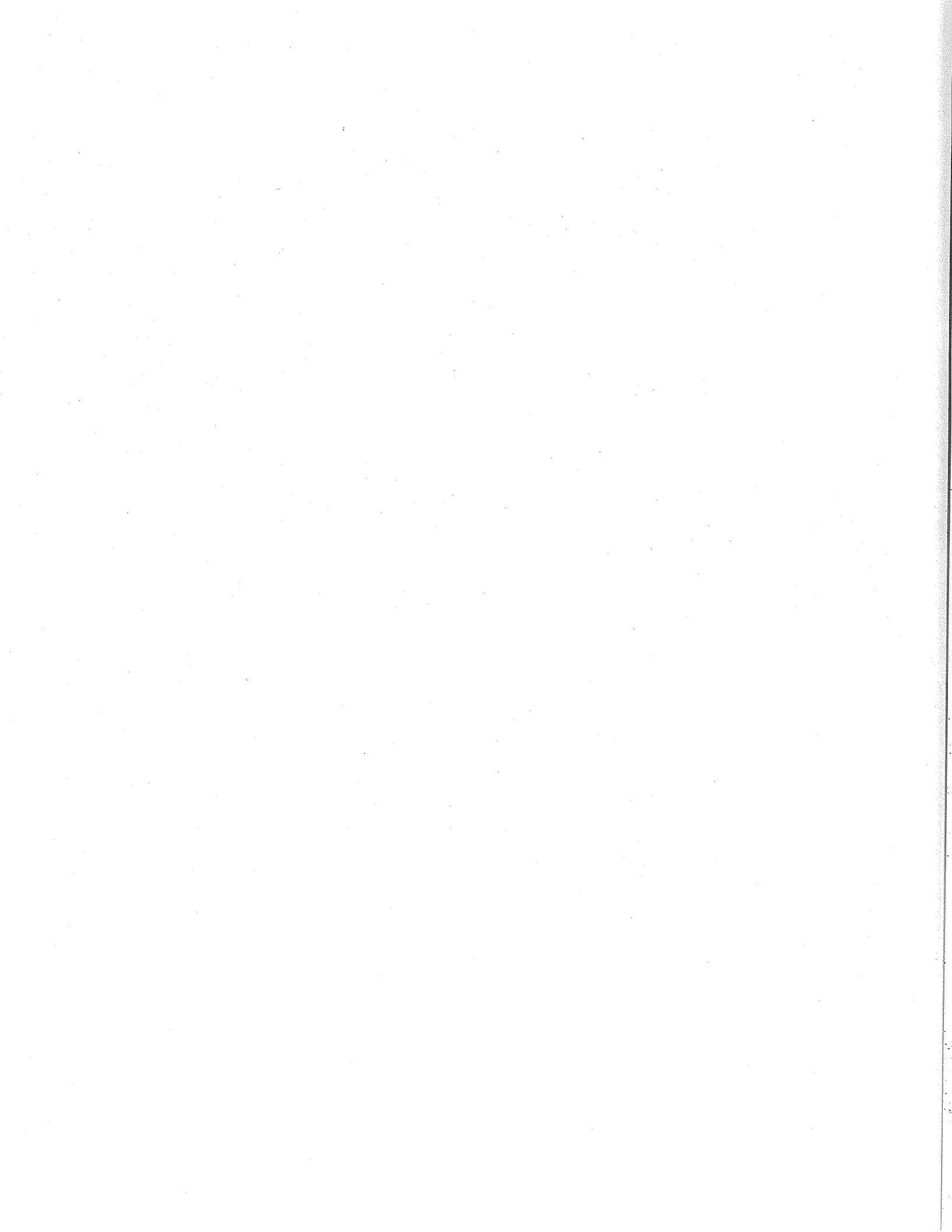
Parameter Correlations

	K	Ss	K'	Ss'	Sw	Sf
K	1.00	0.97	-0.45	0.45	0.98	-0.45
Ss	0.97	1.00	-0.31	0.32	0.99	-0.31
K'	-0.45	-0.31	1.00	-0.99	-0.42	1.00
Ss'	0.45	0.32	-0.99	1.00	0.43	-1.00
Sw	0.98	0.99	-0.42	0.43	1.00	-0.42
Sf	-0.45	-0.31	1.00	-1.00	-0.42	1.00

Residual Statistics

for weighted residuals

Sum of Squares	219.3 ft ²
Variance	0.1757 ft ²
Std. Deviation	0.4192 ft
Mean	-0.1025 ft
No. of Residuals	1254
No. of Estimates	6





LABORATORY ANALYTICAL REPORT

Client: Nicklin Earth and Water
 Project: Mountain Lake
 Lab ID: B07060466-001
 Client Sample ID: MLTW0605

Report Date: 06/12/07
 Collection Date: 06/05/07 11:00
 Date Received: 06/06/07
 Matrix: Aqueous

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.3	s.u.		0.1		A4500 H	06/06/07 13:58 / jak
Conductivity	177	umhos/cm		1		A2510 B	06/06/07 14:00 / jak
Solids, Total Dissolved - Calculated	108	mg/L		1		A1030F	06/08/07 10:27 / klc
INORGANICS							
Alkalinity, Total as CaCO3	82	mg/L		1		A2320 B	06/06/07 15:39 / jak
Bicarbonate as HCO3	100	mg/L		1		A2320 B	06/06/07 15:39 / jak
Carbonate as CO3	ND	mg/L		1		A2320 B	06/06/07 15:39 / jak
Chloride	ND	mg/L		1		E300.0	06/07/07 12:41 / qed
Sulfate	3	mg/L		1		E300.0	06/07/07 12:41 / qed
Sodium Adsorption Ratio (SAR)	0.26			0.01		Calculation	06/07/07 15:05 / klc
Sulfide	ND	mg/L		0.04		A4500 S-D	06/11/07 09:00 / pwc
Hardness as CaCO3	76	mg/L		1		A2340 B	06/07/07 15:05 / klc
Hardness as CaCO3 - Grains	4.5	grains/gal		0.1		Calculation	06/07/07 15:05 / klc
A/C Balance Sigma	-0.21					Calculation	06/08/07 10:27 / klc
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.39	mg/L		0.05	10	E353.2	06/08/07 09:51 / bls
METALS, TOTAL							
Antimony	ND	mg/L		0.003	0.006	E200.8	06/07/07 20:34 / sas
Arsenic	0.002	mg/L		0.001	0.01	E200.8	06/07/07 20:34 / sas
Barium	ND	mg/L		0.1	2	E200.8	06/07/07 20:34 / sas
Beryllium	ND	mg/L		0.001	0.004	E200.8	06/07/07 20:34 / sas
Cadmium	ND	mg/L		0.001	0.005	E200.8	06/07/07 20:34 / sas
Calcium	23	mg/L		1		E200.7	06/07/07 15:05 / rlh
Chromium	ND	mg/L		0.01	0.1	E200.8	06/07/07 20:34 / sas
Iron	0.11	mg/L		0.03		E200.7	06/07/07 15:05 / rlh
Magnesium	4	mg/L		1		E200.7	06/07/07 15:05 / rlh
Manganese	ND	mg/L		0.01		E200.8	06/07/07 20:34 / sas
Mercury	ND	mg/L		0.0002	0.002	E200.8	06/07/07 20:34 / sas
Nickel	ND	mg/L		0.01		E200.8	06/07/07 20:34 / sas
Potassium	1	mg/L		1		E200.7	06/07/07 15:05 / rlh
Selenium	ND	mg/L		0.005	0.05	E200.8	06/07/07 20:34 / sas
Sodium	5	mg/L		1		E200.7	06/07/07 15:05 / rlh
Thallium	ND	mg/L		0.001	0.002	E200.8	06/07/07 20:34 / sas

Report Definitions: RL - Analyte reporting limit.
 QCL - Quality control limit.

MCL - Maximum contaminant level.
 ND - Not detected at the reporting limit.